On The Colonial Origins of Agricultural Development in India: A Re-examination of Banerjee and Iyer, 'History, Institutions and Economic Performance'

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Abstract

Banerjee and Iyer (henceforth, BI) (American Economic Review, 2005) find that districts which the British assigned to landlord revenue systems systematically underperform districts with non-landlord based revenue systems, especially in agricultural investment and productivity and mainly after the onset of the Green Revolution in the mid 1960s. On this basis BI claim there were long-lasting effects of the Land Revenue system instituted in British India on a variety of variables after independence. We correct a mis-interpretation of the land revenue system in Central Provinces, which BI characterise as landlord based, when reliable historical evidence suggest that this region should have been attributed to a mixed landlord/non-landlord based revenue system. Using a more appropriate classification of the land revenue system of the Central Provinces constructed from documented archival research, we find no evidence that agricultural performance of Indian districts in the post-independence period was adversely affected by the colonial landlord land revenue system. Our results demonstrate that the key BI argument that the more 'oppressive' landlord based colonial land revenue systems mattered for post-independent agricultural development in India rests on fragile historical and statistical foundations.

JEL Classification: N55, O13, O17

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Introduction

In a prize-winning article published by the *American Economic Review*, Abhijit Banerjee and Lakshmi Iyer (2005) (BI from now on) attribute variation in agricultural performance, health and education in post-independence India (up to about 1991) to variation in the land revenue institutions put in place during British colonial rule.[i] Their findings rate among the most compelling examples of how present development performance may be shaped and determined by institutions of the past, here dating back a century or more. Their paper contributes to the rapidly growing empirical literature addressing the persistent effects of colonial rule on contemporary economic performance (e.g. La Porta et al., 1998 and 1999, Acemoglu et al., 2001 and 2002, Lange et al. 2006, Aghion et al. 2008, Mkandawire 2010, Wilson 2011) and lends support to new-institutionalist interpretations of history, economic development and policy (e.g. North, 1990, Bardhan, 2005, Chang, 2007).

BI's main contention is that in areas of India where the colonial administration implemented land tax collection, either directly from cultivators (the so-called *raiyatwari* system), or was organised at the village level (the *mahalwari* system), subsequent agricultural and broader development has outperformed areas with so-called *zamindari* or *malguzari* settlements, which BI classify as landlord-systems. Remarkably, the most pronounced long-term impacts became apparent around 1965, or some two centuries after the East India Company acquired the first revenue collection rights in Bengal and Bihar. They show: 'that districts in India where the collection of land revenue from the cultivators was assigned to a class of landlords systematically underperform the districts where this type of intermediation was avoided, after controlling for a wide range of geographical differences' (BI: 1190)'.

This paper revisits the historical and empirical foundations of BI's main findings and, in particular, their classification of the land revenue systems in British India into landlord and non-landlord categories, on which these findings primarily rest. We argue that classification of the Central Provinces (CP) (comprising much of contemporary Madhya Pradesh, and parts of Maharashtra and Orissa) as a predominantly landlord revenue system by BI is misguided , since reliable historical evidence (including the sources BI apparently use for coding the land revenue systems of districts in India) suggests that for the most part the *malguzari* settlement of the CP was very different from the Permanent (*zamindari*) settlement introduced in Eastern India by Cornwallis 70 years earlier (1793), and more closely resembled a village-based land revenue system (Baden-Powell,1894:148-149[ii]).

BI construct a continuous variable for the proportion of the area of a district under non-landlord land revenue settlement, with most districts in the CP classified as entirely landlord. They also test their hypothesis on the role of historical land revenue systems in determining post-independence agricultural development in India with a second, dichotomous variable, by dividing districts into either landlord or non-landlord based revenue systems, again with the districts in the CP classified as landlord. We construct a

new measure of non-landlord land in each of the districts in the former CP, derived from documented archival research, that takes into account the proportion of land area that is under landlord and non-landlord control (as we will argue later, under the *malguzari* settlement, most of the districts in the CP had parts of the land area under *de facto* landlord control and other parts that were characterised by non-landlord revenue systems). We also use a new dichotomous variable in which the CP districts are classified as entirely non-landlord. Finally, along with other robustness tests, we omit the CP from the BI sample.

When we re-run the BI regression specification with these new variables, and when we omit the CP from the BI sample, the positive and significant relationship between non-landlord land revenue systems and post-independence agricultural performance largely disappears. Thus, there is no longer support for BI's key proposition that historical property rights institutions – that is, the more 'oppressive' landlord-based colonial land revenue institutions set up by the British in India – are to blame for sustained differences in agricultural performance in the post-independence period.[iii]

The rest of our paper is organised as follows. Section 2 provides a brief synthesis of BI's main arguments and results. Section 3 reviews the land tenure and revenue administration systems during different periods of British colonial rule, focusing, in particular, on BI's classification of the CP. Section 4 re-examines BI's key finding on agricultural performance, using our alternate and historically more appropriate classifications of the colonial land revenue system. Section 5 concludes.

2. Summary of Banerjee-Iyer's main arguments and results

BI presents a rich synthesis of the history of revenue administration and reforms during various periods of British rule. In Bengal and Bihar, the East India Company obtained revenue collection rights in 1765; by 1805 the British formally controlled the districts of an enlarged Madras Presidency, the North-West Provinces (not including Oudh) and parts of Gujarat. Other districts belonging to the expanding Bombay Presidency and to what became the CP in 1861, were acquired by the defeat of the Marathas in 1818. The revenue system implemented in Bengal and Bihar (plus the Benares Province) is popularly known as the Permanent (*zamindari*) Settlement (e.g. Baden-Powell 1892), where landlords' revenue commitment to the government was fixed in perpetuity. Landlord-based revenue systems were also established in Orissa, some parts of the Madras Presidency, and according to BI, also the CP (BI, p. 1193).

In such landlord areas 'the revenue liability for a village or a group of villages lay with a landlord', who 'was free to set the revenue terms for the peasants under his jurisdiction and to dispossess any peasant that did not pay the landlord what they owed him' (BI, p1193)). Thus, the landlord effectively had property rights in the land, and tenants had no security of tenure.[iv]

Contrast this with Madras and Bombay Presidencies, where in most areas , the revenue settlement was made directly with the cultivator (*raiyat*) following extensive cadastral surveys of the land that were accompanied by a detailed record of rights, 'which served as the legal title to the land for the cultivator' (BI, p.1193).

In the *mahalwari* system, in the North-West Provinces (NWP) and Punjab, 'village bodies that jointly owned the village were responsible for land revenue' (BI, p.1194):

> In some areas it was a single person or family that made up the village body and hence was very much like the Bengal landlord (*zamindari*) system while in other areas the village body had a large number of members with each person being responsible for a fixed share of the revenue (BI, p.1194).

BI suggest three explanations for why areas conquered at later dates were less likely to have a landlord system: the influence of two administrators, Thomas Munro and Holt Mackenzie; the shifting perceptions among economists and others in Britain in response to the French Revolution and other international events; and finally, the perceived (mistaken) presence of landlords in areas to be settled (BI, pp. 1195-96). BI describe Oudh, where the settlement was not permanent, but was often made with landlords (termed *taluqdars*), as the main setback to this increasingly progressive colonial regime. When the CP were formally established as late as 1861, about a century after revenue rights were secured for Bengal, Bihar and parts of Orissa, and almost half a century after *raiyatwari* settlements were introduced in Bombay and most of Madras Presidency, it was also decided to have what BI term a landlord-based system there[v]. Given the apparently increasing enlightenment of colonial administrators and the Mutiny of 1857, why should the British revert to a revenue system that according to BI's interpretation most closely resembled the *zamindari* systems of Bihar and Bengal? We return to this issue below.

2.1 Empirical strategy

While BI presents a series of results of the possible effects of colonial land revenue systems on contemporary economic and social development in India, their most striking findings relate to the effects of colonial land revenue systems on post-independence agricultural performance. They show that districts where the British assigned proprietary rights in land to landlords (as they classify them) had significantly lower agricultural investments and productivity in the post-independence period than districts where rights were given to cultivators, either directly or through village bodies; this effect is particularly pronounced after 1965, a date that marks the beginning of the Green Revolution, and a period with extensive public investment in rural India. Their main explanatory variable is the extent of non-landlord control in a particular district, while the key dependent variables are agricultural investment outcomes (the proportion of gross cropped area that was irrigated, quantity of fertilisers used per hectare of gross cropped area, the proportion of area sown with high-yielding varieties (HYV) of rice, wheat and other cereals), and productivity of rice, wheat and an index of 15 crops. BI use two measures to capture the extent of landlord

control, a continuous variable defined on the [0,1] interval (*p_nland*), which measures the proportion of the district under a *raiyatwari*/*mahalwari* revenue system, and a simple binary dummy, indicating the predominance of non-landlord land revenue systems, which is displayed in BI's map (a version of which we reproduce in Figure 1). The areas classified as *raiyatwari* cover Bombay and most of Madras Presidencies, while the *mahalwari* system was found in the North-West Provinces (most of Uttar Pradesh minus Oudh) and Punjab. The areas coded as landlord are Bengal, Bihar, CP, Orissa and parts of Madras Presidency.

In their regression analyses, BI study agricultural performance using a data set from the World Bank covering 271 districts from 1956-1987, together with variables from original archival research.[vi] In their main regressions relating to agricultural performance, they use agricultural data for only 166 of these districts, which were mainly under British rule and for which information on land revenue systems were available. BI's results, presented more fully in Section 4, show that non-landlord areas perform better than landlord areas, on a variety of indicators of agricultural performance. Their main results suggest a strong colonial overhang and survive a series of robustness tests that we discuss in more detail in Section 4.
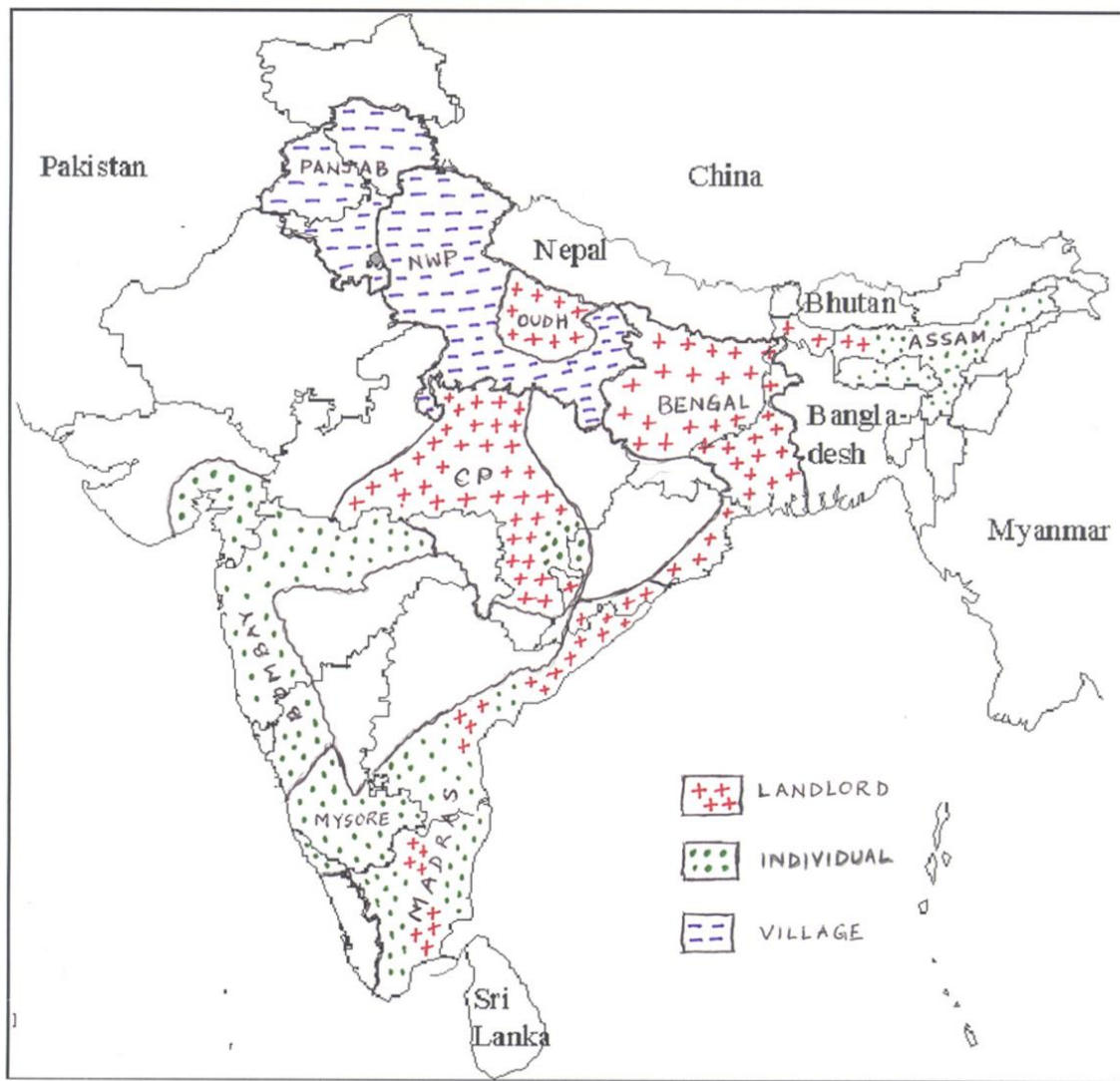
Fig 1: Map of India

Figure 1: Location of land revenue systems in India (from BI, 2002)

BI contend that the differences in agricultural performance between non-landlord and landlord districts can be attributed to differences in the political environment and a possible failure of collective action in the landlord areas or states (chiefly, Bihar, Madhya Pradesh, Orissa and West Bengal) as compared to the non-landlord states (chiefly, Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Punjab and Uttar Pradesh):

> the masses in the landlord areas, with their memories of an oppressive and often absentee landlord class, may perceive their interests as being opposed to that of the local elite, while those in the non-landlord areas may be more interested in working with that elite (BI, p.1210).

While BI do not provide a direct test of this explanation in this paper (but see Banerjee, Iyer and Somanathan, 2005), they provide some suggestive evidence in support of their argument. First, they show that landlord states had a higher degree of land inequality (which may have led the landlord states to enact more land reform legislation post-independence, which could have hampered growth). Second, they show that landlord states had lower per capita levels of state development expenditures in the post-1965 period than non-landlord states.

While it is not clear how differences in development expenditures across states can in themselves explain agricultural investments and productivity differences between districts, especially when trends in state development expenditures may be picking up unobserved state-specific trends in omitted variables, we also do not here test for the suggestive causal mechanisms responsible for BI's findings. This is in part due to the fact that we find their results to be fragile and in part because we think the causal mechanisms behind differential agricultural development in India deserve separate scrutiny.

3. Land tenure and land revenue administration in British India

3.1 The Permanent (zamindari) settlement

The acquisition of the so-called 'Diwani (revenue collection rights)' by the East India Company in 1765 was followed by a period of overzealous taxation. By the time of the Permanent (*zamindari*) settlement in 1793, land revenue had almost doubled (Chaudhuri 1983). In the 1793 settlement, the landed aristocracy, which mainly comprised of the heads of large feudal estates, were declared the proprietors of the soil and their dues to the state fixed 'in perpetuity' (Chaudhuri 1983, p.88). According to Fuller (1922, p.32) 'the settlement conferred the hereditary rights of property over areas sometimes larger than English counties and left the immediate cultivators mere tenants at will'. The perceived harshness of this settlement, especially towards tenants and small cultivators, has subsequently been held responsible for the concentration of poverty and ill-being in Eastern India (e.g. Chaudhuri 1984, RBI 1985).

Further, and in contrast to subsequent settlements, no cadastral survey was undertaken until the late 19th century. This absence of detailed land mapping, the vesting of proprietary rights in large landlords, and the complete failure to protect the *raiyats* or tenants, are the main distinguishing attributes of the Permanent (*zamindari*) settlement.[vii] The settlement is thus perceived to have cemented the pre-existing feudal structure. When seen from this angle, it is easy to gauge the merit of BI's main hypothesis.

3.2 The Central Provinces: an introduction

The erstwhile CP include districts currently in Madhya Pradesh, Chhattisgarh, Maharashtra and Orissa, and were formally established in 1861. The legend to Figure 1 makes clear that most CP districts were interpreted and classified by BI as 'landlord'. However, Figure 1 runs counter to the maps in Baden Powell (BP), 1892 and 1894 (the latter reproduced as Figure A2 in our Online Appendix) and which portray the 'chief features of the development of (our) revenue systems' (BP, 1892:p.373). Our Figure A1 (taken from Banerjee and Iyer 2001) appears to be a precursor to the AER version of BI's map and strongly resembles BP's 1894 map (Our Figure A2). The legend to BP's two maps makes clear that the CP are classified under the village or mahalwari system. The same applies to BP's three-volume text (1892), where the CP and the *malguzari* settlement feature in the volume covering the *mahalwari* (village) systems. BP's (1894: 148-49) summary, quoted in our Online Appendix page 3, is similarly unambiguous. The historian Tirthankar Roy (2011: pp.10-11) dismisses BI's coding of 'Central India, formerly called Berar and the Nagpur territories' as landlord as 'a misclassification'. The next section looks more closely at the history of revenue administration in CP.

3.3 Central Provinces: revenue collection history

The formal establishment of the CP involved, as J. B. Fuller put it, 'the piecing together of a veritable territorial puzzle (cited in Baden-Powell 1892, p.369)'. While most districts were under Maratha revenue administration prior to the British takeover in 1818, the regimes preceding Maratha rule were Gond kingdoms in some districts, Mohamedan kings in others and Hindu Rajput kingdoms in yet others. The CP districts can be divided into the Sagar Narbada territories, including Nimar; the Nagpur districts; and Chhattisgarh and Sambalpur. A district map of the CP that includes the time of British acquisition is presented in Online Appendix Figure A3.

For the Sagar/Narbada territories, the conquest in 1818 marked the beginning of a period of sustained British rule, while for districts in Nagpur and Chhattisgarh an initial and brief period of direct British rule, from 1818-1830, was followed by an interim period of native rule between 1830 and the death of the heirless Raja of Nagpur in 1853, returning these districts to British rule through the so-called doctrine of 'lapse'.

The early settlements varied across districts, were short-term and often involved considerable initial experimentation. A consensus among historians would be that initial revenue demands, and thus taxation burdens, often were unprecedented, overzealous and unsustainable. In the mid 1830s, the Sagar/Narbada territories were administratively appended to the North-West Provinces and strongly influenced by events and revenue debates there: local officers were often recruited from N-W P districts (Fuller 1922, p. 30). In Nimar, the intermediate period *khalsa* system was based 'on the model of the Bombay *'Ryotwar'* system from whence officials acquainted with the *ryotwar* system were recruited (Report on the Land Revenue Settlement of British Nimar District 1870, p.5). Meanwhile, the Nagpur province system during the intermediate period with native rule has been described both as 'lax' and as resembling the village system (Fuller 1922, p.41).

The 30 year *malguzari* settlement,[viii] implemented from 1863 onwards, bestowed proprietary rights mainly on village headmen. However, as in Bombay and Madras, the settlement was accompanied by a cadastral survey, where each individual field was mapped, measured and assessed. Crucially, the strengthening of the village headmen or Patels that the settlement entailed through the granting of proprietary rights was accompanied by the categorisation of peasants as having *malik makbuza*, absolute occupancy and occupancy rights alongside tenants-at-will deprived of any such rights (Raghavan, 1985, p.171[ix]). [x] According to Baden-Powell (1892: Vol 2, p.388), 'the '*Malguzari*' Settlement, therefore, presents this feature – that we have here a system of landlords, with tenants over a large proportion of whom they have no power of enhancement or interference.'[xi]

This is synthesised by Fagan (1932, p.280):

> In the newly constituted Central Provinces most of the villages were of the ryotwari type. Under the oppressive rule of the Marathas very many of them had been farmed, commonly to their own headmen, who were termed patels… It was decided at the regular settlement, which began in 1863 and was completed in 1870, to recognise all the above classes as proprietors, under the common designation of malguzar, or revenue-payer, and to make the settlement with them. This arrangement, however, *in strong contrast to the Bengal system (our italics)*, was combined with an ample measure of tenant-right, by which a large majority of tenants received substantial protection.

In almost all the CP districts, substantive shares of the land were in the hands of raiyats, whose occupancy status were formally recognised.

Nevertheless, with the exception of Sambalpur and to a lesser extent Bhalagat and Narsinghpur, BI classify the 19 districts in their sample drawn from CP as *wholly* landlord (thus assign a value of zero in their *p_nland* measure of land revenue systems), effectively equating the land revenue system of the CP with the Permanent (*zamindari*) settlements of Bengal and Bihar, which are also coded as zero in their *p_nland* measure.

3.4 The recoding of the Central Provinces districts

A problem for BI's paper is that, while they test and verify robustness of their results by running regressions omitting the uncontested *zamindari* arrangements of Bengal and Bihar, they do not consider how the more qualified, much later settlements of the CP affect their results.

Our discussion of the *malguzari* settlement suggests that it approximated neither a wholly landlord system (as in BI) nor a wholly non-landlord system (by a naïve inversion of the classification of BI, we term this, with perhaps some historical injustice, the 'Baden-Powell (BP) interpretation'); rather, it was closer to a mixed landlord/non-landlord system, where the pure *malguzari* components of the land areas in each CP district could be regarded as approximating a *de facto zamindari* settlement, given the clearly defined hereditary rights of the village headmen, and that they were acting as intermediaries, albeit with much limited authority (Baden Powell (1892; 410) in revenue collection for the British. Thus, a more accurate classification of the land revenue system in the CP would need to take into account that almost all districts in CP had some land under a *de facto* landlord system and some land under a non-landlord system. In all districts of CP a considerable (variable area) should thus be classified as non-landlord. To obtain this proportion of non-landlord area in each CP district, we add up the land areas over which tenants have *malik makbuza*, absolute occupancy and occupancy rights, and take the proportion of non-landlord land in a district to be the sum of these land areas as a share of the total (*khalsa*) land held by *malguzars* and tenants.

In Table 1, we report our revised statistics of the proportions of non-landlord area (which we term *p_nland_alt*) in each CP district. The reference period (with two exceptions) is the beginning of the 30-year *malguzari* settlement (1865-69) .

To see how sensitive the BI results are to the coding of the CP land revenue system as a landlord settlement, we proceed in three steps. Firstly, we use what we termed the 'Baden-Powell interpretation' of the Central Province districts as in the same category as the *mahalwari* settlements (Baden-Powell (1894):149), recoding the CP districts as *wholly* non-landlord (that is, *p_nland* takes the value of one for all former CP districts). This could be taken as the polar opposite of the BI land revenue classification for the CP districts. Secondly, we re-estimate BI's model with our revised continuous variable *p_nland_alt* allowing for the possibility that parts of the land areas in the CP districts are under *de facto* landlord control. Finally, we drop the CP districts to see how sensitive BI's results are to their inclusion. This tests whether there is any remaining effect of landlord control in those areas the classification of which is not disputed. We also repeat the BI robustness test using an instrumental variable strategy with our *p_nland_alt* variable in CP districts (as in Table 1).

Table 1. Proportion of non-landlord area in Central Province Districts as in Banerjee-Iyer (BI), in the Baden-Powell interpretation (BP) and our re-coding (*p-nland_alt*).

District name	BI	BP	p_nland_alt	Source
Nimar	0	1	1	RLRS, British Nimar 1868-69, Paragraph 9 (pp.5-6), Introduction (not in BI sample).
Hoshangabad	0	1	0.53	1865-69, CPDG, Hoshangabad , (Calcutta 1908), p. 262.
Betul	0	1	0.47	RLRS, Baitool, 1866 (Bombay 1867), pp. 156-57.
Chhindwara	0	1	0.38	1865-69, CPDG, Chhindwara ,1907, pp. 170-73.
Seoni	0	1	0.28	1865-69, CPDG, Seoni , (Allahabad 1907), pp. 141-43.
Narsinghpur	0.05	1	0.48	RLRS, Narsinghpur, 1867, Appendix, Table 15.
Sagar	0	1	0.45	1865-69, CPDG , Saugor, 1907.
Damoh	0	1	0.45	RLRS, Damoh, 1888-91.
Jabalpur	0	1	0.44	1865-69, CPDG, Jubbulpore (Bombay 1909), pp. 293-94.
Mandla	0	1	0.098	RLRS, Mundlah, 1868-69, (Bombay), Appendix I, p. 107.
Bilaspur	0	1	0.31	RLRS, Belaspore, 1868, Appendix III.
Sambalpur	1	1	1	RLRS, Sambalpur, Paragraph 17 (p.7) plus pp.48-54, (Patna 1906).
Raipur	0	1	0.26	1865-69, CPDG, Raipur (Bombay 1909), p. 238.
Balaghat	0.4	1	0.68	1890, RLRS, Balaghat 1895-98. p.2 para 6 for total malguzari and p.3, para 10 for the total ryotwari acres. p.27 (table) for breakdown of malguzari areas by occupancy status.
Bhandara	0	1	0.42	RLRS, Bhundara, (Bombay 1867), pp. 124-26.
Nagpur	0	1	0.48	1865-69, CPDG, Nagpur, (Bombay 1908), pp. 241-42.
Wardha	0	1	0.40	1865-69, CPDG, Wardha (Allahabad 1906), pp.197 and 201.
Chanda	0	1	0.45	RLRS, Chanda, (Nagpore 1870). Table, p.18 in foreword/cover letter.

Note: Raigarh and Bastar were Princely States coded by BI in the CP, and are included in the BI sample with p_nland = 1 for the former and zero for the latter. CPDG and RLRS are short for Central Provinces District Gazetteer and Report on Land Revenue Settlement, respectively.

4. Re-examining the Banerjee-Iyer findings

In this section, we re-examine BI's main findings relating to agricultural development, using our re-estimations of the continuous and dummy land revenue variables used by BI. We begin with the plot of the differences in agricultural investments and yields between landlord and non-landlord districts presented in BI as Figure 5 (p.1207), using the same BI data-set for this plot and for the rest of the replication exercises.[xii] In Figure 2, we present the original BI plots of the annual averages for landlord and non-landlord districts of proportion of irrigated area, fertiliser usage and mean log yield, using the original BI land revenue classification in panels A, B and C, and the same variables, using the Baden-Powell recoded land revenue classification, in Panels D, E and F.[xiii] BI find that the gaps in the proportion of gross cropped area, fertiliser usage and mean log yield widen between landlord and non-landlord districts after 1965. This is evident from Panels A, B and C of Figure 2. However, when we use the 'Baden-Powell interpretation' of the land revenue classification for the CP districts, there is no widening of the gap in proportion of irrigated area and mean log yields between landlord and non-landlord districts after 1965, though a (smaller) widening continues to be observed for fertiliser usage.

BI provide a more systematic analysis of the relationship between colonial land revenue systems and post-independence agricultural investment and productivity differentials between districts using regressions of the form:

$$Y_{it} = \text{constant} + \alpha_i + \beta NL_i + \gamma X_i + \alpha_t + \varepsilon_{it}$$

where Y_{it} is the outcome variable of interest (investment or productivity) in district i and year t, α_t is a year fixed effect, NL_i is the historical measure of non-landlord control in district *i*, X_i are the other control variables, which do not vary over time (see below), and α_t are year fixed effects. The coefficient of interest is β, which captures the impact of the non-landlord land revenue system in the post-independence period on the outcome variable. All BI's regressions and our replications, [xiv] control for the same set of geographical and historical variables (see footnote to Table 2). In their regressions and in all our replications, the standard errors of the regressions are adjusted for within-district correlation.
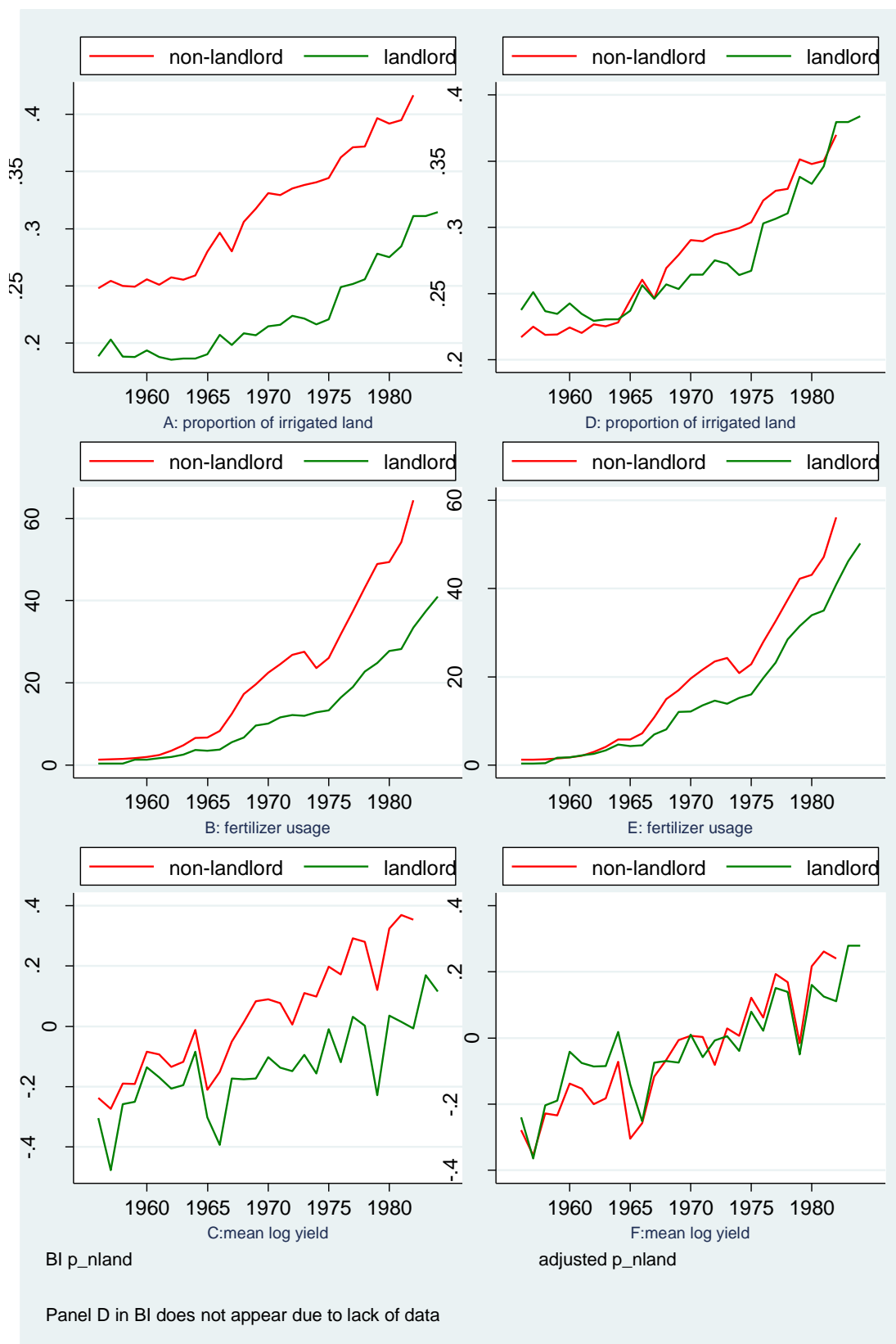
Figure 2: Agricultural investment and productivity: Banerjee-Iyer and alternate specification.
Note: adjusted p_nland is equal to BI binary measure for pn_land, except for Central Province districts, where p_nland=1

BI first estimate equation (1) using Ordinary Least Squares (OLS), with the proportion of a district that is under non-landlord control (the continuous variable *p_nland*), and present the OLS results in col. (1) of Table 3 of their paper. We begin our re-examination of BI's findings by replicating their OLS results, using our .do files and their STATA data. [xv] These results are presented in col. (1) of Table 2.

The coefficient on the non-landlord proportion is positive and statistically significant at 10 percent or lower for all the outcome variables. The results show that non-landlord districts have a 24 percent higher proportion of irrigated area, a 43 percent higher level of fertiliser use, a 27 percent higher proportion of rice area and 27 percent more wheat area under high-yielding seed varieties. Overall, agricultural yields are 16 percent higher, rice yields 17 percent higher and wheat yields are 23 percent higher in non-landlord districts. As noted above, BI also check whether their results are robust to replacing the continuous measure with a binary landlord-non-landlord classification.[xvi] It is clear from col. (2) of Table 2, that their results are relatively robust to this alternate specification of the land revenue variable.[xvii]

We now re-run the BI regressions following the same structure as in Table 2. We use identical STATA code and the identical STATA data file used in Table 2 here (with the same specifications, the same periodisation, and the same set of control variables). The only difference between the BI and our regressions is that we use our recoding of the land revenue system in the CP districts presented in Table 1. We also present results using the 'Baden-Powell interpretation', and omitting the CP districts. Our results are given in Table 3.

The differences between BI and our results in Table 3 are striking. Re-estimating equation (1) using the Baden-Powell interpretation of the land revenue system in CP, we find that six of the eight coefficients are not significant, and the remaining two (proportion of gross cropped area irrigated, and log yield of 15 major crops) are *negative* and significant at five percent and one percent, respectively (col. (1) of Table 3). When we use our revised continuous land revenue measure (col. (2) of Table 3), we find that only two of the eight coefficients, those of fertiliser and log wheat yields, are positive and significant (five percent), and the rest of the coefficients are statistically insignificant.

Table 2. Banerjee-Iyer main results

Dependent variable	Mean of dependent variable	Coefficient on non-landlord proportion (*p_nland*)	Coefficient on non-landlord dummy
Agricultural investments		(1)	(2)
Proportion of gross cropped area irrigated	0.276	0.0654*	0.0775**
		(0.0343)	(0.0266)
Fertiliser use (kg/ha)	24.64	10.71***	9.988***
		(3.345)	(2.301)
Proportion of rice area under HYV	0.285	0.0789*	0.0164
		(0.0437)	(0.0318)
Proportion of wheat area under HYV	0.494	0.0917**	0.0309
		(0.0459)	(0.0359)
Proportion of other cereals area under HYV	0.188	0.0572*	-0.0348
		(0.0309)	(0.0247)
Agricultural productivity			
Log(yield of 15 major crops)	--	0.157*	0.173**
		(0.0712)	(0.0527)
Log (rice yield)	--	0.171*	0.0993
		(0.0809)	(0.0620)
Log (wheat yield)	--	0.229***	0.188***
		(0.0675)	(0.0538)
No. of districts	--	166	166
Year fixed effects	--	YES	YES
Geographic controls	--	YES	YES
Date of British land revenue control	--	YES	YES

Notes: Standard errors in parentheses, corrected for district-level clustering. *Significant at 10 percent level; ** Significant at five percent level; *** Significant at one percent level. Each cell represents the coefficient from a regression of the dependent variable on the measure of non-landlord control. Estimation method: Ordinary Least Squares (OLS). Data are from 1956 to 1982 for irrigation, 1956-1987 for productivity variables, and 1965-1987 for HYVs. Geographic controls are altitude, latitude, mean total annual rainfall, and dummies for soil type and coastal regions. The non-landlord dummy is assigned as follows: the dummy equals one for all individual-based districts and all village-based districts, except those in Oudh. For landlord-based districts (including CP) and the village-based districts of Oudh, the dummy is zero.

Table 3. Regression results with alternate specifications for Central Provinces districts

Dependent variable	Baden-Powell interpretation	Continuous p_nland (*p_nland_alt*)	Omitting Central Province districts
Agricultural investments	(1)	(2)	(3)
Proportion of gross cropped area irrigated	-0.0878*	0.0284	-0.0319
	(0.0450)	(0.0414)	(0.0468)
Fertiliser use (kg/ha)	-3.386	8.356**	3.055
	(4.150)	(4.111)	(4.634)
Proportion of rice area under HYV	0.0347	0.0822	0.0565
	(0.0544)	(0.0548)	(0.0630)
Proportion of wheat area under HYV	-0.0765	0.0553	-0.0203
	(0.0554)	(0.0533)	(0.0605)
Proportion of other cereals area under HYV	-0.0292	0.0428	-0.00300
	(0.0362)	(0.0379)	(0.0429)
Agricultural productivity			
Log yield of 15 major crops	-0.135*	0.0886	-0.0300
	(0.0780)	(0.0773)	(0.0778)
Log rice yield	-0.109	0.116	-0.0103
	(0.0836)	(0.0890)	(0.0906)
Log wheat yield	-0.0975	0.176**	0.0525
	(0.0847)	(0.0773)	(0.0770)
No. of districts	166	166	145
Year fixed effects	YES	YES	YES
Geographic controls	YES	YES	YES
Date of British annexation	YES	YES	YES

Notes: BI sample; Standard errors in parentheses, corrected for district-level clustering. *Significant at 10 percent level; ** Significant at five percent level; *** Significant at one percent level. Each cell represents the coefficient from a regression of the dependent variable on the measure of non-landlord control. Column 2 includes the Central Provinces districts taking the values reported in Table 1; see the text for details of the non-landlord share in the CP provinces. Estimation period and controls are as in Table 2.

The differences from the BI results with the revision and re-coding of the CP districts to be under non-landlord revenue control is remarkable, although only 21 of the 166 districts (13 per cent of the total sample) used in BI's empirical analysis are recoded. Finally, we re-estimate equation (1) without the CP districts (col. (3) of Table 3), and find that the coefficient on non-landlord proportion is not statistically significant, and in some cases negative, for the various measures of agricultural development. This provides clear and substantial evidence that the coding by BI of the CP districts as a landlord land revenue system is driving BI's main results. [xviii]

BI undertake two further robustness tests – first, they attempt to control for possible omitted unobserved district characteristics by using an extremely restricted sample, in which they consider only districts which are geographical neighbours (that is, share common borders[xix]), and, second, they estimate equation (1) using instrumental variables (IV), to address the possible endogeneity of British placement of land revenue systems to more productive districts, and possible measurement errors in their land revenue measure (Table 4 of BI). The first of these tests is unconvincing, because the clusters of districts with common boundaries are rather artificial, and may still be geographically confounded. Thus, in the Andhra Pradesh cluster, only one of the two landlord districts has a common border with the non-landlord district. Further, BI compare 10 non-landlord (*mahalwari*) with eight landlord (*taluqdari*) districts in present-day Uttar Pradesh; five of these 18 districts can be seen as mis-classified if we use the BI *p_nland* cut-off of p_nland = 0.4 for a district to be classified as a landlord district; in the case of the geographical cluster of Western UP, only one of the nine districts can be legitimately classified as non-landlord (see Online Appendix Table A4, and its notes for more details).[xx]

We therefore focus on the instrumental variable estimate and first present the BI results using their instrumental variable strategy (col. (1) of Table 4), where they use a dummy variable that takes the value of one if the date that the district came under British land revenue control was between 1820 and 1856, as the instrument for their non-landlord land revenue proportion variable.[xxi] Their coefficient on the non-landlord proportion remains positive and statistically significant for fertiliser use, proportion of wheat and other cereal areas under HYV seeds, log rice yield, and log wheat yield.

Table 4. Results of instrumental variable estimates, Banerjee-Iyer (*p_nland*)
and our specification (*p_nland_alt*))

Dependent variable	BI IV Results	Our specification, IV results
	(1)	(2)
Proportion of gross cropped area irrigated	0.216	-1.404
	(0.137)	(1.369)
Fertiliser use (kg/ha)	26.20**	-110.2
	(13.24)	(111.1)
Proportion of rice area under HYV	0.411**	0.594
	(0.163)	(0.710)
Proportion of wheat area under HYV	0.584***	1.266
	(0.163)	(1.430)
Proportion of other cereals area under HYV	0.526***	2.796
	(0.129)	(2.702)
Log (yield of 15 major crops)	0.409	-2.648
	(0.261)	(2.828)
Log (rice yield)	0.554*	-0.620
	(0.285)	(1.169)
Log (wheat yield)	0.706***	-2.568
	(0.214)	(3.842)
No. of districts	166	166
Year fixed effects	YES	YES
Geographic controls	YES	YES
Date of British land revenue control	YES	YES

Notes: Standard errors in parentheses, corrected for district-level clustering. *Significant at 10 percent level; ** Significant at five percent level; *** Significant at one percent level. Each cell represents the coefficient from a regression of the dependent variable on the measure of non-landlord control. Controls and periods of estimation are as in Table 2. The instruments are described in the text and endnote xxiii.

We now re-run the IV estimates using our recoded non-landlord proportion variable, *p_nland_alt*.[xxii] We find that the coefficient on *p_nland_alt* is negative and statistically insignificant for proportion of gross cropped area irrigated, fertiliser use, log yield of major crops, and log wheat yield (col. (2) of Table 4). The coefficient is positive but statistically insignificant for the IV estimate only for the proportion of other cereal area under HYV. Our instrumental variable estimates support our earlier OLS results that the positive and significant relationship that BI find between non-landlord revenue control and agricultural performance is due to their coding of the CP as landlord and, using a more accurate classification of the land revenue system in this region from original land revenue settlement records, we again find that the BI results no longer hold.[xxiii] . We find a dramatic over-turning of BI's key findings on post-independence agricultural development in India.

As a robustness test of our *p_nland_alt* results we proceed to account for the presence of the large (Jagir & Zamindari[xxiv]) estates in some CP districts. These estates were mostly untouched or much less affected by the *Malguzari* settlement as explained in the Appendix Section A1. Because of their location in forested, hilly and marginal areas, 'the wilder sections of the province (Fuller 1922:70)', the population density and share of cultivated land in these estates was often significantly lower than elsewhere. One could nevertheless contend that our *p_nland_alt* variable overestimates the share of non-landlord land in CP districts. To put this potential objection to rest, we generate an alternative variable denoted *p_nland_alt_zam* where we add cultivated land in these large estates to the total cultivated land in *p_nland_alt* and treat all cultivated land in these estates as landlord. A comparison of *p_nland_alt* and *p_nland_alt_zam* is presented in the Online Appendix Table A1 with regressions using *p_nland_alt_zam* presented in Table A2. Our results are unaffected by these adjustments.

Why are the Central Provinces making such a difference to BI's results?

What explains why the recoding of the CP districts from being under landlord revenue control to being (at least partially) under non-landlord revenue control makes such a difference to the BI results? One plausible explanation is that the districts in the former CP performed significantly worse with respect to agricultural development than the classic Green Revolution impacted states of Punjab and Haryana, which were mostly under non-landlord revenue control. When the CP districts are reclassified from being landlord to non-landlord districts, as in our *p_nland_alt*, the averages of agricultural investments and yields in the non-landlord districts decrease with the inclusion of the CP districts so as to be not very different from corresponding averages for landlord districts. This is clear from Table A6 in the Online Appendix, where we find that the averages of the agricultural investment and outcome variables for the CP are significantly below those for the districts in Bengal and Bihar, Punjab and Haryana, and for the remaining British districts (except the case of proportion of rice area under HYV, as compared to Bengal and Bihar).To examine this

hypothesis more rigorously, we run a set of robustness tests, dropping Bengal and Bihar (the archetypal landlord states) first, and then Haryana and Punjab (the archetypal non-landlord states). We present our results in the Online Appendix, Table A7 in cols. (2) and col. (3), with the all-districts case presented in col. (1) for comparison. Panel A presents the regression results when we use BI's *p_nland*, and Panel B presents the results when we use our *p_nland_alt*. From Panel A, col (3) it is clear that BI's results are sensitive to the dropping of Haryana and Punjab (and not to Bengal and Bihar as they have already established in their paper), as most of the coefficients on the agricultural performance variables lose significance in this case. With our *p_nland_alt*, the dropping of Punjab and Haryana causes the coefficients on fertiliser use and yield of wheat to lose significance, so that *all* coefficients on *p_nland_*alt in the agricultural investments and yield regressions are now statistically insignificant (compare col. (3) in Panel B to col (1)).[xxv]

5. Conclusions

A large and influential literature argues that institutions are the fundamental cause of long-run economic progress. BI's seminal contribution to this literature was to identify the role of the more 'oppressive' colonial land revenue systems in explaining widely differing agricultural development across districts in India in the post-independence era including after 1965, when the Green Revolution brought about significant increases in agricultural investments and output in some regions of the country, but not in others. BI purport to show that property rights institutions that were the product of colonial times mattered for comparative economic development within India, and that areas where proprietary rights were historically given to landlords performed far worse than areas where proprietary rights were allocated to village bodies or individual cultivators.

In this paper, we re-examine the empirical basis of the key proposition put forward by BI that there is a causal effect of landlord-based land revenue systems on lack of agricultural development in post-independence India. We argue that the classification of the CP as a landlord revenue system is mistaken, since reliable historical evidence suggests that the *malguzari* settlement of the CP implemented in the 1860s was accompanied by cadastral surveys and extensive protection of tenants, and is interpreted both in the colonial literature and by modern historians to more closely resemble a village-based or a mixed landlord/non-landlord land revenue system. Drawing on historical texts and original land revenue settlement reports, we use new values for and re-code the key explanatory variables used by BI in their empirical analysis for the districts which were in the former CP, reflecting what we consider to be more accurate categorisations of the colonial land revenue systems. Using these new measures we re-run the regression specifications used by the BI and find dramatic over-turning of their key results. A similar overturning occurs if we drop the CPdistricts. We show that, contrary to expectations, it is the CP and not the harsh Permanent (*zamindari)* settlements of Eastern India that are responsible for BI's results (together with the areas of

north western India that responded favourably to the green revolution). Hence, we argue that BI's argument that colonial land revenue systems mattered for post-independent agricultural development in India rests on fragile historical and statistical foundations.

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Online Appendix to "*On The Colonial Origins of Agricultural Development in India: A Re-examination of Banerjee and Iyer, 'History, Institutions and Economic Performance'*"
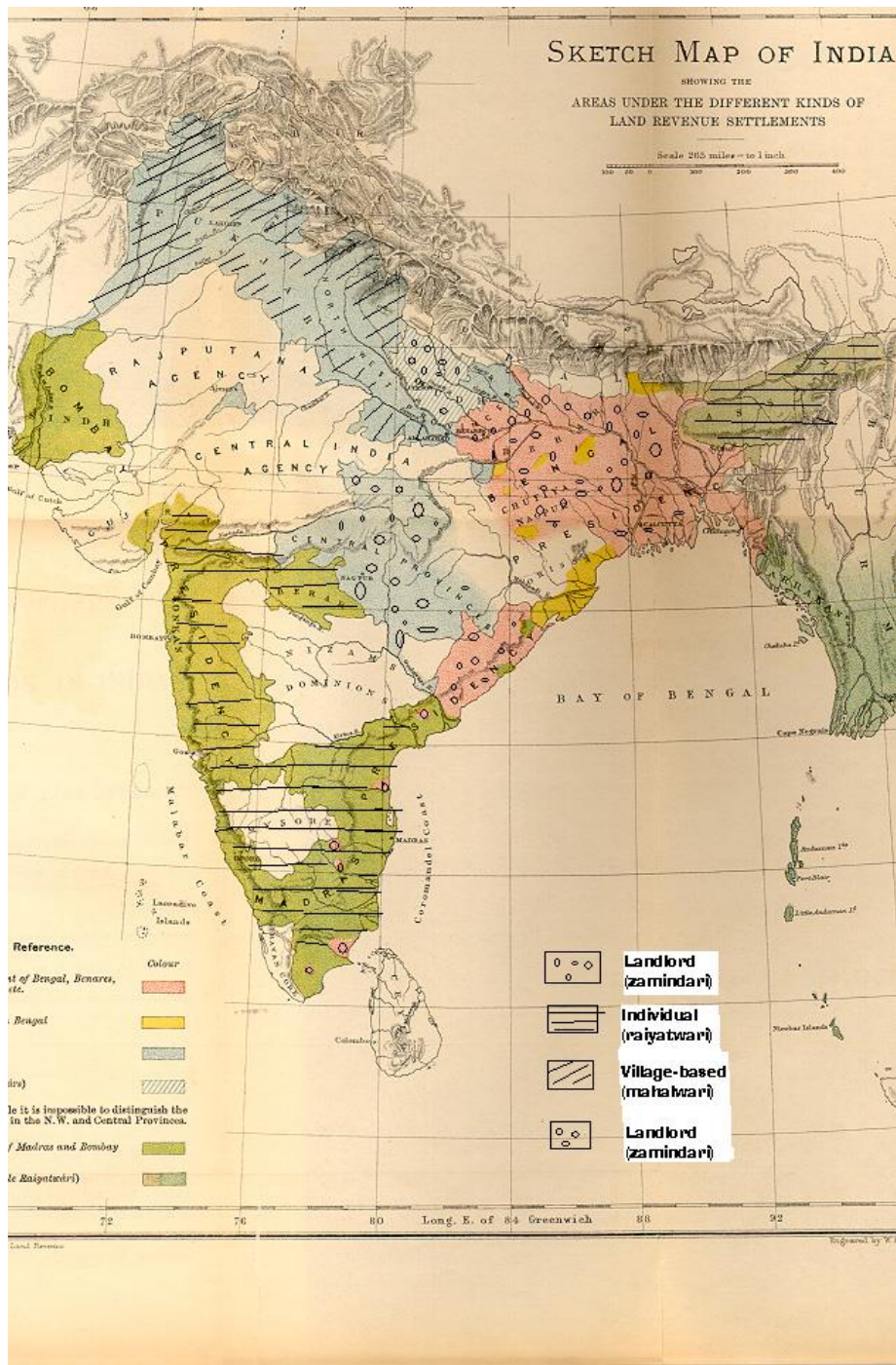
Figure A2: Colour Version of Figure 1 in Main Text - Location of land revenue systems in India (from BI, 2001)

Figure A2: Location of Land Revenue Systems (from Baden-Powell, 1894)

Extract from Baden-Powell, 1894, pages 148-9:

"**Three main kinds of Settlement**.—As a matter of fact, there have been three main kinds of Settlement, following (as will have been already anticipated) the fact noted, that we have always to deal either with landlord estates, with village estates (or *maháls*), or with separate holdings. Each kind has one or two local varieties, depending partly on peculiarities of the agricultural conditions, and partly on the features and incidents of the prevailing tenure of land in the Province. I will at once give a comprehensive list of the varieties, which will afterwards be briefly explained and described.

1. Settlement for single estates under one landlord.—
　　　Usually large estates, but not always (p. 122).
Varieties : —
　　　(i) Settlement with Zamindars, i. e. Permanent Settlement of Bengal and North Madras.
　　　(2) Settlement (Temporary) in Bengal of estates and districts not subject to the Permanent Settlement.
　　　(3) With Taluqdars in Oudh.

2. **Settlement for estates of proprietary bodies**, usually VILLAGE COMMUNITIES. (These are sometimes called *mauzawar*, or more correctly *mahalwar* Settlements).
　　　Varieties : —
　　　(1) Settlement of the North-West Provinces (including Oudh for villages that are not under Taluqdars)
　　　(2) Settlement of the Central Provinces (called the *Malguzari* Settlement).
　　　(3) Settlement of the Panjab.

3. **Settlement for individual occupancies or holdings**.
　　　Varieties:—
　　　(1) The Raiyatwari system of Madras.
　　　(2) The Raiyatwari system of Bombay and Berar.
　　　(3) Special systems (in principle *raiyatwari*, but not officially so called) of Burma, Assam, and Coorg."

OUTLINE MAP
of the
CENTRAL PROVINCES
Coloured according to the date and method of their acquisition
by the British Governmet
Scale 1 Inch = 80 Miles

EXPLANATION

1 Sovereignty acquired in 1818 by cession from Appaji Bhonsla
2 Sovereignty acquired in 1818 by cession from Sindhia
3 Sovereignty acquired from Peshwa in 1818
4 Management made over by Sindhia in 1820-25: Sovereignty acquired in 1860
5 Management made over by Sindhia in 1844; Sovereignty acquired in 1860.
6 Sovereignty acquired in 1860 from Sindhia by treaty

7 Confiscated for rebellion in 1857
8 Acquired by transfer from Bundelkhand
9 Escheated in 1849
10 Escheated in 1854
11 Obtained from the Nizam in exchange in 1860
12 Transferred from Bengal in 1905
13 Transferred to Bengal (now Bihar & Orissa in 1905)
14 Transferred to Madras in 1874 & 1909

Note - The tracts left uncoloured are Feudatory Chiefships.

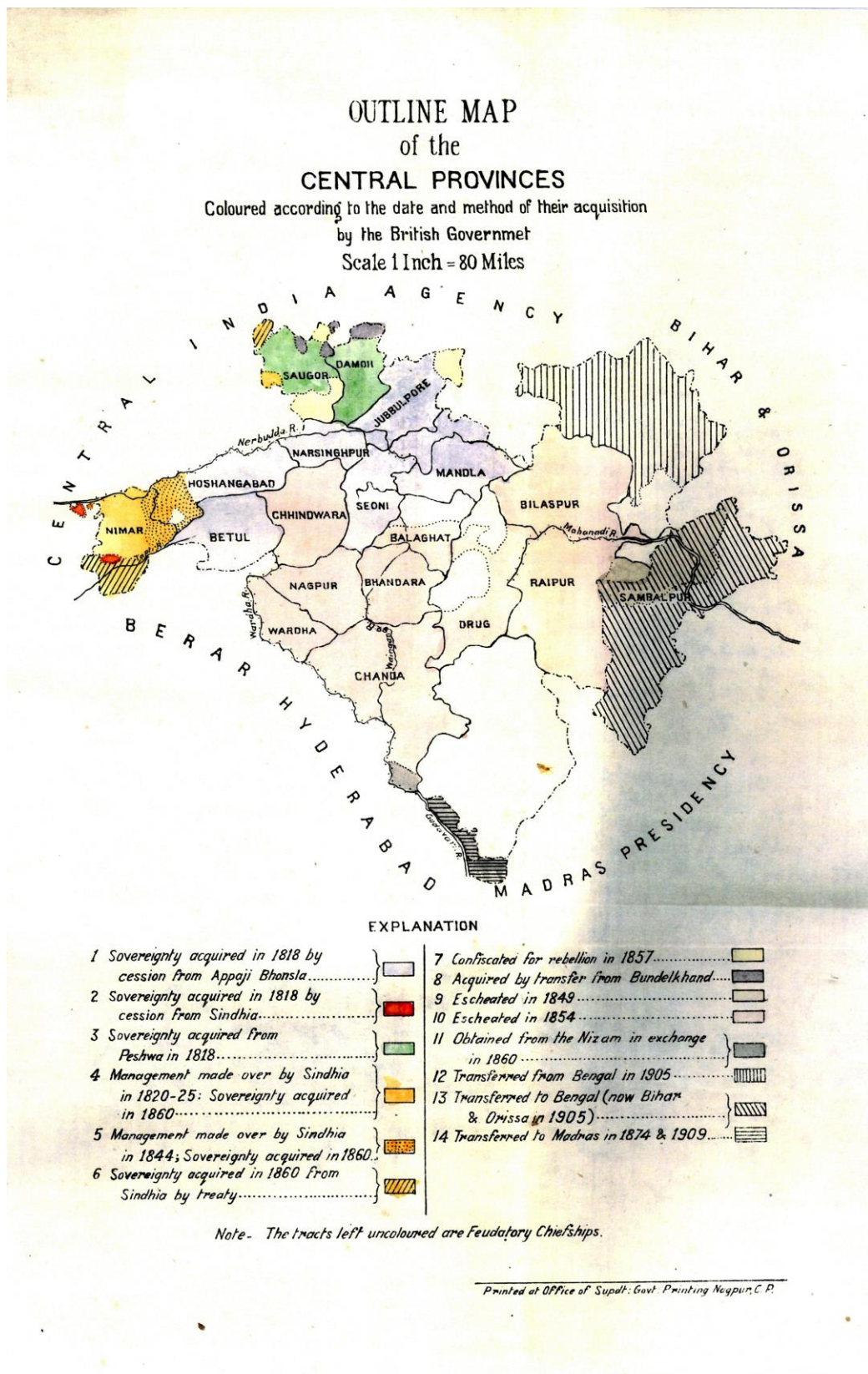Printed at Office of Supdt: Govt: Printing Nagpur, C.P.

Figure A3: Central Provinces (from Fuller, 1922)

SECTION A1. ACCOUNTING FOR THE PRESENCE OF LARGE ESTATES IN THE CENTRAL PROVINCES

We perform this robustness test to satisfy readers with a deeper interest in India's economic history in general and the revenue history of the Central Provinces, in particular. The phrase '*Zamindari'* was often used loosely by British Administrators including to describe large areas or estates in several Central Provinces districts: Unlike the *Zamindari* estates of Eastern India, the CP Feudatory, *Zamindari* or *Jagir* estates were often remnants of past (Gond) kingdoms and frequently located in hilly, forested and marginal areas, what Fuller (1922; 72) describes as the 'wilder portions of the province'.[1] The term '*Zamindari'* thus has a different meaning here (ibid. 72). Such estates could cover as much as 1,500 square miles and often predated the Maratha conquests (1740-55). At the time of the establishment of the Central Provinces in 1861, a distinction was made between the Feudatory and other areas with the former judged to be outside British territory and jurisdiction (McEldowney 1980).

The remaining *Zamindari* or *Jagir* estates were typically differentially treated, much less affected and more lightly assessed in the 30 year *Malguzari* settlement (ibid: 72) which focused on the more fertile and centrally located 'khalsa' or 'government' lands. Even so the custom of asking the estate rulers or 'Chiefs' (territorial magnates with extensive powers and de facto rights) to pay a tribute to the government of any given period was maintained. The power base of these Chiefs was particularly pronounced in Chanda, Bilaspur, Raipur and Chhindwara districts (ibid), but there were also estates in other districts.

For our purposes and although the ultimate intention on the part of the British administration may have been to secure similar tenurial rights for cultivators of agricultural land within the *Zamindari* and *Jagir* estates that were extended to the cultivators on *khalsa* land, the location, settings and limited resource base of the most important estates were inevitably very different as reflected in the much lighter settlements of these estates. As mentioned in endnote viii in the main text, the choice of revenue collection system in the Central Provinces was thus clearly endogenous.

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[1] This was usually but not always the case. In the few instances where the distinction was less blatant estates were treated on par with 'khalsa' areas.

Our final robustness test is undertaken in the following manner: we redefine our pn_land_alt to pn_land_alt_zam where pn_land_alt_zam is interpreted to also include all cultivated land located within Central Provinces *Jagir* and *Zamindari* estates. Given the extensive powers of the Chiefs and weaker tenurial rights within these estates, we define all cultivated land within them as landlord. This adjustment affects our computation of pn_land_alt in Chhindwara, Bilaspur, Raipur, Bhalagat, Bandara and Chanda districts.

Table A1 comprises pn_land_alt and pn_land_alt_zam along with a sourcing of the additional information necessary to compute pn_land_alt_zam for these six districts. These adjustments to pn_land_alt do not affect our findings, as Table A2 comparing the regressions with pn_land_alt and pn_land_alt_zam demonstrates.

Table A1. Accounting for Cultivated Land within CP Jagir and Zamindari estates

District	pn_land_alt	pn_land_alt_zam	Sources
Hoshangabad	0.53	0.53	
Betul	0.47	0.47	
Chhindwara	0.38	0.31	Central Provinces District Gazetteer, Chhindwara, 1907, p. 173
Seoni	0.28	0.28	
Narsinghpur	0.48	0.48	
Sagar	0.39	0.39	
Damoh	0.45	0.45	
Jabalpur	0.44	0.44	
Mandla	0.098	0.098	
Bilaspur	0.31	0.21	Report on the Land Revenue Settlement of the Belaspore District, 1868, Appendix VI
Sambalpur	1	1	
Raipur	0.26	0.18	Central Provinces District Gazetteer, Raipur District, 1906, pp. 136-37.
Balaghat	0.68	0.55	Report on the Land Revenue Settlement of the Bhalagat District, 1895-98, pp. 24-25.
Bhandara	0.42	0.29	Report on the Land Revenue Settlement of the Bhandara District, 1867, pp. 124-26.
Nagpur	0.48	0.48	
Wardha	0.4	0.4	
Chanda	0.45	0.39	Report on the Land Revenue Settlement of Chanda District, 1870, p. 187 onwards.

Table A2. Our Results, when using pn_land_alt_zam and comparing to pn_land_alt

| Dependent variable	p_nland_alt	pn_land_alt_zam
	(1)	(2)
Agricultural investments		
Proportion of gross cropped area irrigated	0.0284	-0.0300
	(0.0414)	(0.0406)
Fertiliser use (kg/ha)	8.356**	8.672**
	(4.111)	(4.040)
Proportion of rice area under HYV	0.0822	0.0795
	(0.0548)	(0.0630)
Proportion of wheat area under HYV	0.0553	0.0579
	(0.0533)	(0.0639)
Proportion of other cereals area under HYV	0.0428	0.0478
	(0.0379)	(0.0375)
Agricultural productivity		
Log yield of 15 major crops	0.0886	0.0911
	(0.0773)	(0.0761)
Log rice yield	0.116	0.118
	(0.0890)	(0.0875)
Log wheat yield	0.176**	0.195**
	(0.0773)	(0.0767)
No. of districts	166	166
Year fixed effects	YES	YES
Geographic controls	YES	YES
Date of British annexation	YES	YES

SECTION A2. REPLICATING THE IV RESULTS OF BI
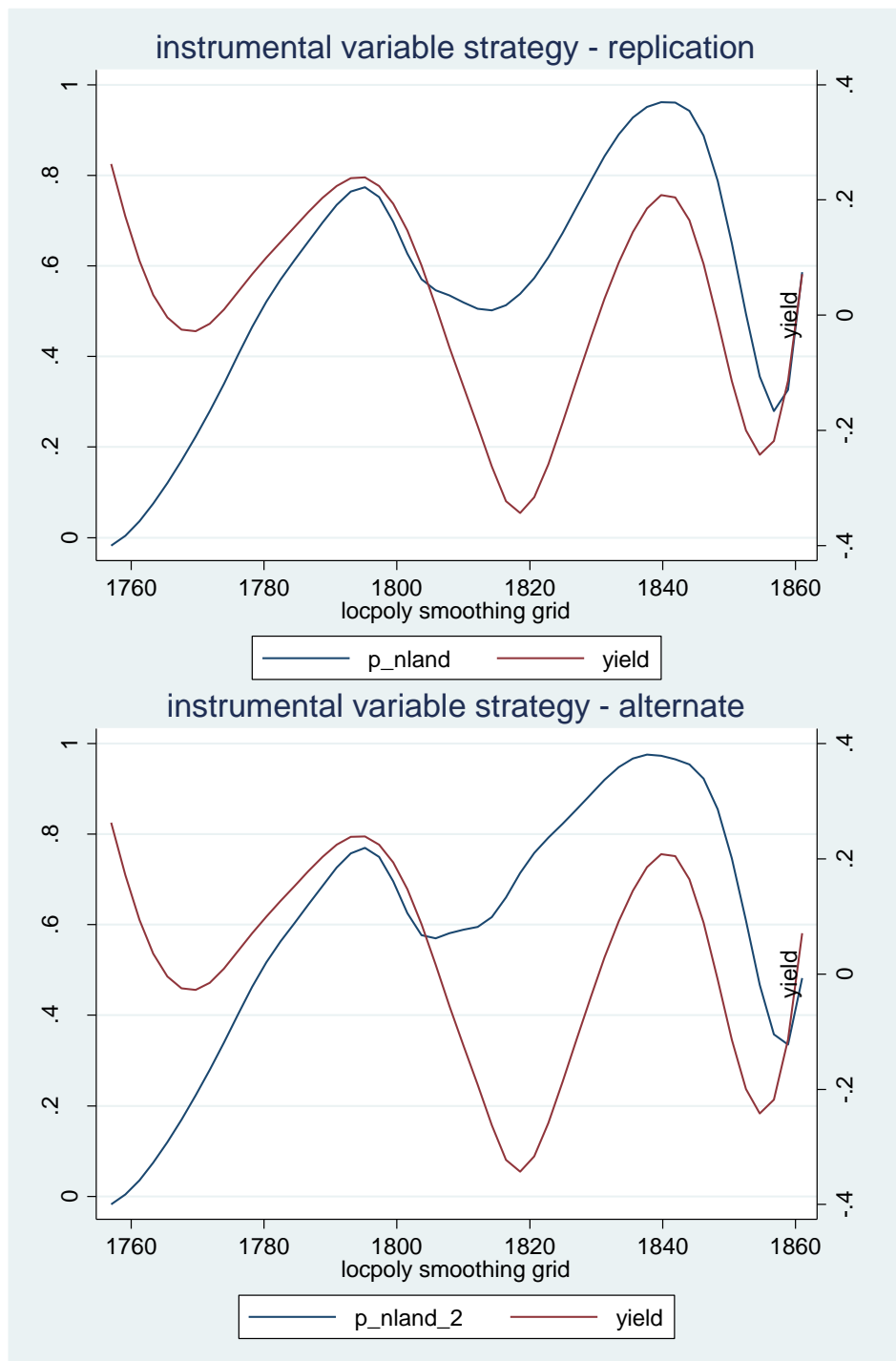
Figure A4: Instrumental variables strategy, as in Banerjee-Iyer and Alternate p_nland specification

Plotting the kernel regressions of our recoded non-landlord proportion and the mean log agricultural yield against the data of conquest and comparing the plot to that of a similar kernel regression of BI's non-landlord proportion and the mean log agricultural yield against date of conquest in Figure A4 (Panel A of this figure corresponds to Figure 4, p. 1206, of BI's paper), we find that there is a good fit in the shapes of the two lines in both our case and in BI's. Thus, in our case, a dummy with the date of conquest from 1813 to 1856 serves as a good instrument of non-landlord revenue control. We present the first stage regressions of the IV strategy as in BI and with our recoded non-landlord revenue control proportion variable in Panels A and B of Table A3. The table suggests that the coefficient on the instrument is positive and statistically significant for both BI and in our case, underscoring the validity of the dummy for British conquest, 1820-1856 in BI and 1813-1856 in our case, as an instrument for non-landlord proportion.

Table A3. First stage regressions for IV, Banerjee-Iyer and our results

A. First stage results for IV estimation of Equation 1

Dependent variable: Non-landlord proportion, as in Banerjee-Iyer

Coefficient on	(1)	(2)	(3)
Instrument (=1 if date of British revenue control is between 1820 and 1856)	0.330***	0.430***	0.419***
	(0.0160)	(0.092)	(0.087)
R-squared	0.439	0.437	0.63
No. of districts	166	166	166
Geographic controls	YES	YES	YES
Date of British land revenue control	YES	YES	YES
Date of British land revenue squared	NO	YES	NO
State fixed effects	NO	NO	YES

B. First stage results for alternate specification

Dependent variable: authors' non-landlord proportion of area in district

Coefficient on:	(4)	(5)	(6)
Instrument (=1 if date of British revenue control is between 1813 and 1856)	0.0725***	0.0694***	0.0738***
	(0.0122)	(0.0112)	(0.0134)
R-squared	0.498	0.495	0.61
No. of districts	166	166	166
Geographic controls	YES	YES	YES
Date of British land revenue control	YES	YES	YES
Date of British land revenue squared	NO	Y ES	NO
State fixed effects	NO	NO	YES

Notes: Standard errors in parentheses, corrected for district-level clustering. *Significant at 10 percent level; ** Significant at five percent level; *** Significant at one percent level. Each cell represents the coefficient from a regression of non-landlord specification (Banerjee-Iyer, in Panel A, and alternate specification in Panel B) on the date of British land revenue control (=1 if the date is between 1820 and 1856 in Banerjee-Iyer, and =1 if between 1813 and 1856 in the alternate specification). Geographic controls are altitude, latitude, mean annual rainfall, and dummies for soil type and coastal regions. This table differs from BI Table 4 Panel B in that here we report the actual first stage regressions (from STATA ivreg) for the three periodisations used – for irrigation growth 1956-1982; for % area under HYV 1965 – 1987; and 1956 – 1987 for log yields.

Table A4. Neighbouring districts comparison (Districts in North-Western Provinces and Oudh)

	BI p_nland	Landlord (L) or non-landlord (NL) as in BI	Mis-classificaton?	Cluster	Province
Faizabad	0.174951	L		Uttar Pradesh-East (UPE)	Oudh
Gonda	0.200038	L		UPE	Oudh
Partabgarh	0.159703	L		UPE	Oudh
Sultanpur	0.344224	L		UPE	Oudh
Allahabad	0.337912	NL		UPE	North-West Provinces (NWP)
Azamgarh	1	NL		UPE	NWP
Basti	0.688866	NL		UPE	NWP
Gorakhpur	0.530357	NL		UPE	NWP
Jaunpur	0.232432	NL	M	UPE	NWP
Hardoi	0.380418	L		Uttar Pradesh, West (UPW)	Oudh
Kheri	0.040446	L		UPW	Oudh
Rai-Bareli	0.128456	L		UPW	NWP
Unao	0.306323	L		UPW	Oudh
Farukhabad	1	NL		UPW	NWP
Fatihpur	0.275058	NL	M	UPW	NWP
Pilibhit	0.024731	NL	M	UPW	NWP
Shahjahanpur	0.284688	NL	M	UPW	NWP
Kanpur Nagar	0.322889	NL	M	UPW	NWP

The Table covers districts in North-Western Provinces and Oudh used in the neighbouring districts robustness test in Banerjee and Iyer, Table 4. See BI Online Appendix, Table 5, for a list of the neighbouring districts used in their analysis, along with the geographical cluster and their landlord/non-landlord classification.

BI state in their paper that that they use the cut-off value of pn_land=0.4 and above to classify districts as non-landlord, except if the district is in Oudh province, in which case it is classified as landlord, regardless of the value of p_nland (see footnote 21 of their paper, and page 1202). Using the BI cut-off, the number of inconsistent landlord/non-landlord classifications among these 18 districts would be five (marked by the letter M). In the case of Uttar Pradesh West, only one district remains as non-landlord, while eight are landlord, rendering the comparision between landlord and non-landlord districts in the same geographical cluster meaningless.

Table A5. Regression results for alternate classification of districts

	(1) irr_g	(2) pfert	(3) phrce	(4) phwht	(5) phcer	(6) lyld	(7) lyrice	(8) lywht
Zamindari	-0.0500	-8.097	-0.0673	0.0318	0.0472	-0.165	-0.502*	0.268
	(0.133)	(15.02)	(0.215)	(0.261)	(0.132)	(0.272)	(0.296)	(0.209)
Raiyatwari	-0.172***	-2.428	0.0327	0.0968	0.151***	-0.164	-0.0796	-0.0169
	(0.0566)	(5.907)	(0.0624)	(0.0868)	(0.0516)	(0.122)	(0.105)	(0.161)
Mahalwari	0.160***	12.94**	0.0994	0.000215	-0.0505	0.227**	0.104	0.303***
	(0.0564)	(5.710)	(0.0770)	(0.0638)	(0.0429)	(0.0961)	(0.134)	(0.0766)
Malguzari	-0.320***	-22.54**	-0.0238	-0.104	0.0378	-0.534***	-0.472**	-0.306
	(0.111)	(8.785)	(0.0861)	(0.159)	(0.0725)	(0.198)	(0.191)	(0.316)
Statistics								
N	4460	5293	3708	3541	3611	5311	5293	4484
r2	0.765	0.671	0.679	0.846	0.612	0.459	0.405	0.539
N_clust	166	166	166	166	166	166	166	158
yfe	Y	Y	Y	Y	Y	Y	Y	Y
geog	Y	Y	Y	Y	Y	Y	Y	Y
brit	Y	Y	Y	Y	Y	Y	Y	Y

Standard errors in parentheses
="* p<0.1 ** p<0.05 *** p<0.01"

This table reports the results of estimating the following equation reflecting an alternate four-way classification of districts:

$$(A1) \quad y_{it} = \alpha_{zam} zam + \alpha_{mah} mah + \alpha_{mal} mal + \alpha_{rai} rai + \gamma_j X_{i,t} + \delta_t + \varepsilon_{i,t}$$

Where:

y_{itj} is outcome i of interest in district j and year t.

$\alpha_{zam, rai, mah \& mal}$ are coefficients on variables which are 0/1 dummies for districts (*zam, mah, mal, rai*) that are predominantly *zamindari, raiyatwari, mahalwari or malguzari* multiplied by p_nland_alt (*Taluqdari* classified with *Zamindari*). **X** is the set of (geographic, year and time since annexation) controls as in all the BI specifications), and δ_t are year fixed effects. If a settlement system had consistent adverse effects, we would expect smaller intercepts for this type. We also tested a version of equation (A1) with intercepts for the different land revenue types (i.e. 0/1 dummies for zam, rai, mah, & mal only), and with a five way classification – subdividing the landlord districts into permanent settlement (zamindari) and taluqdari with substantively equivalent results which are available from the authors.

Table A6. Agriculture Investment and Productivity, Summary Statistics, by district groupings

	All British Districts			Central Provinces			Bihar & West Bengal			Punjab & Haryana			Remaining British Districts		
	N	mean	sd	N	mean	sd	N	mean	sd	N	mean	sd	N	mean	sd
Proportion of gross cropped area irrigated	5357	0.29	0.23	704	0.12	0.15	992	0.24	0.20	352	0.58	0.26	3309	0.30	0.22
Fertilister use (kg/ha)	5357	23.13	33.92	704	7.32	10.04	992	17.14	26.18	352	46.85	53.84	3309	25.77	34.61
Proportion of rice area under HYV	5375	0.21	0.38	704	0.16	0.23	992	0.15	0.21	352	0.52	0.83	3327	0.21	0.35
Proportion of wheat area under HYV t	5375	0.41	0.93	704	0.31	0.41	992	0.48	0.44	352	0.54	0.45	3327	0.40	1.13
Proportion of other cereals area under HYV	5219	0.19	1.07	704	0.10	0.17	932	0.25	0.28	352	0.20	0.36	3231	0.19	1.34
Log of yield of 15 crops	5375	-0.02	0.46	704	-0.38	0.32	992	0.00	0.30	352	0.39	0.45	3327	0.01	0.48
Log of rice yields	5357	-0.03	0.52	704	-0.30	0.44	992	-0.06	0.37	352	0.52	0.45	3309	-0.02	0.54
Log of wheat yields	4645	-0.09	0.65	704	-0.50	0.57	987	-0.03	0.54	352	0.59	0.42	2602	-0.09	0.64
Number of Districts (1991) (modal)		168			22			31			11			104	

Table A7. Results when dropping group of States in turn

	All districts included	Bengal & Bihar	Punjab & Haryana
Panel A: depvar=p_nland	(1)	(2)	(3)
Proportion of gross cropped area irrigated	0.0654*	0.0656*	0.0453
	(1.91)	(1.86)	(1.33)
Fertiliser use (kg/ha)	10.71***	10.99***	8.620***
	(3.20)	(3.23)	(2.63)
Proportion of rice area under HYV	0.0789*	0.0938**	0.0144
	(1.81)	(2.19)	(0.36)
Proportion of wheat area under HYV	0.0917**	0.119***	0.0744
	(2.00)	(2.66)	(1.56)
Proportion of other cereals area under HYV	0.0572*	0.0841***	0.0285
	(1.85)	(3.45)	(0.91)
Log yield of 15 major crops	0.157**	0.152**	0.132*
	(2.21)	(2.05)	(1.77)
Log rice yield	0.171**	0.195**	0.0786
	(2.11)	(2.40)	(1.02)
Log wheat yield	0.229***	0.228***	0.187***
	(3.39)	(3.27)	(2.67)
Panel B: depvar = p_nland_alt			
	(1a)	(2a)	(3a)
Proportion of gross cropped area irrigated	0.0284	0.0252	0.00313
	(0.69)	(0.58)	(0.07)
Fertiliser use (kg/ha)	8.356**	8.811**	5.802
	(2.03)	(2.07)	(1.41)
Proportion of rice area under HYV	0.0822	0.113**	0.00999
	(1.50)	(2.10)	(0.20)
Proportion of wheat area under HYV	0.0553	0.0961*	0.0316
	(1.04)	(1.76)	(0.57)
Proportion of other cereals area under HYV	0.0428	0.0970***	0.00811
	(1.13)	(3.38)	(0.21)
Log yield of 15 major crops	0.0886	0.0737	0.0534
	(1.15)	(0.90)	(0.65)
Log rice yield	0.116	0.148	0.00511
	(1.30)	(1.65)	(0.06)
Log wheat yield	0.176**	0.173**	0.116
	(2.27)	(2.07)	(1.42)
Standard controls	Y	Y	Y

Note: results dropping the Central Provinces are in the main text Table 3 column 3.

Data Sources used by BI

Table A8: data sources and construction of variables

BI Appendix	*Comments*
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:	This source in no longer working. The data are cu (03/05/2012) available at: http://ipl.econ.duke.edu/dthomas/dev_data/datafile _climate.htm We can provide code to read the dat STATA.
District level data on 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: :	This reference is correct in so far as it goes. Caref needed to the notes to tables to correctly extract t the Vanneman data set.
Districts and maps of modern India: http://www.mapsofindia.com:	We cannot find any of the maps in BI from this sou
Village infrastructure variables: State statistical abstracts of 1981:	More detailed referencing desirable.
Land-holdings by size category: Agricultural census of 1990-91:	More detailed referencing desirable.
Data on poverty and inequality (1972, 1987): based on National Sample Surveys:	This source is inexactly specified. It seems that th use secondary analyses of the NSS HES surveys.
Data on state development expenditure: Database on Poverty and Growth in India compiled by Berk Ozler, Gaurav Datt and Martin Ravallion (World Bank):	This source does not seem to be presently availa (http://econ.worldbank.org/WBSITE/EXTERNAL/E RESEARCH/0,,contentMDK:20699301~pagePK:6 PK:64214943~theSitePK:469382,00.html) but car from the authors.
Data on state land reforms: Besley and Burgess (2000):	this source is available at: http://sticerd.lse.ac.uk/eopp/_new/data/indian_dat
Historical data	
Districts and maps of British India: Baden-Powell (1892):	The map we find in BP 1892 is reproduced as Fig
Non-landlord proportion:	
For Uttar Pradesh, Madhya Pradesh and Panjab: computed from district-level Land Settlement Reports as the proportion of villages, estates or land area not under the revenue liability of landlords.The Settlement Reports were compiled by British administrators in the 1870s and 1880s.	Exact sources and page number are not provided.
For Madras Presidency: non-landlord proportion obtained from Baden-Powell (1892):	We cannot verify this source. The figures given by Madras (volume 3 p.24, following the report of Dr not correspond to the figures given in BI. The figu BI are very close to those found in the Report of th Irrigation Commission 1901, Appendix, p.374 (Ma Presidency).
For Bombay Presidency, Bengal Presidency, Orissa, Berar	We have not attempted to verify these sources. Id

and districts for which we do not have district-level settlement reports: Non-landlord measure is assigned as zero or one based on historical accounts of the dominant land tenure system in the district. Sources of information include Baden-Powell (1892), Gupta (1940), Kumar (1982), Misra (1942), Mukherjee (1962) and Patel (1957):	exact sources for each figure would be given as ir our JDS paper – ie. with the full source including p
Land revenue inequality 1885: Digital South Asia Library (http://dsal.uchicago.edu):	It is not clear what this source refers to, as there a resources available through this page.
Land revenue inequality 1948 for districts of Uttar Pradesh: Report of the United Provinces Zamindari Abolition Committee, 11 (Zamindari Abolition Committee, 1948) pp. 12-17.	This source occurs on pages 224-25 of Stokes 19

Additional References:

Besley, T. and Burgess, R. (2000). Land Reform, Poverty Reduction and Growth: Evidence from India, *The Quarterly Journal of Economics*, 117(4): 389-430.

Gupta, R.M.N., 1940. *Land system of Bengal.*, Calcutta: University of Calcutta.

Kumar, D. ed., 1982. *The Cambridge economic history of India, Vol. 2:c. 1757-c. 1970*, Cambridge: Cambridge University Press.

Misra, B.R., 1942. *Land revenue policy in the united provinces under British rule*, Benares: Nand Kishore & Brothers.

Patel, G.G., 1957. *The land problem of re-organized Bombay State*, Bombay: Tripath Pvt.

Mukherjee, N., 1962. *The Ryotwari System in Madras 1792-1827*, Calcutta: K.L. Mukhopadhyay.

(Allahabad) Zamindari Abolition Committee, 1948. *United Provinces Zamindari Abolition Committee: Volume 1*, Allahabad: M.G. Shomr, Printing and Staionary, U.P., India.

Stokes, E., 1978. The Structure of Landholding in Uttar Pradesh 1860-1948. In *Dynamism and Enervation in North Indian Agriculture: the Historical Dimension*. Cambridge: Cambridge University Press, pp. 228–242.

END-NOTES:

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[i] The paper received the Inaugural Michael Wallerstein Award from the Political Economy Section of the American Political Science Association. There are currently more than 500 Google Scholar cites for the several versions of the paper. Web of Knowledge reports 93 non-self citations in 57 journals, many highly rated in economics, political science and other disciplines.

[ii] A relevant section is quoted in the Online Appendix page 3 (Extract from Baden-Powell, 1894). We return to Baden-Powell's interpretation below.

[iii] Apart from its contributions to India's economic history, the present paper undertakes what Hamermesh (2007) would classify as a (partial) scientific replication of BI's (2005) study. Pure replication or 'checking' (Collins 1991) may be useful for detecting errors in data or in computer code. Scientific replication requires effort to develop contextual understanding, and attention to potential confounders and rival explanations.

[iv] BI use the term 'landlord system' as synonymous with the Permanent (*zamindari*) settlement apart from a footnote (fn.3 p.1193; see also fn. 10 p.1197; see also Robb, 1988, 1997).

[v] On the nature of the Central Provinces (CP) settlement, BI, in footnote 9 (p.1196), quote B. H. Baden-Powell (BP, 1892): 'In the Central Provinces we find an almost wholly artificial tenure, created by our revenue-system and by the policy of the Government of the day (volume 2 p.455)'. Later in the same paragraph, BP writes: 'It is however generally recognised that it was a mistake to find proprietors at all; not only have portions of the province been left purely *raiyatwari*, but in all cases the proprietary rights of the *malguzar* has been much limited (BP: p.456)'.

[vi] The World Bank data set could be downloaded at the date of writing from the source given in our Online Appendix. It contains some errors and misclassifications which are not corrected in the BI data set or the one used here to maintain maximum comparability with BI. The sources for much of the rest of the BI data set are given in their web appendix, Table 3. .

[vii] The Bengal Rent Act of 1859, culminating in the Bengal Tenancy Act of 1885, and subsequent revisions attempted to control landlord-tenant relations in Bengal, particularly some protection from eviction (see Robb, 1977: 36-75; Robb, 1988)..

[viii] Notice that the CP also included very large feudal or semi-feudal estates that often were remnants of former Gond and other Kingdoms and typically were located in forest and/or marginal lands in what Fuller (1922:70) describes as the 'wilder portions of the province': for revenue purposes these areas, described as *Zamindari* estates in CP district revenue settlement reports, were treated separately. This illustrates the endogenous placement of land revenue systems in CP districts with low productivity and remoteness correlating with *Zamindari* status. Our Appendix Section A1 describes these estates in more detail and in a robustness test explained below we check whether our main results are sensitive to their presence.

[ix] Referring to Jabalpur, Narsinghpur and Hoshangabad districts.

[x] See further Fuller, 1922:p 47.

[xi] 'The *malik makbuza* paid revenue to the government but no rent to the malguzar: The right of absolute occupancy was conferred at the time of the first settlement (1860s) to selected tenants and could not be acquired later. This right was hereditary, transferable and ensured fixity of rent for the term of the settlement. The occupancy tenant was entitled to cultivate his plot at a rent to be fixed by a revenue officer and not the landlord' (Raghavan 1985, p.171).

[xii] This data-set is a STATA data file named *yld_sett_aug03.dta,* which is available on the website of the *American Economic Review*, with the appropriate README file. Some errors in this data set have been retained to maintain as much consistency with BI as possible.

[xiii] BI also present plots of 10 landlord and non-landlord districts in Tamil Nadu from the colonial period onwards. However, we are unable to replicate this figure, as the original data are not provided by BI in the online AER data repository, no specific references are given for them by BI, and we have not found them readily available from the archives.

[xiv] We can nearly exactly replicate all BI results from the data provided by BI and our STATA code; these results are available from the authors.

[xv] Our do files are written using different code to BI, but benefitting from a reading of their do files. This is done as part of good replication practice to force checking of the way the code represents the model reported in the text.

[xvi] BI classify the district as 'landlord' if it was under a landlord-based system and only partly converted to a different system or if it was in Oudh, which they argue had a higher proportion of landlords, due to a reversal of British colonial policy after 1856. See page 1202 and the web appendix, Table 2 of their paper for further details

[xvii] It should be noted that when we run the BI do file for col. (2) of Table 3 with their data-set, we obtain results for 107 districts, and not 109 districts as reported in their text.

[xviii] We have explored in greater detail which type of land revenue system (*mahalwarii*, *raiyatwari*, *zamindari* and *malguzari*) mattered for agricultural development in post-independent India, and show that there is considerable

heterogeneity in the impact of individual land revenue systems on agricultural performance, which is masked by the dichotomous landlord-non-landlord classification used by BI. See Table A5 in Online Appendix.

[xix] See Appendix Table A2 in BI, available on the website of the *American Economic Review*.

[xx] See also footnote 21 in BI, p.1202.

[xxi] BI argue that this dummy variable is a valid instrument as the areas that came under British land revenue control from 1823 onwards were predominantly non-landlord systems, under an explicit British policy from that year. In this year Thomas Munro became the Governor of Madras Presidency and actively argued for the establishment of a land revenue system which was imposed directly on individual cultivators (the *raiyatwari* system). According to BI, the proponents of the *raiyatwari* became dominant following the adoption of Holt MacKenzie's famous minute (dated 1 July 1819, passed into law in 1822). This policy was reversed in 1856 when the British annexed the region of Oudh and brought back landlords as collectors of revenue, as they felt that having landlords on their side would be politically advantageous (BI, p.1196). BI argue that the placement of non-landlord systems in districts that came under British rule from 1820 to 1856 was due to exogenous political developments and unrelated to any district-level characteristics. Therefore, according to BI, a dummy for the date of British conquest being between 1820 and 1856 is a valid instrument for the non-landlord revenue proportion measure.

[xxii] The only difference between our IV strategy and that of BI is that we use as an instrument a dummy variable which takes the value of one if the date of British revenue control is between 1813 and 1856, while BI's instrument takes the value one if a district came under British rule after 1820. However, historical records suggest that the *raiyatwari* system became the preferred system much before 1823, and closer to 1813. Indeed, the whole subject came to be looked at from a new point of view between 1807 and 1820, not only as a consequence of the inquiries made in the North-Western Provinces, but because of the general interest in the subject excited by the strong '*Raiyatwari*' minutes of Sir Thomas Munro in Madras, and his visit home and conferences with the Directors in 1807 (Baden-Powell 1892; 17)'. Thus, we use the earlier date to construct our instrument. Substantively this changes the value of the instrument for the districts that were conquered between 1813 and 1818 and which are predominantly in Bombay Presidency, Berar and the subsequent CP (of the 30 districts affected by this reclassification, 14 are in present-day Madhya Pradesh, and 10 in Maharashtra).

[xxiii] In the Online Appendix (Figure A4 and Table A3), we provide further justification of our instrumental variable, as well as present the first-stage regression results for BI and our specifications.

[xxiv] Here the term 'Zamindari' has an altogether different meaning – see Appendix Section A1 for more details.

[xxv] While outside the scope of this paper, an issue that needs further exploration is why the non-landlord settlement areas in Punjab, Haryana and parts of Western Uttar Pradesh responded favorably to the introduction of Green Revolution technology in the 1960s, but the non-landlord settlement areas of the CP (now most of Madhya Pradesh) failed to do so.