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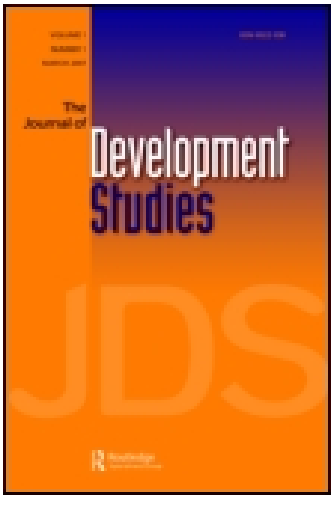

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On the Colonial Origins of Agricultural Development in India: A Re-examination of Banerjee and Iyer, 'History, Institutions and Economic Performance'

Vegard Iversen[a], Richard Palmer-Jones[b] & Kunal Sen[c]
[a] Jindal School of Government and Public Policy, India and IDPM, University of Manchester, UK
[b] School of International Development, University of East Anglia, Norwich, UK
[c] IDPM and BWPI, University of Manchester, UK
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On the Colonial Origins of Agricultural Development in India: A Re-examination of Banerjee and Iyer, 'History, Institutions and Economic Performance'

VEGARD IVERSEN*, RICHARD PALMER-JONES** & KUNAL SEN†
*Jindal School of Government and Public Policy, India and IDPM, University of Manchester, UK, **School of International Development, University of East Anglia, Norwich, UK, †IDPM and BWPI, University of Manchester, UK

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ABSTRACT *Banerjee and Iyer find that districts which the British assigned to landlord revenue systems systematically underperform districts with non-landlord based revenue systems in agricultural performance, after the onset of the Green Revolution in the mid-1960s. Based on colonial documents, archival research and the work of historians, we correct a mis-interpretation of the land revenue system in Central Provinces, which BI characterise as landlord based. The historical evidence suggests that this region should be attributed to a mixed landlord/non-landlord based revenue system. Using a more appropriate classification, we find no evidence that agricultural performance of Indian districts in the post-independence period was adversely affected by the landlord land revenue system.*

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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.[1] 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. Acemoglu, Johnson, & Robinson, 2001, 2002; Aghion, Burgess, Redding, & Zilibotti 2008; Lange, Mahoney, & Hau, 2006; La Porta, Lopez de Silanes, Schleifer, & Vishny, 1998, 1999; Mkandawire, 2010; Wilson, 2011) and lends support to new-institutionalist interpretations of history, economic development and policy (e.g. Bardhan, 2005; Chang, 2007; North, 1990).

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.

Correspondence Addresses: Vegard Iversen: vegard.iversen@manchester.ac.uk; Richard Palmer-Jones: r.palmer-jones@uea.ac.uk; Kunal Sen: Kunal.Sen@manchester.ac.uk
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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, p. 1190).

This article 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, pp.148–149).[2]

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.[3]

The rest of our article 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

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peasant that did not pay the landlord what they owed him' (BI, p. 1193). Thus, the landlord effectively had property rights in the land, and tenants had no security of tenure.[4]

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 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. 1195–1196). 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.[5] 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 to 1987, together with variables from original archival research.[6] In their main regressions relating to agricultural performance, they use agricultural data for only 166 of

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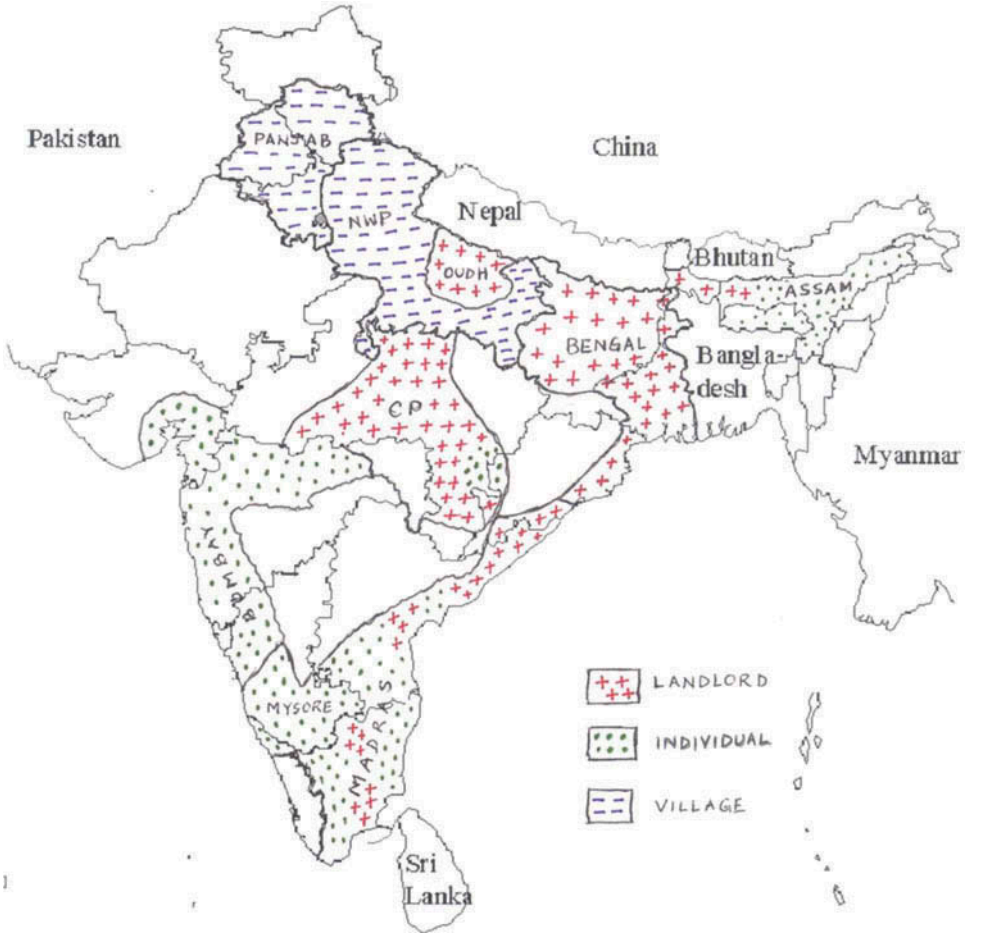

Figure 1. Location of land revenue systems in India (from Banerjee & Iyer, 2002).

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.

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 & 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).

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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; Reserve Bank of India, 1985).

Further, and in contrast to subsequent settlements, no cadastral survey was undertaken until the late nineteenth 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.[7] 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, 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' (Baden-Powell, 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 Baden-Powell's 1894 map (our Figure A2). The legend to Baden-Powell's two maps makes clear that the CP are classified under the village or mahalwari system. The same applies to Baden-Powell's three-volume text (1892), where the CP and the *malguzari* settlement feature in the volume covering the *mahalwari* (village) systems. Baden-Powell's (1894, pp. 148–149) summary, quoted in our Online Appendix, 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

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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 to 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 North-West Provinces 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,[8] 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[9]).[10] 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'.[11]

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*, was combined with an ample measure of tenant-right, by which a large majority of tenants received substantial protection. (our italics)

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 (see note to Table 1) in their sample drawn from the CP and Bastar and Raigarh 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.

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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 1868–1869, Paragraph 9 (pp. 5–6), Introduction (not in BI sample).
Hoshangabad	0	1	0.53	1865–1869, CPDG, Hoshangabad (Calcutta, 1908), p. 262.
Betul	0	1	0.47	RLRS, Baitool, 1866 (Bombay, 1867), pp. 156–157.
Chhindwara	0	1	0.38	1865–1869, CPDG, Chhindwara,1907, pp. 170–173.
Seoni	0	1	0.28	1865–1869, CPDG, Seoni (Allahabad 1907), pp. 141–143.
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, 1888–1891.
Jabalpur	0	1	0.44	1865-69, CPDG, Jubbulpore (Bombay, 1909), pp. 293–294.
Mandla	0	1	0.098	RLRS, Mundlah, 1868–1869 (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	1865–1869, CPDG, Raipur (Bombay, 1909), p. 238.
Balaghat	0.4	1	0.68	1890, RLRS, Balaghat, 1895–1898. 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. 124–126.
Nagpur	0	1	0.48	1865–1869, CPDG, Nagpur (Bombay, 1908), pp. 241–242.
Wardha	0	1	0.40	1865–1869, CPDG, Wardha (Allahabad, 1906), pp. 197 & 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. The 18 districts in the CP are subdivided by BI into 21 districts in 1991. Two of these 1991 districts (Bastar and Raigarh) were former princely states meaning that there are strictly only 19 districts (1991 classification) in the estimation data set from the former CP.

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 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, p. 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 (1865–1869).

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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 CP districts as in the same category as the *mahalwari* settlements (Baden-Powell, 1894, p. 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).

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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.[12] 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.[13] 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:

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

where Y_{it} is the outcome variable of interest (investment and productivity) in district i and year t, 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,[14] 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.

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.[15] These results are presented in col. (1) of Table 2.

The coefficient on the non-landlord proportion is positive and statistically significant at 10 per cent or lower for all the outcome variables. The results show that non-landlord districts have a 24 per cent higher proportion of irrigated area, a 43 per cent higher level of fertiliser use, a 27 per cent higher proportion of rice area and 27 per cent more wheat area under high-yielding seed varieties. Overall, agricultural yields are 16 per cent higher, rice yields 17 per cent higher and wheat yields are 23 per

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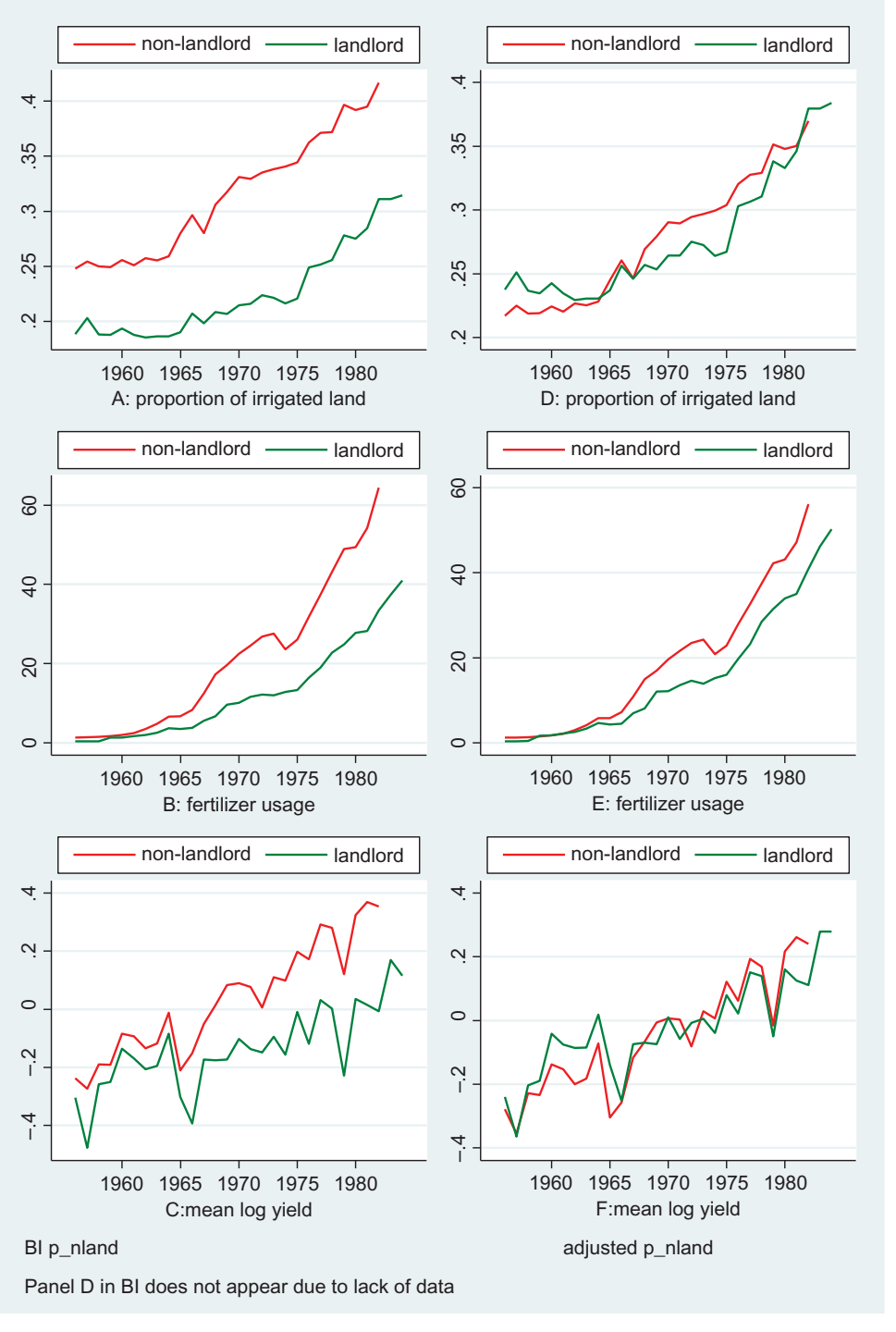

Figure 2. Agricultural investment and productivity: Banerjee–Iyer and alternate specification.
Note: Adjusted *p_nland* is equal to BI binary measure for *pn_land*, except for Central Province districts, where *p_nland*=1.

cent 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.[16] It is clear from

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 per cent level; **Significant at 5 per cent level; ***Significant at 1 per cent 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.

col. (2) of Table 2, that their results are relatively robust to this alternate specification of the land revenue variable.[17]

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 a ten percent level (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 (5 per cent), and the rest of the coefficients are statistically insignificant.

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

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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 per cent level; **Significant at 5 per cent level; ***Significant at 1 per cent 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.

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.[18]

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),[19] 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).[20]

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.[21] 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.

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

	BI IV Results	Our specification, IV results
Dependent variable	(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 per cent level; **Significant at 5 per cent level; ***Significant at 1 per cent 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 22 and 23.

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We now re-run the IV estimates using our recoded non-landlord proportion variable, *p_nland_alt*.[22] 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 rice and wheat yields (col. (2) of Table 4). The coefficient is positive but statistically insignificant for the IV estimate for the proportion of rice, wheat and 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.[23] We find a dramatic overturning 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 and Zamindari[24]) estates in some CP districts. These estates were mostly untouched or much less affected by the *Malguzari* settlement as explained in the Online Appendix Section A1. Because of their location in forested, hilly and marginal areas, 'the wilder sections of the province' (Fuller, 1922, p. 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.

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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)).[25]

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 article, 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 CP districts. 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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Notes

1. 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.
2. A relevant section is quoted in the Online Appendix p. 3 (extract from Baden-Powell, 1894). We return to Baden-Powell's interpretation below.
3. Apart from its contributions to India's economic history, the present article 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.
4. 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).
5. On the nature of the Central Provinces (CP) settlement, BI, in footnote 9 (p. 1196), quote B. H. Baden-Powell (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' (vol. 2, p. 455). Later in the same paragraph, Baden-Powell 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' (Baden-Powell, p. 456)'.
6. 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.
7. 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, pp. 36–75, 1988).
8. 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, p. 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 Online 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.
9. Referring to Jabalpur, Narsinghpur and Hoshangabad districts.
10. See further Fuller, 1922, p. 47.
11. '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).
12. 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.
13. 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.
14. 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.
15. Our do files are written using different code to BI, but benefiting 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.
16. 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
17. 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.
18. 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.
19. See Appendix Table A2 in BI, available on the website of the *American Economic Review.*
20. See also footnote 21 in BI, p. 1202.
21. 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.

22. 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, p. 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).
23. 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.
24. Here the term 'Zamindari' has an altogether different meaning – see Online Appendix Section A1 for more details.
25. While outside the scope of this article, 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.

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