



UNIVERSITAT DE
BARCELONA

Land revenue, inequality and development in colonial India (1880-1910)

Jordi Caum-Julio

ADVERTIMENT. La consulta d'aquesta tesi queda condicionada a l'acceptació de les següents condicions d'ús: La difusió d'aquesta tesi per mitjà del servei TDX (www.tdx.cat) i a través del Dipòsit Digital de la UB (diposit.ub.edu) ha estat autoritzada pels titulars dels drets de propietat intel·lectual únicament per a usos privats emmarcats en activitats d'investigació i docència. No s'autoritza la seva reproducció amb finalitats de lucre ni la seva difusió i posada a disposició des d'un lloc aliè al servei TDX ni al Dipòsit Digital de la UB. No s'autoritza la presentació del seu contingut en una finestra o marc aliè a TDX o al Dipòsit Digital de la UB (framing). Aquesta reserva de drets afecta tant al resum de presentació de la tesi com als seus continguts. En la utilització o cita de parts de la tesi és obligat indicar el nom de la persona autora.

ADVERTENCIA. La consulta de esta tesis queda condicionada a la aceptación de las siguientes condiciones de uso: La difusión de esta tesis por medio del servicio TDR (www.tdx.cat) y a través del Repositorio Digital de la UB (diposit.ub.edu) ha sido autorizada por los titulares de los derechos de propiedad intelectual únicamente para usos privados enmarcados en actividades de investigación y docencia. No se autoriza su reproducción con finalidades de lucro ni su difusión y puesta a disposición desde un sitio ajeno al servicio TDR o al Repositorio Digital de la UB. No se autoriza la presentación de su contenido en una ventana o marco ajeno a TDR o al Repositorio Digital de la UB (framing). Esta reserva de derechos afecta tanto al resumen de presentación de la tesis como a sus contenidos. En la utilización o cita de partes de la tesis es obligado indicar el nombre de la persona autora.

WARNING. On having consulted this thesis you're accepting the following use conditions: Spreading this thesis by the TDX (www.tdx.cat) service and by the UB Digital Repository (diposit.ub.edu) has been authorized by the titular of the intellectual property rights only for private uses placed in investigation and teaching activities. Reproduction with lucrative aims is not authorized nor its spreading and availability from a site foreign to the TDX service or to the UB Digital Repository. Introducing its content in a window or frame foreign to the TDX service or to the UB Digital Repository is not authorized (framing). Those rights affect to the presentation summary of the thesis as well as to its contents. In the using or citation of parts of the thesis it's obliged to indicate the name of the author.

UNIVERSITAT DE
BARCELONA



UNIVERSITAT DE
BARCELONA

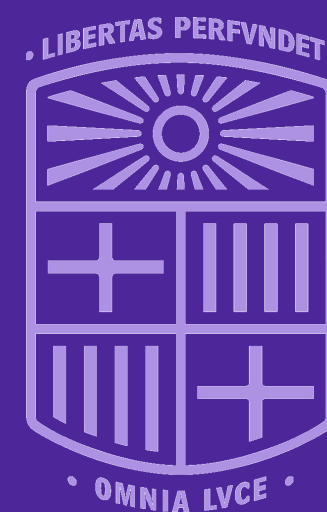
PhD in Economic History | Land revenue, inequality and development in colonial India (1880-1910) |

2023 | Jordi Caum-Julio

PhD in Economic History

**Land revenue, inequality and
development in colonial India
(1880-1910)**

Jordi Caum-Julio



UNIVERSITAT DE
BARCELONA

PhD in Economic History

Thesis title:

Land revenue, inequality and development in colonial
India (1880-1910)

PhD candidate:

Jordi Caum-Julio

Advisors:

Alfonso Herranz-Loncán

Gabriele Cappelli

Date:

February 2023



UNIVERSITAT_{DE}
BARCELONA

Acknowledgements

Durant aquests anys d'investigació, he comptat amb l'ajuda de moltes persones que han estat fonamentals en el desenvolupament d'aquesta investigació així com en la meva formació com a investigador. Primerament, voldria agrair la infinita dedicació i recolzament dels meus directors de tesis, Alfonso Herranz i Gabriele Cappelli. Els seus comentaris i aportacions han estat determinants per definir i completar aquesta investigació. Tant es així, que s'han convertit per mi en referents, tant a nivell personal com a nivell intel·lectual.

Les deliveracions i convivències amb tots els companys i companyes del Departament d'Història Econòmica, Institucions, Política i Economia Mundial han estat també un pilar clau en el meu desenvolupament i el de la meva investigació. Arriscant-me a no mencionar a tothom, voldria donar les gràcies a Marc Badia, Yolanda Blasco, José Peres, Anna Carreras, Bruno Esperante, Sergio Espuelas, Javier San Julián, Oriol Sabaté, Sergi Lozano, Enrique Jorge, Federico Tadei, Julio Martinez, Ramon Ramon, Pep Colomé i Miquel Gutiérrez per les reflexions i les estones compartides. També voldria agrair l'acollida, les reflexions i les estones passades a tots i totes les que han compartit amb mi espai com a estudiants del Programa de Doctorat del Departament, especialment al Pablo, Xabi, Guillem, Noelia, Guillermo, José, María José, Roser, Yuan, Songlin, Julio i Martín.

I would also like to give my gratitude to everyone at the Department of Economics from the University of Warwick. In particular, I am extremely grateful to Bish-

nupriya Gupta, James Fenske and Claudia Rei for their support and observations during my stay at the department. I am also indebted to Jean Lacroix and Maylis Avaro for introducing me to the process of paper selection while organizing the YSI-EHES Economic History Graduate Webinars and for their comments. Additionally, I would like to thank everyone attending the seminars, workshops and congresses where I have presented, this research has benefited greatly from their comments and suggestions.

También me gustaría agradecer al Ministerio de Universidades y a todos los contribuyentes españoles por la ayuda financiera recibida a través de la Ayuda para la formación de profesorado universitario (FPU). Igualmente, voldria reconèixer i agrair el suport financer rebut del grup de recerca "Economic History and Development (Industry, Business and Sustainability)" (2017SGR1466) i el Centre d'Estudis Jordi Nadal d'Història Econòmica.

Per últim, també volia donar les gràcies als papes, al Miquel i a la Carme, per la seva estima, per ser un exemple de constància en tots els àmbits de la vida, per despertar-me la curiositat pel coneixement i per fer d'aquesta tesi un projecte menys solitari. A la Beth, per la seva estima i per ajudar-me a seguir i a veure les coses amb perspectiva. I a la resta de la família i amics, especialment als Cacauets, per les hores de bromes, xerrades i jocs.

Contents

List of Tables	i
List of Figures	iii
List of Abbreviations	iv
1 Introduction	1
2 The global economy and land revenue systems: evolution of inequality across India's provinces (1880-1910)	9
2.1 Introduction	9
2.2 What explains the evolution of income inequality?	13
2.2.1 Economic factors	13
2.2.2 Institutional factors	15
2.3 Methodology and data	18
2.3.1 Dependent variable: W/LP ratio	18
2.3.2 Independent variables	21
2.3.3 Econometric analysis	26
2.4 Results	27
2.4.1 National agricultural income inequality	27
2.4.2 Provincial agricultural income inequality	31
2.5 Conclusions	41
Appendix	43

2.A	Wages series comparison	43
2.B	Further details on W/LP calculations	43
2.C	Checking for differences in using Banerjee & Iyer (2005) or <i>Agricultural Statistics of India</i> to measure land revenue systems	47
2.D	Estimating tenants' incomes for 1881 & 1901	48
2.E	Williamson's W/R estimates	49
2.F	Controlling for castes	49
2.G	Land revenue systems' effect through time	50
3	Land revenue systems and the levels of agricultural income inequality in colonial India	52
3.1	Introduction	52
3.2	Agricultural income inequality in colonial India	55
3.3	Data and Empirical Framework	57
3.3.1	Dependent variable: W/I ratio	57
3.3.2	Variable of interest: non-landlord proportion	66
3.3.3	OLS and controls	67
3.3.4	IV strategy: Districts conquered between 1820 and 1856	69
3.4	Results	73
3.4.1	Robustness checks	78
3.4.2	Mechanisms	83
3.5	Conclusions	90
	Appendix	92
3.A	1911 W/I ratio	92
3.B	1911 Tenants' income estimations	92
3.C	Adding irrigation rates	94
3.D	Alternative thresholds for outliers	94
3.E	More on spatial correlation	96
3.F	Robustness checks (OLS)	99

3.G	More on employment intensity	99
3.H	Using Donaldson's income estimates	99
4	Institutions, local agency and allegiance: healthcare provision in colonial India	104
4.1	Introduction	104
4.2	Hospitals, decentralization and land revenue systems	109
4.3	Data and Empirical Framework	115
4.3.1	Baseline regression (OLS)	115
4.3.2	IV: Districts conquered between 1820 and 1856	119
4.4	Results	125
4.4.1	Robustness checks	128
4.4.2	Mechanisms	134
4.5	Conclusions	145
	Appendix	147
4.A	Distribution of hospitals and dispensaries in 1901	147
4.B	Distribution of revenue sources and residuals (untransformed)	148
4.C	Infant mortality rates and per capita revenue for hospitals and dispensaries	148
4.D	Local funds as a viable estimate for revenue from district and local boards	150
4.E	District and local board funds over land revenue collected	153
4.F	OLS regressions with untransformed revenue sources	153
4.G	Dropping potential outliers	153
4.H	Alternative measures of spatial correlation	155
4.I	1857 revolt mutinied posts	160
4.J	Summary statistics	160
5	Concluding remarks	162

Bibliography

166

List of Tables

2.1	Potential economic and institutional factors' link to W/LP ratio changes	19
2.2	W/LP correlates including provincial fixed effects	40
2.C.1	Non-landlord proportions using Agricultural Statistics of India (1909) -ASI- or just Banerjee and Iyer -BI-.	47
2.F.1	Share of Brahmans over total provincial population	50
2.G.1	Land revenue systems' effect through time	51
3.3.1	Estimation of wages, tenants' incomes, share of wage-earners and non-landlord proportion for the Indian provinces in 1911	64
3.4.1	OLS Baseline estimations	74
3.4.2	Instrumental variable estimates using a dummy for districts conquered between 1820 and 1856	77
3.4.3	Link between the non-landlord proportion and wages and agricultural income	78
3.4.4	Robustness checks on the instrumental variable strategy	79
3.4.5	IV estimates with Conley standard errors	82
3.4.6	OLS estimates testing the rents mechanism	85
3.4.7	OLS estimates testing the subinfeudation mechanism	87
3.4.8	OLS estimates testing the indebtedness mechanism	88
3.A.1	IV estimates using 1911 W/I ratio	93
3.C.1	Adding irrigation rates in the IV estimates	94

3.D.1	IV estimates with different thresholds for outliers	95
3.E.1	Spatial Autoregressive Models (SAR) for IV estimates	96
3.E.2	Spatial Autoregressive Models (SAR) without instrument	97
3.E.3	IV estimates with arbitrary clustering structures	98
3.E.4	Instrumental variable estimates with standard errors clustered at the provincial level	100
3.F.1	Robustness checks on OLS estimates	101
3.G.1	OLS and IV estimates with Wage/income ratio using the <i>Agricultural Labour Enquiry</i> (ALE) or the <i>6th Round Report of the National Sample Survey (NSS)</i> to estimate employment intensity between provinces and gender	102
3.H.1	OLS and IV estimates with a wage/income ratio using Donaldson's agricultural income estimates	103
4.3.1	Conquest between 1820 and 1856 is unrelated to pre-colonial state capacity and the power of pre-colonial elites	124
4.4.1	OLS estimates for each revenue source	126
4.4.2	IV first and second stage estimates	127
4.4.3	General robustness checks	129
4.4.4	Conley standard errors with different cutoffs	132
4.4.5	IV with alternative transformations of the dependent variables and specifications	133
4.4.6	Testing coefficient robustness through unobservable selection (Oster, 2019)	135
4.4.7	OLS estimates showing how the share of village officials and the presence of permanent settlement relate to the non-landlord proportion and the land revenue collection	138
4.4.8	OLS estimates testing the land revenue collection mechanism	140
4.4.9	OLS estimates testing the alignment mechanism	143

4.C.1	Infant mortality rates and per capita revenue for hospitals and dispensaries	150
4.D.1	IV using District Board per capita medical expenditure in 1901 . . .	153
4.F.1	OLS regressions using untransformed revenue sources	154
4.G.1	IV dropping potential outliers with high values of district and local boards, native subscriptions and total revenue	156
4.H.1	Spatial Autorregressive Models (SAR)	158
4.H.2	IV estimates considering arbitrary clustering structures	159
4.J.1	Summary statistics	161

List of Figures

2.1	Map of colonial India including all British provinces used in this chapter	11
2.2	McAlpin's agricultural price index vs agricultural price index estimated using rice and wheat	22
2.3	National W/LP ratio	28
2.4	National W/LP ratio vs National agricultural prices	29
2.5	National W/LP ratio vs National land/labour ratio	29
2.6	National W/LP ratio vs National share of non-foodstuff acreage . .	30
2.7	Provincial W/LP ratios disaggregated by groups of provinces with similar evolution	32
2.8	Provincial W/LP ratios, agricultural prices, land/labour ratios and non-foodstuff acreage share	35
2.9	Provincial W/LP vs Non-landlord proportion	36
2.10	T/LP and W/LP in 1901 vs Non-landlord proportion	37
2.11	Evolution of agricultural prices by province	39
2.A.1	Enquiry W/LP ratios vs Prices and Wages in India W/LP ratios . .	44
2.B.1	Market sales vs compulsory sales for available provinces	45
2.E.1	National W/LP ratio, W/LP ratio for Punjab and Williamson's W/R ratio for Punjab	49
3.3.1	Landownership inequality and the non-landlord proportion	59
3.3.2	1911 and 1916 district wages	61

3.3.3	Dummy for districts conquered between 1820 and 1856 (IV) and non-landlord proportion (BI)	72
3.4.1	Non-landlord proportion (BI) and wage/income ratio maps	75
4.1.1	Government per capita health expenditure (2017-18) vs Public per capita expenditure on hospitals and dispensaries (1901)	108
4.2.1	Total revenue per capita of hospitals and dispensaries at the district level	113
4.3.1	Dummy for districts conquered between 1820 and 1856 (IV) and non-landlord proportion (BI)	121
4.A.1	Georeferenced hospitals and dispensaries in 1901	147
4.B.1	Histograms for untransformed revenue sources and residuals	149
4.D.1	District Board Medical Expenditure vs local funds for hospitals and dispensaries clustered at the district level	152
4.E.1	District and local boards revenue over land revenue collected	155
4.I.1	Georeferenced 1857 mutinied posts and non-landlord proportion at the district level	160

List of Abbreviations

2SLS Two Stage Least Squares.

CRFI Caste and Religious Fragmentation Index.

EIC East India Company.

IV Instrumental variable.

OLS Ordinary Least Squares.

SAR Spatial Autoregressive Models.

Chapter 1

Introduction

The determinants of economic development have been largely studied in social sciences. Researchers have mostly pointed at geographic (Roy, 2014; Sachs and Warner, 2001) and institutional factors (Acemoglu et al., 2001; Acemoglu et al., 2002; Banerjee and Iyer, 2005; Dell, 2010; North, 1991; Nunn, 2008) as the main determinants of development. The basic argument for institutions affecting development is that institutions that provide secure property rights can incentivise investment in physical and human capital, leading to greater levels of income per capita (North, 1991). Most famously, Acemoglu et al. (2001) argue that colonial institutions have been the main driver of differences in long-term development around the globe. Similarly, Dell (2010) presents evidence on the long-run impact of an Incan institution adopted by the Spanish on household consumption and stunted growth in children.

While the determinants of development have been extensively addressed,¹ less is known on the factors affecting how the benefits of development are distributed. Engerman and Sokoloff (2000) argue that institutions might explain the persistence of differences in inequality originated during the pre-colonial or colonial periods up to

¹The effect of institutions on development has been criticised for the compression of history in seminal works on institutions. This criticism arises from comparing two moments widely separated in time, which translates in unstable actors and categories of analysis (Austin, 2008, p. 998).

today. However, the link between institutions and inequality has not been empirically tested for colonial times except in some recent works (Galli and Rönnbäck, 2020). Moreover, when addressing the impact of colonial institutions on development, the role of local agency has been under-researched (Austin, 2008; Bayly, 2008). In fact, recent studies have emphasized the importance of local agency in the administration and development of most colonies (Chaudhary, 2009; Frankema, 2010; Grafe and Irigoien, 2012; Hong and Paik, 2018; Van Zanden, 2010). Nonetheless, the link between local agency, colonial institutions and development remains puzzling.

Colonial India is an interesting and plausible case study to present evidence on the influence of institutions on inequality as well as to dig into the link between local agency, colonial institutions and development. First, colonial India presents regional variation on probably the most important institution introduced by the British: the land revenue systems. It was an institution introduced by the British that determined who was liable for the payment of the land revenue² and who was granted landownership rights. Land revenue systems could be classified as landlord-based -where landownership was granted to a landlord or intermediary- or non-landlord based -where landownership intended to be granted to the cultivator-. Second, researchers have recently presented evidence on the influence of land revenue systems on post-colonial socio-economic outcomes (Banerjee and Iyer, 2005; Ratnoo, 2022). However, empirical evidence on the impact of this institution on inequality and development during the colonial period is missing in the literature. That is the case despite the extensive literature signalling colonialism as a major cause of inequality in colonial and post-colonial India (Alavi, 1975; Bagchi, 1982; Bhaduri, 1976). Finally, despite caste diversity and the presence of elites have been highlighted as factors explaining education provision in colonial India (Chaudhary, 2009; Chaudhary, 2010a), the influence of local agency on the provision of other public goods -e.g. healthcare- remains mostly unstudied.

²Land revenue was the main revenue source for governments in India during the pre-colonial and most of the colonial period.

In a nutshell, this dissertation provides evidence on the impact of colonial institutions on development and the distribution of its benefits during the colonial period. Evidence on the latter adds to the limited empirical confirmation on the link between colonial institutions and inequality during the colonial period while discussing significant within-country differences driven by variation on the colonial institutions. This regional comparison for colonial India differs from the usual cross-country approach on most studies on the influence of institutions on development -e.g. Acemoglu et al. (2001)-. Particularly, this allows to present empirical evidence on how colonial institutions explain inequality in colonial India, presenting the first regional comparative estimates of income inequality for the largest economic sector in the colony: agriculture. These estimates also allow to check if correlations between inequality and institutional or economic factors observed at the national level hold for sub-national comparisons. Additionally, studying how colonial institutions affected inequality during the colonial period provides vital insights to understand how the differences introduced by these institutions could have persisted.

As for the impact of colonial institutions on development during colonial times, this work presents evidence on local agency driving the impact of colonial institutions on the provision of public goods. Specifically, this research looks at how the agency of local landowners drove the effect of colonial land revenue systems on the (re)resources available for healthcare provision. This tackles the still understudied role of local agency in colonial contexts and the criticism of its neglect in most studies focused on colonial institutions (Austin, 2008).

This dissertation proceeds following a structure of three interconnected yet independent chapters. In Chapter 2, I estimate indicators of the evolution of agricultural income inequality and analyse their relationship with economic and institutional factors both at the national and provincial levels. Chapter 3 studies the relationship between land revenue systems and the levels of agricultural income inequality in colonial India. Finally, in Chapter 4 I explore the impact of land revenue systems

on the total revenue and revenue sources available to hospitals and dispensaries as well as the capacity of local landowners' agency to drive this effect.

Chapter 2, "*The global economy and land revenue: inequality across India's provinces (1880-1910)*" presents the first comparative regional estimates of agricultural income inequality for colonial India and uses them to study the link between both economic and institutional factors and the evolution of such inequality. Economic factors have been associated with agricultural income inequality in particular (Willebald, 2015), which is specially relevant in peripheral countries where agriculture is still the main source of income. However, as pointed out by Piketty (2014, p. 43), we could have all the economic resources needed to reduce inequality, and we would still require proper policies and institutions to effectively reduce it. Hence, in this chapter I treat both factors simultaneously and try to disentangle provincial and national patterns of correlation with the evolution of agricultural income inequality.

To study the influence of economic and institutional factors on the evolution of agricultural income inequality in colonial India, I estimate national and provincial wage/land price (W/LP) ratios. This estimate of agricultural income inequality represents the returns to labour relative to land (Jeffrey G. Williamson, 2002, p. 14) and has often been used in the literature to measure the evolution of income distribution in agrarian economies (Bohlin and Larsson, 2007; O'Rourke, Taylor, et al., 1996; Shanahan and J. K. Wilson, 2007). The provincial series also represents the first sub-national comparative estimates on agricultural income inequality for colonial India. W/LP ratios are then compared with various proxies for economic and institutional factors both at the national and provincial levels. In addition, I present a basic econometric analysis with provincial level data that allows to compare the influence of all factors simultaneously.

Economic factors such as agricultural prices (Arroyo-Abad, 2013; Bohlin and Larsson, 2007), factor endowments (O'Rourke, Taylor, et al., 1996; Roy, 2007; Jeffrey G. Williamson, 2002) and commercialization (Charlesworth, 1985; Washbrook, 1994)

have been correlated with the evolution of income inequality in the literature and I also analyse them in this chapter. As for the institutional factors, I study the connection between land revenue systems and shifts in agricultural income inequality.

Addressing the correlations between shifts in agricultural income inequality and these factors at the national and provincial levels shows salient differences in such correlations depending on the level of analysis. In particular, commercialization shows a correlation with changes in agricultural income inequality at the national level but presents no clear relation at the provincial level. Factor endowments present significant variability in their link with agricultural income inequality across provinces, although in most of them were negatively correlated with the W/LP ratio. At the national level, factor endowments do not correlate with the evolution agricultural income inequality. Similarly agricultural prices seem to correlate negatively with the W/LP ratio at the national level and for all provinces except Bengal. However, when accounting for the time trend, these results vanish. Most importantly, these results emphasise the importance of studying the evolution of inequality below the national level to test the robustness of the national results and avoid spurious relations. This is specially relevant for the literature studying the evolution of inequality and its determinants (Arroyo-Abad, 2013; Milanovic et al., 2011; O'Rourke, Taylor, et al., 1996), where national-level studies are the norm.

Finally, land revenue systems appear to correlate systematically with changes in agricultural income inequality, even after considering the aforementioned economic factors. This link between institutions and the evolution of income distribution contradicts the exclusively idiosyncratic dynamics of Kuznets waves explaining shifts in income inequality in pre-industrial and stagnant societies (Milanovic, 2016).

Chapter 3, "*Land revenue systems and the levels of agricultural income inequality in colonial India*" studies the impact of land revenue systems on agricultural income inequality across colonial India's districts. While the effect of institutions on development has been widely studied (Acemoglu et al., 2001) and despite the con-

nection of institutions and inequality is signalled in theoretical models (Acemoglu et al., 2005), the link between institutions and inequality has been comparatively understudied. In fact, there is very limited empirical evidence on the influence of institutions on inequality for the colonial period (Galli and Rönnbäck, 2020). Similarly, colonialism has been signalled as the main factor explaining countrywide large poverty and inequality levels in colonial India (Alavi, 1975; Bagchi, 1982), however, it is unclear how to explain regional differences -if they even existed- and which colonial institutions were actually driving this potential effect.

District level agricultural income inequality is estimated using the wage/income (W/I) ratio. This ratio presents the income of agricultural labour as a share of the average agricultural income. In other words, it estimates how much poor labourers earned relative to the average or per capita income. The W/I ratio is then used as the dependent variable in OLS regressions including the non-landlord proportion as the variable of interest. The non-landlord proportion represents the acreage share of land under non-landlord based land revenue systems. To present evidence on causality, an instrumental variable strategy is included using a dummy for districts conquered between 1820 and 1856. This instrument has its source of exogeneity on the shifts in the mainstream ideology of British officials in colonial India.

This chapter presents empirical evidence on the link between institutions and inequality, and presents important regional differences on inequality in colonial India while arguing that the introduction of different colonial land revenue systems can explain these differences to some extent. Particularly, the evidence presented shows that districts with a large non-landlord proportion presented more egalitarian distributions of income. Larger rents and a larger share of under-tenure rights in landlord areas could be mechanisms explaining this effect.

Ultimately, this chapter suggests that colonial institutions can not only explain differences in income and development but also on how its outcomes were distributed. Particularly for colonial India, this work draws attention to the substantial differ-

ences in agricultural income inequality across regions and explains them through colonial policy -land revenue systems-.

Chapter 4, "*Institutions, local agency and allegiance: healthcare provision in colonial India*" moves on from the link between land revenue systems and inequality, and explores an alternative impact of this institution on development and the revenue (re)sources of colonial healthcare services. This work adds to the previous research on institutions and development by introducing the role of local agency as the mechanism through which colonial institutions affected public goods provision -healthcare in particular-. In fact, despite recent studies have highlighted the role of local agency in the administration and development of most colonies (Chaudhary, 2009; Frankema, 2010; Grafe and Irigoien, 2012; Hong and Paik, 2018; Van Zanden, 2010) it has been understudied as a relevant factor channeling the effect of colonial institutions on development (Austin, 2008; Bayly, 2008). Similarly, this chapter presents evidence on how institutional settings explain the provision of public goods (Baten and Hippe, 2018; Chaudhary, 2010b; Chaudhary, Musacchio, et al., 2012; Cvrcek and Zajicek, 2019; Galor et al., 2009; Lindert, 2004) by focusing on an understudied public service -healthcare-.

To assess the impact of land revenue systems on the revenue sources and overall revenue available to hospitals in colonial India a new 1901 cross-section database. This presents data for almost 2000 georeferenced hospitals and dispensaries and includes data from the *Reports on the civil hospitals and dispensaries* on the revenue structures of each of these hospitals. An instrumental variable strategy is also used to avoid potential omitted variable biases and to present evidence on causality.

The evidence suggests that depending on the colonial land revenue system introduced, hospitals and dispensaries received more revenue in total and more revenue from public institutions -in non-landlord districts- or less total revenue but more revenue from private native individuals -in landlord districts-. The mechanisms driving these effects are connected to the agency of local landowners. In landlord

areas, landowners were more capable to influence the land revenue collected by public institutions and used private subscriptions and donations to hospitals to show their allegiance to the British. Showing their allegiance allowed landowners to protect their landownership rights, as rebellious activities during the 1857 revolt were more frequent in landlord areas, and land was confiscated to those who did not unconditionally surrender and show allegiance to the British after the revolt.

Overall, these results present the significant role played by local agency -e.g. the agency of local landowners- to explain development differences across regions. In other words, they show how colonial institutions can explain differences in the revenue structure and total revenue available to hospitals in colonial India.

Finally, Chapter 5 concludes outlining and connecting the results obtained in the previous chapters.

Chapter 2

The global economy and land revenue systems: evolution of inequality across India's provinces (1880-1910)

2.1 Introduction

What explains the evolution of income inequality? This question has been recurrent in recent literature (Arroyo-Abad, 2013; Milanovic, 2016; Milanovic et al., 2011; O'Rourke, Taylor, et al., 1996). Economic factors seem to have influenced agricultural income inequality in particular (Willebald, 2015), which is particularly relevant in peripheral countries where agriculture is still the main source of income. However, as pointed out by Piketty (2014, p. 43), we could have all the economic resources needed to reduce inequality, and we would still require proper policies and institutions to effectively reduce it. In fact, the relation between institutions and the evolution of income distribution has been explored in some studies (Bértola et al., 2010; Engerman and Sokoloff, 2000).

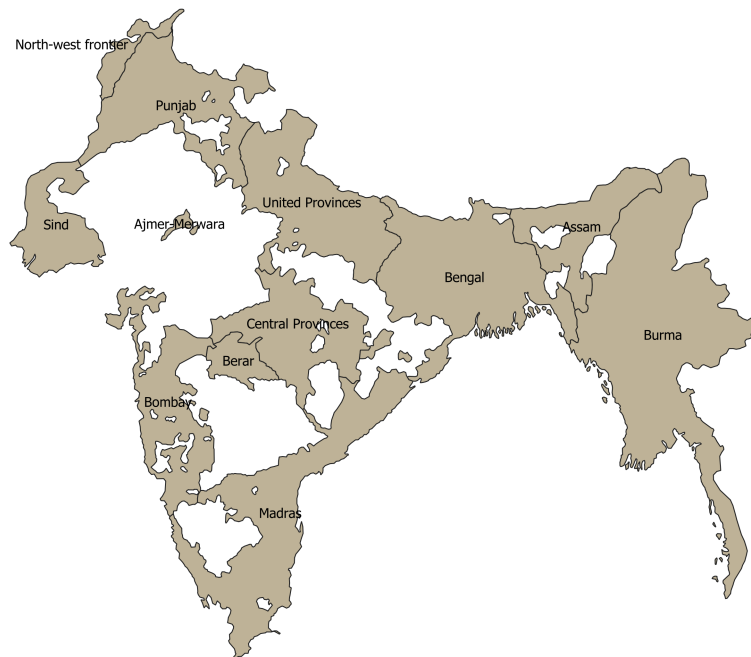
Particularly for colonial India,¹ agricultural income inequality has traditionally been considered to have increased throughout the whole colonial period due to increasing exploitation resulting from colonial institutions -the British state and certain land revenue systems- (Alavi, 1975; Bagchi, 1982; Bhaduri, 1973; Bhaduri, 1976). However, recent research has also reassessed the importance of economic factors (Roy, 2007, p. 91). Overall, colonial India was an active participant of the first globalization and the evolution of its agricultural income distribution could be influenced by global economic factors and local institutions.

Therefore, the question rises as to whether (and how) local institutions and global economic trends relate with changes in agricultural income inequality. For the first time, I analyse the evolution of agricultural income inequality and its potential explanatory variables in colonial India by producing brand-new provincial estimates. This avoids the introduction of spurious relations that could affect more aggregated analysis –e.g. national level analysis-. Such disaggregated analysis controls for specific provincial processes or characteristics and can be used as a robustness check for national level studies on the evolution of income inequality (Arroyo-Abad, 2013; Milanovic et al., 2011). Last but definitely not least, a provincial comparative study allows to introduce the role of some institutions -land revenue systems-, which cannot be considered in a national level analysis. Despite these advantages, there are only a few regional historical studies of income inequality (Shanahan and J. K. Wilson, 2007) and, to the best of my knowledge, there is no such study for agricultural income in colonial India. Hence, this work fills the lack of regional comparative studies on agricultural income inequality in colonial India as the literature has focused either on mostly qualitative studies (Habib, 1975; Patel, 1952), aggregate estimates (Roy, 2007), non-comparative regional analysis of agricultural income inequality

¹In this work, colonial India refers to most of the directly controlled British India. This includes Bengal (including Bihar, Orissa and Eastern Bengal), United Provinces (including Agra or the North-Western Province and Oudh), Bombay (including Sind), Madras, Punjab (including North-Western Frontier) and Central Provinces (excluding Berar). This represents 90% of the population in British directly controlled India and 70% of total Indian population according to the 1911 census. Princely states -or British indirectly controlled India- are excluded from this work as data is much more scarce for them.

(Bhaduri, 1973; Charlesworth, 1985; Kumar, 1965; Washbrook, 1994) or national and provincial top income studies (Alvaredo et al., 2017) that do not take into account agricultural incomes.

Figure 2.1: Map of colonial India including all British provinces used in this chapter



Sources and notes: Map of colonial India including all British provinces used in this chapter. Own elaboration based on the political division and provincial maps from the Imperial Gazetteer of India Atlas (1909) available in the Digital South Asia Library.

To measure agricultural income inequality, I estimate wage/land price ratios (W/LP) at the provincial and national levels. W/LP ratios represent the returns to labour relative to land. Using this series, I describe provincial differences and analyze the potential factors connected to the evolution of agricultural income inequality.

In this chapter I argue that agricultural prices correlate with the evolution of agricultural income inequality at the national and provincial levels from 1880 to 1909. In line with the literature relating commodity with factor prices (Arroyo-Abad, 2013; Bohlin and Larsson, 2007) in those provinces where agricultural prices increased, agricultural income inequality appears to have increased as well. I also find a positive relation between the national W/LP ratio and commercialization, although it

vanishes at the provincial level. Moreover, factor endowments are linked to changes in agricultural income inequality at the provincial level, although not as expected by O'Rourke, Taylor, et al. (1996). In fact, factor endowments correlate with changes in income inequality according to the effect of factor prices on their supply and the dynamics of Malthusian cycles. Despite these results, economic factors may not explain the whole story. Institutional factors such as exploitation from landowners or the introduction of tenancy acts -both related to land revenue systems- can help to explain changes in income distribution even after controlling for economic factors. Tenancy acts started being introduced in Bengal by 1885 and gave rights to tenants and protection against abusive rent increases by landlords. I argue that the link between land revenue systems and changes in agricultural income inequality is not driven by differences in the exploitation from landowners but by the introduction of tenancy acts. This opposes the concept of Kuznets waves which claims that inequality changes in societies with stagnant mean incomes only occur through malign idiosyncratic events (Milanovic, 2016).

The chapter is structured as follows. In Section 2.2 I present an extensive review of the literature analysing the evolution of income inequality. In Section 2.3, I introduce the methodology and data used to estimate the W/LP ratios and the indicators to explore the links between W/LP ratios and economic and institutional factors. In Section 2.4, I present the W/LP ratios at the national and provincial levels and test the factors that correlate with the evolution of agricultural income inequality. In Section 2.5, I discuss and draw my main conclusions.

2.2 What explains the evolution of income inequality?

2.2.1 Economic factors

Economic factors, and more specifically the evolution of factor endowments, are potentially the most important determinants of changes in income inequality, specially during the first globalization. In their seminal work, O'Rourke, Taylor, et al. (1996) conclude that during the first globalization, income inequality increased in land abundant regions -new world, where the land/labour ratio decreased- and decreased in labour abundant regions -Europe, where the land/labour ratio increased-. Arroyo-Abad (2013) also finds that Latin American countries experienced significant changes in their income distribution that were correlated with changes in factor endowments after independence.

Other authors have studied the relation between factor endowments and income inequality in preindustrial societies using a Malthusian or supply/demand framework (Hansen and Prescott, 2002; O'Rourke and Jeffrey G. Williamson, 2005). Jeffrey G. Williamson (2002, p. 77-79) found a negative correlation between land/labour ratios and W/R ratios in the periphery prior to World War II. He argued that a change in the W/R ratio could induce factor-supply responses. For instance, following a Malthusian cycle, an increase in the W/R ratio could lead to a drop in the land/labour ratio due to higher child survival or fertility rates. Alternatively, a decrease in the W/R ratio could lead to an increase in the land/labour ratio, since relatively larger rents -i.e. land prices- incentivise land expansion and relatively lower wages could force workers to emigrate. This can be interpreted as the effect of factor price changes on their supply.

Particularly for colonial India, factor endowments have recently been pointed out as an explanatory factor for the evolution of agricultural income inequality. Roy (2007) argues that the inability of the agricultural sector to expand its per capita income

and the transformation of India from a land-abundant to a land-scarce economy increased rural poverty in the subcontinent as wages stagnated.

The evolution of factor prices or income inequality has also been related to commodity prices. Different commodities use different productive factors -land or labour-intensively (Bohlin and Larsson, 2007). Therefore, countries or regions that experience larger price increases in commodities using land intensively, will probably experience larger increases in landowners' incomes, potentially leading to more unequal distributions of income. In her study of Latin American income inequality after independence, Arroyo-Abad (2013) finds that changes in terms of trade were related to the evolution of income inequality. When export prices -mostly prices of agricultural (land intensive) products- increased relative to import prices, income inequality tended to increase. At a more disaggregated level, price variations of agricultural products could lead to changes in cultivation for instance, from more land intensive to labour intensive agricultural products -e.g. cotton-, resulting in increases in wages and potential reductions in inequality (Brandt, 1989; McAlpin, 1975).

These changes in prices and the crops cultivated have been usually connected to commercialization. Washbrook (1994) states that benefits from the expansion of cash cropping in South India went mostly to a small group of large farmers. For Bombay, Charlesworth (1985, p. 292–300) also observes an increasingly larger social stratification with the expansion of commercialization, especially during the late 19th century, as it was a process pioneered by the elite. It was not until the turn of the century when the gains from increasing commercialization seem to have been distributed on a broader basis. This occurred since relative price increases of non-foodstuff compared to foodstuff allowed poorer peasants to switch to the former. However, commercialization has not always been presented as a factor affecting negatively income distribution. Roy (2007, p. 91) pointed out that increasing rural poverty is explained by factors from within the organization and production of the

agricultural sector and not by globalization or commercialization. Finally, Brandt (1989) argues that commercialization could reduce agricultural income inequality if the cash crops introduced were more labour intensive.

2.2.2 Institutional factors

Some authors have emphasised the role of political economy and institutional factors to explain changes in agricultural income inequality. Famously, Engerman and Sokoloff (2000) signal that institutions allowed former inequality to persist in America. Europeans introduced less egalitarian institutions in areas where cotton, sugar plantations and/or mining was more feasible. Similarly, Acemoglu et al. (2001) state that more or less extractive institutions introduced during colonial times can explain the evolution of income and wealth distribution.

The role of institutional factors explaining changes in agricultural income inequality in colonial India seems to be inconsistent with the Kuznets waves theory from Milanovic (2016). According to this theory, changes in inequality in preindustrial societies -i.e. societies with stagnant per capita income, such as colonial India²- are driven exclusively by "malign"/catastrophic idiosyncratic events such as plagues, famines and wars (Milanovic, 2016, p. 46-70). In other words, in these societies there is no room for institutions, laws, political pressure and other "benign" forces to affect *changes* in inequality.

Conversely, scholars focusing on the Indian subcontinent have pointed at institutions being linked to changes in agricultural income inequality. Bhaduri (1976) has pointed out that, as a consequence of fixing land revenue in Bengal, a system of under-tenures emerged. Such system worked as an insurance for landowners, who in case of losing their land, continued having a claim on its surplus through the under-tenures. Eventually, agricultural output could not absorb these increasing

²Colonial India's annual growth rate of agricultural output was 0.84 between 1891-1916 which combined with a 0.44 annual population growth rate for the same period translates into an almost stagnant agricultural per capita output (Roy, 2006, p. 117).

claims and peasants were forced to continuously reduce their net incomes to generate enough surplus to cover the growing number of claims on land. In another chapter, Bhaduri (1973) also observes how landowners exploited their peasants through property rights -i.e. the payment of rents- and usury -which eventually became a necessity for peasantry survival-.

This argument of landowner exploitation is mostly linked to provinces with landlord-based land revenue systems, as those were the provinces with more landless cultivators (Habib, 1975). The land revenue systems determined who was responsible for the payment of the land revenue and who owned the land. There were three different land revenue systems: zamindari, ryotwari and mahalwari. The zamindari system made a landlord -zamindar- the owner of the land. Zamindars usually leased their lands to tenants or paid labourers/servants to cultivate it. This system has been classified in the literature as landlord-based, since the owner of the land was usually not the cultivator. In contrast, the ryotwari system gave landownership to cultivators, eliminating all intermediaries between cultivators and the state -e.g. zamindars-. This system has been usually described as non-landlord based. Finally, in the mahalwari system landownership was given to a village body which could be more like a zamindari -landlord based- system or like a ryotwari -non-landlord based- system (Banerjee and Iyer, 2005). Therefore, increasing levels of exploitation by landowners in provinces with landlord-based systems should have translated into larger increases in agricultural income inequality during this period.

An alternative argument to that of landowner exploitation can be made based on the impact of tenancy acts (Chaudhry, 2016; Roy and Swamy, 2016; Swamy, 2011). From 1859 -with the Bengal Rent Act of that year- a slow process of tenants' protection and, in some cases, formalization of their rights on land started at the provincial level. Tenancy was much more abundant in provinces with landlord-based than in those with non-landlord based systems. Hence, tenancy acts gave protection and rights to a larger share of the population in provinces with landlord-based

systems. Those acts reduced the exploitation mechanisms available to landowners and could have reduced income inequality in landlord provinces more than anywhere else. The Bengal Tenancy Act of 1885 established a period of at least 15 years between rent increases and limited each of them to a maximum of 12.5%. It also provided occupancy rights to all tenants that held land in a village for 20 years or more -these rights were permanent and inheritable, although its saleability was left to custom; see Roy and Swamy (2016, p. 62–63)-. In addition, this act provided occupancy rights to tenants holding any land –not a specific plot- in a village, which makes it a watershed in the provision of occupancy rights. Before this act, it was usually specified that occupancy rights were provided to tenants after a period holding a particular plot of land, and landlords avoided the clause by switching tenants to different plots before the period required to acquire an occupancy right ended (Swamy, 2011, p. 145).

There was some variability across provinces in the time of enactment of tenancy acts. While in Bengal the first tenancy act effectively providing occupancy rights was passed in 1885, it was not until 1908 that an equivalent act was passed in Madras, a province with mostly non-landlord based systems –Madras Estates Land Act- (Roy and Swamy, 2016, p. 47). The content of those acts also changed from province to province as historical context and officialdom ideology changed: T. R. Metcalf (1962, p. 301–305) points out how after the 1857 Mutiny in Oudh,³ British officials reintroduced *taluqdars*⁴ as loyal allies of the British supremacy in the region. This view of landlords as political allies and the lack of evidence of pre-colonial formal occupancy rights resulted in a slower path towards tenant protection. Overall, this legislation affected mostly landlord provinces and limited the exploitation mechanisms available to landlords. This could consequently reduce agricultural income inequality in those provinces, especially from the Bengal Tenancy Act (1885) onwards.

³Oudh was a former princely state that became a region of the United Provinces

⁴Landlords in Oudh were called taluqdars.

Table 2.1 summarizes the different economic and institutional factors potentially affecting changes in the W/LP ratio and their expected signs.

2.3 Methodology and data

Following the arguments from the literature, I study the relation between agricultural income inequality and agricultural prices, factor endowments, commercialization and land revenue systems. To do so, I estimate different measures of those factors and compare their changes with the evolution of agricultural income inequality at the national level and for the following provinces: Bengal, Bombay, Central Provinces, Madras, Punjab and the United Provinces. This descriptive comparison is complemented with an exploratory panel analysis which, although cannot be used to claim causality, allows to measure the extent and sign of the correlations between the W/LP ratios and their potential explanatory variables.

2.3.1 Dependent variable: W/LP ratio

I use the wage/land price ratio (W/LP) to measure agricultural income inequality in colonial India. I calculate 3-year moving averages to correct for outliers coming from year-to-year fluctuations since I am interested in exploring medium-term changes in the span of 30 years, not short-term deviations. The W/LP ratio represents the returns to labour relative to land (Jeffrey G. Williamson, 2002, p. 14) and has often been used in the literature to measure the evolution of income distribution in agrarian economies (Bohlin and Larsson, 2007; O'Rourke, Taylor, et al., 1996; Shanahan and J. K. Wilson, 2007) as a proxy of the wage/rental ratio (W/R). I do not use rents to measure W/R ratios as they are not systematically available for all provinces. More recent literature (Arroyo-Abad, 2013; Willebald, 2011) estimates W/R ratios using land prices, the interest rate and the depreciation rate, following Jorgenson (1963). Despite this being a more accurate estimate of the W/R ratio (Jeffrey G Williamson, 2007, p. 204), I have no information on interest nor

Table 2.1: Potential economic and institutional factors' link to W/LP ratio changes

Factor	Measure	Expected sign
Commodity (agricultural) prices	Weighted average of wheat and rice prices	-
Factor endowments	Land/labour ratio	+ or -
Commercialization	Acreage share of non-foodstuff	+ or \emptyset or -
Landlord based systems	Non-landlord proportion	+ or -

Sources and notes: Economic and institutional factors potentially correlating to changes in the W/LP ratio, the measures used to account for them and their expected signs.

depreciation rates at the sub-national level.⁵

Using the W/LP ratio to estimate inequality has its limitations. First, wage-earners could also be landowners of small plots of land, meaning that some individuals received their income both as rent (or through the cultivation of their own land) and as seasonal wage revenue. Income differences among these owners of multiple factors of production and between them and landless wage-earners are hardly being captured by the W/LP ratio, which only captures the differences in incomes between the poorest cultivators -those landless and earning their income exclusively from wages- and those landowners getting all their income from land rents. Second, the W/LP ratio does not capture differences in income distribution coming from differences in the distribution of factors of production -e.g. land distribution-. However, since the distribution of land tends to be sticky, this should not substantially affect the variations of income inequality over time.

I obtain data on wages to estimate my W/LP ratios from *Prices and Wages in India*, which were published yearly from 1873 to 1922. Wage data are also available at the *Enquiry into the Rise of Prices in India (1914)*. *Prices and Wages in India* reported wages mostly based on what was the tradition of the village according to village officials, while the *Enquiry* reported data on casual labour wages, which were more market-based (Roy, 2007, p. 79–80). I use *Prices and Wages in India* because it covers all my period of study (1880 to 1910) -the *Enquiry* started reporting wages from 1890 onwards-. Moreover, during the late 19th century the wage-setting process was still substantially based on tradition, at least for the 1880s.⁶ I do not combine both sources, as done by Roy (2007) since he points out that his results⁷ are not affected by the use of one or another source during the 1891-1912 period. Although

⁵Estimating W/R ratios without different provincial interest and depreciation rates does affect the levels of the ratios but not their evolution –W/R ratio would evolve just as W/LP- as assuming constant interest and depreciation rates for all provinces makes the evolution of the ratio depend on land prices and wages exclusively.

⁶There is evidence that custom-based infrequently negotiated wages were gradually being replaced by market-based wages, especially from the 1920s onwards (Roy, 2007).

⁷His results show the evolution of poverty in India since the late 19th century. More precisely, he estimates a wage/income ratio for colonial India using both, *Prices and Wages in India* and the *Enquiry*.

using one or another source does not seem decisive, I present a comparison of W/LP ratios using *Prices and Wages in India* and the *Enquiry into the Rise of Prices in India (1914)* from 1890 to 1909 in Figure 2.A.1 of the Appendix where no major differences in the main trends can be observed.

Land prices for the W/LP ratios are obtained from the *Reports on the (land) revenue administration*.⁸ These reports were delivered at the provincial level, and provide detailed information on the land revenue requested and collected, irrigation, rainfall and lands sold and mortgaged among other useful information.

I estimate the W/LP ratio at the national level to compare it with the available estimates of agricultural income inequality in colonial India, check its robustness and provide evidence on the factors explaining agricultural income inequality at the national level. To estimate the W/LP ratio at the national level, I use the *Statistical abstracts relating to British India* -which presents data on rural population from the 1911 census- to weight provincial W/LP ratios. Section 2.B in the appendix presents further details on how the W/LP ratios are estimated.

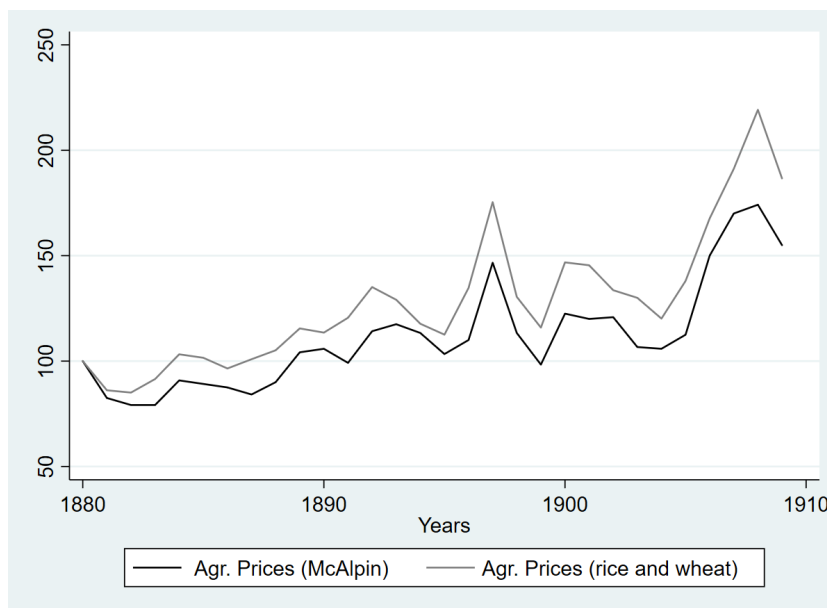
2.3.2 Independent variables

Economic variables

Regarding commodity prices, I consider agricultural prices. The reason for this is that agricultural prices determined the net income of landowners (Bohlin and Larsson, 2007, p. 58). To measure agricultural prices, I calculate the weighted averages of rice and wheat retail prices using the 1891-92 and 1909-10 acreage of each food grain in each province as weights. I use rice and wheat prices to represent agricultural prices given their importance in the Indian agricultural sector. More precisely, rice and wheat accounted for 35.2 and 11.6 percent of the net area sown in 1895 respectively (Chaudhary, Gupta, et al., 2016, p. 104). Similarly, Jeffrey G.

⁸Data on land prices for the United Provinces is estimated, from 1900-01 onwards, using rents from the *Enquiry into the rise of prices in India* due to the lack of land prices data for those years.

Figure 2.2: McAlpin's agricultural price index vs agricultural price index estimated using rice and wheat



Sources and notes: McAlpin's agricultural price index vs agricultural price index estimated using rice and wheat.

Williamson (2002) uses the weighted average of wheat -by 1891-92 representing 37 percent of the total agricultural acreage in Punjab⁹-, bajra, gram and barley to measure agricultural prices in the province. Since official statistics report no wheat prices for Madras, the agricultural prices for this province are only based on rice. For all available provinces, rice and wheat prices went hand-in-hand, so using only rice prices for Madras should not significantly affect my results.¹⁰ For the national level analysis, I use the available national agricultural price series (McAlpin, 1983).

To test the robustness of my agricultural price index, I compare this national agricultural price index with a national price index estimated using my provincial indexes weighted by rural population from the 1911 census. Figure 2.2 shows that both indexes follow the same trend.

⁹Data from the *Agricultural Statistics of India (1891-96)*.

¹⁰For Bombay, United Provinces and Bengal I use unweighted averages of the rice and wheat prices of the different parts of the province for which those prices were reported, as prices were not provided aggregately for these provinces (Bombay: "Bombay" and "Sind and Baluchistan"; United Provinces: "Agra" and "Oudh"; Bengal (only from 1902 onwards): "Bengal" and "Eastern Bengal and Assam"). I do not weight these because prices in regions within provinces are highly correlated -for instance, the coefficient of correlation between the rice price of Bengal and Eastern Bengal and Assam is 0.9654- and therefore, weighting or not these prices should not significantly affect the trends of provincial agricultural prices.

Agricultural prices were published in *Prices and Wages in India*, which started reporting wholesale prices in 1897 and retail prices from 1873 onwards. To my knowledge, *Prices and Wages in India* presents the only series of official agricultural prices available at the provincial level covering all my period of analysis, since data on prices in the *Enquiry into the Rise of Prices in India (1914)* only covered the period from 1890 onwards. The acreage data to weight the rice and wheat prices comes from *Agricultural Statistics of India*.

Land/labour ratios represent the factor endowments of each province. I estimate the ratio both at the provincial and national levels using land cultivated in the numerator and actual agricultural workers in the denominator. Cultivated land is available from 1884-85 onwards, except for Bengal, for which it is only available since 1890-91.

I use data on acreage of cultivated land from *Agricultural Statistics of India* to measure land supply. I use *Agricultural Statistics of India* instead of *Estimates of Area and Yield of the Principal Crops in India* as the latter started being reported in 1891 while the former reported data on acreage since 1884-85. I also systematically use *Agricultural Statistics of India* data instead of Blyn (1966) because the earliest acreage data he reports are for 1891-92. The corrections on the official acreage estimates presented in Blyn (1966) only affect Madras. These involve the addition of crop acreage from zamindari estates which was neither reported in *Agricultural Statistics of India* nor in the *Estimates* until 1907-08 and 1910-11 respectively. Overall, using Blyn's data or *Agricultural Statistics of India* should not change the results significantly, as the coefficient of correlation of land cultivated from Blyn (1966) and *Agricultural Statistics of India* is 0.9622.

For labour supply, I consider as population occupied in agriculture or actual agricultural workers those that were engaged in gainful occupations in the sector (O'Rourke, Taylor, et al., 1996, p. 524-527). Census classified as actual workers those that

earned their income from the work that they actually did.¹¹ However, using actual workers is not without discussion as I could consider not only them but also dependants. Dependants could help work the land despite the census instructions considered dependants -children and women- as people not working.¹² In 1931, the census classification changed and instead of “actual workers” and “dependants”, occupational data distinguished between “actual workers”, “working dependants” and “non-working dependants”, which recognised the possibility of dependants working -helping in the fields-.¹³ Including dependants could affect the amount of labour available, especially if there were differences in family patterns or infant/female mortality between provinces. Those could be explained by different factors, such as the incidence of poverty, differences in gender discrimination (Gupta, 2014), the presence of protestant missionaries (Calvi and Mantovanelli, 2018), acceptance of western medical techniques –e.g. vaccination- and provision of those by the provincial government (Arnold, 1993) or calamities (Klein, 1973). Nonetheless, using actual workers and dependants instead of only actual workers does not significantly change the tendencies of the land/labour ratio in the different provinces as the coefficient of correlation between the two variables is very high: 0.8697. To estimate the land/labour ratios yearly, I interpolate population data from the 1881, 1901 and 1911 census. I measure national series following the same methodology as the provincial series but adding up all provincial data for each year.

Finally, I estimate the acreage share of non-foodstuff products -non-food acreage divided by total acreage- and use it as an indicator of commercialization. This classification is based on the assumption that foodstuffs were the least marketed crops and was suggested by Blyn (1966, p. 79–80). Following this author, I consider rice, wheat, jowar, gram, bajra, barley, maize and ragi as foodstuff and sugarcane, cotton,

¹¹ *Census of India. Volume VIII. Bombay and its feudatories. Part I (1891, p. 170).*

¹² *Census of India. Volume VIII. Bombay and its feudatories. Part I (1891, p. 170).*

¹³ *Census of India. Volume VII. Bihar and Orissa. Part I (1931, p. 179).* This new classification is explained with an illustrative example: “A boy who helps his father in the fields or tends his father’s cattle is a [working] dependant; but one who receives wages, in money or otherwise, for looking after somebody else’s cattle is entitled to regard himself as an earner.” In previous census, the boy from the example would be classified simply as dependant if he helped his father in the fields, as he would earn no income, therefore not being classified as a worker in the 1881 census.

jute, tea, tobacco, rape and mustard, sesamum, linseed and indigo as non-foodstuff. I also introduce the category “Other food grains including pulses” and the miscellaneous crops “food” as foodstuff. Introducing these categories allows me to estimate a share of non-foodstuff acreage comparable from 1884-85 to 1909-10. Adding the latter –miscellaneous crops “food”- was a way to consider those crops that were not reported separately for all provinces as they were very particular of a province. I also consider “Other Oilseeds” as non-foodstuff to make the ratio homogeneous as oilseeds –e.g. linseeds- were reported together in *Agricultural Statistics of India* from 1884-85 to 1889-90. I admit this is a rude indicator for commercialization, as foodstuffs experienced significant price increases during this period (Hurd, 1975), which can be associated to increasing commercialization. However, other authors –following Blyn (1966)- have used the acreage share of non-foodstuff to measure cash-cropping in colonial India –see Kapur and Kim (2007)-. To measure it I use data from the *Agricultural Statistics of India*.

Institutional variable

I use the so called non-landlord proportion to estimate which land revenue systems dominated in each province –landlord based or non-landlord based systems-. This measure of land revenue systems is based on the share of ryotwari land in each province over total land supply. To estimate the non-landlord proportion I use two sources: Banerjee and Iyer (2005) and, for those non-mahalwari provinces for which these authors do not report data, the *Agricultural Statistics of India*. In mahalwari provinces it is necessary to differentiate between those villages where the land revenue was distributed by ancestry (pattidari system) from those where it was distributed by the actual possession of the land (bhaiachara system). The former led to less representative village bodies and in those areas, the mahalwari system can be classified as a landlord based system. By contrast, the latter led to more representative village bodies –closer to non-landlord based systems- (Banerjee and Iyer, 2005, p. 1194). *Agricultural Statistics of India* does not distinguish between

landlord or non-landlord mahalwari systems and, therefore, for provinces with these systems, I can only use Banerjee and Iyer (2005). Banerjee and Iyer's non-landlord proportion is reported for present-day Indian states. Thus, I had to calculate a population weighted average¹⁴ of those present-day Indian states roughly composing former colonial provinces.¹⁵

2.3.3 Econometric analysis

Apart from the descriptive analysis, I present exploratory panel regressions to examine the relationship between the evolution of the W/LP ratio and changes in the economic and institutional factors pointed out in the literature. Although this panel analysis is descriptive and does not claim causality, it allows to establish a certain hierarchy between potential explanatory variables. I use the 3-year moving averages of the W/LP ratios normalized as 1880=100 -in ln- as the dependant variable.¹⁶ All the economic factors -factor endowments, agricultural prices and commercialization- are normalized to the earliest estimate and also in natural logarithms. Finally, I also include the non-landlord proportion as an explanatory variable. The baseline model is:

$$\begin{aligned}
 WLPMA_{it} = & \beta_0 + \beta_1 LandLabour_{it} + \beta_2 AgrPrices_{it} + \beta_3 AcreageShare_{it} \\
 & + \beta_4 NonLandlord_i * Year_t + \beta_6 C_{it} + \alpha_i + Year_t + \epsilon_{it}
 \end{aligned}
 \tag{2.1}$$

where $WLPMA_{i,t}$ represents the W/LP ratio, $LandLabour_{i,t}$ is the land/labour ratio, $AgrPrices_{i,t}$ stand for the agricultural prices, $AcreageShare_{i,t}$ presents the acreage share of non-foodstuff products and $NonLandlord_i$ is the non-landlord proportion of each province, which is interacted with the time trend ($Year_t$). In order to avoid collinearity, the non-landlord proportion is accounted with an interaction

¹⁴I use population data from the 1951 census, which was the first census reporting data for post-independence Indian states.

¹⁵See Section 2.C in the Appendix for more details.

¹⁶Central Provinces W/LP MA ratio is normalized as 1885=100. This is because 1885 is the earliest year for which I could estimate W/LP ratios for the Central Provinces.

with the time trend since the non-landlord proportion does not change over time, and its variation would otherwise be captured by the provincial fixed effects (α_i). $C_{i,t}$ represents a matrix with a set of controls: a dummy for the years in which major famines occurred during my period of study -1896, 1897, 1899 and 1900- and the proportion of districts that had at least a railway line in each province and year.¹⁷ I do this to control for the potential effect that access to railways could have on market access and factor prices. Finally, I introduce provincial fixed effects (α_i) to control for province-specific factors. Provincial fixed effects are required since all variables are normalized, hence cross-country variance in any year is meaningless. Finally, I add a time trend ($Year_t$) to control for statistical associations resulting from common trends.

2.4 Results

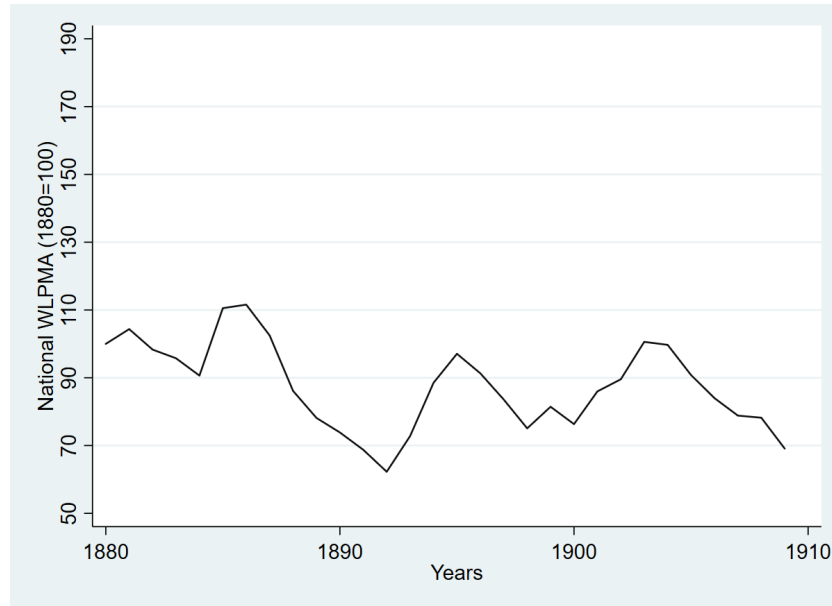
2.4.1 National agricultural income inequality

The evolution of the W/LP ratio in colonial India from 1880-81 to 1909-10 is represented in Figure 2.3. The picture it shows is similar to that provided by Roy (2007, p. 85). He presents a wage/income ratio estimate at the national level. Both series present a significant deterioration of income distribution with some fluctuations from 1880 to 1910. Alternatively, Jeffrey G. Williamson (2002, p. 73) presents W/LP ratios for Punjab, which are presented in Figure 2.E.1 of the appendix. The significant differences between the evolution of Williamson's series for Punjab and my national series point to the potential importance of differences in the evolution of agricultural income inequality across Indian provinces.

As already mentioned, the evolution income inequality might largely be associated with the evolution of agricultural prices. In late 19th century colonial India, wages were still largely set by custom and rarely renegotiated (Roy, 2007). Given that

¹⁷Railway data comes from Donaldson (2018).

Figure 2.3: National W/LP ratio



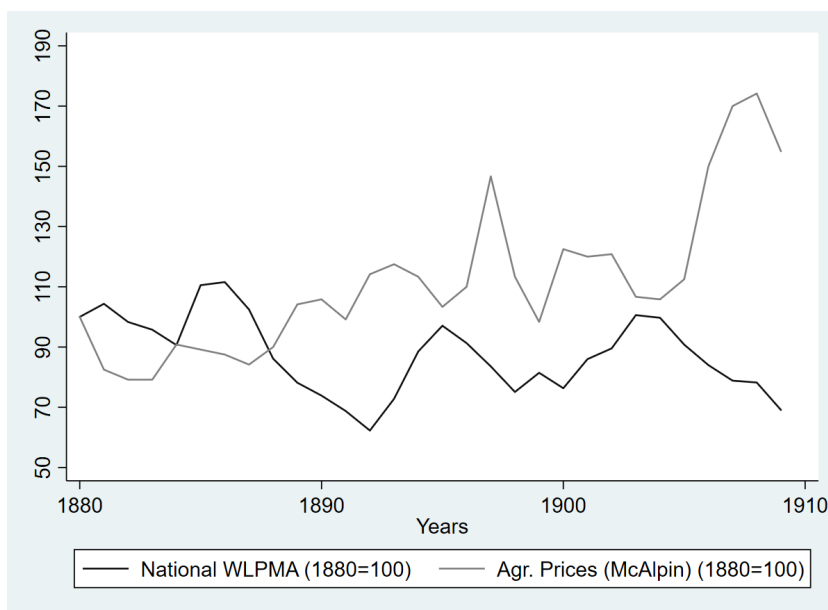
Sources and notes: Evolution of the 3-year moving averages of the W/LP ratio in colonial India from 1880-81 to 1909-10. The ratios for Central Provinces are considered only from 1884-85 onwards due to the lack of land prices data. Data on W/LP ratio for the United Provinces is estimated, from 1900-01 onwards, using rents from the *Enquiry into the rise of prices in India* due to the lack of land prices data for those years. Finally, the W/LP ratio for Punjab from 1885-86 to 1886-87 is measured using only the 1884-85 and 1887-88 data respectively since no land prices were reported for 1885-86 and 1886-87.

agricultural prices partly determined landowners' net income (Bohlin and Larsson, 2007), an increase in agricultural prices should lessen the W/LP ratio. Figure 2.4 shows how this relation held in colonial India as a whole, from 1880 to 1910. The coefficient of correlation between these two variables is -0.5323.

As for factor endowments, when the land/labour ratio drops the W/LP ratio is expected to shrink as well due to the increasing population per land cultivated (O'Rourke, Taylor, et al., 1996). However, the opposite relation can also be expected based on a malthusian or supply/demand framework. An increase (decrease) in the W/LP ratio may bring about a decrease (increase) in the land/labour ratio. The relation between inequality and factor endowments is explored at the national level in Figure 2.5. It suggests no correlation between changes in W/LP and land/labour ratios in colonial India from the 1880s to the end of the 1900s as the correlation coefficient between these variables is -0.0725.

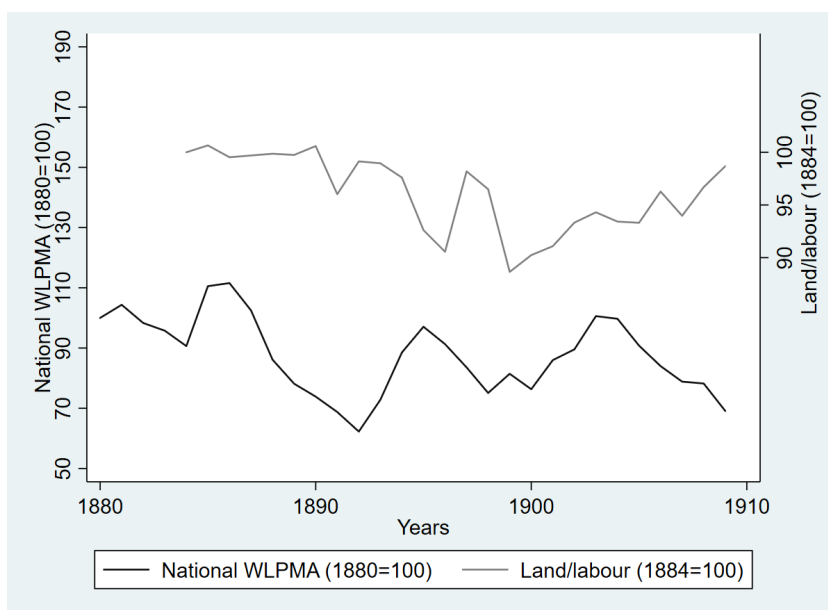
Increasing commercialization has also been pointed out as a potential factor affect-

Figure 2.4: National W/LP ratio vs National agricultural prices



Sources and notes: Evolution of the national W/LP MA ratio vs evolution of national agricultural prices. Weighted agricultural prices from McAlpin (1983). National W/LP MA ratios measured as in Figure 2.3. See Section 2.3.

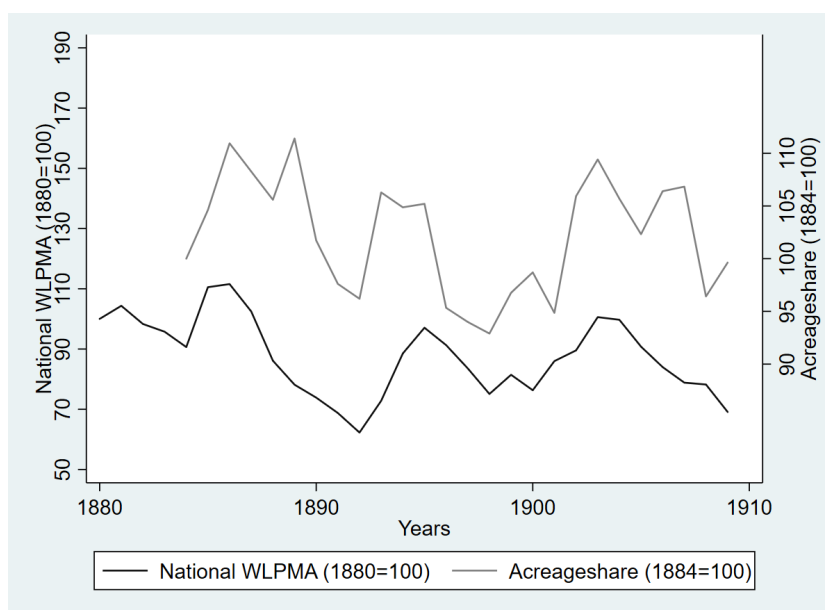
Figure 2.5: National W/LP ratio vs National land/labour ratio



Sources and notes: Evolution of the national W/LP MA ratio vs evolution of the national land/labour ratio. National land/labour ratio measured adding all provincial cultivated land and using the 1881, 1901 and 1911 census data on agricultural workers. Labour is interpolated for non-census years. See Section 2.3.

ing changes in agricultural income inequality. Figure 2.6 shows a positive relation between the acreage share of non-foodstuff products and the national W/LP ratio. This result is in line with the literature arguing that increasing commercialization is associated with a reduction of agricultural income inequality due to the larger commercialization of labour intensive crops -e.g. cotton- (Brandt, 1989). The coefficient of correlation between these variables is 0.4658.

Figure 2.6: National W/LP ratio vs National share of non-foodstuff acreage



Sources and notes: Evolution of the national W/LP MA ratio vs evolution of the national share of non-foodstuff acreage. Share of non-foodstuff acreage measured using *Agricultural Statistics of India* and the classification of food and non-foodstuff from Blyn (1966). National W/LP MA ratio measured as in Figure 2.3. See Section 2.3.

I infer three important points from my analysis of the evolution of agricultural income inequality at the national level. First, my measure of agricultural income inequality -W/LP- follows the same trend as other measures of national agricultural income inequality already present in the literature. This reinforces the reliability of my W/LP ratios as a measure of agricultural income inequality. Second, agricultural prices are indeed linked to the evolution of agricultural income inequality at the national level. By contrast, the evolution of the land/labour ratio does not seem to be associated with national changes in agricultural income inequality. Finally, commercialization seems to be positively connected to national W/LP changes, which goes against the literature arguing that commercialization increased income inequality in

the Indian countryside. In the following subsection I exploit provincial differences in the evolution of the W/LP ratio to further explore its potential explanatory factors, including the role of a local colonial institution -land revenue systems- in the analysis.

2.4.2 Provincial agricultural income inequality

Figure 2.7 presents the evolution of the provincial W/LP ratios. Taken together, these ratios tend to show a common decreasing trend, as in the case of the national ratio -see Figure 2.3-. However, W/LP ratios evolved differently at the provincial level. In Bombay, Central Provinces and Madras, the W/LP experienced an initial decrease but then stagnated since the 1890s. In the United Provinces and Punjab,¹⁸ the initial decrease lasted until the turn of the century while in Bengal the W/LP stagnated until starting an increasing trend by the 1890s. These provincial differences can be used to study the potential explanatory factors of the evolution of agricultural income inequality.

The relation between agricultural prices and the provincial W/LP ratios -see Figure 2.8- is in line with what would be expected according to the literature and the results at the national level for all provinces but Bengal. Rising agricultural prices are linked with decreasing W/LP ratios in Bombay (correlation coefficient: -0.69), Central Provinces (-0.70), Madras (-0.37), Punjab (-0.39) and the United Provinces (-0.45). The exceptional case of Bengal (0.45) can be explained by its practical monopolistic position in the jute world market and the importance of this commodity for the Bengali economy -specially for East Bengal-. Jute prices rose significantly from the late 19th century to well into the 20th century: according to *Prices and Wages in India* the price of a bale of 400lb exported from Calcutta increased from 31 rupees in January 1880 to 45 rupees in the same month of 1908. Moreover, R. K. Ray (1973) points at how raw jute value exports almost tripled from the late

¹⁸Notice that my W/LP ratio series for Punjab is almost identical to the W/R ratio series estimated by Jeffrey G. Williamson (2002) -see Figure 2.E.1-.

Figure 2.7: Provincial W/LP ratios disaggregated by groups of provinces with similar evolution



Sources and notes: Provincial W/LP ratios disaggregated by groups of provinces with similar evolution. See Figure 2.3 and Section 2.3.

1880s to the 1910s and how jute acreage also rose -mainly replacing rice in already cultivated land- to a maximum of 3.88 million acres in 1907-08.¹⁹ Considering that jute is more labour intensive than rice (Trairatvorakul, 1984), the jute boom and rice substituting process during this period increased labour demand, which combined with a stagnant population, could have reduced agricultural income inequality.

Changes in the provincial land/labour ratios and their W/LP ratios correlate negatively in most provinces, although there are significant differences across provinces and periods. In Bengal (-0.61), Bombay (-0.43) -from 1890 onwards-, Madras (-0.20) and Punjab (-0.40), W/LP ratios are negatively correlated with their respective land/labour ratios. This evidence is in line with the argument that land/labour ratios are affected by changes in W/LP ratios. On the other hand, the Central Provinces (0.40) and the United Provinces (0.17) present a positive relation between

¹⁹Jute cultivation represented around 13% of total cultivated land in Bengal in 1907-08, leaving jute only behind rice in acreage cultivation. Data from *Agricultural Statistics of India*.

W/LP and their land/labour ratio. Both provinces show no significant changes in their land/labour ratios throughout the period. The United Provinces and the Central Provinces experienced modest changes in their cultivated land -specially in the western districts for the former and the Narmada Valley for the latter- and almost null population growth during the period (Chaudhary, Gupta, et al., 2016, p. 103). Punjab, on the other hand, experienced an impressive growth of the land/labour ratio mainly achieved with the construction of government irrigation canals (Chaudhary, Gupta, et al., 2016, p. 103-5). This was probably a response to increasing commercialization and a consistent increase in land prices -i.e. decrease in the W/LP ratio-.

The provincial results from Figure 2.8 shed some doubts on the potential distributional impact of commercialization -that seemed to be apparent at the national level in Figure 2.6-. While the latter shows a positive correlation between the share of non-foodstuff acreage and the W/LP ratio at the national level, this correlation appears ambiguous at the provincial level. In Bengal (0.18), Punjab (0.41) and the United Provinces (0.63) changes in the acreage share of non-foodstuff are positively associated with the evolution of W/LP ratios. However, Bombay (-0.19), the Central Provinces (-0.12) and Madras (-0.50) present the opposite relation. Charlesworth (1985) has argued that in Bombay, commercialization contributed to increase agricultural stratification, specially during the late 19th century. The negative sign in the coefficient of correlation of the Central Provinces might be explained by the shift from labour intensive cotton to more land intensive wheat production from the end of the American Civil War to the mid 1890s (Harnetty, 1977). This replacement of cotton by less labour intensive crops could have reduced the demand of labour and its returns. For Madras, the prevalence of agricultural magnates in certain districts²⁰ allowed such privileged landowners to collect most of the benefits from commercialization, rising income inequality (Washbrook, 1994).

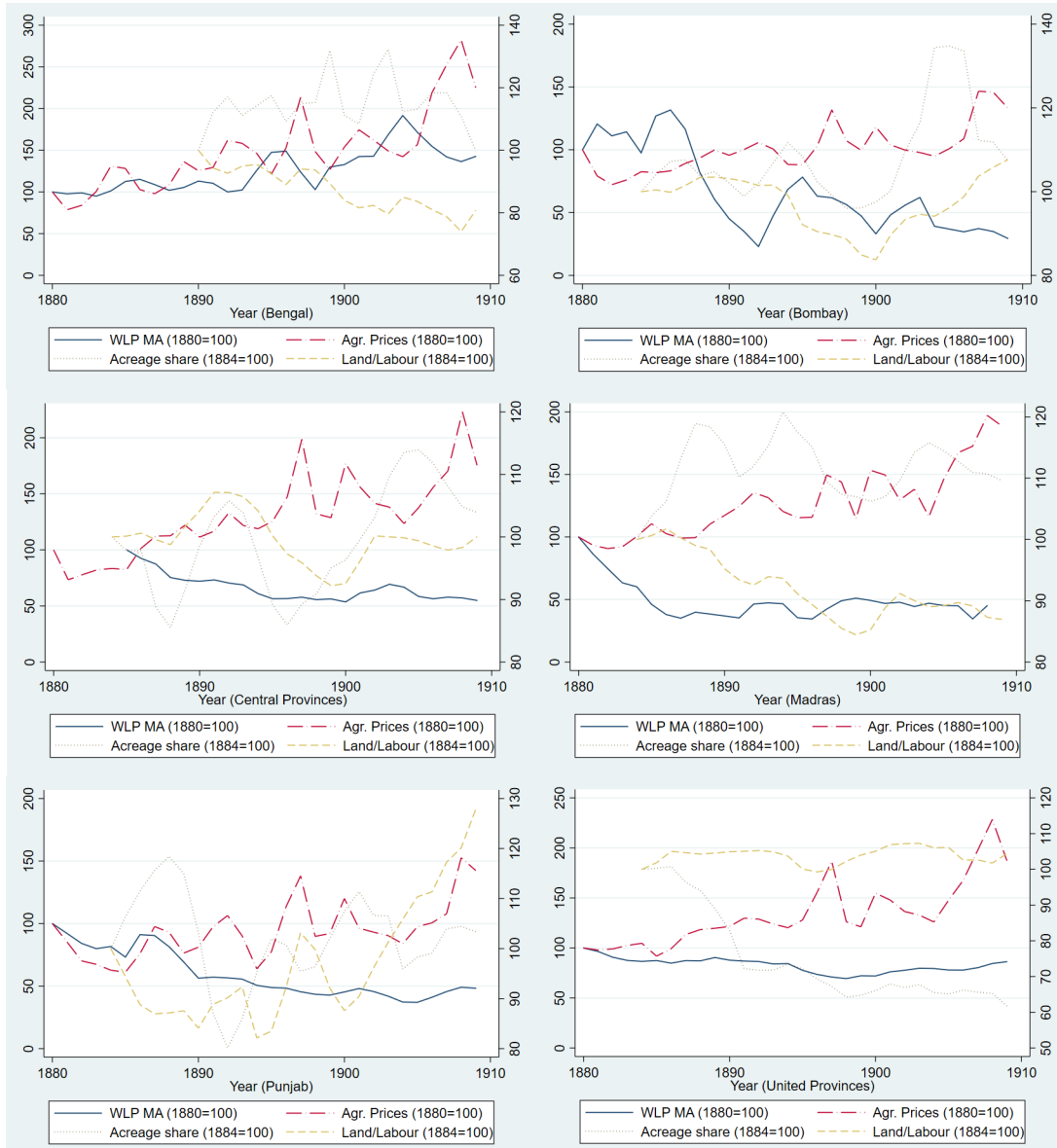
²⁰According to Washbrook (1994, p. 136), the large land revenue demanded from landowners in Bellary -and certainly in other Madras districts- made working for owners of lands with privileged land revenue rates or lands not paying land revenue (*inams*) more profitable than cultivating own lands having to pay the normal land revenue

Overall, Figure 2.8 shows how changes in agricultural prices were positively linked to changes in agricultural income inequality in most provinces -as happened at the national level-. Also, while no nationwide relation appeared between factor endowments and agricultural income inequality, provincial land/labour ratios seem to be negatively associated with the evolution of the W/LP ratios in most provinces. Similar differences appear analysing the relation between commercialization and the W/LP ratios at the national and provincial levels. While there is a positive relation with W/LP national ratio, this seems ambiguous once analysed at the provincial level, not matching the national results. Provincial analysis presents some variability across provinces -specially when studying commercialization- which indicates that the national results cannot be extrapolated for all provinces of colonial India. For certain provinces, some economic factors present a low correlation with the evolution of agricultural income inequality. Moreover, the sign of such correlation is not always the expected by the literature. Provincial specialization in certain products, as well as crop substitution could account for these unexpected relations.

The exploitation of the peasantry by landowners, which may explain agricultural income inequality, has been related to the land revenue systems. Such exploitation was arguably more acute and persistent in provinces with landlord-based systems. In those provinces, landlords and intermediaries had increasing claims on the surplus that tended to reduce the share of agricultural surplus that cultivators could retain (Bhaduri, 1976). Coherently with this process of increasing claims on the surplus, a larger increase in agricultural income inequality could be expected in provinces with landlord-based systems. On the other hand, agricultural income inequality should decrease or increase less in provinces with non-landlord based systems.

The impact of tenancy reforms might also correlate with land revenue systems and changes in income inequality. Some scholars argue that the introduction of tenancy reforms -specially in provinces with landlord based systems- could have reduced agricultural income inequality (Chaudhry, 2016; Roy and Swamy, 2016; Swamy,

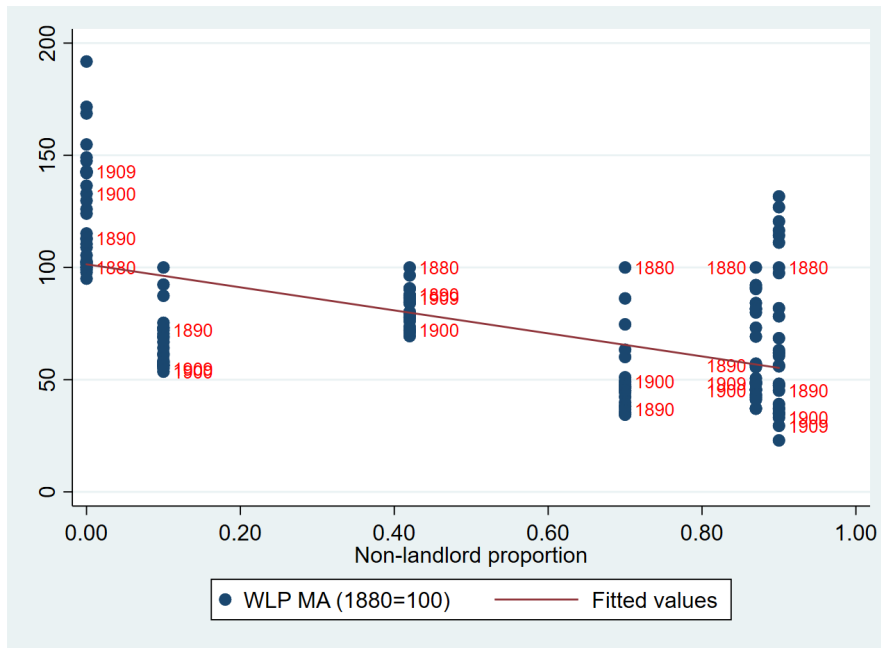
Figure 2.8: Provincial W/LP ratios, agricultural prices, land/labour ratios and non-foodstuff acreage share



Sources and notes: W/LP MA ratios (1880=100), land/labour ratios (1884=100), agricultural prices (1880=100) and acreage share of non-foodstuff (1884=100) for all provinces. See Section 2.3.

2011). Figure 2.9 shows the relation between the evolution of the W/LP provincial ratios and the non-landlord proportion of each province. For the whole period, agricultural income inequality grew more in non-landlord than in landlord provinces. This result reinforces the hypothesis that tenancy acts actually reduced inequality in the Indian countryside and casts doubt on the role of the exploitation mechanism explaining changes in agricultural income inequality during the period of study.²¹

Figure 2.9: Provincial W/LP vs Non-landlord proportion



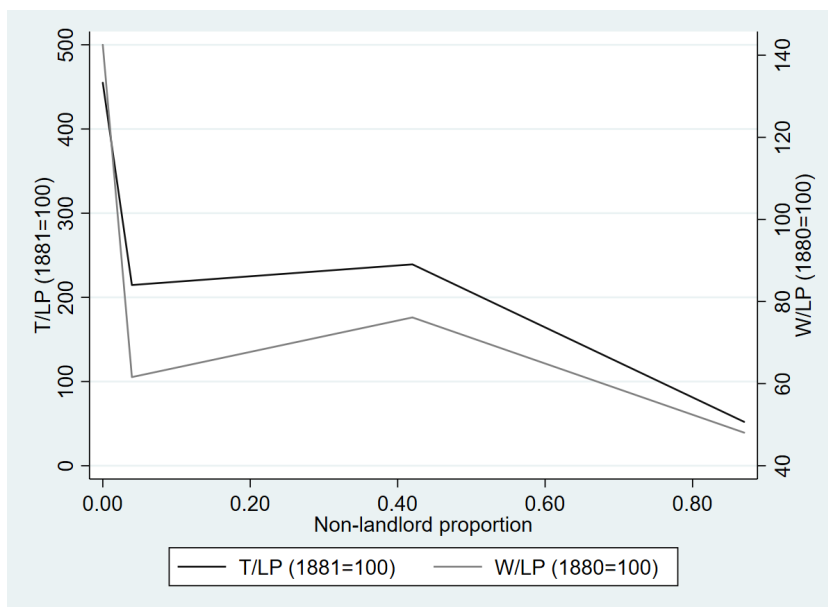
Sources and notes: Provincial W/LP vs Non-landlord proportion. From left to right, observations are from Bengal (NonLandlord=0.00), Central Provinces (NonLandlord=0.07), United Provinces (NonLandlord=0.42), Madras (NonLandlord=0.70), Punjab (NonLandlord=0.87) and Bombay (NonLandlord=0.90). See Section 2.3.

Some concerns on the validity of this result may arise on the use of wages to account for the income of cultivators. The impact of tenancy reforms and the increasing protection of tenants should ideally be tested using tenants' incomes instead of wages. However, data on tenants' incomes was not collected in official reports. To mitigate this concern, I estimate tenants' incomes in Bengal, Central Provinces, Punjab and United Provinces for two years, 1881 and 1901.²² I use these estimates to check

²¹Notice that this does not mean that landowners -specially in landlord areas- did not hold a predominant position in the Indian countryside and could collect abusive rents from their tenants. In this chapter I am just studying *changes* agricultural income inequality -not *levels*-, which means that it could still be the case that overall agricultural income inequality was larger in landlord areas.

²²For details on how tenants incomes are estimated see Section 2.D in the Appendix.

Figure 2.10: T/LP and W/LP in 1901 vs Non-landlord proportion



Sources and notes: T/LP in 1901 (1881=100) (blue) and W/LP MA in 1901 (1880=100) (red) vs Non-landlord proportion. National W/LP MA ratio measured as in Figure 2.3. See Section 2.3 and Section 2.D in the Appendix.

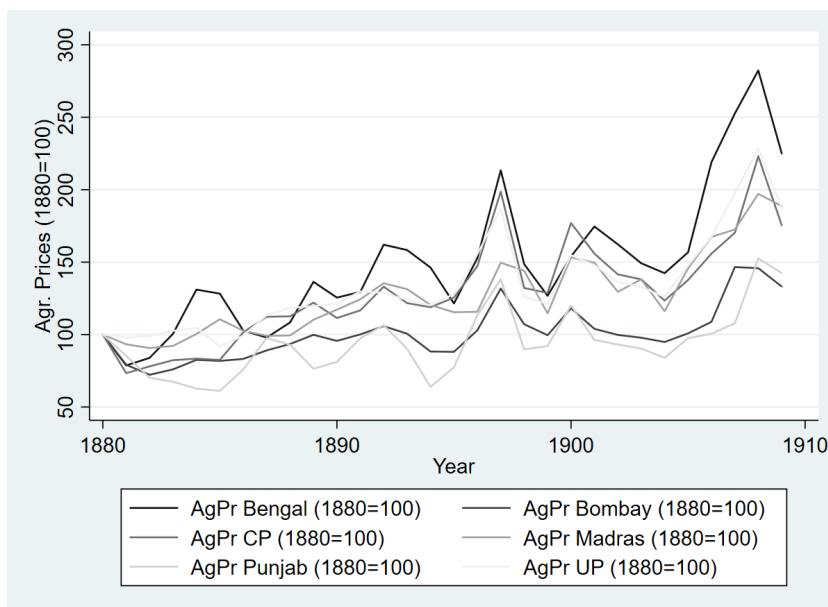
if both, changes in tenants' income/land prices ratio (T/LP) and changes in the W/LP ratio, correlate negatively with the non-landlord proportion. Such relations are shown in Figure 2.10. The evidence suggests that using estimated tenants' incomes instead of wages does not change my results: landlord based provinces tended to reduce their agricultural income inequality more than non-landlord based provinces during the period.

Finally, table 2.10 presents the results of the econometric analysis. As stated in section 2.3.3, this panel analysis shows the magnitude and signs of correlations between changes in agricultural income inequality and, economic and institutional factors, but does not claim causality. With that in mind, results from column (1) show how economic factors correlate with the W/LP ratio when not controlling for the time trend. A negative and significant correlation between the W/LP ratio and agricultural prices (*AgrPrices*) as well as with the land/labour ratio (*LandLabour*) is observed, while a negative correlation is also observed for the acreage share of non-foodstuff (*AcreageShare*), although the coefficient is much smaller and is not significant.

Column (2) presents a regression including the time trend (*Year*) and its interaction with the non-landlord proportion (*NonLandlord*). The coefficients for all economic factors drop in absolute value and become insignificant in all cases, although all coefficients remain negative. The insignificance of the agricultural prices coefficient can be explained by the lack of variability in their evolution between provinces -see Figure 2.11-. This lack of variability can be linked to the Indian market integration process (Andrabi and Kuehlwein, 2010; Donaldson, 2018) driven by its large railway network, which by 1910 was comparable to that of economically developed countries (Hurd, 1975, p. 267). Given such market integration, the relation between agricultural prices and the W/LP ratio within provinces is driven by changes that are common to all provinces, resulting in all provincial agricultural price series following the same trend. The introduction of a time trend captures, by definition, those changes. The coefficient for the acreage share of non-foodstuffs is virtually 0, which is in line with the idea that commercialization does not seem to have a consistent correlation with the W/LP ratio below the national level. The negative coefficient for the land/labour ratio is in line with the idea that the relation between factor endowments and factor prices in colonial India during this period resulted from changes in factor prices influencing the supply of factors and Malthusian cycles (O'Rourke and Jeffrey G. Williamson, 2005; Jeffrey G. Williamson, 2002) rather than from changes in factor endowments affecting factor prices (O'Rourke, Taylor, et al., 1996). Finally, the only significant -and negative- coefficient is the one on the interaction between the non-landlord proportion and the time trend (*NonLandlord * Year*). This coefficient shows how, for each year passing, non-landlord provinces presented a reduction in the W/LP ratio 2.86% larger than landlord provinces.

Column (3) presents a regression including all controls, and shows no changes in the signs of the coefficients. Results are very similar to those in column (2), except for the fact that the coefficient for the land/labour ratio is now significant and with a larger absolute value. Finally, column (4) presents an estimation dropping the province of Bengal. In this case, the coefficient of the interaction between the non-

Figure 2.11: Evolution of agricultural prices by province



Sources and notes: Evolution of agricultural prices by province. All values normalized as 1880=100.

landlord proportion and the time trend drops but remains significant at 5%. This drop could be explained by the fact that Bengal was where effective tenancy rights and reforms were first requested by the peasantry. In fact, a revolt in Pabna -a district located in the middle of Bengal- in 1873 led to the creation of the Agrarian league which challenged zamindars at court and withheld rents (Roy and Swamy, 2016; Swamy, 2011) ultimately leading to the pass of the Bengal Tenancy Act of 1885. In a nutshell, the evolution of agricultural income inequality is significantly correlated with an institutional variable (the non-landlord proportion). The rest of coefficients remain with the same sign -except for the one on agricultural prices- and very similar magnitude to that in column (3).

These results confirm that (1) economic factors correlate with changes in agricultural income inequality, although the correlations are not always consistent across provinces and, (2) a local institution introduced by the British -land revenue systems- is connected to changes in agricultural income inequality. The non-landlord proportion correlates negatively and significantly with changes on the W/LP ratios -probably due to the introduction of tenancy acts in landlord provinces-, which goes against the concept of Kuznets waves (Milanovic, 2016). According to this con-

cept, inequality shifts in pre-industrial economies with stagnant per capita incomes should not be driven by institutional settings but exclusively by "malign" idiosyncratic events. These results also illustrate the need to study the evolution of income inequality at different aggregate levels as results at the more aggregate level -i.e. national- may not be consistent with those at lower levels.

Table 2.2: W/LP correlates including provincial fixed effects

	W/LP ratio (1880=100) in ln			
	(1)	(2)	(3)	(4)
AgrPrices	-0.429*** (0.096)	-0.133 (0.128)	-0.073 (0.133)	0.042 (0.156)
AcreageShare	-0.105 (0.201)	-0.008 (0.183)	-0.084 (0.189)	-0.116 (0.201)
LandLabour	-0.748*** (0.274)	-0.369 (0.266)	-0.614** (0.289)	-0.583* (0.321)
Year		0.005 (0.006)	0.004 (0.008)	-0.003 (0.009)
NonLandlord*Year		-0.032*** (0.008)	-0.029*** (0.009)	-0.021** (0.010)
Constant	10.138*** (1.706)	28.117*** (6.585)	28.122*** (10.039)	37.644*** (10.153)
<i>N</i>	148	148	141	123
R-Squared	0.158	0.321	0.342	0.358
Controls	NO	NO	YES	YES
Time Trend	NO	YES	YES	YES
Provincial FE	YES	YES	YES	YES

Sources and notes: (1) OLS estimates without controls nor time trend. (2) OLS estimates adding a time trend and its interaction with the non-landlord proportion. A year time trend is introduced instead of year fixed effects as they would capture all the effect of the non-landlord proportion (NonLandlord). (3) OLS estimates including controls, the time trend and its interaction with the non-landlord proportion. (4) OLS dropping Bengal. All estimates include provincial fixed effects. Controls include: a Famine year dummy and proportion of districts with railway access. All variables in natural logarithms. W/LP -in 3-year moving averages- normalized as 1880=100 is the dependent variable for all models. AgrPrices represents the agricultural prices normalized as 1880=100. NonLandlord is the non-landlord proportion. AcreageShare is the acreage share of non-foodstuff normalized as 1884=100. LandLabour is the land/labour ratio normalized as 1884=100.

2.5 Conclusions

In this chapter I present the first comparative estimate of provincial agricultural income inequality in colonial India and use it to analyse the relationship between its evolution and changes in potential explanatory economic and institutional factors. This series allows to study agricultural income distribution below the national level and allows to further explore the evidence available at the national level. I find that changes in institutional factors -land revenue systems- and economic factors were associated to the evolution of agricultural income inequality.

In particular, commercialization shows a correlation with changes in agricultural income inequality at the national level but presents no clear relation at the provincial level. Factor endowments present significant variability in their link with agricultural income inequality across provinces, although in most of them were negatively correlated with the W/LP ratio. At the national level, factor endowments do not correlate with the evolution agricultural income inequality. Similarly agricultural prices seem to correlate negatively with the W/LP ratio at the national level and for all provinces except Bengal. However, when accounting for the time trend, these results vanish. All these discrepancies make it difficult to establish consistent relations between those factors. Most importantly, the analysis of agricultural income inequality at the provincial level shows how the national results cannot be generalized for all provinces of colonial India.

Land revenue systems appear to correlate systematically with changes in agricultural income inequality, even after considering the aforementioned economic factors. This result is also robust to dropping the pioneer province in the introduction of tenancy acts, Bengal. Considering the evidence presented in this chapter, tenancy acts rather than increasing exploitation from landowners seem a more plausible mechanism to explain the relation between land revenue systems and the evolution of agricultural income inequality over time. Last but not least, the link between an institution and income inequality changes in a society with an stagnant pre-industrial economy

-such as colonial India- points at the need to rethink the mechanisms through which Kuznets waves operate in those societies.

This work represents a first step towards filling the lack of sub-national comparative studies on agricultural income distribution in colonial India. Most importantly, it presents the need to test the factors connected to the evolution of income inequality at different aggregate levels.

Appendix

2.A Wages series comparison

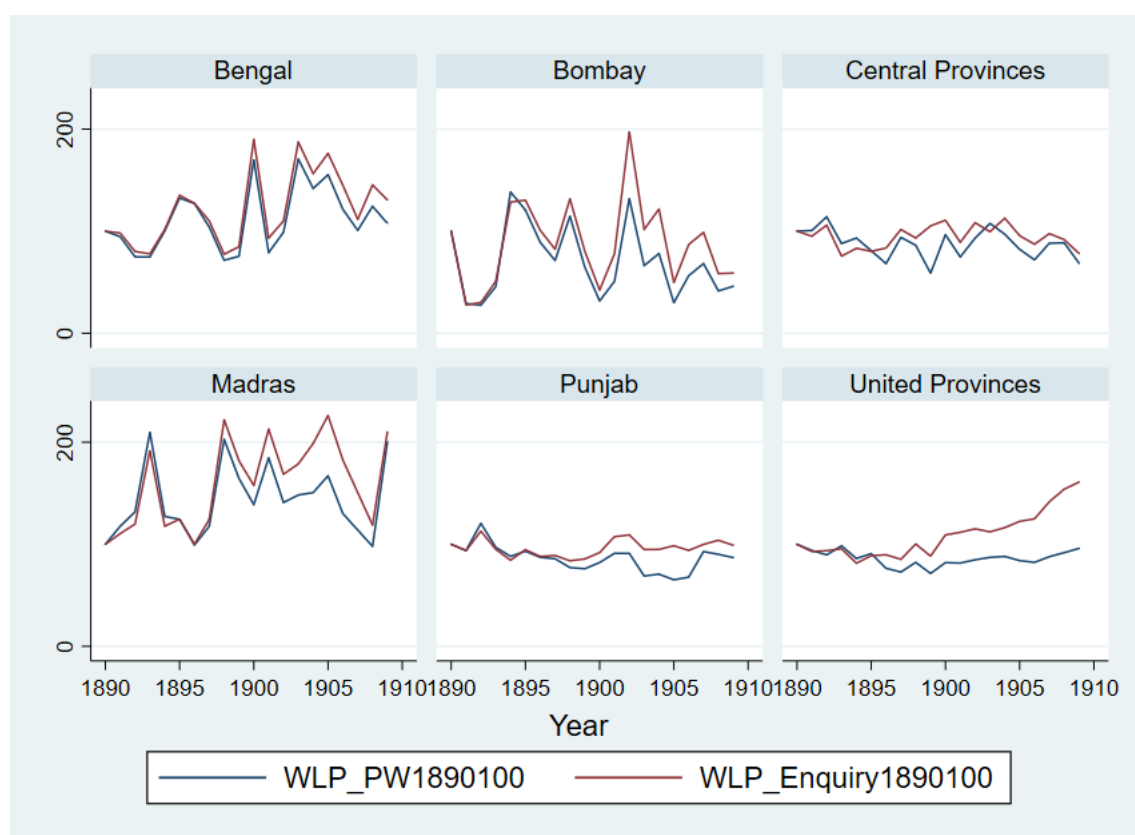
As mentioned in the methodology and data section, there are two official series for agricultural wages in colonial India: the *Enquiry into the Rise of Prices in India (1914)* and the *Prices and Wages in India*. I use the last since it's the only one that covers all the period of study (1880-1910). However, since it has been argued that both series measure different agricultural wages (Roy, 2007), I build two provincial W/LP ratio series each using a different wage series. These W/LP ratios are estimated from 1890 to 1910, which are the years for which both series were reported. Both W/LP provincial series are presented in Figure 2.A.1.

The evolution of W/LP ratios was not affected by using wages from the *Enquiry into the Rise of Prices in India (1914)* or the *Prices and Wages in India*. The United Provinces is the only province showing some differences between both series -only for the 1900s-. Overall, the coefficient of correlation between both series is 0.8978.

2.B Further details on W/LP calculations

In some provinces –Bengal, Bombay and Madras- only compulsory sales forced -and executed- by the government or court for arrear of land revenue or private debt were reported. On the other hand, for some provinces –Central Provinces, Punjab

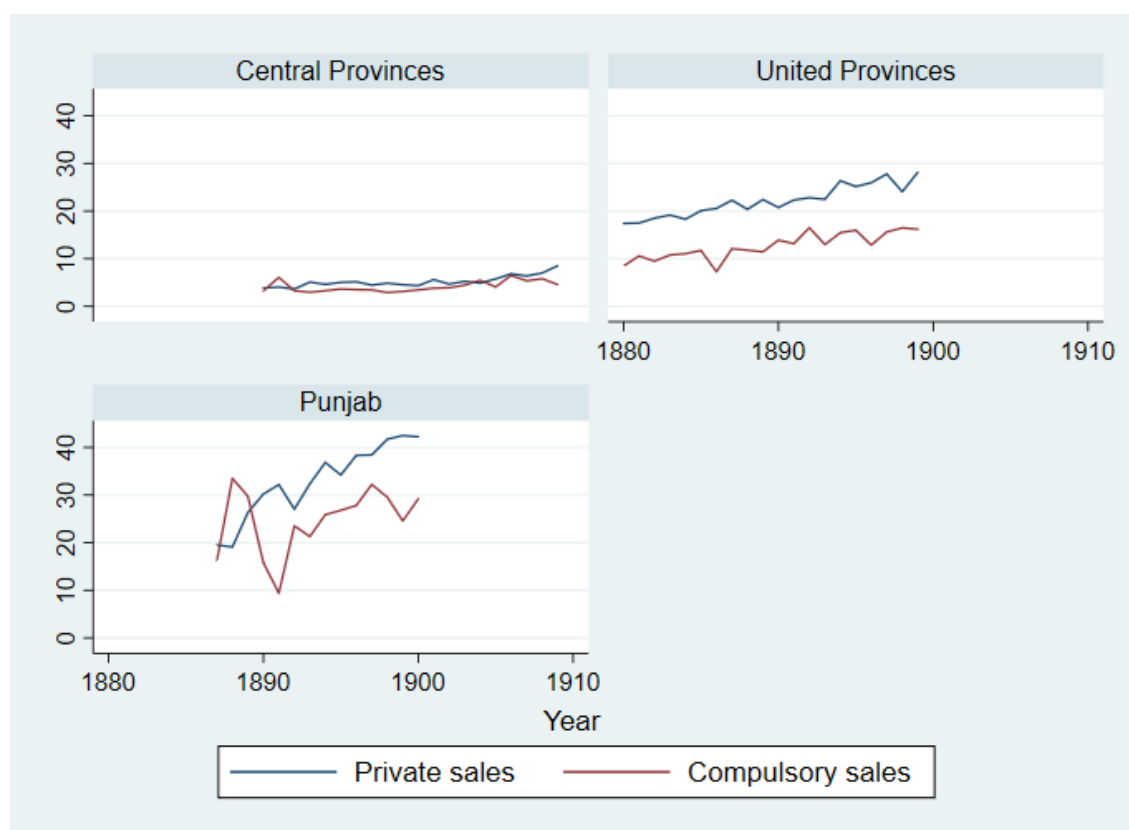
Figure 2.A.1: Enquiry W/LP ratios vs Prices and Wages in India W/LP ratios



Sources and notes: W/LP ratios (1890=100) using the *Enquiry into the Rise of Prices in India (1914)* or the *Prices and Wages in India* wages series from 1890 to 1909. Land prices data from provincial reports on the land revenue.

and United Provinces- both compulsory and private market sales were reported. Therefore, in order to estimate land prices, I could either only use compulsory sales, or try to convert compulsory sales from Bengal, Bombay and Madras into private market sales using a coefficient created from those provinces having both types of land sales reported. In this work I follow the second strategy, and convert all land prices into private market land prices, but since I am only interested in the evolution of income distribution and not in its levels, the strategy I use should not affect my results. This is because there is evidence that private market land prices and compulsory land prices followed the same trend, as is shown in Figure 2.B.1. The coefficient of correlation between compulsory sales and market sales for all available provinces is 0.8704.²³

Figure 2.B.1: Market sales vs compulsory sales for available provinces



Sources and notes: Market sales and compulsory sales in Central Provinces (1890-91 to 1909-10), Punjab (1887-88 to 1900-01) and United Provinces(1880-81 to 1899-00). Land prices data from provincial reports on the land revenue.

²³Likewise, Bohlin and Larsson (2007) spotted similar trends between private market land prices and government land prices for the same period of study in Sweden.

Moreover, acres that were sold each year were not recorded in all provinces and in some cases -Bengal and United Provinces-, the provincial administrations simply reported the land revenue paid to the state that corresponded to the land sold. In order to transform this land revenue data to acres –homogenizing the land prices to rupees/acre- I use a coefficient for both provinces which is created from the mean ratio of fully assessed acres of each province and the land revenue on this fully assessed area between 1884-85 and 1909-10.²⁴ For this ratio, I use data from the *Agricultural Statistics of India*. I use non-privileged -fully assessed- land revenue and acreage since both Bengal and the United Provinces had small proportions of privileged tenures²⁵ –e.g. revenue-free tenures- which paid reduced land revenue rates or no land revenue at all. This means that those lands were almost never sold for arrears of land revenue and were probably hardly sold in private transfers, as they were extremely valuable lands.

From 1900-01 onwards, the land prices for the United Provinces stopped being reported. This forced me to estimate them using rents of ordinary tenants reported in the *Enquiry into the Rise of Prices in India (1914)*. The methodology I use is similar to the one employed by Willebald (2011), except that in my estimation I do not take into account the interest rates, since I have no data for them at the sub-national level. This is, considering the rent of a given year and the land price of the same year –I take 1898-99 as my benchmark since, for that year, I have data on both land prices and rents-, I obtain the relation between the two variables, and I update the land price of 1898-99 by the movement of ordinary rents reported in the *Enquiry*:

$$LandPrices_i = Rent_i * LandPrice_{1898-99} / Rent_{1898-99}$$

²⁴For all provinces except Bengal, data on fully assessed acreage is reported from 1884-85 onwards. For Bengal, it started being reported in 1890-91.

²⁵Around 15 percent and 6 percent of the total acreage surveyed in Bengal and the United Provinces (Agra and Oudh) at the turn of the 20th century according to *Agricultural Statistics of India (1913)*.

Finally, wages for some provinces -Bengal, Central Provinces, Madras and United Provinces- were not reported in the *Prices and Wages in India* from 1908 to 1910. I interpolated these three years with 1911 daily wages from the *Prices and Wages in India (1919)* assuming 30 days per month.

2.C Checking for differences in using Banerjee & Iyer (2005) or *Agricultural Statistics of India* to measure land revenue systems

As a sensitivity test, I compare the non-landlord proportion from the *Agricultural Statistics of India* with the non-landlord proportion using weighted averages from Banerjee and Iyer (2005). Following Banerjee and Iyer (2005) and historical as well as present-day maps, I have estimated provincial non-landlord proportions for colonial provinces using weighted means from Indian estates.²⁶ On the other hand, I use the *Agricultural Statistics of India* data on the incidence of the land revenue assessment. I compare the results from both sources for those provinces where the mahalwari system was not implemented -Bengal, Bombay, Central Provinces²⁷ and Madras-.

Table 2.C.1: Non-landlord proportions using Agricultural Statistics of India (1909) -ASI- or just Banerjee and Iyer -BI-.

Source/Province	ASI	BI
Bengal	0	0.07
Bombay	0.92	0.90
Central Provinces	0.04	0.10
Madras	0.69	0.70

²⁶Bengal (Bihar, Orissa and West Bengal), Bombay (Karnataka, Gujrat and Maharashtra), Central Provinces (Madyha Pradesh) and Madras (Andhra Pradesh and Tamil Nadu).

²⁷Whether the Central Provinces were a landlord or a non-landlord based province has been debated in the literature and is still not clear (Banerjee and Iyer, 2013; Iversen et al., 2013). However, in this work it will be considered, following Banerjee and Iyer (2005), a landlord based province.

The results obtained from using only the *Agricultural Statistics of India* or only Banerjee and Iyer (2005) to determine the non-landlord proportion are extremely similar, as is shown in Table 2.C.1.

2.D Estimating tenants' incomes for 1881 & 1901

In order to test my results on the relation between land revenue systems and the evolution of agricultural income inequality, I estimate tenants' incomes in 1881 and 1901 and use them to measure the tenants' incomes/land prices ratio (T/LP). I compare my W/LP with the T/LP to see how both ratios evolve depending on the non-landlord proportion of each province. Tenants' incomes are estimated as the difference between the average yield per acre, the rents in each province and the cost of cultivation per acre -seeds, ploughs and bullocks costs-. This difference -net tenants' income per acre- is multiplied by the total area under cultivation and weighted by the share of tenants in total agricultural population -landowners, tenants, and wage earners- to represent the proportion of land under cultivation actually being cultivated by tenants. This results in a rough estimate for tenants' total net income for Bengal, Central Provinces, Punjab and United Provinces. After that, I divide the tenants' total net income by the number of tenants in the province to obtain the per capita estimate of tenants' net income.

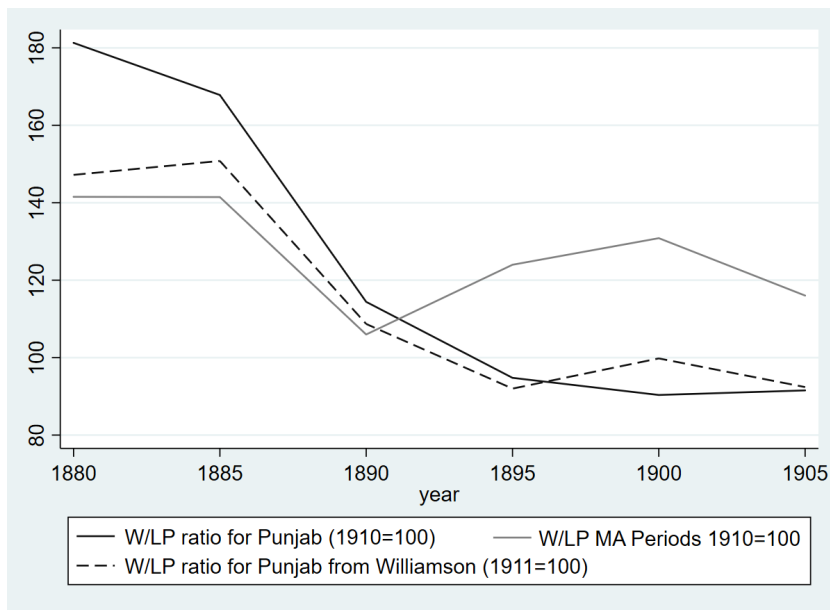
To carry out that estimation, I use provincial yields from Blyn (1966) for 1901 and Baring and Barbour estimates from Heston (1989) for 1881. I use ordinary tenants' rents from the *Enquiry into the rise of prices in India* for 1901 and an estimation based on land prices for 1881.²⁸ Data on cultivation costs comes from Narain (1929). This data is based on Punjab, but due to the lack of alternative sources, I used it for all provinces and transformed it into current prices using McAlpin's weighted index of all commodity prices. Cultivated land is from the *Agricultural Statistics of India* -for 1881, I use data from the first available year, which is 1884-85 for all

²⁸See the appendix for more on estimating rents from land prices.

provinces but Bengal (1890-91)-. Data on tenants and agricultural population is obtained from the 1881 and 1901 census.

2.E Williamson's W/R estimates

Figure 2.E.1: National W/LP ratio, W/LP ratio for Punjab and Williamson's W/R ratio for Punjab



Sources and notes: National W/LP ratio, W/LP ratio for Punjab and Williamson's W/R ratio for Punjab. See Figure 2.3 and Section 2.3 for calculation of the national W/LP MA ratio. I present my series in 5-year averages in order for it to be comparable to Williamson's. For Williamson's ratio 1911=100 while for my series 1910=100.

2.F Controlling for castes

In my panel analysis, I control for provincial fixed effects, capturing with them the effect of different levels of caste concentration in the provinces -along with all other characteristics particular of each province-. However, it could still be the case that the evolution of such concentration affected changes in agricultural income inequality. I argue that this hypothesis is (1) difficult to test, considering the census-to-census changes in the measurement of castes and (2) improbable, considering the evidence on the Brahman caste -present in all Colonial India and frequently used to take into account the presence of elite castes (Banerjee and Somanathan, 2007;

Chaudhary, 2009)-. First, from census to census, castes were reported differently: for instance, a caste could be reported one census, and then the next reported as two different castes. Also, new castes were reported from census-to-census, making the comparison of caste concentration between census difficult. Second, in order to present some evidence that changes in caste concentration had no impact on changes in agricultural income inequality I present Table 2.F.1. This table shows the evolution of the share of brahman population over total provincial population for my period of study. Notice how the evolution is similar across all provinces and changes were small, meaning that there was little change in the shares of brahmans and that such changes were common throughout provinces. Overall, this means that it is improbable that changes in caste concentration or its levels drove my results.

Table 2.F.1: Share of Brahmans over total provincial population

Province (share of brahmans)	1891	1901	1911
Bengal	100	97.9	94.9
Bombay	100	95.0	96.4
Central Provinces	100	112.2	93.2
Madras	100	98.7	100.6
Punjab	100	93.3	85.9
United Provinces	100	98.1	96.6

Sources and notes: Share of Brahmans over total provincial population 1891=100 for each province. Data from the *Census of India*.

2.G Land revenue systems' effect through time

Table 2.G.1 shows how the effect of land revenue systems evolved through time using the interaction between NonLandlord and year dummies to explain the evolution of W/LP ratios.

Table 2.G.1: Land revenue systems' effect through time

	(1)
1880.Year*NonLandlord	0.028
1881.Year*NonLandlord	0.019
1882.Year*NonLandlord	-0.106
1883.Year*NonLandlord	-0.173
1884.Year*NonLandlord	-0.247
1885.Year*NonLandlord	-0.263
1886.Year*NonLandlord	-0.233
1887.Year*NonLandlord	-0.307
1888.Year*NonLandlord	-0.456**
1889.Year*NonLandlord	-0.646***
1890.Year*NonLandlord	-0.863***
1890.Year*NonLandlord	-0.863***
1892.Year*NonLandlord	-1.065***
1893.Year*NonLandlord	-0.780***
1894.Year*NonLandlord	-0.679***
1895.Year*NonLandlord	-0.744***
1896.Year*NonLandlord	-0.852***
1897.Year*NonLandlord	-0.826***
1898.Year*NonLandlord	-0.842***
1899.Year*NonLandlord	-0.896***
1900.Year*NonLandlord	-1.032***
1901.Year*NonLandlord	-0.857***
1902.Year*NonLandlord	-0.805***
1903.Year*NonLandlord	-0.811***
1904.Year*NonLandlord	-1.027***
1905.Year*NonLandlord	-1.074***
1906.Year*NonLandlord	-1.062***
1907.Year*NonLandlord	-1.069***
1908.Year*NonLandlord	-0.973***
1909.Year*NonLandlord	-1.029***
Constant	4.583***
<i>N</i>	174
R-Squared	0.588
Controls	NO
Provincial FE	NO
Time Trend	NO

Chapter 3

Land revenue systems and the levels of agricultural income inequality in colonial India

3.1 Introduction

This chapter I dig into the relation between institutions and the *levels* of income inequality, which lies at the core of neo-institutionalism. Similarly to the previous chapter, I study the influence of land revenue systems on agricultural income inequality in colonial India, but instead of focusing on its evolution, I look at how land revenue systems can explain regional differences in the levels of agricultural income inequality.¹ Results from Chapter 2 have shown that provinces with mostly landlord areas could relate to lower increases or even decreases in agricultural income inequality during the late 19th century. However, this is not contradictory to the idea that in landlord regions, the distribution of agricultural income was less egalitarian even by the early decades of the 20th century. In fact, land revenue systems could affect income inequality levels through the type of landownership as-

¹In this work I study the impact of land revenue systems on colonial districts from Assam, Bengal, Bombay, Burma -Upper and lower Burma-, Central Provinces, Punjab and the United Provinces. I include Burma in the analysis as it was part of the British Raj from 1852 to 1937.

sociated to them. For instance, in landlord areas, landowners could collect abusive rents from cultivators or pay subsistence wages to their agricultural wage workers. By contrast, in non-landlord areas, landowners were intended to be the cultivators themselves -who could eventually hire temporary wage-earners to help on the fields-, allowing for less exploitation through abusive rents or wages.

In a nutshell, I build a cross-section database with, to the best of my knowledge, the first district-level comparative agricultural income inequality estimates for colonial India. To measure income inequality I use a wage/income ratio (W/I) based on agricultural income estimates and wages from 1916. The W/I ratio represents the income of an agricultural wage-earner compared to the mean agricultural income. To deal with the potential endogeneity of land revenue systems, I use a dummy for districts conquered between 1820 and 1856 (Banerjee and Iyer, 2005) as an instrument for the proportion of land under non-landlord based land revenue systems in each district. Most importantly, between 1820 and 1856 utilitarianism became mainstream among officials both in India and Britain, which led to the introduction of non-landlord based systems in districts conquered during these years. This presents an exogenous shock that can be used to test the causal direction of the link between land revenue systems and agricultural income inequality.

This work contributes most directly to the literature that studies the impact of colonial institutions on economic outcomes. Most studies on the role of colonial institutions look at their impact on the provision of public goods and output per capita (Acemoglu et al., 2001; Angeles and Elizalde, 2016; Banerjee and Iyer, 2005; Engerman and Sokoloff, 2000; Maloney and Valencia Caicedo, 2016). However, the relation between institutions and income distribution has rarely been empirically tested for colonial times.² However, the neo-institutionalist theory clearly connects institutions and the distribution of resources (Acemoglu et al., 2005, p. 389-396), as the differentiation between extractive and inclusive institutions is based on in-

²To the best of my knowledge, there are only a few examples testing the relation between colonial institutions and inequality, most notably Galli and Rönnbäck (2020).

equalities in the political decision process, which are linked to economic inequalities (Acemoglu et al., 2001, p. 1370). In this regard, I provide evidence that differences in land revenue systems caused differences in income inequality across Indian districts during the colonial period.

More broadly, this study contributes to the literature on the effects of colonialism on the global south (Bagchi, 1982; Bértola et al., 2010). This literature points at colonial heritage as a fundamental factor to explain inequality and underdevelopment in the long term. However, little evidence has been provided on the effect of colonial institutions on inequality during the colonial period. Thus, this chapter explores the impact of colonialism on inequality during a period for which it has been mostly unexplored.

Finally, this work also relates to the large literature on the impact of Indian colonial institutions. Recently, the presence of direct or indirect colonial rule, the caste system and colonial land revenue systems have been highlighted as explanatory factors for development in colonial and present-day India (Banerjee and Iyer, 2005; Iyer, 2010; Jha and Talathi, 2021; Ratnoo, 2022; Verghese, 2018). Nonetheless, the link between land revenue systems and inequality is yet to be studied despite colonialism being highlighted as a major cause of large inequality in India (Alavi, 1975; Bagchi, 1982; Bhaduri, 1976).

Summing up, in this chapter I argue that there were important differences in agricultural income distribution across colonial India, based on novel district-level estimates of agricultural income inequality. I also analyse to what extent these differences can be explained by the presence of landlord or non-landlord based land revenue systems. Overall, the OLS results show that non-landlord based districts presented a wage/income ratio 35.8% larger than that of landlord districts. The IV results reported below show that such relationship was causal, and that non-landlord districts presented larger wage/income ratios than landlord districts. Additionally, I tackle the potential understatement of geographic factors (Roy, 2014) and spatial noise

causing misleading inferences (Kelly, 2020) introducing Conley standard errors, Spatial Autoregressive Models (SAR) and clustering standard errors at the provincial level. The IV results are also robust to alternative measures of the wage/income ratio -e.g. using Donaldson (2018) income estimates- as well as to a large set of robustness tests.

The chapter is structured as follows. In Section 3.2 I present a general overview of inequality and rural poverty in colonial India. In Section 3.3, I introduce the data and methodology I am using in this chapter while in Section 3.4 I present my main results (IV), their robustness checks and some evidence on the mechanisms driving my results. Finally, in Section 3.5 I conclude.

3.2 Agricultural income inequality in colonial India

The colonial Indian countryside has always been defined as highly unequal. Generally, cultivators were said to always live near subsistence levels, exploited by a landlord elite and/or moneylenders (Bagchi, 1982, p. 84). Accordingly, the presence of a rich peasant stratum in India has been considered extremely limited (Patnaik, 1983, p. 78). This generalized poverty was even worsened by the yield stagnation and the change from land surplus to land shortage by the early twentieth century (Roy, 2007, p. 91).

These general views of poverty and inequality in colonial India have also allowed for some regional diversity. For Bengal, the excessive land revenue demands just after the introduction of the landlord-based system motivated the creation of an under-tenure system by the landlords to secure part of their revenues in case of arrears. Overtime, this led to the growth of rents collected by intermediaries, that accentuated inequality and the pauperization of cultivators (Bhaduri, 1976, p. 47-48). Bengal has also been signalled as a province where indebtedness and debt interest

were important factors in the exploitation of the peasantry (Bose, 1993, p. 122-128). In Bombay, the increasing number of landless cultivators -following a disruption of the local land revenue system- and the rich peasants' role in the commercialization process allowed for increasing inequality (Charlesworth, 1985, p. 174-224). Meanwhile, in some southern districts excessive land revenue requirements in the first settlements and increasing commercialization led to the growth of income inequality in the second half of the nineteenth century (Washbrook, 1994, p. 136-137). This situation changed at the turn of the century through a more egalitarian land distribution due to lower land revenue charges and the declining prices of some commercialized crops.

Overall, the Indian peasantry was mostly poor and inequality was high throughout all colonial India. However, based on previous literature little can be said about the differences in inequality across regions. Several factors, though, such as differences in the extent of commercialization or indebtedness, could have generated different levels of inequality across regions. In this chapter, we focus on the potential differential impact of colonial institutions and, in particular, the land revenue systems established in each district.

The land revenue systems determined who owned the land. However, landownership was not given without liability, as landowners were also responsible for the payment of the land revenue to the colonial state. The British introduced their first long-lasting land revenue system in the Bengal presidency in 1789 (Baden-Powell, 1892a, p. 284, 391). Such system was the zamindari one, in which the zamindars -former revenue collectors of the Nawabs of Bengal³- became landowners. Under the mainstream classification of land revenue tenures, such land revenue system is classified as landlord-based (Banerjee and Iyer, 2005, p. 1193). In zamindari areas, the zamindar was the proprietor of the land and so, he was also liable for the payment of the land revenue. Land was usually cultivated by tenants or under-tenants -who had to pay a rent to the zamindar- and by servants or agricultural labourers. Therefore, in

³The Nawabs were the provincial rulers under Mughal domination.

zamindari areas land was owned by an intermediary -zamindar- between the actual cultivator -tenant or agricultural labourer- and the state.

By contrast, in most of Madras and Assam and all of Bombay, Berar and Burma the ryotwari system was adopted. This land revenue system gave landownership to cultivators, dropping any intermediary between them and the government. The ryotwari system has therefore been classified as a non-landlord based system given that the landowner cultivated the land himself or with the aid of agricultural labourers. Finally, the mahalwari system was introduced in Punjab and the United Provinces. Such system established a village body as the responsible for land revenue payment and landownership. In the case of this system it is necessary to differentiate between villages where the share of the land revenue and representation in the village body was distributed by ancestry and those where they depended on the actual possession of the land. The former led to less representative village bodies –in those areas, the mahalwari system can be classified as landlord-based- while the latter led to more representative village bodies, closer to non-landlord based systems (Banerjee and Iyer, 2005, p. 1194).

In the next sections I focus on the potential influence of those differences among land revenue system on differences in agricultural income inequality across the Indian districts.

3.3 Data and Empirical Framework

3.3.1 Dependent variable: W/I ratio

To estimate the levels of agricultural income inequality in colonial India's districts, I use the 1916 wage/income ratio (W/I). The W/I ratio is a ratio measuring the income of agricultural labour as a share of the mean agricultural income. In other words, it estimates how much poor labourers earned relative to the average or per capita income. The wage/income ratio has already been used to estimate agri-

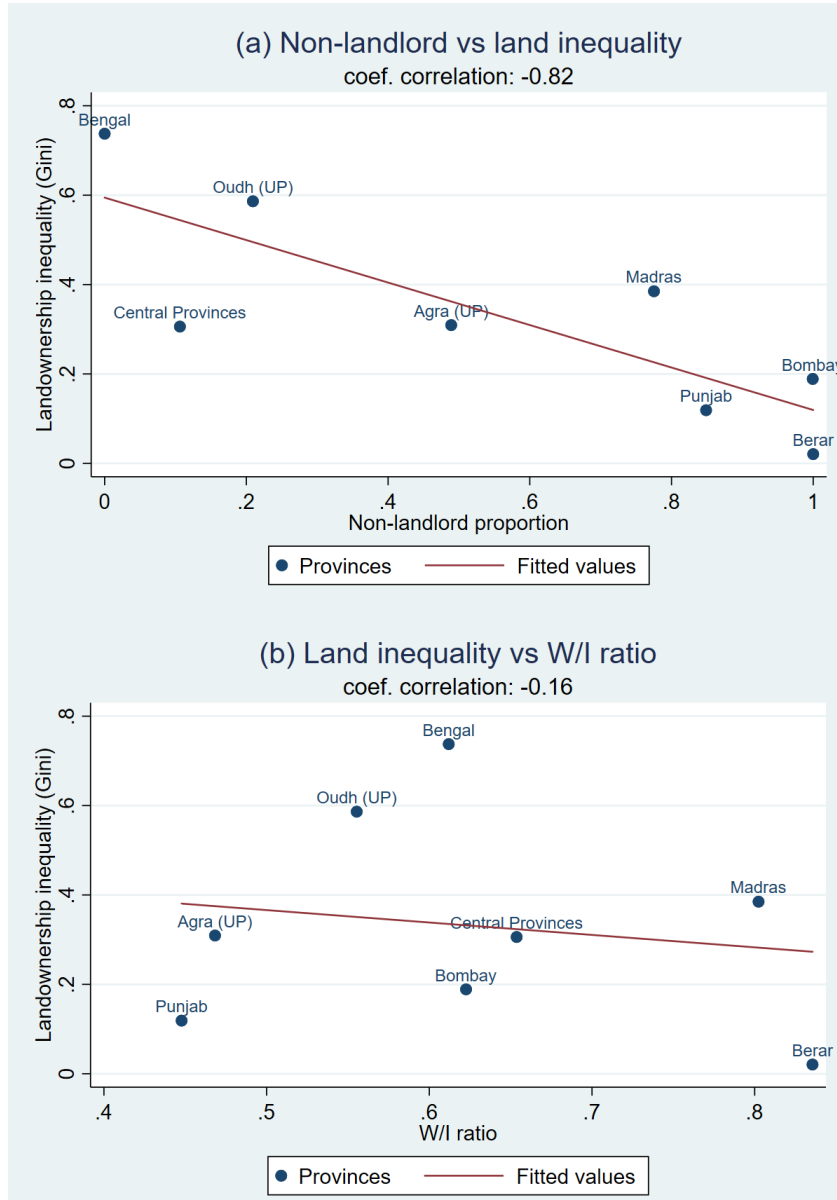
cultural income inequality in India (Roy, 2007, p. 85) and in other world regions (Willebald, 2015).

A potential concern when using the W/I ratio as a crude inequality measure is that inequality depends on (a) the returns to land and labour and (b) the distribution of both factors. Looking just at wages and agricultural income to estimate inequality might leave out information on the distribution of labour and land. I argue, though, that this should not be worrying in the current analysis as the potential bias introduced by estimating inequality using the W/I ratio goes against my hypothesis that non-landlord areas presented less inequality. In landlord regions, landownership was usually granted to former tax collectors (Lee, 2018, p. 13). By contrast, in non-landlord regions, landownership was intended to be given directly to the cultivator. Thus, landownership rights in landlord areas were created clustering various former cultivator's lands while in non-landlord areas, landownership rights usually consisted of a plot from a single cultivator. Hence, the introduction of landlord systems could have led to more land inequality in landlord regions. There is very limited data on land inequality, but Figure 3.3.1(a) shows evidence of such negative link between landownership inequality and the non-landlord proportion. Also as expected, the W/I ratio does not seem to perfectly capture inequality from land distribution -see Figure 3.3.1(b)-. Therefore, any result showing a clear association between the non-landlord proportion and the W/I ratio might be seen as a lower-bound estimate of the actual relationship between non-landlord proportion and inequality.

I estimate agricultural income inequality for 1916, the only year for which comparable data on wages at the district level are available for all the British Raj.⁴ However, this is also a reasonable choice for the current analysis, for several reasons. First, there were no major famines throughout the 1910s. Second, by 1916 a number of tenancy acts had been introduced in landlord-based areas, which limited the capacity of landlords to obtain large shares of the agricultural surplus through rents.

⁴This is, including Burma. If Burma is excluded, data is available for most provinces at the district level from 1911.

Figure 3.3.1: Landownership inequality and the non-landlord proportion



Sources and notes: (a) shows the relation between landownership inequality -measured using the Gini index- and the non-landlord proportion. Data to estimate landownership inequality comes from the *Statistical abstract relating to British India from 1894-95 to 1903-04*, 39 (1905). I use provinces instead of districts because data on landownership inequality at the district level, to the best of my knowledge, is unavailable. (b) presents the potential link between landownership inequality and the W/I ratio.

Thus, landlord-based districts could have experienced a reduction of agricultural income inequality after the introduction of these acts, which would go against my hypothesis that landlord-based districts presented larger levels of income inequality. This would provide more robustness to the results if my hypothesis holds. Last but definitely not least, one might be concerned that 1916 could have had a special agricultural season in some regions, and that heterogeneity might be affecting the results. However, qualitative evidence suggests that monsoon rain was remarkably uniform in 1916, meaning that 1916 agricultural season was rather uniform across regions.⁵ As a robustness test, I estimate the W/I ratio for 1911 -a year for which data are available for the whole Raj except Burma-. The IV coefficient remains significant at 1% -see column (5) in Table 3.A.1-, suggesting that results are not driven by using a 1916 cross-section.

The wage/income ratio is estimated using daily agricultural labourers' wages in 1916 from *Prices and Wages in India* and a district-level estimation of agricultural income for the same year. The way of collecting and reporting Indian agricultural wage statistics changed over time. From 1873 onwards, wage statistics started being reported yearly, providing average wages per month for a small number of districts.⁶ However, it was not until the introduction of the quinquennial wage census that daily wages were reported for most districts in directly controlled British India. In all provinces -except Burma (1916/17)- quinquennial wage censuses were introduced by 1911/12. Therefore, the first year for which there is comparable district data on wages for all directly controlled British Indian regions is 1916. These wages were reported as a sort of average or common wages in a district.⁷ One might be concerned about the use of wages data during the 1st World War, but agricultural wages in India did not seem to have been substantially affected by the war (Roy, 2007) as shown in Figure 3.3.2, which compares the 1911 and 1916 wage data.

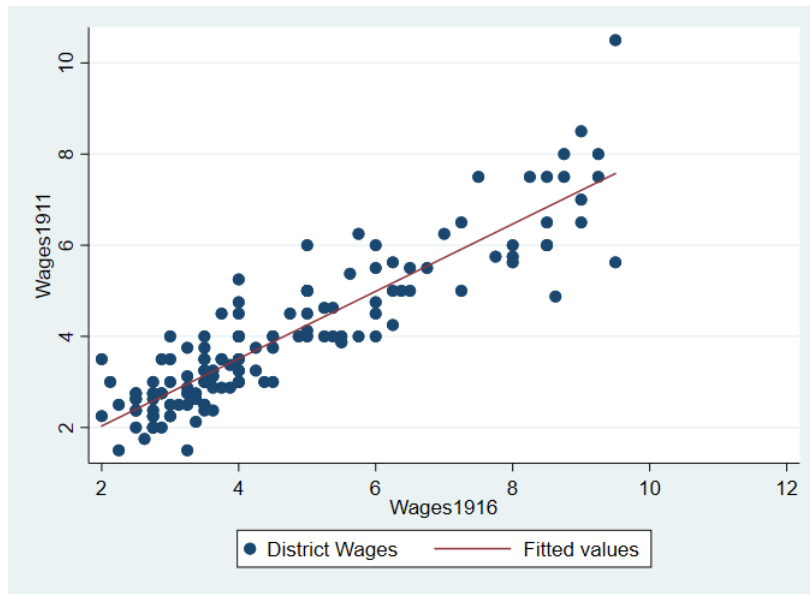
Wages reported in *Prices and Wages in India* are most certainly cash wages, and

⁵*Estimates of Area and Yield of Principal Crops in India, 1916-17, XIX (1917), p. 1.*

⁶*Report on the Enquiry into the Rise of Prices in India, I (1914), Appendix G.*

⁷*Report on the Enquiry into the Rise of Prices in India, I (1914), Appendix G.*

Figure 3.3.2: 1911 and 1916 district wages



Sources and notes: 1911 and 1916 district wages from *Prices and Wages in India*.

to the best of my knowledge, there is no wage series specifically reporting in-kind wages. Not accounting for in-kind wages could be problematic if such wages were more common in landlord areas. However, there is evidence that contradicts this hypothesis. First, there is plenty of evidence of wages paid in-kind in non-landlord regions. In most non-landlord districts of Madras, grain wages were common even in 1893 (Kumar, 1965, p. 145). In Bombay and Berar, there are also plenty of instances where wages were paid in-kind.⁸ Second, several scholars argue and provide evidence on in-kind wages becoming less common as prices rose steadily during the late nineteenth century throughout India (Kumar, 1965; Roy, 2005; Roy, 2007). Overall, it seems that in-kind wages were on the decline by 1916 and, were present throughout India independently of the non-landlord proportion. Hence, I suggest that it is improbable that not accounting for in-kind wages significantly influences results.

Finally, I transform 1916 daily wages into yearly wages assuming 250 working days (De Zwart and Lucassen, 2020, p. 658), although I test the robustness of my results to differences on working days by gender -see Table 3.4.4- and province -see Table

⁸Royal Commission on Agriculture, VII (1927), p. 394.

3.G.1 in the Appendix-. Roy (2007, p. 83) has used a similar number as upper bound yearly working days (260) for the agricultural sector of colonial India.

Using the wage/income ratio to measure inequality requires wages to be representative of the poorest throughout the Indian countryside. This is a strong assumption considering the extent and diversity of colonial India. For instance, in some Indian regions -e.g. Bengal- most cultivators were not wage earners but tenants, which casts doubts on the wages representing the income of the poorest in such regions. To mitigate this concern, I estimate tenants' incomes for 1911 at the provincial level.⁹ As Table 3.3.1 shows, my estimated yearly wages were below tenants' incomes in all provinces, which reinforces the hypothesis that these wages were representative of the poorest cultivators' incomes across colonial India. Moreover, wages reported in *Prices and Wages in India* reflected the income of those cultivators with the lowest bargaining power. These wages were reported by village-level administrative officers, who were usually part-time peasants and received a salary from the government to supply village level information. Those officers tended to report wages from peasants that lived permanently in a village, worked the same plot of land throughout most of their lives and were mostly low caste wage-earners. These wage-earners tended to work for the same employer -usually of a superior caste- for a long time¹⁰ and their wages were rarely renegotiated, being rather rigid to changes in market conditions (Roy, 2007, p. 79). By the late nineteenth century, wage setting processes in colonial India could be classified into two major groups:¹¹ one -common among settled and attached-to-land labour- driven by institutional constraints -e.g. custom and hierarchy- and another -connected to casual/mobile labour- more driven by market forces. The former led to more fragmented labour markets while the latter led to less fragmented markets. As argued previously, the reporting system of *Prices and Wages in India* was better at observing wages from settled/attached-to-land labour-

⁹For details on how I estimated tenants' incomes, see section 3.B in the Appendix.

¹⁰This type of agricultural labour tended to be hereditary.

¹¹Despite seasonal migration started transforming agricultural labour markets from rigid/custom wage setting to more market wage setting by the late nineteenth century, institutional constraints remained relevant for wage-setting, specially for settled labourers (Roy, 2007; Roy, 2016).

ers. Hence, wages from *Prices and Wages in India* were probably the less affected by market conditions and migration in a district, while mostly being set through institutional constraints and collusion (Roy, 2007). For all these reasons, it seems reasonable to assume that wages from *Prices and Wages in India* were representative of the bottom of the agricultural income distribution.

Another concern that may arise is that in landlord regions, most tenants and under-tenants cultivated the land themselves, which could lead to a low demand for wage labourers and lower wages in those regions, this resulting simply from the labour market structure of the region. However, Table 3.3.1 provides evidence against this hypothesis: first, it shows that the share of wage-earners was similar across provinces with completely different non-landlord proportions -see, for instance, Madras and Central Provinces-, meaning that being in a landlord or a non-landlord province does not seem to dramatically affect the demand of wage-earners. Second, from the previous reasoning, we might expect regions with a low share of wage-earners to have lower wages, simply because the demand for wage-earners was low. Nonetheless, Table 3.3.1 shows no positive link between the share of wage-earners and wages.

To estimate the 1916 gross agricultural income I use data on acreage at the district level for 17 different crops reported in *Agricultural Statistics of India*.¹² I also use provincial data from *Agricultural Statistics of India* on yields per acre for those 17 crops. For those provinces with no data on yields per acre for certain crops, I use the British India average for 1916.¹³

The use of provincial yield per acre from *Agricultural Statistics of India* instead of district yield per acre as done by Donaldson (2018) is due to potential biases of the official statistics. The official yield per acre data has been criticised as being unreliable, especially in permanently settled areas -all being landlord-based- (Dewey, 1979). To exemplify, for Bihar & Orissa -landlord permanently settled western part

¹²Those crops are: rice, wheat, barley, cholum or jawar, cumbu or bajra, ragi or marun, maize, gram, linseed, sesammum, rape and mustard, sugarcane, cotton, jute, indigo, tea and tobacco.

¹³This comes from Blyn (1966).

Table 3.3.1: Estimation of wages, tenants' incomes, share of wage-earners and non-landlord proportion for the Indian provinces in 1911

Province	Wages	Tenants' incomes	Share of wage-earners	Non-landlord proportion
Bengal	74.07	176.77	23.63%	0.00
Bombay	60.38	ND	33.16%	0.92
Central Provinces	58.50	127.17	39.59%	0.04
Madras	63.67	ND	34.32%	0.69
Punjab	88.77	280.37	12.08%	0.87
United Provinces	42.92	103.48	17.31%	0.42

Sources and notes: 1911 yearly wages in rupees from *Prices and Wages in India*. 1911 yearly tenants' income estimates in rupees. For details on the methodology and data used to estimate 1911 tenants' income see Section 3.B in the Appendix. The share of wage-earners (farm servants and field labourers) over total agricultural population -landowners, tenants, and wage earners- comes from the *Census of India (1911)*.

of Bengal- official provincial estimates were not updated using district crop cutting data because the figures were not trustworthy enough to be considered as standard.¹⁴ Consequently, provincial estimates in Bihar & Orissa remained based on rough approximate estimates made by district officers in 1892. These were considered more reliable than the district yield per acre estimates, which were updated each 5 years using crop cutting experiments. This critique has been acknowledged by Donaldson (2018, Appendix A) although he argues that such measurement errors are unrelated with his regressors. In this work, these potential measurement errors affect my dependent variable -W/I ratio- and my variable of interest -non-landlord proportion-. Therefore, I use provincial estimates to reduce these potential measurement errors. In order to mitigate concerns on the robustness of my results, in Table 3.H.1 of the Appendix I present my estimation results using alternative W/I ratios based on Donaldson's district-level estimates of agricultural yields. The relation between the non-landlord proportion and the W/I ratio remains strongly significant in all cases, both for OLS and IV estimates.

I transform output data into monetary terms by applying the 1916 district wholesale prices from *Prices and Wages in India*. For those districts with no data available, I use the average provincial price. Prices in *Prices and Wages in India* were only reported for articles that were staples of local trade.¹⁵ Therefore, unreported prices for certain crops in a district or province should not significantly affect my income estimates as those crops were not largely cultivated in the region. Also, since indigo and tea prices are not reported in *Prices and Wages in India*, for them I use 1924/25-28/29 prices from Blyn (1966, p. 314) brought back to 1916 using McAlpin (1983) agricultural price index. To express the resulting agricultural income estimation at the district level in per capita terms, I use data on actual agricultural workers and cultivators in each district from the *Census of India (1911)*.

Finally, I have used gross agricultural income instead of net agricultural income,

¹⁴See *Estimates of Area and Yield of Principal Crops in India (1916-17)* and *Agricultural Statistics of India (1919)*.

¹⁵*Prices and Wages in India*, (1919), Introductory note.

assuming no significant differences across provinces in the ratios between these two measures. To the best of my knowledge, provincial data on the cost of cultivation is scarce and more so at the district level, meaning that estimating a robust net agricultural income for each district seems unfeasible. Moreover, the evidence available shows that bullocks and ploughing represented the largest expenses for cultivation. More importantly, the market for cattle appears to have been fairly integrated through a series of fairs, leading to some traders specializing in inter-provincial cattle trade (Narain, 1929; Stowe, 1910). Such an integrated market might suggest some degree of homogeneity in cultivation costs, although some provincial and district differences might have been discernible.

3.3.2 Variable of interest: non-landlord proportion

To measure the land revenue systems, I use Banerjee and Iyer (2005) non-landlord proportion except for those districts that are not available in their sample, for which I use *Agricultural Statistics of India*. This indicator states the acreage proportion of non-landlord land revenue systems in each district. Banerjee and Iyer (2005) classify all ryotwari systems and those mahalwari systems described as bhaiachara as non-landlord land revenue systems. Nonetheless, there is debate on the validity of their non-landlord proportion estimate for the Central Provinces. More specifically, it has been argued that the zamindari land revenue system established in the Central Provinces differed substantially from the typical zamindari system as -where cultivators had absolute occupancy rights- rents were not fixed by the local landlord but by the revenue officer (Iversen et al., 2013). Consequently, Iversen et al. (2013) estimate a different non-landlord proportion for the Central Provinces. As an alternative measure for the land revenue systems, I also use the non-landlord proportion estimate for the Central Provinces from Iversen et al. (2013) to test the validity of my results.

3.3.3 OLS and controls

With my measures of agricultural income inequality and land revenue systems at hand, I study their relation by estimating my baseline district-level cross-section regression (3.1):

$$\begin{aligned} WageIncomeL_i = \beta_0 + \beta_1 NonLandlord_i + \beta_2 CRFI_i + \beta_3 X_i + \beta_4 \Pi_i \\ + \beta_5 Conquest_i + \epsilon_i \end{aligned} \quad (3.1)$$

where the dependent variable representing income inequality is the natural logarithm of the wage/income ratio. $NonLandlord_i$ represents the non-landlord proportion estimate for district i -either using the estimation from Banerjee and Iyer (2005) or Iversen et al. (2013)-.

$CRFI_i$ represents a caste and religious fragmentation Index (CRFI). This is a Herfindahl index including Hindu and Muslim castes -and tribal groups for Burma- (Banerjee and Somanathan, 2007). The index is estimated following this equation: $CRFI = 1 - \sum S_i^2$ where S represents the weight of each caste over total district population. Therefore, large values on the CRFI represent larger caste and religious fragmentation. Given the impressively large number of castes and following Banerjee and Somanathan (2007), I use those Hindu and Muslim castes that provincially represent at least a 1% of the overall population. Data on castes is obtained from the *Census of India (1911)*. Caste distribution could affect income inequality levels as large ethnic diversity could lead to polarization and rent-seeking behaviours by the landowners (Easterly and Levine, 1997, p. 1205-1206).

X_i is a matrix of economic controls -share of trade occupations and land/labour ratio-. I use the share of people in trade occupations in each district as a proxy for commercialization. I estimate it using data from the *Census of India (1911)*. The idea is that in districts with a larger share of people involved in trade occupations, I expect to find more commercialization as more people works in commercial occupations. As for the land/labour ratio, I use the 1916 acreage from *Agricultural*

Statistics of India and actual female and male workers and cultivators from the various volumes of the *Census of India (1911)*. The land/labour ratio represents the relative abundance of cultivated land over labour. This ratio might capture labour's bargaining power in agriculture, as in places where land was more abundant, the cultivator could probably pressure for better conditions. Additionally, factor endowments could be influenced by differences in wage levels. Districts with higher wages could end up with lower land/labour ratios due to higher population growth. Overall, the land/labour ratio presents a clear negative correlation with the W/I ratio (-0.634) and a very weak correlation with the non-landlord proportion (0.088). This ratio presented important regional differences. In regions where major investments in government canals led to lots of new cultivable land by the end of the nineteenth century -e.g. Punjab-, the land/labour ratio was relatively large (Chaudhary, Gupta, et al., 2016, p. 105). The Central Provinces also presented a relatively large land/labour ratio, but mostly due to the extremely low population growth and some expansion of land cultivated during the second half of the nineteenth century. Alternatively, regions such as Bengal, where no new land was available for cultivation by the early twentieth century, had a relatively low land/labour ratio.¹⁶

Π_i is a matrix including geographic controls such as latitude, longitude, maximum altitude, mean altitude, rainfall, coast dummy and dummies for different types of soils.¹⁷ Latitude, longitude, maximum altitude, mean altitude and the type of soil dummies are estimated using georeferenced maps. I build a district-level map of the British Raj using maps from the *Atlas of the Imperial Gazetteer of India (1909)* that I georeferenced. With that, I estimate the latitude and longitude of the centroid of each district. To estimate the maximum and mean altitudes of each district, I use maps from the STRM Database while for the type of soil dummies I use FAOs

¹⁶An additional potential economic control is irrigation, which might affect W/I by enhancing income. However, this variable is not correlated with W/I (the correlation coefficient is -0.036) and the regression results are not affected significantly by its inclusion -see Table 3.C.1 in Section 3.C of the Appendix-.

¹⁷I use dummies for the four most common types of soil in colonial India following FAO's soil classification from the legend of the soil map of the world (1974). The most common soil types according to this classification are: Cambisols, Fluvisols, Luvisols and Nitosols.

digital soil map of the world. To estimate the average rainfall in each district, I use data from the *Imperial Gazetteer of India (1909)* while for the coast dummy I also use the maps from the *Atlas of the Imperial Gazetteer of India (1909)*.

Finally $Conquest_i$ controls for the length of British rule -i.e. the date of British conquest-. Earlier conquered districts could have more developed trade and credit markets, or be overall better districts for cultivation, which could have affected income inequality. Following Banerjee and Iyer (2005) I use the date of conquest and its squared term to control for particular characteristics of early conquered districts.

3.3.4 IV strategy: Districts conquered between 1820 and 1856

It could be argued that the introduction of land revenue systems was linked to former income and wealth distribution. Landlord land revenue systems could have been introduced in areas formerly with larger inequality and powerful landlord claimants¹⁸ that were able to persuade the British to maintain their status with the provision of landownership rights. In this sense, some areas with wealthy and powerful former landlord claimants had their landlord privileges recognized through the introduction of landlord-based systems. For example, in the Central Provinces most wealthy pre-colonial tax collectors were able to hold landownership during colonial times through the introduction of a landlord-based system (Baden-Powell, 1892c, p. 387-388). However, the introduction of colonial land revenue systems cannot only be explained by pre-existing local conditions as exogenous factors appear to also have influenced their introduction. The ability of the British administration to effectively collect the land revenue on its own (Baden-Powell, 1892a, p. 394-398, 401-407) and the ideology and British agency (Banerjee and Iyer, 2005; Ludden, 1993; Stokes, 1959) could have influenced the introduction of certain land revenue systems.

¹⁸Pre-colonial landownership was not individual. Cultivators, intermediaries and the state had some right on the land produce. See Roy (2013).

To deal with this potential endogeneity, I use a dummy for districts conquered between 1820 and 1856 following Banerjee and Iyer (2005). It could be argued that non-landlord systems were introduced in districts conquered between 1820 and 1856 due to the agency of particular British officials and a switch in the mainstream ideology among officialdom in India and Britain.

Before 1820, most British officials adopted Whig policies, which motivated the introduction of large landlords and granted them privileges (Banerjee and Iyer, 2005; Stokes, 1959). Essentially, Whigs saw landlords as the natural elite and as providers of social order. Moreover, Whigs argued that political power was inevitably corrupting and abused and, therefore, had to be reduced to a minimum (Stokes, 1959, p. 5). The most prominent example of a Whig policy was the introduction of the Permanent Settlement in Bengal (1793), which clearly sought to reduce the functions of government to guaranteeing property rights and security while providing landownership to large landlords -zamindars-.

After 1820, utilitarian ideas gained momentum in India -as they did in England- (Banerjee and Iyer, 2005; Stokes, 1959). Utilitarians argued that all rent from land¹⁹ should be collected by the state as it was a particularly suitable source of taxation (Stokes, 1959, p. 77). Additionally, they added among the functions of the state the protection of the peasants and their way of life (Stokes, 1959, p. 26). These principles led to the promotion of non-landlord systems, which dropped all intermediaries that could capture rent and, at the same time, protected cultivators granting them landownership rights over their holdings. Thus, following the settlement in Bengal, the initial intention of the Madras Board of Revenue was to introduce zamindari -landlord- systems in the region. However, such intention could not completely materialize due to the influence of Thomas Munro on the Court of Directors of the EIC in London. By 1818, the minute on the ryotwari -non-landlord- settlement was approved (Baden-Powell, 1892c, p. 32) and the policy was implemented through-

¹⁹Utilitarians defined rent in the Ricardian sense, that is, land rent was the surplus earning above the cost necessary to deploy and use the resource.

out the province after 1820 (Banerjee and Iyer, 2005). Non-landlord systems were introduced in most districts conquered after that.

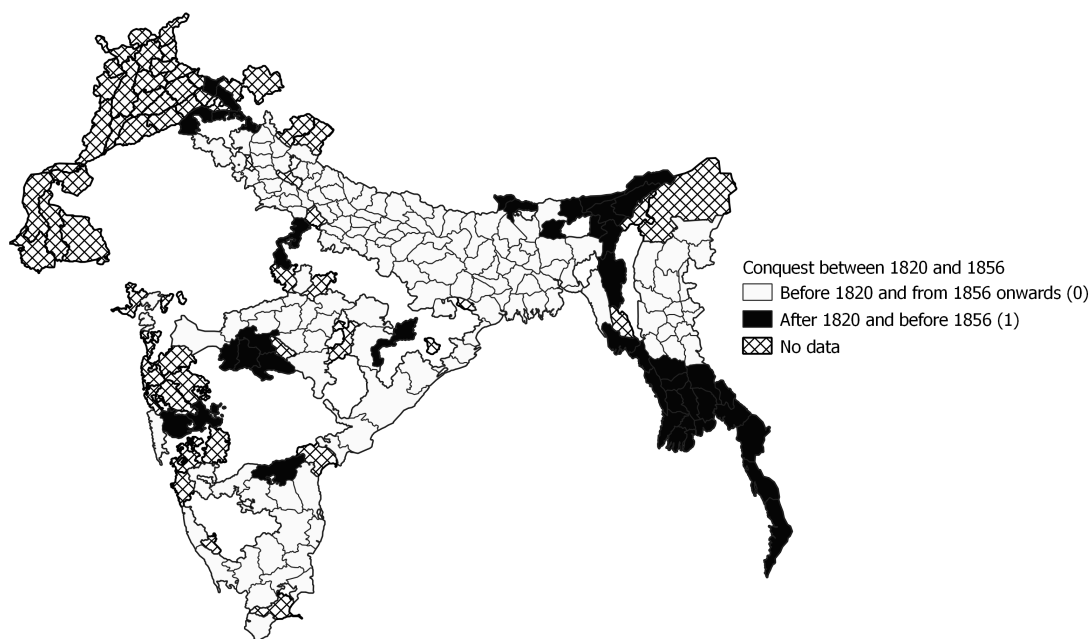
However, with the uprising of 1857, British officialdom reassessed their priorities. The colonial government acknowledged the usefulness of having large landlords on their side to protect social order and avoid massive turmoil (T. Metcalf, 1961, p. 156-157). In Oudh -a former princely state which was annexed in 1856 through the Doctrine of lapse²⁰- this led to a reversal of the tenure policy and the introduction of landlord systems in detriment of the mahalwari system that started being implemented in 1856 (Banerjee and Iyer, 2005, p. 1196).

A threat to the exogeneity of the dummy for districts conquered between 1820 and 1856 would be that the date of British conquest might have been correlated with pre-colonial conditions. It could be argued that the EIC selected the richest -and probably most unequal- regions of India to conquer first, potentially leading to a correlation between the date of British conquest, income and agricultural inequality in 1916. However, this selection bias is rather unlikely for several reasons. First, at the time of the conquest of Bengal (1757) the EIC employees had very limited data and knowledge on land productivity and on the land revenue they could demand (Baden-Powell, 1892a, p. 395). This lack of real knowledge makes it rather improbable that the EIC selected its initially acquired territories by their land productivity. Second, the events preceding the EIC conquest of Bengal (1757) seem to have unfolded as a response to the EIC fears rather than planned warmongering. Hostilities due to the outbreak of the Austrian Succession War (1740) led to a series of French conquests in South India -including Madras-. That, together with the EIC distrust of the Nawab -provincial Mughal ruler- of Bengal to protect them from French incursions, led to a crisis in Bengal (Bandyopadhyay, 2004, p. 42-43). Siraj-ud-Daulah, the young Nawab of Bengal, threatened the EIC trade in Bengal and eventually besieged Calcutta. Such crisis resulted in the Battle of Plassey (1757) and British dominion over the region. Finally, even if the EIC selected some rich territories

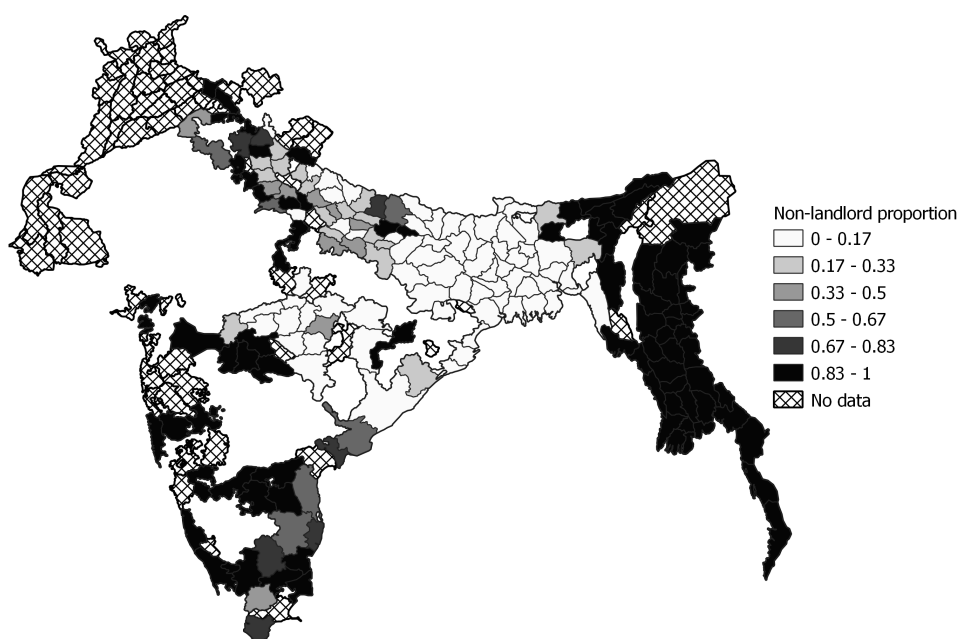
²⁰For more on the Doctrine of lapse see below or Iyer (2010).

Figure 3.3.3: Dummy for districts conquered between 1820 and 1856 (IV) and non-landlord proportion (BI)

IV: Conquest between 1820 and 1856



Non-landlord proportion



Sources and notes: Maps showing the dummy for districts conquered between 1820 and 1856 (IV) and the non-landlord proportion. Both variables come from Banerjee and Iyer (2005).

for conquest -which, as previously argued, is rather unlikely-, my estimates include controls on most variables that could be observed by the EIC for this hypothetical selection -e.g. coast, altitude and average rainfall- as well as on the length of British rule and its squared term -see Section 3.3.3-. Therefore, even if earlier conquered districts were richer or more unequal in pre-colonial times, this potential bias should already be captured by these controls and the linear and quadratic measures of the length of British rule.

In a nutshell, the agency of particular British officials and a switch in the mainstream ideology among officialdom in India and Britain explains the tendency to introduce non-landlord based systems in districts conquered between 1820 and 1856. Hence, I argue that such a decision was exogenous. As shown in Figure 3.3.3, districts conquered between 1820 and 1856 tended to have a large non-landlord proportion. The dummy for districts conquered between 1820 and 1856 comes from Banerjee and Iyer (2005) and is based on the date when the district came under British land revenue administration.

3.4 Results

Table 3.4.1 shows the estimation outcomes of the baseline OLS model, using the non-landlord proportion from Banerjee and Iyer (2005). After accounting for all controls, the coefficient of non-landlord proportion is positive and significant. More precisely, the estimation with all controls in column (4) shows that a non-landlord district had a wage/income ratio 35.8% larger than a landlord district.

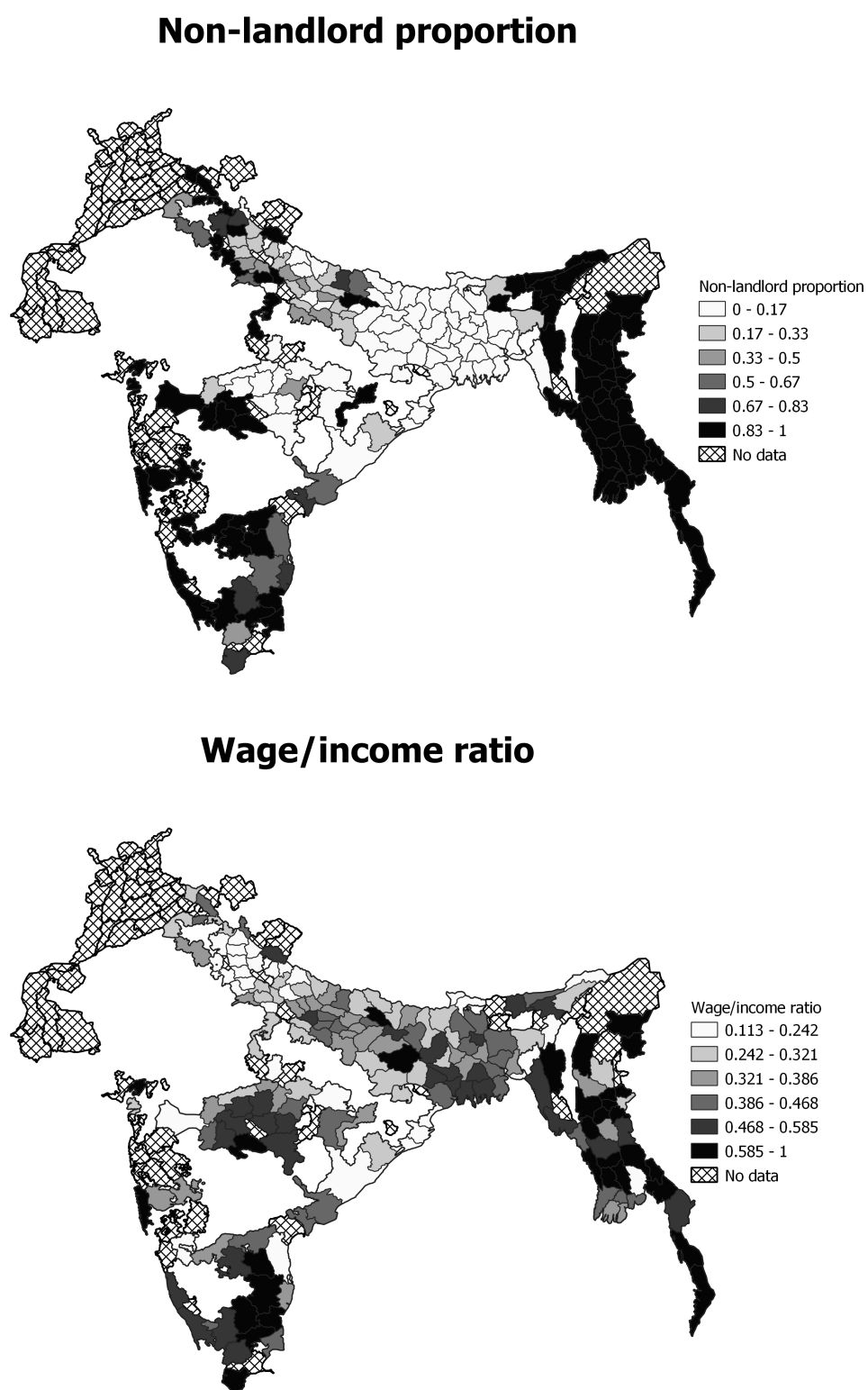
The positive relation between the non-landlord proportion and the wage/income ratio can also be observed in Figure 3.4.1. This relation is clear in Burma, Madras, United Provinces and most of Punjab and the Central Provinces. However, Bengal shows clear differences in income inequality between Eastern Bengal and its western region -Bihar & Orissa-. Both regions are landlord-based, but Eastern Bengal shows

Table 3.4.1: OLS Baseline estimations

	Wage/income ratio in ln			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	0.390*** (0.098)	0.366*** (0.089)	0.332*** (0.087)	0.306*** (0.093)
Date of British conquest	-0.408*** (0.104)	-0.205*** (0.078)	-0.105 (0.094)	-0.173* (0.097)
Date of British conquest ²	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000* (0.000)
Share of trade occupations in ln		0.033 (0.057)	0.043 (0.051)	0.025 (0.053)
Land/labour ratio in ln		-0.644*** (0.074)	-0.661*** (0.075)	-0.589*** (0.077)
CRFI in ln			-0.069* (0.037)	-0.041 (0.039)
Latitude				-0.013* (0.008)
Longitude				-0.005 (0.006)
Coast				-0.202** (0.092)
Average rainfall in ln				0.101 (0.071)
District's maximum altitude in ln				0.102* (0.061)
District's mean altitude in ln				-0.119* (0.067)
Cambisols Dummy				-0.050 (0.052)
Fluvisols Dummy				-0.005 (0.054)
Luvisols Dummy				0.088* (0.052)
Nitisols Dummy				0.017 (0.059)
Constant	369.50*** (94.23)	185.26*** (70.41)	95.13 (85.18)	155.87* (88.03)
Observations	190	190	190	190
R-Squared	0.177	0.563	0.573	0.616
Length British rule	YES	YES	YES	YES
Economic controls	NO	YES	YES	YES
Caste fragmentation	NO	NO	YES	YES
Geographic controls	NO	NO	NO	YES

Sources and notes: OLS Baseline estimations using Banerjee and Iyer (2005) non-landlord proportion. Dependent variable -wage/income ratio- is in ln assuming 250 working days. For more details on the data and controls used, see Section 3.3.

Figure 3.4.1: Non-landlord proportion (BI) and wage/income ratio maps



Sources and notes: Non-landlord proportion (BI) and wage/income ratio maps. The wage/income ratio is measured as an index where value 1 is the district with the largest W/I ratio.

comparatively low levels of income inequality compared with Bihar & Orissa. This difference can be explained by the singularity of Eastern Bengal. Eastern Bengal landlords had significant obstacles to raise rental rates and diversify their portfolios to include credit and product market investments (Bose, 1993). That was because in Eastern Bengal, most peasants held their occupancy rights with fixed rents. This differed drastically from the situation in the west, where most landlords were able to increase rents and their direct control over land (Bose, 1993, p. 69-70, 120).

Notice that my estimations do not include provincial fixed effects. This is due to the small -and sometimes nonexistent- land revenue systems' variability within provinces. Berar, Burma, Bombay and Bengal presented no within-province variation. This means that adding provincial fixed effects would capture the non-landlord proportion effect of all districts from these provinces. Those districts represent almost half of the sample -90 out of 190 districts-, which can easily lead to biased results. Considering spatial correlation of the wage/income ratio and the error term allows to check for spatial correlation without introducing province fixed effects.²¹

The results using the dummy for districts conquered between 1820 and 1856 as an instrument for the non-landlord proportion are shown in Table 3.4.2. The first stage estimation in column (1) shows that the dummy for districts conquered between 1820 and 1856 is a strong instrument for the non-landlord proportion. More precisely, the coefficient for the districts conquered between 1820 and 1856 is positive and significant at 1% when estimating the non-landlord proportion. Also, the F-statistic is large enough in all specifications to consider the dummy a strong instrument.

The second stage estimations confirm that the non-landlord proportion has a significant impact on agricultural income inequality. The IV coefficient remains significant in all specifications, even after including all controls. These IV results show that

²¹This leads to consistent standard errors, while clustering standard errors at the provincial level requires residuals to be uncorrelated between clusters, which is not usually the case in spatial data -see Kelly (2020)-. Alternatively, I introduce Conley standard errors -see Table 3.4.5-, I also present the IV with clustered standard errors at the provincial level -see Table 3.E.4-, and alternative Spatial Autoregressive Models (SAR) -see Tables 3.E.2, 3.E.3-. Results hold in most alternative specifications.

Table 3.4.2: Instrumental variable estimates using a dummy for districts conquered between 1820 and 1856

	1st IV Stage		2nd IV Stage		
	(1)	(2)	(3)	(4)	(5)
Conquest between 1820 and 1856	0.536*** (0.047)				
Non-landlord prop. (BI)		0.709** (0.307)	1.049*** (0.269)	1.047*** (0.275)	0.845*** (0.205)
Constant	0.393*** (0.035)	415.7*** (100.5)	345.6*** (109.3)	338.5** (140.4)	295.1*** (111.8)
Observations	190	190	190	190	190
R-Squared	0.266	0.133	0.382	0.383	0.520
Kleibergen-Paap rk Wald F statistic		27.58	26.88	27.80	39.35
Length British rule	NO	YES	YES	YES	YES
Economic controls	NO	NO	YES	YES	YES
Caste fragmentation	NO	NO	NO	YES	YES
Geographic controls	NO	NO	NO	NO	YES

Sources and notes: Instrumental variable estimates using a dummy for districts conquered between 1820 and 1856. This table presents the first -column (1)- and second -columns (2), (3), (4) and (5) - stages including caste and economic and geographic controls. Wage/income ratio in ln assuming 250 working days is the dependent variable. For more details on the data and controls used, see Section 3.3.

colonial land revenue systems clearly contribute to explaining the differences in income inequality levels between districts of colonial India.

Finally, when looking at the effect of the non-landlord proportion on wages and agricultural income separately -see Table 3.4.3-, the regression results show that the positive connection between the non-landlord proportion and the W/I ratio is explained by the positive and significant link between wages and the non-landlord proportion. This suggests that the non-landlord proportion was more relevant for the wage setting process than for agricultural investment or income. The fact that in non-landlord areas most cultivators were also landowners themselves might explain a larger bargaining power of wage-earners -they could always chose to cultivate their own lands- and larger wages in non-landlord districts.

Table 3.4.3: Link between the non-landlord proportion and wages and agricultural income

	Wages in ln		Agr. Income pc in ln	
	OLS	IV	OLS	IV
Non-landlord prop. (BI)	0.397*** (0.079)	0.975*** (0.207)	0.090 (0.063)	0.130 (0.126)
Constant	214.243*** (75.312)	363.809*** (108.526)	58.373 (51.831)	68.669 (60.540)
Observations	190	190	190	190
R-Squared	0.526	0.346	0.801	0.800
Length British rule	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES

Sources and notes: This table shows the non-landlord proportion OLS and IV estimates separately for 1916 wages and agricultural income. For more details on the data and controls used, see Section 3.3.

3.4.1 Robustness checks

In order to test the robustness of the IV estimates, I present a set of robustness checks whose results are shown in Table 3.4.4.

First, I present the IV estimates after dropping observations within the highest

Table 3.4.4: Robustness checks on the instrumental variable strategy

	(1)	(2)	(3)	(4)	(5)	(6)
Non-landlord prop. (BI)	0.674*** (0.157)	0.897*** (0.209)		0.640*** (0.145)	0.698*** (0.194)	1.251*** (0.433)
Non-landlord prop. (IPS)			1.165*** (0.282)			
Constant	302.09** (130.52)	295.60*** (113.19)	415.17*** (141.32)	368.01*** (133.50)	0.526 (94.31)	399.98** (168.59)
Observations	171	190	190	155	146	190
R-Squared	0.273	0.419	0.515	0.510	0.622	0.319
Length British rule	YES	YES	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES	YES	YES

Sources and notes: (1) shows the IV estimates dropping all observations with a wage/income within the highest decile. (2) shows the IV estimates with a different measure of wage/income ratio. This new measure presents differences in working days for male and female agricultural labourers using data for 1953 from Som. (3) shows the IV estimates using the non-landlord proportion with the changes in the Central Provinces suggested by Iversen et al. (2013). (4) presents the IV estimates dropping all Burma districts and (5) does the same for Bengal. (6) presents the IV estimates using the presence of permanent settlements as an alternative instrument. For all estimations except (2), the dependent variable is the wage/income ratio in ln assuming 250 working days.

wage/income ratio decile -column (1)-. The resulting coefficient drops but remains fairly close to that including these observations -see column (5) in Table 3.4.2- and statistically significant. Since choosing a threshold to drop observations is arbitrary, I also test my results dropping observations with different wage/income ratio levels -see Table 3.D.1 in the Appendix-. The IV remains significant in all specifications.

Second, I redo the IV estimates introducing a different wage/income ratio. Instead of estimating the wage/income ratio assuming a uniform amount of working days (250), I present a wage/income ratio considering different working days for male and female agricultural workers. To do so, I use 1953 data on working days for all-India male and female agricultural workers from the *6th Round Report of the National Sample Survey (NSS)* (Som, 1960). This introduces variation in the employment intensity, changing the wage/income ratio among districts depending on their gender labour structure. The estimation in (2) shows an IV coefficient which is similar to the IV baseline estimation and remains significant. I also introduce provincial-based variation in the gender-based employment intensity with no significant changes in my results -see Table 3.G.1 in the Appendix-.

Third, I introduce the non-landlord proportion changes for the Central Provinces suggested by Iversen et al. (2013). With this new estimate of the non-landlord proportion, the IV coefficient remains positive and significant at 1%. The value of the coefficient is close to that obtained in my initial IV results, although a bit larger.

Additionally, I present the IV baseline estimations dropping all districts from the province of Burma. I drop Burma's districts as they are not always included in studies on colonial India. Dropping Burma does not affect my results, as the IV coefficient remains positive and significant with a value close to those in my baseline estimations.

In column (5) of Table 3.4.4, I present the IV estimates dropping Bengal districts from the sample. Bengal is also usually studied as the paradigmatic case for the zamindari system -specially Bihar & Orissa, its western region- and was the first

province in which a landlord-based system was introduced. This does not affect either the sign or the significance of the IV coefficient.

Column (6) provides an alternative IV with a different source of exogeneity. This column presents the results using the presence of permanent settlements as an instrument for the non-landlord proportion. When land revenue systems were introduced, it had to be decided if the land revenue tax was to be fixed in perpetuity (permanent settlement) or updated each 20 to 30 years (temporary settlements). The weak EIC administration -specially during the early years of British rule- (Baden-Powell, 1892a; Lee, 2018; Swamy, 2011) and the eventual rewarding of some loyal allies²² explain the introduction of permanent settlements by the British. Significantly, permanent settlements were introduced in landlord areas while all non-landlord areas were temporary settled. I argue that the presence of permanent settlements fulfills the exclusion restriction since it should not affect the W/I ratio other than through its link with the non-landlord proportion. First, the weak administrative capacity of the EIC and the rewarding of some loyal allies was probably independent of the W/I ratio. Second, having the land revenue tax fixed should not directly affect wages. Third, the presence of permanent settlements was probably negatively correlated with agricultural income, which is against my hypothesis that W/I ratios were smaller in landlord areas. There are several potential explanations for that: first, most landlords with permanently settled lands were absentees, which means that they tended to invest very little on land (S. C. Ray, 1915; Swamy, 2011). Second, the state had less incentives to invest in permanently settled areas since such investments would not translate into more land revenue (Banerjee and Iyer, 2005; Swamy, 2011). In fact, several researchers have signalled how landlord regions did worse than non-landlord regions in terms of agricultural productivity and acreage of non-food grains by the early twentieth century and after independence (Banerjee and Iyer, 2005; Kapur and Kim, 2007). Overall, the coefficient using this alternative

²²*Bahraich: A Gazetteer of the District Gazetteers of the United Provinces of Agra and Oudh*, XLV (1921), p. 144), *Unao: A Gazetteer of the District Gazetteers of the United Provinces of Agra and Oudh*, XXXVIII (1903), p. 97), T. Metcalf (1961).

IV remains significant and positive, suggesting that results are robust to alternative potential sources of exogeneity.

Table 3.4.5: IV estimates with Conley standard errors

	Wage/income ratio in ln					
	(1)	(2)	(3)	(4)	(5)	(6)
Non-landlord prop. (BI)	0.67*** (0.174)	0.67*** (0.174)	0.67*** (0.206)	0.67** (0.268)	0.67** (0.286)	0.67** (0.310)
Observations	190	190	190	190	190	190
R-Squared	0.553	0.553	0.553	0.553	0.553	0.553
Length British rule	YES	YES	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES	YES	YES

Sources and notes: IV estimates with Conley standard errors with various cutoffs (in km). (1) 25k; (2) 50km; (3) 100km; (4) 200km; (5) 300km; (6) 500km. The dependent variable -wage/income ratio- is in ln. For more details on the data and controls used, see Section 3.3.

Finally, I also check for the need to consider spatial correlation in my analysis. There are two main reasons why it is important to check for spatial correlation: first, it could be the case that the wage/income ratio was spatially autocorrelated -see Figure 3.3.3-. In that case, geographic characteristics influencing the wage/income ratio could be a plausible explanation for such autocorrelation.²³ Second, the error term could be spatially correlated. Such autocorrelation may come from unmeasured or aggregated variables that are correlated through space. In econometric terms, spatial autocorrelation in the error term can lead to artificially low p-values if not accounted for, both in OLS or 2SLS (Beale et al., 2010; Kelly, 2020). Thus, I check for spatial correlation by introducing Conley standard errors with different cutoffs in Table 3.4.5. For all cutoffs the IV coefficient remains significant at least at 5%. Additionally, I present Spatial Autorregressive estimations and estimations clustering standard errors at the province level in Tables 3.E.1, 3.E.2, 3.E.3, 3.E.4 in the Appendix. Results in these tables are mostly in line with those presented in Table 3.4.5.

²³This identification strategy is used by Roy (2014, p. 339-344) for socioeconomic outcomes other than agricultural income inequality.

3.4.2 Mechanisms

Based on the previous results, I argue that land revenue systems contribute to explaining differences in agricultural income inequality in colonial India. However, this could occur through different mechanisms, such as differences in rents and illegal charges, the presence of a system of under-tenures and differences in indebtedness. These mechanisms are linked to the differences in bargaining power and effective law protection of landowners and cultivators.

Rents and illegal charges

With the arrival of the British, landlords had no limit to increase rents and could evict cultivators at their will. This situation changed with the introduction of tenancy reforms such as the Bengal Tenancy Act of 1885. In particular, this act introduced a period of at least 15 years between rent increases and limited each of them to less than 12.5%. It also gave occupancy rights to tenants holding land in a village for 20 years or more. Other tenancy acts were introduced, specially in landlord-based regions where tenancy was much more abundant, with similar measures to those included in the Bengal act. Tenancy -as well as rents- was more common in landlord areas than in non-landlord areas as in the latter the colonial government specifically intended to avoid all intermediaries between cultivators and the state. Despite these limitations for landlords, tenants did not have to be the actual cultivators -e.g. the land could have been sublet to a sharecropper or a wage labourer- who had neither support nor protection (Swamy, 2011, p. 144–145). Moreover, it could be argued that rents per acre were larger in landlord areas than in non-landlord areas. That could be the case because in landlord areas cultivators were usually landless and landownership was more concentrated. This left cultivators in landlord areas with less alternatives to work the land than in non-landlord areas. In the latter, most cultivators were landowners themselves and landownership was less concentrated. Apart from rents, landlords obtained illegal charges -*abwabs*- and allowed their employees to extract such charges throughout the whole colonial period

(Roy and Swamy, 2016, p. 41–42). These charges were mostly used by landlords to reduce their costs by allowing their employees to obtain part of their payment extorting the cultivator. In a nutshell, tenancy rights might have reduced income inequality effectively -specially in landlord areas- but, by the 1910s, landlords still had effective mechanisms to obtain extra profits from their cultivators.

Therefore, I expect landlord districts to present larger rents. To test this hypothesis, I use official statistics on 1910 rents (cash rents) from the *Report on the (land) revenue administration of the United Provinces of Agra and Oudh (1911)*. I do not consider rents in kind, as they represent less than 5% of the total rents reported and I could not find information on how they were monetized in the report. Thus, I present OLS estimates using the natural logarithm of district-level 1910 cash rents per acre in the United Provinces as my dependent variable. The United Provinces was a province in northern India -today's Uttar Pradesh- that presented some variability in land revenue systems. This means that I observe within-province variation but in a low number of districts (41). Therefore, results should be interpreted cautiously. District level rent data for other provinces is unavailable -Assam, Bengal, Bombay, Burma and Madras- or such provinces present no variability in land revenue systems -Central Provinces-.

The reported rents are a lower-bound estimate of the actual landlord's income obtained from cultivators since illegal charges -*abwabs*- were not reported in the official reports. Not accounting for them introduces a downward bias in the landlord's income obtained from cultivators in landlord districts. Such bias goes against my hypothesis that landlord districts should have larger rents and income extracted from cultivators.

Table 3.4.6 presents the OLS estimates. The non-landlord proportion coefficient is negative in all estimates and significant only after including geographic controls in column (4). The fact that the coefficient is not significant until the inclusion of geographic controls -column (4)- may be due to not accounting for land productivity

Table 3.4.6: OLS estimates testing the rents mechanism

	Cash rents per acre in ln				W/I in ln
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	-0.10 (0.18)	-0.13 (0.18)	-0.20 (0.18)	-0.36*** (0.12)	
Cash rents per acre in ln					-0.35*** (0.123)
Constant	-141.48 (203.41)	-150.27 (244.60)	-160.64 (287.51)	-212.45 (190.18)	-276.33** (133.43)
Observations	41	41	41	41	41
R-Squared	0.140	0.152	0.272	0.785	0.898
Length British rule	YES	YES	YES	YES	YES
Economic controls	NO	YES	YES	YES	YES
Caste fragmentation	NO	NO	YES	YES	YES
Geographic controls	NO	NO	NO	YES	YES

Sources and notes: (1) shows the relation between cash rents and non-landlord proportion only considering the length of British rule. (2) shows the same OLS including economic controls -share of trade occupations and factor endowments-. (3) includes the above mentioned controls and caste and religious fragmentation. (4) includes the above mentioned controls and all geographic controls from Section 3.3.3. Finally, (5) shows the relation between the wage/income ratio and the 1910 rents per acre in the UP.

-i.e. I could be comparing rents in very productive districts with rents in drier or less productive districts-. In column (4) I control for rainfall and the type of soil, among other geographic variables that allow for a comparison between similarly productive lands. Therefore, districts with lower non-landlord proportion presented larger rents after controlling for land productivity and other factors. After including all my controls in column (4), a non-landlord district presented rents 30.5% lower than those in landlord districts. Finally, (5) shows how a 1% increase in the rent per acre results on a 0.347% reduction of the wage/income ratio. In a nutshell, these results are consistent with my hypothesis that larger rents in landlord areas could be driving differences in income inequality.

System of under-tenures: subinfeudation

Landowners -especially in landlord-permanently settled areas- benefited from a system of under-tenures²⁴ that they could use as an insurance: if the landlord was to lose landownership, he continued having a claim on the surplus, owning one, some or all under-tenure rights on the land. Additionally, landowners could use these rights to bypass rent limitations introduced by the tenancy acts, as many under-tenure rights were unregulated (Roy, 2005; Swamy, 2011). This creation of under-tenure rights was especially acute in permanently settled areas, where the difference between rents -paid by tenants- and land revenue -paid by landowners- was the greatest. In fact, according to an official report,²⁵ some districts in Bengal had between 15 and 20 grades of tenure-holders.

Almost all zamindars in Bengal possessed under-tenure rights in their estates which allowed them to collect even more rents from cultivators. To exemplify, the Nawab of Bogra -a large landowner- collected rents from cultivators through six or seven different under-tenure rights (Islam, 1983, p. 208). Similarly in Bakarganj (Bengal), where there were often a dozen under-tenure rights per holding, the same middleman appears repeatedly in different grades of tenure rights. In fact, despite being one of the districts where tenures were more abundant, the ratio of landowners and under-tenure owners relative to cultivators was not larger than in the rest of Bengal.²⁶

The introduction of these under-tenure rights forced cultivators to give most of their surplus to landlords and other under-tenure owners (Bhaduri, 1976). Data on the level and existence of subinfeudation is extremely limited but suggests that there were higher rents in estates in which there were under-tenure rights. In fact, in Bakerganj, Faridpur and Mymensingh rents paid for under-tenure rights were 30% to 50% larger than rents paid for conventional tenure rights -i.e. from the tenant directly to the landowner- (Islam, 1983, p. 210). Similarly, data available for 8

²⁴Tenants did not always cultivate the land themselves, and in some cases leased their land to under-tenants -who could be the landowner or any peasant willing to cultivate the land-.

²⁵*Report of the Land Revenue Commission Bengal*, I (1940), p. 33-37

²⁶*Census of India, Bengal, Part I, V* (1921), p. 386

districts in Bengal shows a positive correlation (0.85) between rent per acre and the ratio of all kinds of tenures -including under-tenures- over cultivator holdings.²⁷ Such a correlation suggests that districts with more under-tenures had larger rents per acre and, as suggested in Section 3.4.2, more unequal distributions of agricultural income.

Table 3.4.7: OLS estimates testing the subinfeudation mechanism

	Share of agents, managers and rent col.				W/I in ln
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	-0.004*** (0.001)	-0.005*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	
Share of Agents, etc.					-28.76** (11.11)
Constant	1.134** (0.501)	0.895** (0.443)	1.561*** (0.577)	0.774 (0.497)	129.54 (88.66)
Observations	190	190	190	190	190
R-Squared	0.331	0.335	0.344	0.427	0.610
Length British rule	YES	YES	YES	YES	YES
Economic controls	NO	YES	YES	YES	YES
Caste fragmentation	NO	NO	YES	YES	YES
Geographic controls	NO	NO	NO	YES	YES

Sources and notes: (1), (2), (3) and (4) show the link between my estimate for the presence of under-tenures -share of agents, managers and rent collectors- and the non-landlord proportion. In (5), the relation between the share of agents, managers and rent collectors and my estimate of inequality -the wage/income ratio- is shown. For more details on the controls used, see Section 3.3.

Due to the lack of data on the presence of under-tenure systems, I use the share of agents, managers of landed estates (not planters), clerks and rent collectors over total agricultural workers and cultivators to estimate the extent and presence of under-tenures. The presence of these agents, rent collectors and managers can be linked to the presence of multiple-layer tenure systems.²⁸ That could be the case since more complex tenure systems require more workers to collect the rents for each tenure layer and managers to coordinate cultivation and rent collection between

²⁷Islam (1983, p. 212). The coefficient of correlation is my own calculation based on data from Islam.

²⁸*Census of India, Bengal, Part I, V* (1921), p. 386-8.

the different tenures. To measure this share of agents, managers, clerks and rent collectors, I use data from the different volumes of the *Census of India (1911)*.

Table 3.4.7 shows how the presence of agents, managers and rent collectors is negatively and significantly correlated with the non-landlord proportion -see columns (1), (2), (3) and (4)-. This means that a non-landlord district would have a share of agents, managers and rent collectors 1 standard deviation lower than a landlord district -see column (4)-. Finally, column (5) shows that a 1 standard deviation increase in the share of agents, managers and rent collectors led to a 11.1% reduction in the wage/income ratio. This is in line with the hypothesis that subinfeudation can explain why landlord areas were less egalitarian.

Credit and indebtedness

Table 3.4.8: OLS estimates testing the indebtedness mechanism

	Share of rent-receivers lending				W/I in ln
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	-0.005*	-0.003	-0.004	-0.004	
	(0.003)	(0.003)	(0.003)	(0.003)	
Share of rent-receivers					-4.164 (2.736)
Constant	-1.347	2.043	-0.777	0.195	84.065
	(1.971)	(2.400)	(2.655)	(2.806)	(87.044)
Observations	190	190	190	190	190
R-Squared	0.107	0.174	0.189	0.399	0.586
Length British rule	YES	YES	YES	YES	YES
Economic controls	NO	YES	YES	YES	YES
Caste fragmentation	NO	NO	YES	YES	YES
Geographic controls	NO	NO	NO	YES	YES

Sources and notes: (1) shows the link between the non-landlord proportion and the share of rent-receivers reporting moneylending and grain dealing as their secondary occupation including the date of conquest and its square term. Economic controls (2), the caste and religious fragmentation index (3) and geographic controls (4) are included. Finally, (5) shows the relation between the share of rent-receivers reporting moneylending and grain dealing as their secondary occupation and the wage/income ratios. For more details on the controls used, see Section 3.3.

With the rapid expansion of India's primary exports to the world market -especially during the second half of the nineteenth century-, credit and indebtedness became

more acute in the Indian countryside. This indebtedness could have been used to extract surplus from the peasantry (Bose, 1993, p. 122–130). Increasing demand for credit was common in all of India, although legislation protecting the borrower introduced in non-landlord areas could have reduced indebtedness in those regions.²⁹ More specifically, these legislation reduced consumption credit without hurting productive credit in provinces with non-landlord land revenue systems (Chaudhary and Swamy, 2017; Chaudhary and Swamy, 2020). In the paradigmatic landlord area of western Bengal, perpetual indebtedness of small tenants forced them to take consumption loans from their landlords who then obtained their usual rent and interests from their loans (Bhaduri, 1973). Similarly, in the United Provinces -mostly a landlord region- most cultivators were trapped in debt cycles. Cultivators were unable to cultivate without borrowing money and this forced them to poorly sell their crops, which trapped them into borrowing again to cultivate in the next season (Whitcombe, 1971, p. 168-9). Moreover, there is qualitative evidence that local landowners were major lenders in the province (Whitcombe, 1971, p. 166-7). Finally, in the Narmada valley of the Central Provinces, *malguzars* -local landlords- were able to accumulate wealth from combining agriculture with moneylending, being the latter their most profitable business (Stokes, 1980, p. 257, 262).

Thus, I test the hypothesis that there was more indebtedness among cultivators in landlord areas and that this was associated to higher agricultural income inequality. Since -to the best of my knowledge- there is no systematic data on indebtedness at the district level, I have to proxy it using the share of rent-receivers who reported moneylending or grain dealing as their secondary occupation. The idea is that districts with more rent-receivers -i.e. landowners- lending money should present more indebted cultivators. To estimate the share of rent-receivers that reported moneylending or grain dealing as their secondary occupation, I use the different volumes of the *Census of India (1911)*.

²⁹Examples of these legislation are the *Deccan Agriculturists' Relief Act (1879)* and the *Punjab Land Alienation Act (1900)*.

Table 3.4.8 shows the link between the share of rent-receivers reporting moneylending or grain dealing as their secondary occupation and the non-landlord proportion -see columns (1), (2), (3) and (4)-. In all cases, the non-landlord proportion is negatively related with the share of rent-receivers lending money or dealing with grain, although such relation is only significant -at 10%- in column (1). The share of rent-receivers lending money or dealing with grain is also negatively related with the W/I ratio, meaning that in districts with a larger share of rent-receivers lending money or dealing with grain, agricultural income inequality was higher. The relation is also insignificant, hence results must be interpreted cautiously, although some tentative conclusions might be drawn from them. Evidence leans towards confirming the hypotheses that indebtedness (i) was more abundant in landlord regions and (ii) was negatively related with the W/I ratio, although coefficients are insignificant and definitely not conclusive. Such inconclusiveness might be due to the use of an imperfect supply side feature of the credit market to proxy for indebtedness or due to indebtedness also being largely present in non-landlord regions. In some non-landlord regions, the indebtedness of the cultivators was also acute. To exemplify, Darling's enquiry shows that only 17% of proprietors in Punjab were not indebted by 1919 (Darling, 1978, p. 4). Another potential explanation could be that indebtedness might not always be negatively related with the W/I ratio. If credit was taken for productive purposes (Chaudhary and Swamy, 2020), more indebtedness would indicate more investment and, potentially, more labour productivity and higher wages.

3.5 Conclusions

In this chapter I explore the relation between land revenue institutions and agricultural income distribution in colonial India. Based on a new district-level database on agricultural income inequality, I present the following results. First, there were significant differences in the levels of agricultural income inequality throughout colo-

nial India. Second, non-landlord districts presented more egalitarian distributions of income than landlord districts. More precisely, a non-landlord district had a wage/income ratio 35.8% larger than that of landlord districts. Third, land revenue systems contribute to explaining these differences on agricultural income inequality. Some potential mechanisms behind this link were the under-tenure systems securing large parts of agricultural surplus and the excessive rents in landlord districts. These findings are robust to a variety of checks and alternative estimations.

This evidence suggests that colonial institutions can explain not only differences in income and development but also on how its outcomes were distributed. These results are also in line with the literature on various regions of the global south, which point at colonial heritage as a fundamental factor explaining inequality. Thus, inequality in colonized territories is not -only- shaped by pre-colonial/endogenous heritage but -also- by exogenous structural features introduced by the colonizers. Regarding Indian economic history, this work provides the first comparative quantitative evidence on the impact of colonial rule -and its institutions- on inequality in the Indian countryside at the district level. With that evidence I concur with the existing literature pointing at colonial rule as a major cause of poverty and inequality in the subcontinent. However, and in contrast with previous literature, this work draws attention to the substantial differences in agricultural income inequality across regions and explains them through colonial policy -land revenue systems-. Overall, British conquest of India significantly affected differences in income distribution across the Indian countryside through the introduction of institutions regulating landownership and land revenue liability.

Appendix

3.A 1911 W/I ratio

3.B 1911 Tenants' income estimations

Measuring agricultural income inequality using W/I ratio may not capture differences in rents and tenants' incomes across regions. Also, using the wage/income ratio to capture rural income inequality requires wages to be representative of the poorest in the countryside. In order to test this, I looked at the link between 1916 wages and an estimate of 1911 tenants' incomes in Table 3.3.1.

Since there was no official data on tenants' incomes, I estimated them as the difference between the provincial average net income per acre (Blyn, 1966) and rents -estimated from *Enquiry into the Rise of Prices in India (1914)* and land prices from *Reports on the (land) revenue administration*-. The cost of cultivation per acre -seeds, ploughs and bullocks costs- is for 1923 in 1911 prices.³⁰ This difference is multiplied by the total area under cultivation and weighted by the share of tenants over total agricultural population -landowners, tenants, and wage earners- from the *Census of India (1901)*. This represents the proportion of land under cultivation actually being cultivated by tenants, except for Punjab, for which this data is available

³⁰This cost of cultivation is estimated for a district in Punjab (Narain, 1929). I use it as an estimate for all-India. To the best of my knowledge, there is very little or no data on the cost of cultivation for most regions of colonial India.

Table 3.A.1: IV estimates using 1911 W/I ratio

	1916 W/I in ln		1911 W/I in ln		
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	0.640*** (0.145)	0.893*** (0.316)	0.885*** (0.291)	0.650*** (0.243)	0.584*** (0.221)
Constant	368.010*** (133.497)	435.698** (214.369)	359.249* (202.023)	229.804 (184.840)	147.451 (168.575)
Observations	155	154	154	154	154
R-Squared	0.510	-0.217	-0.130	0.122	0.248
Length British rule	YES	YES	YES	YES	YES
Economic controls	YES	NO	YES	YES	YES
Caste fragmentation	YES	NO	NO	YES	YES
Geographic controls	YES	NO	NO	NO	YES

Sources and notes: (1) shows the IV results for 1916 dropping Burma. (2) shows the IV results for 1911 controlling only for the length of British rule. (3) includes economic controls, (4) includes the CRFI and (5) includes all controls. I estimated 1910 agricultural income following Section 3.3. I used 1911 wages from *Prices and Wages in India*.

in the 1913-14 *Reports on the (land) revenue administration*. Overall, this results in a rough estimate of tenants' total net income for Bengal, Central Provinces, Punjab and United Provinces. After that, I divide the tenants' total net income by the number of tenants in the province to obtain the per capita estimate of tenants' net income.

3.C Adding irrigation rates

Table 3.C.1: Adding irrigation rates in the IV estimates

	Baseline estimations		Adding irrigation rates	
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	0.348** (0.166)	0.845*** (0.205)	0.324* (0.173)	0.862*** (0.208)
Irrigation rate (%)			-0.122 (0.176)	-0.468*** (0.162)
Constant	-0.618*** (0.093)	295.140*** (111.827)	-0.581*** (0.108)	301.500*** (104.937)
Observations	190	190	190	190
R-Squared	0.087	0.520	0.088	0.535
Length British rule	NO	YES	NO	YES
Economic controls	NO	YES	NO	YES
Caste fragmentation	NO	YES	NO	YES
Geographic controls	NO	YES	NO	YES

Sources and notes: (1) and (2) present the IV results not including and including all controls, respectively. (3) and (4) present the same specifications than (1) and (2) but including the irrigation rate. For details on the data and controls used, see Section 3.3.

3.D Alternative thresholds for outliers

Given that the omission of observations treated as outliers is rather arbitrary, Table 3.D.1 presents various estimations considering different thresholds to label observations as outliers.

Table 3.D.1: IV estimates with different thresholds for outliers

	Wage/income ratio in ln					
	(1)	(2)	(3)	(4)	(5)	(6)
Non-landlord prop. (BI)	0.845*** (0.205)	0.674*** (0.157)	0.646*** (0.166)	0.577*** (0.156)	0.546*** (0.158)	0.590*** (0.162)
Constant	295.14*** (111.83)	302.09** (130.52)	310.35** (130.81)	330.59** (128.63)	316.32** (125.12)	287.59** (129.56)
Observations	190	171	167	163	159	152
R-Squared	0.520	0.273	0.248	0.256	0.253	0.215
Length British rule	YES	YES	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES	YES	YES

Sources and notes: (1) shows the IV results without dropping outliers. (2) shows the IV results dropping observations with a wage/income ratio within the highest decile. (3) shows the IV results dropping observations with a wage/income ratio within the highest octile. (4) shows the IV results dropping observations with a wage/income ratio within the highest septile. (5) shows the IV results dropping observations with a wage/income ratio within the highest sextile. Finally, (6) shows the IV results dropping observations with a wage/income ratio within the highest quintile. For details on the data and controls used, see Section 3.3.

3.E More on spatial correlation

Spatial Autoregressive Models (SAR) are estimated using Generalized Spatial Two Stage Least Squares (GS2SLS) and include a spatial weighted matrix W_n representing the inverse of the distances between the different district centroids. Interacting this spatial weighted matrix W_n allows these models to account for spatial lags of the dependent variable and spatial correlation within the error term -see equations 3.2 and 3.3-:

$$WageIncomeL_i = \beta_0 + \beta_1 NonLandlord_i + \beta_2 CRFI_i + \beta_3 X_i + \beta_4 Z_i + \lambda W_n WageIncomeL_i + u_i \quad (3.2)$$

$$u_i = \rho W_n u + \epsilon_i \quad (3.3)$$

Table 3.E.1: Spatial Autoregressive Models (SAR) for IV estimates

	Wage/income ratio in ln			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	0.282 (0.192)	1.051*** (0.211)	0.606*** (0.172)	0.338*** (0.124)
Constant	334.985*** (93.458)	379.891*** (95.127)	158.142* (92.226)	157.083* (93.086)
λ	0.619* (0.363)	0.112 (0.293)	-0.553 (0.401)	0.121 (0.447)
ρ	0.331 (0.686)	4.339*** (1.475)	2.651*** (0.602)	3.386*** (1.045)
Observations	190	190	190	190
Length British rule	YES	YES	YES	YES
Economic controls	NO	YES	YES	YES
Caste fragmentation	NO	NO	YES	YES
Geographic controls	NO	NO	NO	YES

Sources and notes: λ is the coefficient representing the spatial lag. ρ represents the spatial correlation in the error term. (1) shows the SAR only controlling for the length of British rule. (2) shows SAR including economic controls. (3) shows SAR with economic and caste controls. Finally, (4) shows SAR with economic, caste and geographic controls. The dependent variable -wage/income ratio- is in ln assuming 250 working days. For details on the data and controls used, see Section 3.3.

λ in equation 3.2 represents the spatial lag coefficient for the dependent variable. ρ

in equation 3.3 is the coefficient representing spatial dependence of the error term. In other words, it estimates the effect of an exogenous shock on one district to neighbouring districts.

Table 3.E.2: Spatial Autoregressive Models (SAR) without instrument

	Wage/income ratio in ln				
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	0.334*** (0.120)	0.280*** (0.084)	0.263*** (0.085)	0.409*** (0.081)	0.270*** (0.086)
λ	0.338 (0.283)	-0.434 (0.475)	-0.552 (0.483)	-0.327 (0.392)	-0.529 (0.541)
ρ	0.245 (0.544)	0.954*** (0.041)	0.957*** (0.037)	4.105*** (0.333)	0.959*** (0.037)
δ					0.309 (0.487)
Constant	348.85*** (68.32)	183.80** (72.26)	135.09* (75.72)	165.74*** (2.67)	166.13** (79.72)
Observations	190	190	190	190	190
Length British rule	YES	YES	YES	YES	YES
Economic controls	NO	YES	YES	YES	YES
Caste fragmentation	NO	NO	YES	YES	YES
Geographic controls	NO	NO	NO	YES	YES

Sources and notes: (1) shows the SAR only controlling for the length of British rule. (2) shows SAR with economic controls. (3) shows SAR with economic and caste controls. (4) shows SAR with economic, caste and geographic controls. Finally, (5) shows SAR with all controls including a spatial lag for the non-landlord proportion. λ is the coefficient representing the spatial lag of the dependent variable. ρ represents the spatial correlation in the error term and Delta the spatial lag for the non-landlord proportion. The dependent variable -wage/income ratio- is in ln assuming 250 working days. For details on the data and controls used, see Section 3.3.

Results in Table 3.E.1 show how in all but one estimation -column (1)-, the level of income inequality in a district was unrelated to the income inequality levels of closer districts - λ -. On the other hand, ρ shows that there is a positive and significant spatial correlation within the error term for most specifications. Most importantly, the non-landlord proportion estimated from the IV remains significant in almost all estimations. Overall, this means that after controlling for spatial spillovers, the non-landlord proportion estimate has a significant and positive effect on income

distribution.

Moreover, Table 3.E.2 shows the SAR estimates in OLS. Overall, the results are very similar to those reported for SARs using the instrument -see Table 3.E.1-. Table 3.E.2 presents an additional SAR introducing a spatial lag for the non-landlord proportion (δ). This last estimation is shown in column (5) and follows equations 3.4:

$$\begin{aligned}
 WagesIncomeL_i = & \beta_0 + \beta_1 NonLandlord_i + \beta_2 CRFI_i + \beta_3 X_i \\
 & + \beta_4 Z_i + \lambda W_n WagesIncomeL_i + \delta W_n NonLandlord_i + u_i
 \end{aligned}
 \tag{3.4}$$

Results from column (5) suggest that the introduction of spatial spillovers in the non-landlord proportion does not affect its relation with the wage/income ratio.

Additionally, I look at the significance of the IV estimation for the non-landlord proportion using a different way to cluster standard errors than the one suggested by Conley. I estimate a variance-covariance matrix accounting for the spatial autocorrelation in the error term through arbitrary clustering structures with different sizes.(Colella et al., 2019) Results in Table 3.E.3 show how the IV estimate for the non-landlord proportion remains significant in all specifications.

Table 3.E.3: IV estimates with arbitrary clustering structures

	Wage/income ratio in ln					
	(1)	(2)	(3)	(4)	(5)	(6)
Non-landlord prop. (BI)	0.82*** (0.209)	0.82*** (0.241)	0.82*** (0.284)	0.82** (0.324)	0.82*** (0.309)	0.82*** (0.257)
Observations	190	190	190	190	190	190
R-Squared	0.528	0.528	0.528	0.528	0.528	0.528
Length British rule	YES	YES	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES	YES	YES

Sources and notes: IV estimates with arbitrary clustering structures with various distances (in km) which spatial dependence is likely to reach. (1) 25km; (2) 50km; (3) 100km; (4) 200km; (5) 300km; (6) 500km. The dependent variable -wage/income ratio- is in ln. For details on the data and controls used, see Section 3.3.

Finally, I present the IV estimates clustering standard errors at the provincial level in Table 3.E.4. For these standard errors to be consistent, we need to assume that residuals are uncorrelated between clusters, which is not usually the case for spatial data (Kelly, 2020). Moreover, the limited number of provinces at which I am clustering the standard errors might also mislead the estimates. Therefore, results must be interpreted cautiously. Non-landlord proportion remains significant -at 10%- when including all controls -see column (5) in Table 3.E.4-.

3.F Robustness checks (OLS)

In Table 3.F.1 I present the robustness checks used for the IV estimates on my OLS estimates. The results show that the OLS estimates are also robust to all the robustness test applied to the IV estimation -see Table 3.4.4-.

3.G More on employment intensity

Variability not only between gender, but also between regions is reported in the *6th Round Report of the National Sample Survey (NSS)* (Som, 1960) for 1953 and in the *Agricultural Labour Enquiry* for 1950-51. I use both data sources to present different agricultural employment intensities both at the provincial level and depending on gender as shown in Table 3.G.1. For all estimations -OLS and IV- and sources -the *6th Round Report of the National Sample Survey (NSS)* and the *Agricultural Labour Enquiry*- my coefficient of interest remains positive and significant at least at 5%.

3.H Using Donaldson's income estimates

In this section I check if my results hold when estimating the wage/income using the agricultural income estimates from Donaldson (2018) whenever available -see Table 3.H.1-. In all specifications, where Donaldson's estimates are not available I use

Table 3.E.4: Instrumental variable estimates with standard errors clustered at the provincial level

	1st IV Stage		2nd IV Stage		
	(1)	(2)	(3)	(4)	(5)
Conquest between 1820 and 1856	0.536*** (0.120)				
Non-landlord prop. (BI)		0.709 (0.476)	1.049 (0.650)	1.047 (0.664)	0.845* (0.456)
Constant	0.393** (0.131)	415.74** (204.48)	345.56 (296.67)	338.50 (362.53)	295.14 (222.48)
Observations	190	190	190	190	190
R-Squared	0.266	0.133	0.382	0.383	0.520
Length British rule		YES	YES	YES	YES
Economic controls	NO	NO	YES	YES	YES
Caste fragmentation	NO	NO	NO	YES	YES
Geographic controls	NO	NO	NO	NO	YES

Sources and notes: Dummy for districts conquered between 1820 and 1856 as an instrument of non-landlord proportion (BI). This table presents the first -column (1) - and second -columns (2), (3), (4) and (5) - stages including caste and economic and geographic controls. Wage/income ratio in in assuming 250 working days is the dependent variable. For details on the data and controls used, see Section 3.3.

Table 3.F.1: Robustness checks on OLS estimates

	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	0.211** (0.089)	0.335*** (0.091)		0.242*** (0.090)	0.222** (0.089)
Non-landlord prop. (IPS)			0.466*** (0.098)		
Constant	152.500 (113.898)	150.186* (84.715)	212.093** (88.637)	237.551* (127.400)	-76.296 (86.901)
Observations	171	190	190	155	146
R-Squared	0.414	0.538	0.641	0.581	0.688
Length British rule	YES	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES	YES

Sources and notes: (1) shows the OLS estimates dropping all observations with a wage/income within the highest decile. (2) shows the OLS estimates with a different measure of wage/income ratio. This new measure presents differences in working days for male and female agricultural labourers using data for 1953 from Som. (3) shows the OLS estimates using the non-landlord proportion with the changes in the Central Provinces suggested by Iversen, Palmer-Jones, and Sen. (4) presents the OLS estimates dropping all Burma districts and (5) does the same for Bengal. The dependent variable -wage/income ratio- is in ln. For details on the data and controls used, see Section 3.3.

Table 3.G.1: OLS and IV estimates with Wage/income ratio using the *Agricultural Labour Enquiry* (ALE) or the *6th Round Report of the National Sample Survey (NSS)* to estimate employment intensity between provinces and gender

	(1)	ALE		NSS	
		OLS	IV	OLS	IV
Non-landlord prop. (BI)	0.306*** (0.093)	0.197** (0.081)	0.463*** (0.167)	0.322*** (0.088)	0.860*** (0.207)
Constant	155.87* (88.03)	-6.70 (78.19)	62.11 (88.14)	134.62 (84.20)	273.77** (111.85)
Observations	190	190	190	190	190
R-Squared	0.616	0.638	0.611	0.541	0.430
Length British rule	YES	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES	YES

Sources and notes: Both ALE and NSS use rural areas as units of analysis. These rural areas are: North, East, South, West, North-West and Central India. I match my districts with rural areas as follows: districts in the province of Bengal are matched with the East rural area, Burma (East), UP (North), Punjab (North-West), Bombay (West), Central Provinces (Central), Berar (Central) and Madras (South). (1) shows the baseline OLS estimates. The second column shows the OLS using data on gender and provincial employment intensity from the ALE. The third column shows the IV estimates using the ALE. The fourth column shows the OLS estimates using the NSS data. The fifth column shows the IV estimates using NSS data. For details on the data and controls used, see Section 3.3.

my own to avoid losing 43% of my sample. With OLS estimates, the non-landlord proportion remains significant when using estimates from Donaldson wherever available -see column (1)- and when available except for districts in Bengal -see column (3)-. With IV estimates, the non-landlord coefficient also remains significant when using Donaldson's estimates whenever available and except for Bengal districts -see columns (2) and (4)-.

Table 3.H.1: OLS and IV estimates with a wage/income ratio using Donaldson's agricultural income estimates

	W/I ratio using Donaldson's estimates			
	When available		Except for Bengal	
	OLS	IV	OLS	IV
Non-landlord prop. (BI)	0.205** (0.095)	0.944*** (0.244)	0.302*** (0.101)	0.958*** (0.237)
Constant	213.387** (87.396)	404.401*** (125.935)	175.037** (86.979)	344.631*** (119.263)
Observations	190	190	190	190
R-Squared	0.516	0.336	0.546	0.406
Length British rule	YES	YES	YES	YES
Economic controls	YES	YES	YES	YES
Caste fragmentation	YES	YES	YES	YES
Geographic controls	YES	YES	YES	YES

Sources and notes: OLS and IV estimates with a W/I ratio using Donaldson's agricultural income estimates. For all specifications, where Donaldson's estimates are not available I use my own. The first column shows the OLS results using Donaldson's estimates wherever available. The second column shows the IV results using Donaldson's estimates wherever available. The third column shows the OLS results using Donaldson's estimates where available except for Bengal. The fourth column shows the IV results using Donaldson's estimates where available except for Bengal. For details on the data and controls used, see Section 3.3.

Chapter 4

Institutions, local agency and allegiance: healthcare provision in colonial India

4.1 Introduction

The first two chapters of this dissertation have dealt with the link between a particular colonial institution (land revenue systems) and *changes* as well as *levels* of agricultural income inequality. This last chapter is devoted to the link between this colonial institution and development. In fact, institutions have been largely studied as drivers of long run development (Acemoglu et al., 2002; Banerjee and Iyer, 2005; Engerman and Sokoloff, 2000; Nunn, 2008). Recent studies have emphasized the importance of local agency in the administration and development of most colonies (Chaudhary, 2009; Frankema, 2010; Grafe and Irigoien, 2012; Hong and Paik, 2018; Van Zanden, 2010). However, local elite's role channeling the impact of institutions on public goods provision remains under-researched.¹ Consequently, I explore how

¹Such unclear role is even more so for public goods other than education. However, even for education, the role of local landlord elites remains under discussion -see, for instance, Cvrcek and Zajicek (2019) and Galor et al. (2009)-.

local landowners' agency² drove the impact of colonial land revenue systems on a rather understudied public good in colonial India -and most colonies-: healthcare. In a nutshell, local landlords shaped the effect of land revenue systems on healthcare provision by reducing state's capacity to tax while providing private funding to show allegiance where most needed.

In this chapter, I use a novel cross-section database with georeferenced hospitals and dispensaries from 1901 to explore how the introduction of different colonial land revenue systems can explain regional differences in healthcare provision through their interaction with the actions of local landowners. Land revenue systems determined who owned the land and who was responsible for the payment of the most important revenue source of the colonial period: land revenue. In some regions, cultivators were landowners themselves -non-landlord based systems- while in other, a landlord owned the land -landlord based systems- (see section 4.2).

I analyse the impact of land revenue systems on three distinct yet related outcomes. First, hospitals and dispensaries' revenue from local and district boards -local funds-. District and local boards were established from 1882 and were responsible for education, public works and public health (Tinker, 1967, p. 43-63). Second, revenue from native subscriptions -including donations-, representing revenue from native private individuals. Finally, I check the overall effect on total revenue for hospitals and dispensaries.

My main hypothesis is that hospitals and dispensaries presented larger revenues from district and local boards in non-landlord areas. That would be because non-landlord land revenue systems tended to be temporary settled -which allowed for the update of the land revenue demand each 20-30 years- while most landlord areas were permanently settled -land revenue demand was fixed- (Chaudhary, 2010b). Ad-

²I define local landowners' agency as their influence and actions. More specifically, their ability to influence land revenue demand and collection as well as their donations and subscriptions, both playing a major role explaining the available revenue of hospitals and dispensaries. As will be shown latter in this work, landowners had significant differences in their capacity to influence land revenue demand and need to provide private donations and subscriptions depending on the land revenue system introduced.

ditionally, land revenue assessment and collection was smaller in landlord areas due to the influence of landlords in such processes -see (Baden-Powell, 1892a; Baden-Powell, 1892b; Baden-Powell, 1892c)-. Specifically, I argue that in landlord regions there were fewer village officials, and landlords played a determinant role choosing them. This, in turn, left landowners in a better position to influence land revenue assessment and collection. On the other hand, the presence of wealthy landowners in landlord areas could also have led to more private investment in hospitals and dispensaries -through subscriptions and donations- to justify their social position or to show allegiance to the colonial government. In fact, landowners in landlord areas had more to gain (lose) from (not) showing their allegiance with voluntary subscriptions, which was rewarded with land rights security, honours and institutional recognition -e.g. durbar lists and meetings- (see section 4.4.2).

By using an IV, I show that in non-landlord districts, hospitals and dispensaries' revenue from local and district boards was 0.57 standard deviations larger than that of hospitals and dispensaries in landlord districts. Conversely, hospitals and dispensaries' revenue from private native subscriptions was 0.68 standard deviations smaller in non-landlord districts. Overall, hospitals and dispensaries in non-landlord districts received 0.39 standard deviations more total revenue. These results are robust to including a large set of controls.

This chapter contributes to several strands of literature. First, this chapter contributes to the literature pointing at colonial institutions explaining development (Acemoglu et al., 2002; Banerjee and Iyer, 2005; Engerman and Sokoloff, 2000; Nunn, 2008). This literature has been criticised for missing on the role of local agency. Austin (2008) and Bayly (2008) point at the need to consider local agency to understand the introduction and success of colonial institutions, policies and production in Africa and India, arguing that much of what happened under colonial rule was not solely determined by the colonial authorities. In fact, the importance of local elites on colonial administration and outcomes has recently been emphasized

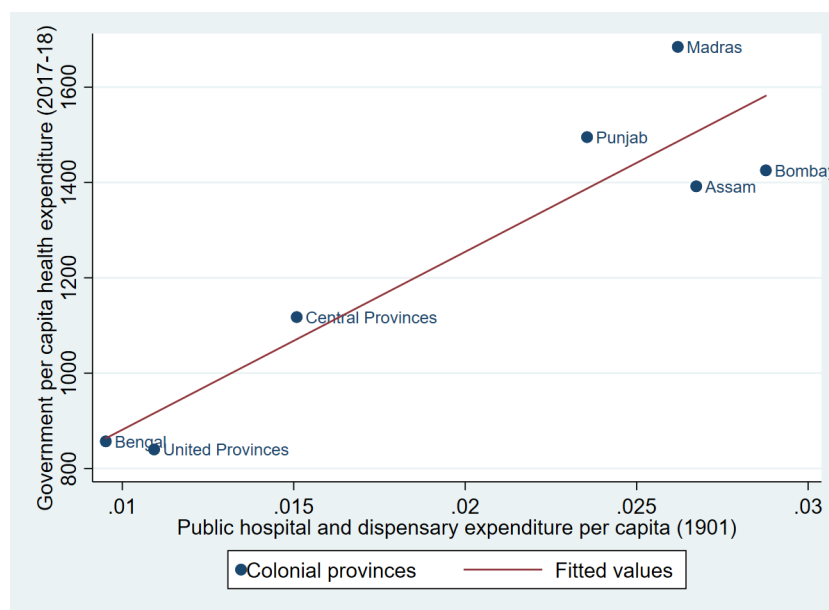
in other colonial contexts (Frankema, 2010; Grafe and Irigoin, 2012; Van Zanden, 2010). This chapter echoes the previous literature providing evidence on how local landowners could drive the effect of a colonial institution on healthcare provision through their agency -i.e. their influence as well as their need to show allegiance and gain prestige-.

Evidence from this chapter also complements the literature on the determinants of public goods provision. Caste diversity, the presence of elites and revenue collection have been signalled as factors determining education provision (Chaudhary, 2009; Chaudhary, 2010a; Chaudhary, 2010b). Other factors such as land inequality have also been recently signalled as determinants of education provision. More specifically, it has been argued that large landowners opposed education as they got little to gain and larger taxes to pay (Baten and Hippe, 2018; Galor et al., 2009; Goñi, 2021) although a positive effect of landowners and land inequality on the provision of education has also been observed, specially for conservative and religious-intensive education systems (Andersson and T. Berger, 2019; Cvrcek and Zajicek, 2019). Lindert (2004) has signalled how regional differences in education provision could be driven by differences in local agency and elite capture after decentralization. Similarly, Chaudhary, Musacchio, et al. (2012) signal that such an elite capture occurred in countries with weak central -or decentralized- administrations and democratic mechanisms. In this work I focus on the determinants explaining public healthcare, in contrast with most of this literature which looks at the determinants of education provision. This is done pointing at the importance of colonial institutions explaining the healthcare financial (re)sources through their interaction with local agency.

Additionally, this chapter adds to the literature pointing at colonial healthcare as a significant factor explaining nowadays health outcomes. Lowes and Montero (2021) find a negative effect of exposure to colonial campaigns against sleeping sickness on present vaccination rates and trust in western medicine in former French Equatorial Africa. For the Indian case, Calvi and Mantovanelli (2018) find a positive association

between proximity to former Protestant medical missions and current individuals' Body Mass Index among other health outcomes. This work provides an explanation on what determined the provision of colonial healthcare, which helps to unravel the colonial origins of nowadays regional differences in health outcomes. Such differences show up on today's per capita government health expenditure, which is much lower in Indian states that presented lower government expenditure in colonial times -see Figure 4.1.1-. This chapter also sheds light on the work from historians on western medicine in colonial India (Arnold, 1993; Harrison and Pati, 2009). The present chapter provides quantitative evidence that helps to disentangle the reasons for the lacking resources and regional differences in the provision of western medicine in colonial India.

Figure 4.1.1: Government per capita health expenditure (2017-18) vs Public per capita expenditure (Government+Local+Municipal) on hospitals and dispensaries (1901)



Sources and notes: Government per capita health expenditure (2017-18) vs Public per capita expenditure (Government+Local+Municipal) on hospitals and dispensaries (1901). The solid line is the regression line. Data for 2017-18 health expenditure from Table A.6 in the National Health Accounts Estimates for India 2017-18. Data in 2017-18 rupees. Today Indian states have been grouped into former colonial provinces and their per capita expenditure weighted by their population over that of the whole colonial province. For 1901 expenditure on hospitals and dispensaries, I use data from the *Reports on the civil hospitals and dispensaries* adding incomes of hospitals and dispensaries from local governments, municipalities and provincial governments in 1901 rupees.

The chapter is structured as follows. In Section 4.2 I present a general overview of the history of healthcare provision and land revenue systems in colonial India.

In Section 4.3, I introduce the data and methodology I am using in this chapter while in Section 4.4 I present my main results (IV), some robustness checks and the mechanisms driving my results. Finally, in Section 4.5 I conclude.

4.2 Hospitals, decentralization and land revenue systems

Hospitals and dispensaries were a relevant tool as centers for vaccination, sanitary education and contact with western medicine in colonial India (Harrison and Pati, 2009, p. 6). In Bengal, Punjab, Central Provinces and Assam, vaccination in hospitals and dispensaries was an important part of the vaccination systems. In these provinces, up to two native vaccinators were assigned per dispensary, being supervised by the officials in charge of each dispensary. Apart from vaccinating people attending dispensaries, these vaccinators traveled throughout the district to vaccinate (James, 1909, p. 26, 29–31). Hospitals and dispensaries also sold medicines -mostly quinine-, were linked to certain market centers for medical officers to visit and were used to train medical students.³ Curing the sick, making surgical operations and reporting information on illness and mortality patterns were also functions of hospitals and dispensaries. The number of surgical operations in hospitals and dispensaries steadily rose throughout all of India⁴ as such operations were neglected by indigenous practitioners but highly demanded by the Indian population (Arnold, 1993, p. 251). The most common surgical operation -with over 300,000 operations in 1901- was the evacuation of abscesses, although the removal of parasites, tumours and setting broken bones -among others- were also common in colonial hospitals and dispensaries.⁵ Lastly, some dispensaries -specially in urban areas- were attached to

³*Notes on the Annual Settlements of the Government Charitable Dispensaries in the Central provinces (1901, p. 3), Triennial Report on the Working of the Charitable dispensaries under the Government of Bengal (1902, p. 13-14) and (Arnold, 1993, p. 247).*

⁴For instance, in Bengal surgical operations rose by almost 8% in one year -from 1907 to 1908- according to the *Annual Returns of the Charitable dispensaries under the Government of Bengal (1909, p. 9)*.

⁵See the 1901 provincial *Reports on the civil hospitals and dispensaries*.

poorhouses (S. Sharma, 2019, p. 143).

The provision of hospitals and dispensaries in colonial India started in the presidency cities -Calcutta, Madras and Bombay- during the late seventeenth and early eighteenth centuries (Arnold, 1993, p. 246–247). This enclavist approach was in line with the focus of the colonial government on the health of the army -specially of British troops- and prisons (Arnold, 1993; Harrison, 1994). Even within these privileged sectors healthcare was segregated, marginalizing the native population. For instance, hospitals for native troops in army cantonments were significantly less equipped than their European counterparts.⁶ This was the result of the British complacent view of Indian health and mortality -which is also linked to Indian's immunity resulting from exposure to multiple pathogens-⁷ and the need of British troops to control the colony combined with the constrained military manpower of Britain.

Nonetheless, the colonial government had one major constraint to expand the provision of health services to the natives in general: the Government was reluctant to commit many financial resources to provide health services to the native population. In fact, resource constraints forced the Government to interact with practitioners of native medicine systems -e.g. *Ayurveda*- to implement health policies (R. Berger, 2013, p. 67). This lack of financial commitment was mostly justified by official authorities by the apparently generalized prejudice of Indian population towards hospitals and western medicine. However, this prejudice appears not to have been so generalized and greatly overrated (Arnold, 1993; Ramasubban, 2008). In the end, before the second half of the nineteenth century, only the main hospitals in the presidency capitals and some dispensaries were financed by the colonial state. Beyond these basic institutions, the finance of new hospitals and dispensaries was mostly left to individual philanthropy and subscriptions (Arnold, 1993, p. 247).

⁶*Report of the Commissioners appointed to inquire into the Sanitary State of the Army in India (1864, p. 324-332).*

⁷Arnold (1993, p. 91) also signals the importance of the abstinence from alcohol and Indians' adaptation to the climate as factors explaining their lower mortality.

This enclavist approach slowly changed when the Crown gained control of India, as the link between Indians' health and the health of troops was clearer (Arnold, 1993; Harrison, 1994), and as public health was considered part of the *civilising mission* of British rule (Arnold, 1993, p. 97) and relevant to the political and economic power of the Empire (R. Berger, 2013). The link between the health of civilian natives and that of the troops was largely stated already in the *Report of the Commissioners appointed to inquire into the Sanitary State of the Army in India (1864, p. 338)* as "[...] nobody [...] can fail to see that the sanitary improvement of the Indian army involves the sanitary improvement and the advancement of civilisation in India.". In line with that, R. Berger (2013, p. 52) argues that Government rising concern on public health was the direct consequence of its increasing worries on the security and position of British rule in the subcontinent. Overall, this slow expansion of western medicine to Indian civilians does not imply that the resource constraint faced by the Government disappeared. However, the Government was able to significantly improve the funding and the number of hospitals and dispensaries provided. To exemplify, by the 1850s there were less than 90 hospitals and dispensaries somehow financed by colonial administrations while by 1901 that number was more than 20 times larger, reaching almost 2000.⁸

Such expansion of hospitals and dispensaries was mainly financed by local funds - mostly composed of district and local boards funds- (35.2%), provincial governments (23.6%), municipalities (19.9%) and private subscriptions from natives (9.5%). It is important to point out that most resources from municipalities as well as provincial governments went to hospitals and dispensaries in important cities. For instance, hospitals and dispensaries in district headquarters received more than 56% of their revenue from municipal and provincial government funds. In the rest of hospitals and dispensaries, revenue from these sources barely represented 36% of total revenue.⁹ On the other hand, funds from native subscriptions as well as district and local

⁸Data from the 1901 provincial *Reports on the civil hospitals and dispensaries* and (Arnold, 1993, p. 248).

⁹Data from the 1901 provincial *Reports on the civil hospitals and dispensaries*.

boards funds were more spread across hospitals and dispensaries throughout the whole territory.

Hence, district boards were the main revenue source for hospitals and dispensaries. These boards were the most important local government institutions in colonial India, being responsible for education, health provision and local infrastructures (Chand, 1947, p. 223). They came into existence after the decentralizing reforms introduced by Lord Ripon's resolution of 1882. The main aim of this resolution was to provide political education, in order to train the growing Indian middle class in the administration of representative institutions (Tinker, 1967, p. 44). To do so, the resolution established the creation of district and local boards, which were to contain a two-thirds majority of non-officials -with chairmen not being officials whenever possible-. However, not all points of this reform were fully implemented. While district boards were introduced in all provinces -and local boards in some-, a significant presence of natives and the chairmanship by non-officials was not as common as intended. In fact, the boards met infrequently with district officers hardly considering native suggestions and zamindar¹⁰ members rarely attending the meetings due to the procedure being unfamiliar to them (Tinker, 1967, p. 54).¹¹

District and local boards got most of their revenue from land revenue cesses and provincial grants. Land revenue cesses were additional surcharges on land revenue that district boards were able to charge, although provincial governments established a minimum and a maximum rate for the cesses.¹² In practice, cesses were usually levied at 6.25% of the district land revenue and this rate was uniform within provinces (Chaudhary, 2010b, p. 281). This means that most variation on the cesses came from differences in land revenue assessment and collection. On the other hand, provincial grants were allocated on a per-capita basis, and in some cases favoured the poorest districts or those with larger minorities (Chaudhary, 2010b). Overall,

¹⁰Zamindars were the landlords in areas under a zamindari system, which was a landlord land revenue system.

¹¹See Tinker (1967) for more on Lord Ripon's reform and its implementation.

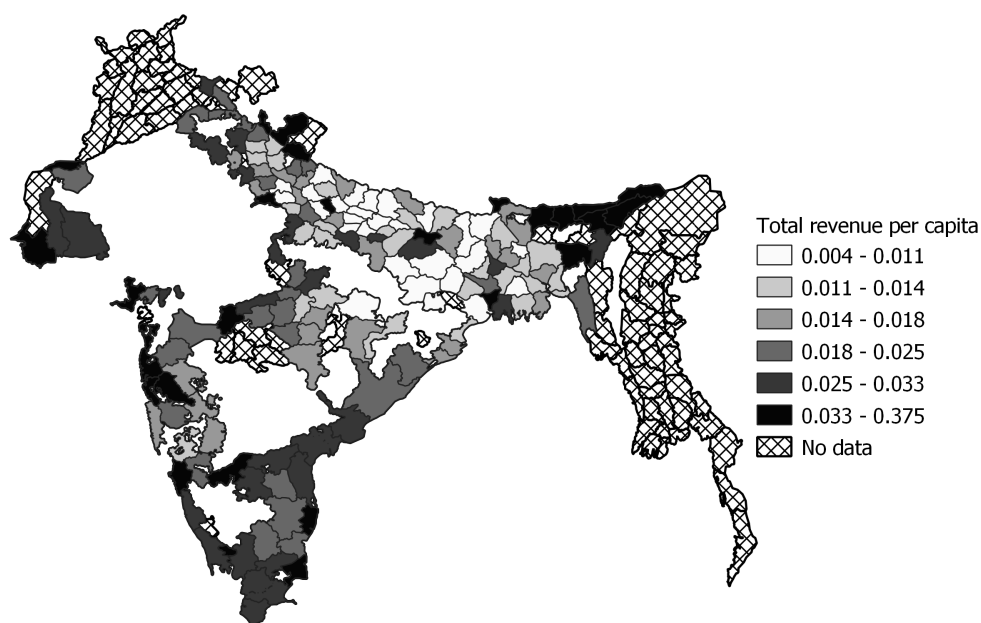
¹²*Report of the Indian Taxation Enquiry Committee 1924-25. Volume I. Page 311* available here.

district and local boards in colonial India had extremely limited financial independence, as most of their revenue depended on land revenue assessment and on grants from the provincial governments (Chand, 1947). This clearly sets them apart from the nineteenth century English local boards, which were mostly able to effectively determine the tax rate of certain local taxes and which were more representative (Goñi, 2021).

In the end, there were substantial differences in the revenue available for district and local boards, specially across different provinces. In 1903, district and local boards in Bombay and Madras had as much revenue per capita as twice that from boards in Bengal or the United Provinces.¹³ This variation translated into important differences in funds devoted to hospitals and dispensaries in colonial India as can be observed in Figure 4.2.1.

Figure 4.2.1: Total revenue per capita of hospitals and dispensaries at the district level

Total revenue per capita of hospitals and dispensaries



Sources and notes: Total revenue per capita of hospitals and dispensaries at the district level. Data on revenue for hospitals and dispensaries from 1901 provincial *Reports on the civil hospitals and dispensaries*. Population data from *Census of India (1901)*.

¹³Data from *Statistical abstract relating to British India from 1894-95 to 1903-04* available here.

These regional differences might be explained by the introduction of distinct land revenue systems. It may be the case that hospitals and dispensaries presented larger revenues in non-landlord areas. That would be because non-landlord land revenue systems tended to be temporary settled -which allowed for the update of the land revenue demand each 20-30 years- while most landlord areas were permanently settled -land revenue demand was fixed- (Chaudhary, 2010b). Additionally, land revenue assessment and collection was smaller in landlord areas due to the influence of landlords in the assessment and collection processes -see (Baden-Powell, 1892a; Baden-Powell, 1892b; Baden-Powell, 1892c)-. Specifically, I argue that in landlord regions there were fewer village officials, and landlords played a determinant role choosing them. This, in turn, left landowners in a better position to influence land revenue assessment and collection. On the other hand, the presence of wealthy landowners in landlord areas could also have led to more private investment in hospitals and dispensaries -through subscriptions and donations- to justify their social position or to show allegiance to the colonial government. In fact, landowners in landlord areas had more to gain (lose) from (not) showing their allegiance with voluntary subscriptions, which was rewarded with land rights security, honours and institutional recognition -e.g. durbar lists and meetings- (see section 4.4.2).

Land revenue systems determined who was the landowner. However, landownership was not given without a cost, as landowners were liable to pay the land revenue to the colonial state. The British introduced three different land revenue systems: the zamindari, where landownership was granted to an intermediary between the state and the cultivator -the literature has classified this as a landlord system-; the ryotwari, where landownership was intended to be granted directly to the cultivator -the literature has classified this as a non-landlord system-. Finally, the mahalwari, which depending on the region was closer to a zamindari or a ryotwari system.¹⁴

In a nutshell, despite the expansion of hospitals and dispensaries by the last half of the nineteenth century, there were important differences in their provision across

¹⁴For a more extensive explanation of the land revenue systems, see Section 3.2 in Chapter 3.

colonial India. These differences might be explained by the introduction of certain colonial land revenue systems, which -through its interaction with landlords' agency- could affect the (re)sources available for hospitals and dispensaries. I explore this hypothesis in the following sections.

4.3 Data and Empirical Framework

As stated in section 4.1, in this chapter I study the effect of land revenue systems on the (re)sources of hospitals and dispensaries. To do that, I use a cross-section database with georeferenced hospitals and dispensaries from 1901. More precisely, I look at the link between land revenue systems and different revenue sources -district and local funds and private native subscriptions- as well as total revenue for hospitals and dispensaries. Finally, to tackle a potential omitted variable bias and present evidence on causality, I use a dummy for districts conquered between 1820 and 1856 as an IV following Banerjee and Iyer (2005).

4.3.1 Baseline regression (OLS)

I study the link between land revenue systems and total revenue as well as different revenue sources following equation (4.1):

$$Revenue_{\delta,i} = \beta_0 + \beta_1 NonLandlord_r + \beta_3 X_i + \beta_4 \Gamma_r + \epsilon_i \quad (4.1)$$

where the dependent variable - $Revenue_{\delta,i}$ - represents revenue source δ for hospital or dispensary i . Revenue source (δ) can either be revenue from local and district boards, revenue from private native subscriptions or total revenue. Unless said otherwise, revenue sources have been transformed using the inverse hyperbolic sine (IHS) function. The main reason for using the IHS transformation is that it corrects -as the natural logarithm transformation- for right-skewed distributions of the residuals, which would imply biased estimates. This is the case for all revenue sources,

since their distributions are right-skewed due to the frequent zeros. To exemplify, 53% of hospitals and dispensaries had no revenue from private native subscriptions, which leads to a right-skewed distribution of the revenue source (dependent variable) and the residuals of regressions.¹⁵ Alternatively to the natural logarithm, the inverse hyperbolic sine transformation allows to include all hospitals and dispensaries which had 0 revenue -for instance from private native subscriptions- which are informative in my analysis. The IHS transformation has been widely used in recent literature on applied economics, for instance to avoid losing observations on counties receiving 0 money from public grants during the New Deal (Caprettini and Voth, 2022), on students having no debt (Frisancho, 2022) and on households having no assets (Balboni et al., 2022) among others.¹⁶ Notice that my results are robust to the use of alternative transformations correcting for right-skewedness of the distribution - $\ln(1 + Revenue_{\delta,i})$ transformations- and alternative specifications -probit estimations- (see Table 4.4.5).

To measure the revenue from district and local boards as well as the revenue from private native subscriptions and total revenue, I use the 1901 provincial *Reports on the civil hospitals and dispensaries*. These reports provide information on all revenue sources for each hospital and dispensary totally or partially financed by colonial authorities.¹⁷

NonLandlord_r -my variable of interest- represents the non-landlord proportion -share of acreage under a non-landlord land revenue system- in district r . Data for the non-landlord proportion comes from Banerjee and Iyer (2005). For those districts not included in their work, I use the *Agricultural Statistics of India* to estimate the non-landlord proportion. Alternatively, I introduce the changes suggested by Iversen et al. (2013) in the non-landlord proportion. These changes are constrained to the Central Provinces, for which they argue that the land revenue system implemented

¹⁵Histograms for all revenue sources and their residuals are displayed in Section 4.B.

¹⁶Bellemare and Wichman (2020) present the theoretical reasoning for using IHS transformations and some guides on how to interpret the resulting coefficients.

¹⁷See Section 4.D in the Appendix for more on the data used to estimate revenue from district and local boards.

was not truly a landlord system in lands under a right of absolute occupancy. According to them, this is the case because in these lands, rents were established by the revenue officials instead of the landlord. There is still debate on whether or not land leased to tenants with absolute occupancy rights in the Central Provinces should be considered under a landlord system (Banerjee and Iyer, 2013); however, I use Iversen et al. (2013) corrections as a robustness check -see column (3) in Table 4.4.3-.

X_i is a matrix including all controls for hospital or dispensary (i) characteristics. This includes a dummy showing whether i is a hospital (1) or a dispensary (0), another dummy showing whether i is a hospital or dispensary for females (1) or not (0), the distance of i to the nearest railway line,¹⁸ the hospital or dispensary longitude and latitude, its altitude and the type of soil around the area. Data on being a hospital or dispensary and on being a hospital or dispensary for females comes from the 1901 provincial *Reports on the civil hospitals and dispensaries*. In some provincial reports -Bombay and Madras-, it was stated whether the institution was a hospital or a dispensary. For those reports where this was not stated and based on Bombay and Madras reports, I define hospitals as all institutions with in-door beds. However, if "dispensary" or "hospital" are included in the institutions' name, I classify them as such. For the distance to railway, latitude, longitude, altitude and type of soil, I had to georeference hospitals and dispensaries. Luckily, in the provincial *Reports on the civil hospitals and dispensaries* the name of the district and city, town or village where the hospital or dispensary was located is stated. With that information, I used Google Maps as well as India Place Finder to locate 1675 hospitals and dispensaries -representing almost 84% of all hospitals and dispensaries reported-. To measure hospitals and dispensaries distance to the nearest railway, I use shapefiles from Fenske et al. (2021).¹⁹ To measure the type of soil, I use dummy variables for the 4 most common soils in the subcontinent following FAOs

¹⁸Closeness to railroads has recently been signalled as a factor positively affecting the introduction of missions and public goods -including health services- (Jedwab et al., 2022).

¹⁹This data is available online at James Fenske's website.

soil classification from the legend of the soil map of the world (1974).

Alternatively, Γ_r is a matrix including all controls for district (r) characteristics. This includes the district population, urbanization rate, a caste and religious fragmentation index (CRFI), the share of Hindus as well as the share of Muslims, the average rainfall, a dummy showing whether the hospital or dispensary is located in a coastal district (1) or not (0) and both the date of conquest and its squared term. District total population is included to control for the population that can benefit from hospitals and dispensaries in each district. District population can work as a rough proxy for hospitals and dispensary demand. Population data comes from the different provincial volumes of the *Census of India (1901)*. The urbanization rate is included to control for urban population and development. Richer districts tend to be more urbanized, which directly affects the funds available for hospitals and dispensaries. Additionally, caste and religious fragmentation has been pointed out as a factor affecting public goods provision (Banerjee and Somanathan, 2007) as well as the presence of large religious groups -Hindus- or minorities -Muslims- (Chaudhary, 2009). Finally, the length of British rule -i.e. the date of British conquest and its squared term- controls for particularities of early conquests (Banerjee and Iyer, 2005). Districts conquered earlier might have a more developed trade and credit markets, or were overall better districts for cultivation. Such characteristics could have affected public and private revenue of hospitals and dispensaries in these districts. Data for the urbanization rate, the CRFI as well as the shares of Hindus and Muslims come from the various volumes of the *Census of India (1901)*. The date of British conquest comes from Banerjee and Iyer (2005). Rainfall data comes from the *Imperial Gazetteer of India (1909)* while for the coastal dummy I used colonial maps from the *Atlas of the Imperial Gazetteer of India (1909)*.

Notice how my baseline estimation does not include provincial fixed effects. This is because land revenue systems were introduced into large territories and there is very low -in some cases non-existent- within province variability in land revenue systems.

Therefore, including provincial fixed effects would capture most of the effect of my variable of interest. Alternatively, I test the robustness of my results by clustering standard errors at the provincial level and including Conley standard errors among alternative ways to control for spatial correlation -see Section 4.4.1-.

Last but definitely not least, all standard errors are clustered at the district level (r). This is the case since the level at which I have data for my variable of interest -non-landlord proportion- is the district level (r).

4.3.2 IV: Districts conquered between 1820 and 1856

The provision of hospitals and dispensaries could be affected by the demand for such services. Despite using the total population in each district as a way to account for demand, this is not a perfect proxy. It could be that in certain caste groups, regions or villages, the acceptance -and demand- of western medicine and services was lower than in others with similar population levels. This could be due to a larger presence of traditional medicine such as *Ayurveda*, pre-colonial patterns of medical consumption (R. Berger, 2013, p. 50) or due to the link between western medicine and foreign rule. The latter could led to suspicions and fears unrelated to its effectiveness (Arnold, 1993, p. 156). Therefore, my OLS estimates could be affected by a omitted variable bias.

To tackle a potential omitted variable bias and to provide evidence on causality, I introduce a dummy variable identifying those districts that were conquered between 1820 and 1856 as an instrument for the non-landlord proportion. In fact, a dummy for districts conquered between 1820 and 1856 has already been used in the literature as an IV (Banerjee and Iyer, 2005). Following Banerjee and Iyer (2005), I argue that districts conquered between 1820 and 1856 got non-landlord based systems through several exogenous channels that allow to capture causality.

First, by 1820 the East India Company (EIC) had a more effective and developed administrative body of tax collectors that allowed it to introduce more bureaucratic-

intensive land revenue systems -i.e. non-landlord systems- (Baden-Powell, 1892a, p. 394-398, 401-407). While in landlord systems tax responsibilities were clustered among a small group of landlords, in non-landlord systems tax collection and assessment had to be done for every individual field (Lee, 2018, p. 12-13). Hence, the introduction of more bureaucratic-intensive land revenue systems was done later, as the position of the EIC was more secure and the EIC administrative body more developed.

Most importantly, the dominant ideology among prominent officers at the time also influenced the introduction of certain land revenue systems. Before 1820, most policies introduced by the British administration had a clear Whig bias, which benefited large landowners who provided a natural elite and social order (Stokes, 1959, p. 5). For instance, the Permanent Settlement in Bengal -introduced by Lord Cornwallis- clearly sought to reduce the functions of government to guaranteeing property rights and security while providing landownership to large landlords -zamindars-. After 1820, utilitarian ideas gained momentum in India -as they did in England- (Banerjee and Iyer, 2005; Stokes, 1959). Utilitarians²⁰ saw the protection of the cultivator and their way of life as a function of government (Stokes, 1959). They aimed to do so by providing cultivators with private landownership rights and abolishing all intermediaries with the introduction of non-landlord systems. Finally, after the revolt of 1857, the Government of India acknowledged landlords as key allies for stability and social order in Oudh -a former princely state which was annexed in 1856 through the Doctrine of lapse²¹- (T. Metcalf, 1961, p. 156-157). Consequently, the British favoured again the landlords, giving landownership in Oudh to taluqdars.²²

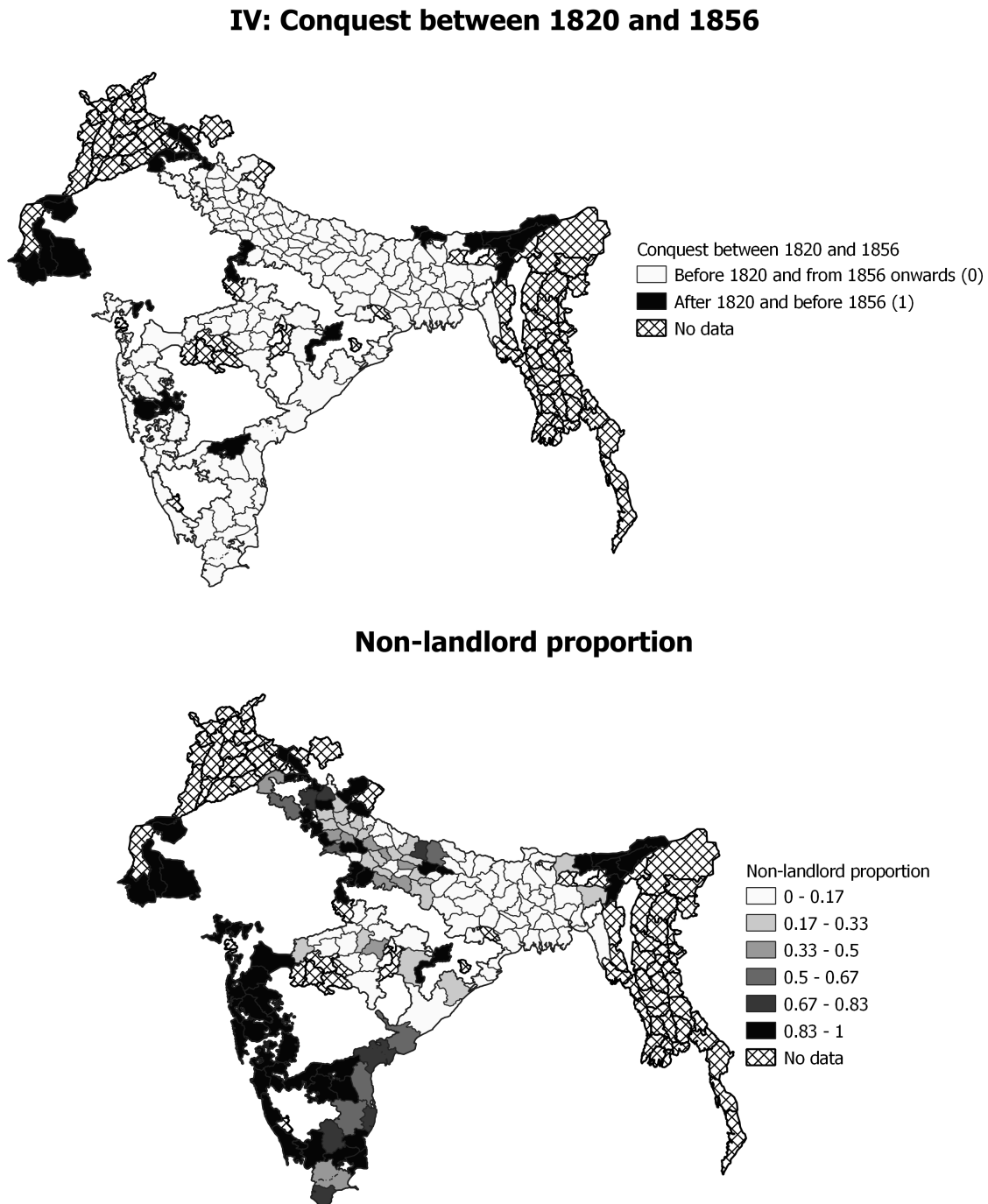
A threat to the exogeneity of the dummy for districts conquered between 1820 and 1856 would be that the date of British conquest was correlated with pre-colonial conditions that affected the revenues available for hospitals and dispensaries. How-

²⁰Such as Thomas Munro (1761-1827), who came to be Governor of Madras and the inventor of the ryotwari system.

²¹For more on the Doctrine of lapse see below or Iyer (2010).

²²Taluqdars were former land revenue collectors in Oudh.

Figure 4.3.1: Dummy for districts conquered between 1820 and 1856 (IV) and non-landlord proportion (BI)



Sources and notes: Maps showing the dummy for districts conquered between 1820 and 1856 (IV) and the non-landlord proportion. Both variables come from Banerjee and Iyer (2005).

ever, I argue that the date of British conquest was mostly exogenous and resulted from a mixture of the EIC fearing potential threats, idiosyncratic conflicts within and outside India as well as arbitrary policies unrelated to the provision of health services. Alternatively, it could be argued that the date of British conquest was endogenous and that the British started annexing the most fertile lands in India, allowing for a larger provision of hospitals and dispensaries in these regions. However, this selection bias -and endogeneity source- seems unlikely for several reasons: first, at least during the initial years of conquest, the EIC employees had very limited data and knowledge on the productivity of land and on the land revenue they could demand (Baden-Powell, 1892a, p. 395). This lack of real knowledge makes it rather improbable that the EIC selected its initial conquests by their productivity. Second, British conquest tended to unfold as a reaction -at least initially- to idiosyncratic political shocks (J. Wilson, 2016). This makes it improbable that the EIC was able to precisely select their annexations based on the economic conditions of the territory.

To illustrate this, the provoking acts of the petty Raja of Travancore -an EIC official ally- led the King of Mysore to attack him in 1789. That was the case, despite the British actively persuaded the Raja to stop provoking the King, even threatening the former with breaking their defensive alliance (Kunju, 1960). In the end, the EIC was forced to enter on a defensive war which ended with the EIC's acquisition of four districts. These conflicts resulted mostly from subjective factors such as perceived threats and old rivalries, which were unrelated to the British future capacity to provide hospitals and dispensaries. Further showing the exogeneity of the date of British annexation, the conquest of Bengal started with the outbreak of the Austrian Succession War (1740) in Europe, which led to a series of French conquests in South India -including Madras-. That, together with the EIC distrust on the capacity and willingness of the Nawab -Mughal provincial ruler- of Bengal to protect them from French attacks, led to a clash in Bengal (Bandyopadhyay, 2004, p. 42-43). The EIC updated their fortifications in Calcutta without the Nawab's

consent and offered refuge to fugitives from the Nawab's court. In response, Siraj-ud-Daulah, the young Nawab of Bengal, threatened the EIC trade in Bengal and eventually besieged Calcutta. Such retaliations resulted in the Battle of Plassey (1757) and British dominion over the region. Finally, another example showing the exogeneity of British conquest is the Doctrine of lapse. This was an annexation policy implemented by the Governor-General Lord Dalhousie between 1848 and 1856 which made the British annex all Princely states for which there was no natural heir, disallowing the adoption of heirs (Iyer, 2010, p. 700-701). Four former princely states were annexed by the British through this rather arbitrary policy.

Most importantly, even if the date of conquest was endogenous, I follow Banerjee and Iyer (2005) and include the date of conquest and its squared term in the analysis to control for particularities of early conquests. Additionally, if the date of conquest was endogenous it would mean that the British selected some rich areas to conquer first. Then I would expect earlier acquired territories to have hospitals and dispensaries with larger revenues as they would have more resources available. This is against my hypothesis that in landlord areas -usually conquered first- hospital and dispensaries received less public funding.

Similarly, it could be the case that the presence of powerful pre-colonial elites and states with large state capacity influenced both the dummy for districts conquered between 1820 and 1856 and the future provision of healthcare. Earlier British conquests could have been on pre-colonial states with large state capacity and powerful elites that later received landownership from the EIC and who seized the opportunity to limit the capacity of the new colonial state to tax them. To mitigate this concern, I use the number of cities and towns for each district presenting forts, palaces, temples and other places of religious or cultural importance during the Mughal period from Schwartzberg (1978).²³ This source and its report of religious and cultural places has also been used by Dincecco et al. (2022) to measure pre-colonial state capacity. In my case, the presence of palaces, forts or temples estimates pre-colonial

²³This data and all maps from Schwartzberg (1978) are available *online*.

Table 4.3.1: Conquest between 1820 and 1856 is unrelated to pre-colonial state capacity and the power of pre-colonial elites

	Religious and cultural sites of the Mughal Period			
	(1)	(2)	(3)	(4)
Districts conquered between 1820 & 1856	-0.131 (0.123)	-0.120 (0.167)	-0.079 (0.230)	-0.005 (0.209)
Constant	0.451*** (0.057)	0.940 (0.733)	-0.994 (1.440)	-1.588 (2.138)
Observations	169	169	159	159
R-Squared	0.005	0.074	0.163	0.200
Geographic controls	NO	YES	YES	YES
Economic controls	NO	NO	YES	YES
Caste and religious controls	NO	NO	NO	YES

Sources and notes: OLS estimates showing no link between the instrument and pre-colonial state capacity and elites. The dependent variable represents the number of cities and towns for each district presenting forts, palaces, temples and other places of religious or cultural importance during the Mughal period (1526-1707). Geographic controls include district longitude, latitude, mean altitude, maximum altitude, rainfall and a coastal dummy. Economic controls include the 1911 land/labour ratio, railway miles in the district and the urbanization rate. Finally, caste and religious controls include the CRFI, the share of Hindus and the share of Muslims. Data sources are pointed out in Section 4.3.1 and IV: Date of conquest.

state capacity and the presence of powerful elites. Table 4.3.1 shows how districts conquered between 1820 and 1856 are not related to the presence of religious and cultural sites -i.e. the presence of powerful pre-colonial states and elites- during Mughal times (1526-1707). In fact, once all controls are considered, the coefficient of the instrument is virtually 0 -see column (4) in Table 4.3.1-.

In a nutshell, the dummy for districts conquered between 1820 and 1856 was exogenous to factors potentially affecting the funding of hospitals and dispensaries -e.g. land productivity, pre-colonial state capacity and elites-. In fact, I argue that districts conquered between 1820 and 1856 got non-landlord based systems due to exogenous factors such as the administrative capacity of the EIC and the mainstream ideology of British officials.

4.4 Results

Table 4.4.1 shows the OLS estimates for each revenue source including estimations with controls from section 4.3.1. Accounting for all controls defined in section 4.3.1 -see column (3) from top to bottom-, a hospital or dispensary in a non-landlord district had a revenue from district and local boards significantly larger -0.57 standard deviations- than an institution in a landlord district. On the other hand, a hospital or dispensary in a non-landlord district received significantly less revenue from private native subscriptions -0.68 standard deviations-. Finally, a hospital or dispensary in a non-landlord district had a total revenue 0.39 standard deviations larger than that of a hospital or dispensary located in a landlord district. In other words, a 1% increase in the non-landlord proportion translates into a 0.84% increase in hospitals and dispensaries' revenues from district and local boards and a 0.16% increase in total revenue. On the other hand, a 1% increase in the non-landlord proportion translates into a 1.08% decrease in the revenue from private native sub-

scriptions.²⁴

Therefore, there was a positive and significant relation between hospitals and dispensaries' revenues from district and local boards and the non-landlord proportion. Conversely, this relation becomes negative when looking at revenue from native subscriptions. Overall, total revenue of hospitals and dispensaries was significantly larger in non-landlord districts, meaning that the positive link with revenues from district and local boards prevailed.

Table 4.4.1: OLS estimates for each revenue source

	District and local boards revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	1.763*** (0.281)	1.435*** (0.374)	1.734*** (0.328)
Constant	3.913*** (0.315)	6.241** (2.440)	286.778 (473.390)
	Native subscriptions revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	-4.028*** (0.294)	-2.048*** (0.373)	-2.129*** (0.363)
Constant	-7.469*** (1.899)	-631.143 (538.603)	7.850*** (0.068)
	Total revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	0.304*** (0.065)	0.329*** (0.072)	0.333*** (0.077)
Constant	7.850*** (0.068)	7.816*** (0.516)	176.670 (107.879)
Observations	1675	1675	1675
District Population	YES	YES	YES
Hospital and dispensary controls	NO	YES	YES
District controls	NO	NO	YES
SE Clustered at district level	YES	YES	YES

Sources and notes: OLS estimates for each revenue source. Revenue sources transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. (1) shows the effect of non-landlord proportion on revenues from district and local boards, native subscriptions and total revenue controlling for district population. (2) shows the same estimates but controlling also for hospital and dispensary features. Finally, (3) shows the different estimates including all controls as defined in Section 4.3.1.

However, the OLS results might be driven by omitted variables -such as the demand

²⁴For more on the interpretation of coefficients in regressions with a dependent variable transformed using IHS see Bellemare and Wichman (2020).

Table 4.4.2: IV first and second stage estimates

1st IV Stage			
Non-landlord proportion (B&I)			
	(1)	(2)	(3)
Districts conquered between 1820 and 1856	0.365*** (0.073)	0.446*** (0.081)	0.492*** (0.090)
Constant	0.581*** (0.073)	3.887*** (0.344)	-293.159*** (97.632)
2nd IV Stage			
District and local boards revenue			
	(1)	(2)	(3)
Non-landlord prop. (BI)	2.169** (1.012)	2.386*** (0.801)	3.214*** (0.835)
Constant	3.623*** (0.813)	2.366 (3.758)	613.770 (480.368)
Native subscriptions revenue			
	(1)	(2)	(3)
Non-landlord prop. (BI)	-2.531** (1.195)	-3.098*** (0.830)	-3.469*** (1.040)
Constant	4.470*** (0.999)	-3.189 (3.786)	-927.026 (670.571)
Total revenue			
	(1)	(2)	(3)
Non-landlord prop. (BI)	0.384* (0.225)	0.596*** (0.191)	0.793*** (0.221)
Constant	7.794*** (0.169)	6.728*** (0.827)	278.299** (127.159)
Observations	1675	1675	1675
Kleibergen-Paap rk Wald F statistic	24.981	30.132	29.815
District Population	YES	YES	YES
Hospital and dispensary controls	NO	YES	YES
District controls	NO	NO	YES
SE Clustered at district level	YES	YES	YES

Sources and notes: IV estimates for each revenue source. Revenue sources transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. (1) shows the effect of non-landlord proportion on revenues from district and local boards, native subscriptions and total revenue controlling for district population. (2) shows the same estimates but controlling also for hospital and dispensary features. Finally, (3) shows the different estimates including all controls as defined in Section 4.3.1.

for hospitals and dispensaries-. To mitigate this concern and provide some evidence on the causality of these relations, I introduce the IV estimates in Table 4.4.2. After including all controls from Section 4.3.1 -see column (3) from top to bottom-, a hospital or dispensary in a non-landlord district received 1.06 standard deviations more from district and local boards than the same institution in a landlord district. This coefficient is significant in all specifications. Conversely, revenue from native subscriptions in hospitals and dispensaries in non-landlord districts was 1.12 standard deviations lower than that in landlord districts. Finally, total revenue for a hospital or dispensary in non-landlord districts was 0.94 standard deviations larger than that of a hospital or dispensary in a landlord district. In all cases, the IV coefficients are larger than those in the OLS -see 2nd IV Stage columns (1), (2) and (3) in Table 4.4.1-.

In a nutshell, the IV estimates confirm the positive effect of non-landlord proportion on revenue from districts and local boards and the opposite effect on revenue from private native subscriptions. It also shows how the overall effect leans towards the district and local boards effect providing some evidence on the causal effect of land revenue systems on the financial (re)sources of hospitals and dispensaries.

4.4.1 Robustness checks

In order to test the robustness of my IV results, I include several changes to the IV baseline estimation in Table 4.4.3.

First, I drop all hospitals and dispensaries in Bengal from my sample -see column (1)-. Bengal was the first large province conquered by the EIC and the paradigmatic province -specially its western part- of the zamindari land revenue system -landlord based system-. Therefore, it could be that results are only driven by hospitals and dispensaries in this important region. Coefficients in (1) remain significant for district and local board funding, native subscriptions and total revenue. Moreover, the magnitudes of the coefficients are similar to those in the IV baseline estimates

Table 4.4.3: General robustness checks

	District and local boards revenue				
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	3.199*** (0.796)	3.214*** (0.868)		3.391*** (0.672)	2.565*** (0.831)
Non-landlord prop. (IPS)			3.819*** (1.039)		
	Native subscriptions revenue				
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	-2.735*** (1.044)	-3.469*** (0.928)		-3.694*** (0.649)	-3.312*** (0.976)
Non-landlord prop. (IPS)			-4.121*** (1.296)		
	Total revenue				
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	0.499*** (0.156)	0.793** (0.249)		0.341** (0.132)	0.520*** (0.166)
Non-landlord prop. (IPS)			0.942*** (0.274)		
Observations	1200	1675	1675	1675	1507
Kleibergen-Paap rk Wald F statistic	43.305	5.585	25.424	63.334	28.930
Hospital and dispensary controls	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES
SE Clustered at district level	YES	NO	YES	YES	YES

Sources and notes: IV estimates for each revenue source introducing some changes to the baseline estimation. (1) shows the IV estimates dropping all hospitals and dispensaries from Bengal. (2) shows the IV estimates clustering standard errors at the provincial level. (3) shows the IV estimates using Iversen et al. (2013) as an alternative to estimate the non-landlord proportion. (4) uses the distance to Plassey as an alternative instrument. Finally, (5) shows the IV estimates dropping the highest decile observations for each revenue source. For more on controls and data sources see Section 4.3.1.

-see column (3) in Table 4.4.2-, although a bit smaller.

Second, I cluster standard errors at the provincial level instead of the district level. This is done to account for correlation within provinces. We could expect such correlation, specially in revenue from district and local boards. Such correlation could be driven by the importance of provincial grants in the finance of district and local boards. For all revenue sources, the IV coefficient remains significant after clustering standard errors at the provincial level -see column (2)-.

Third, I present the IV results including the changes suggested by Iversen et al. (2013). These authors argue that in the Central Provinces, land that was leased by landlords under a right of absolute occupancy was not truly under a landlord based system. If this estimation of the non-landlord proportion is considered valid,²⁵ it would mean that there is a measurement error in my non-landlord estimate. However, using Iversen et al. (2013) non-landlord estimate does not affect my IV results. The IV coefficients remain significant when estimating any of the revenue sources analysed and with a similar magnitude -a bit larger in absolute value for all cases- to that in Table 4.4.2.

Fourth, I use the distance to the Plassey battle site as an alternative instrument for the non-landlord proportion. The battle of Plassey is generally considered as the beginning of British dominion in the subcontinent as it represented the first conquest of a large region of India -Bengal- by the EIC. From Bengal, the EIC expanded its dominions to the east through the Benares region (1775) and to the south, through the Carantic districts (1801). As argued previously, in its initial conquests, the EIC introduced landlord land revenue systems, which means that the distance to the Plassey battle site and the non-landlord proportion are correlated. In fact, the F-statistic shown in column (4) of Table 4.4.3 is large enough to consider it a strong instrument. As pointed out for the dummy for districts conquered between 1820 and

²⁵There is still an ongoing debate on whether lands under absolute occupancy rights in the Central Provinces should be considered to be under a landlord based system or not (Banerjee and Iyer, 2013).

1856 instrument, the conquest of Bengal as well as the acquisition of most territories -specially initially- by the EIC was mostly exogenous. Also, the battle of Plassey (1757) occurred in a crossing of the Hooghly river more than 100km away from Calcutta. This means that the distance to the Plassey battle site could be a good alternative instrument to test my results. Using distance from the Plassey battle site as an alternative instrument, all coefficients remain significant and their magnitude is similar to that obtained using the dummy for districts conquered between 1820 and 1856 as the instrument.

I also present my IV estimates dropping all observations within the highest decile of each revenue source -district and local boards, native subscriptions and total revenue-. This is to show the robustness of my results to dropping potential outliers. For all revenue sources, the IV coefficient drops -in absolute value-, although it does not lose its significance level in any case -see column (5)-. However, since determining which observations are actually outliers is extremely subjective, I repeat my IV estimates using different thresholds to drop observations -see Table 4.G.1 in Section 4.G in the Appendix- and the results remain significant.

Apart from these general robustness checks, I test whether my results are driven by spatial correlation as it could be the case that the standard errors are correlated beyond the level of treatment -in my case, the district level- (Barrios et al., 2012; Kelly, 2020). To do so, I repeat my IV estimates including Conley standard errors in Table 4.4.4. This table shows how all my results hold when using Conley standard errors with different cutoff levels. Additionally, I test my results using spatial autoregressive models -Table 4.H.1 in Section 4.H of the Appendix- and alternative structures of the error covariance matrix -Table 4.H.2 in Section 4.H of the Appendix-, and the results hold in all specifications.

I also test the robustness of my results using different transformations of my dependent variables and alternative specifications. For the revenue from district and local boards as well as for native subscriptions, I estimate my IV using the natural

Table 4.4.4: Conley standard errors with different cutoffs

	District and local boards revenue			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	3.368*** (0.714)	3.368*** (0.782)	3.368*** (0.901)	3.368*** (1.037)
	Native subscriptions revenue			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	-3.700*** (1.160)	-3.700*** (1.146)	-3.700*** (1.235)	-3.700*** (1.109)
	Total revenue			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	0.863*** (0.238)	0.863*** (0.239)	0.863*** (0.250)	0.863*** (0.301)
Observations	1675	1675	1675	1675
District Population	YES	YES	YES	YES
Hospital and dispensary controls	YES	YES	YES	YES
Hospital and dispensary controls	YES	YES	YES	YES
SE Clustered at district level	NO	NO	NO	NO

Sources and notes: Conley standard errors with different cutoffs. Revenue sources transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. (1) shows the results for each revenue source using Conley standard errors with a 25km cutoff. (2) shows the results for each revenue source using Conley standard errors with a 50km cutoff. (3) shows the results for each revenue source using Conley standard errors with a 100km cutoff. Finally, (4) shows the results for each revenue source using Conley standard errors with a 200km cutoff. Data sources are pointed out in Section 4.3.1.

Table 4.4.5: IV with alternative transformations of the dependent variables and specifications

	D & L income		Native subscriptions revenue		Total revenue	
	(1)	(2)	(3)	(4)	(5)	(5)
Non-landlord prop. (BI)	3.052*** (0.769)	0.987** (0.414)	-3.122*** (0.935)	-1.590*** (0.547)	0.793*** (0.221)	0.793*** (0.221)
Constant	594.866 (439.706)	82.590 (270.726)	-792.044 (602.029)	-665.099* (346.006)	277.592** (127.159)	277.592** (127.159)
Observations	1675	1675	1675	1675	1675	1675
R-Squared	0.161		0.392		0.281	
District Population	YES	YES	YES	YES	YES	YES
Hospital and dispensary controls	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES
SE Clustered at district level	YES	YES	YES	YES	YES	YES

Sources and notes: IV estimates with $\ln(1 + Revenue_{\delta,i})$ transformation of the dependent variables. (1) shows the IV estimates for the district and local boards revenue using the $\ln(1 + Revenue_{\delta,i})$ transformation. (2) presents the IV coefficient from a probit model using a dummy with value 1 for hospitals and dispensaries with revenue from district and local boards. (3) shows the IV estimates for the revenue from native subscriptions using the $\ln(1 + Revenue_{\delta,i})$ transformation. (4) presents the IV coefficient from a probit model using a dummy with value 1 for hospitals and dispensaries with revenue from native subscriptions. Finally, (5) shows the IV estimates with \ln transformation for the total revenue. Data sources are pointed out in Section 4.3.1.

logarithm of the revenue plus one $-\ln(1 + Revenue_{\delta,i})$ - and a probit IV model. I use the natural logarithm of the revenue plus one to avoid losing all 0 observations. For the probit model, I used a dummy for hospitals and dispensaries with (1) or without (0) revenue from each of these revenue sources. For the total revenue instead of using the $\ln(1 + Revenue_{\delta,i})$ transformation, since there are no observations with value 0, I used the usual natural logarithm transformation. Table 4.4.5 shows all these alternative estimations, and the coefficient of interest remains significant for all transformations of the dependent variables and when using a probit model.

Finally, I check whether the IV results are driven by selection of unobservables. In other words, it could be the case that unobservable variables that are linked to the revenue for hospitals and dispensaries also relate to the instrument and are actually driving its effect. To mitigate this concern, I follow Oster (2019) methodology to see how important must be these unobservable variables to be fully driving my results on hospital and dispensary revenue sources. Table 4.4.6 shows that these unobservables must be up to 203.818 times as important as the observables to drop the IV coefficient to 0. This is well above equal importance $-|\delta| = 1$ - which has been suggested as an upper bound (Oster, 2019, p. 197). Additionally, the IV coefficients do not change much after taking into account the estimated bias produced by unobservables -see column (3) in Table 4.4.6-.

4.4.2 Mechanisms

There are various mechanisms that can explain the effect of land revenue systems on revenues from district and local boards as well as native subscriptions. In the following paragraphs, I provide evidence on two mechanisms potentially driving the link between land revenue systems and the revenue (re)sources of hospitals and dispensaries in colonial India. Most importantly, both mechanisms are linked to the influence and actions -i.e. agency- of local landlords, which influenced how the land revenue systems affected the (re)sources available to hospitals and dispensaries.

Table 4.4.6: Testing coefficient robustness through unobservable selection (Oster, 2019)

District and local boards revenue	
IV coefficient	IV bias-adjusted coefficient ($\delta=1$)
Non-landlord prop. (BI)	
δ to match $\beta=0$	2.456
	-25.429
Native subscriptions revenue	
IV coefficient	IV bias-adjusted coefficient ($\delta=1$)
Non-landlord prop. (BI)	
δ to match $\beta=0$	-2.758
	-203.81786
	-2.758
Total revenue	
IV coefficient	IV bias-adjusted coefficient ($\delta=1$)
Non-landlord prop. (BI)	
δ to match $\beta=0$	0.568
	-8.19788

Sources and notes: Testing coefficient robustness through unobservable selection (Oster, 2019). The first column shows the IV coefficient including all observable controls -this is the same as column (3) in Table 4.4.2-. The second column presents the relative importance of unobservables - δ - necessary to bring the IV coefficient to 0 -i.e. $\beta = 0$ -. A $|\delta| = 1$ means that unobservables are equally important than observables, which is an upper bound on δ according to Oster (2019, p. 197). A negative δ means that if observables are positively correlated with the dependent variable, then the unobservables have to be negatively correlated. δ values in the second column are estimated assuming (1) that the maximum R^2 to be 1.3 times the original R^2 as suggested by Oster (2019) and, (2) that district population should be included in all regressions. $|\delta| > 1$ in all cases even when (2) is not true, meaning that the importance of unobservables has to be much larger than that of the observables for the IV coefficient to become null. Finally, the last column shows the IV coefficient after adjusting for the estimated bias produced by unobservables assuming (1) $\delta = 1$ and (2) that the maximum R^2 to be 1.3 times the original R^2 as suggested by Oster (2019).

Land revenue collection

Larger collections of land revenue may explain the larger revenue of hospitals and dispensaries in non-landlord districts from district and local boards. In fact, as argued in section 4.2, district and local boards had limited capacity to increase their revenues as they were mainly financed by provincial grants -the extent of which could change depending on the land revenue collected- and land revenue cesses -an additional surcharge on land revenue, whose variability depended mostly on the land revenue assessed and collected-. Land revenue cesses represented 60% of district boards income in the nineteenth century, while provincial grants started gaining ground in the 1900s and by 1929-30 represented 43% of district boards revenue, compared to the 36% of cesses (Chaudhary, 2010b, p. 281). Provinces allocated grants on a per capita basis and, although initially larger grants were provided to districts rising more revenue, over time poorer districts and those populated by minorities received more money (Chand, 1947; Chaudhary, 2010b). Overall, provinces -through grants- and districts -through cesses- collecting more land revenue could provide district and local boards with more resources, which they could spend on hospitals and dispensaries.

In this context, land revenue systems were closely related to the land revenue assessment and collection, and that to the funds available for district and local boards. Landlord (non-landlord) districts tended to collect less (more) land revenue due to several reasons.²⁶

First, the British state maintained a lower number of village officials in landlord areas that allowed landlords to be in a better position to influence land revenue assessment and collection. These village officials were civil servants paid by the colonial state and were vital for the assessment and collection of land revenue (Baden-

²⁶See Figure 4.E.1 in Appendix 4.E for a map showing district and local boards revenue/land revenue collected. This map shows how there was almost no variation in the amount of revenue received from district and local boards when accounting for the land revenue collected. This means that differences in revenue from district and local board appear mostly from differences in the collection of revenue and the capacity of colonial institutions to finance these hospitals and dispensaries rather than from differences in the preferences of officials.

Powell, 1892a; Baden-Powell, 1892b; Baden-Powell, 1892c). Village accountants were responsible for the compilation of each landed estate's statistics required for the assessment of the land revenue while the village headman was responsible for the collection of the land revenue among village landowners and its delivery to the British collector. In landlord areas land was more concentrated than in non-landlord areas (Banerjee and Iyer, 2005, p. 1197), which substantially reduced government's incentives to sustain a large number of village officials, as land revenue demand was clustered in a few landlords (Lee, 2018, p. 13).

Furthermore, landlords' central role on land revenue assessment was not only enhanced by the lower presence of village officials but also by their appointment. Landlords were deeply involved in the selection of these village offices. In the North-Western provinces, landlords nominated all village accountants -subject to final approval by the British collector- while in Oudh landlords directly appointed them (Baden-Powell, 1892b, p. 268-283).²⁷ By contrast, in the non-landlord province of Madras, the village headman and accountants were directly appointed by the British collector (Baden-Powell, 1892c, p. 87-89). Moreover, most accountants and village headmen in non-landlord areas were usually not landowners (Suryanarayan, 2021, p. 12-13). Overall, landlords were in a far better position to hold their case for a low assessment of land revenue than landowners in non-landlord areas, who had no control over the appointment of village officials. This, combined with the larger land concentration and lower presence of village officials, allowed for systematically less land revenue being collected in districts with landlord-based land revenue systems.

Last but not least, landlord districts tended to have a land revenue demand fixed in perpetuity -permanent settlement- while non-landlord districts were temporary settled, meaning that land revenue demand was updated every 20-30 years.²⁸ Therefore, non-landlord districts tended to collect more land revenue simply because its demand could be updated.

²⁷Even more explicitly, the village headman was a notable landlord in the Central Provinces (Baden-Powell, 1892b, p. 504-505).

²⁸For more on the type of settlement see Baden-Powell (1892a).

Table 4.4.7: OLS estimates showing how the share of village officials and the presence of permanent settlement relate to the non-landlord proportion and the land revenue collection

	Officials		Settlement		Land revenue collection PC	
	(1)	(2)	(3)	(4)	(5)	(6)
Non-landlord proportion (B&I)	0.003*** (0.000)	-0.570*** (0.071)			0.940*** (0.118)	0.708*** (0.164)
Share of village officials			156.468*** (17.829)	116.161*** (18.851)		
Presence of permanent settlement			-0.313*** (0.091)	-0.512*** (0.147)		
Constant	0.001*** (0.000)	0.696*** (0.051)	0.961*** (0.077)	0.093 (1.453)	0.769*** (0.052)	0.377 (1.450)
Observations	169	169	164	164	164	164
R-Squared	0.231	0.238	0.393	0.581	0.303	0.528
Geographic controls	NO	NO	NO	YES	NO	YES
Economic controls	NO	NO	NO	YES	NO	YES
Caste and religious controls	NO	NO	NO	YES	NO	YES

Sources and notes: OLS estimates showing how the non-landlord proportion relate to the share of village officials and the presence of permanent settlement. (3) and (4) show the correlation between per capita land revenue collected and the share of village officials and the presence of permanently settled lands. Finally, (5) and (6) show the link between the per capita land revenue collected and the non-landlord proportion. Geographic controls include district longitude, latitude, mean altitude, maximum altitude, rainfall and a coastal dummy. Economic controls include railway miles in the district and the urbanization rate. Finally, caste and religious controls include the CRFI, the share of Hindus and the share of Muslims. Data sources are pointed out in Section 4.3.1 and Section 4.4.2.

In Table 4.4.7 I provide evidence that in landlord areas, local landlords -through their control of the appointment of village officials and the small number of the latter- received lower land revenue demands. More precisely, the 1911 share of male village officials over total male agricultural workers relates positively and significantly with the non-landlord proportion -see column (1)-.²⁹ Additionally, I test if the presence of permanent settlements can explain the differences in land revenue collection. To do so, I use a dummy with value 0 for those districts that had some land permanently settled and with value 1 for those only temporarily settled.³⁰ Column (2) show a negative and significant link between landlord districts and the introduction of the permanent settlement. In line with these results, the non-landlord proportion is positively related with the land revenue collected per capita -see columns (5) and (6)-.³¹ More specifically, non-landlord districts collected 1.31 standard deviations more land revenue per capita than landlord districts -see column (6)-.

Finally, Table 4.4.8 shows how the collection of land revenue was positively and significantly linked with the hospitals and dispensaries' revenue received from district and local boards. Overall, this evidence shows that hospitals and dispensaries in landlord districts had less revenue from district and local boards due to less land revenue being collected in these districts. This was mostly due to the small presence of village officials and landlords' influence in their appointment as well as to permanent settlements being introduced in landlord areas.

Allegiance

Lower land revenue collection in landlord districts can explain the link between the non-landlord proportion and revenue from district and local boards, but it may be more challenging to explain the larger revenue from native subscriptions in landlord areas. I argue that landlords and other Indian elites used these subscriptions and

²⁹See Note in Table 4.4.7 for a complete list of controls included. Data for the share of village officials is obtained from *Census of India (1911)*.

³⁰Data on the type of settlement available at the *Agricultural Statistics of India*.

³¹Data on the land revenue collected comes from the provincial *Reports on the (land) revenue administration*.

Table 4.4.8: OLS estimates testing the land revenue collection mechanism

	District and local boards revenue		
	(1)	(2)	(3)
Land revenue collection in ln (1901)	0.968*** (0.132)	0.789*** (0.168)	0.751*** (0.168)
Constant	-7.583*** (1.727)	-4.069 (3.732)	-99.636 (504.404)
Observations	1630	1630	1630
R-Squared	0.073	0.133	0.162
District Population	YES	YES	YES
Hospital and dispensary controls	NO	YES	YES
District controls	NO	NO	YES
SE Clustered at district level	YES	YES	YES

Sources and notes: OLS estimates testing the land revenue collection mechanism. District and local boards revenue transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. (1), (2) and (3) present hospital and dispensary level estimates for the link between district and local boards revenue and land revenue collection. Data sources are pointed out in Section 4.3.1.

donations to show their allegiance to the British. This was specially useful for landlords in areas where there had been more insurrectional activity during the revolt of 1857 -also known as the Mutiny or First War of Independence-.

For the natives to use these private donations and subscriptions to show their allegiance, the British had to clearly identify them. To do so, the names and amounts from the largest donations and subscriptions were mentioned in the *Reports on the civil hospitals and dispensaries*. To exemplify, in the *Triennial Report on the working of the Charitable Dispensaries under the Government of Bengal (1901)* it is stated how the Maharani Sarat Sundari Barmin of Tajhat donated 12,000 rupees to the Rangpur Hospital, how two Muhammadan noblemen -Syed Mahammad Mehdi Khan and Syed Shah Mahammad Kamal- paid donations of 5,000 and 2,000 rupees to the Bankipore Hospital and how the Maharani of Hathwa donated 500 rupees to the Kurseong Dispensary.³² The *Annual Report of the Dispensaries and Charitable Institutions of the Punjab (1901)*, states the names of subscribers paying over 50 rupees.³³ Moreover, those giving the largest donations were invited to the durbars,

³² *Triennial Report on the working of the Charitable Dispensaries under the Government of Bengal (1901)*. Pages 26-27.

³³ *Annual Report of the Dispensaries and Charitable Institutions of the Punjab (1901)*. Page 9.

which were meetings of Indian notables -mostly landlords and government servants-³⁴ who had demonstrated loyalty to the British. Top tier British officials -from the viceroy to governors- attended such meetings, and granted honours, medals and rewards to these Indian notables (Cohn, 2012). Most importantly, the British prepared lists -durbar lists- with all those individuals that could attend such meetings. Such lists were then distributed among British officials to let them know of the leading individuals in each district, division and province that helped the Government -either through donations, military support or in any other way- (R. Sharma and Mukerji, 1988; Yang, 1992). To illustrate, the already mentioned Maharani of Hathwa was awarded a Kaisar-i-Hind Gold Medal³⁵ for her generous donations and multiple members of her family attended the durbars (Yang, 1992, p. 73, 123).

Using private subscriptions and donations to show allegiance was specially useful after the 1857 revolt and in areas most affected by it. The 1857 revolt started on May the 10th, with the mutiny of the sepoy soldiers stationed in Meerut and ended by late 1858. Such a rebellion was fueled by a diversity of fears, grievances and social groups such as the Indian soldiers in the EIC's army, Hindus, Muslims, Rajas, landlords and even peasants (Chakravarty, 2005, p. 23). The revolt did not only mark the transfer of India from the EIC to the Crown, but it had lasting and significant effects on the British administration, policies and their relations with Indians. In fact, the EIC administration had embarked in a process to anglicize India's administration, society and tradition. However, these goals were partly abandoned with the resistance met during the revolt, after which the British administration swiftly switched to a much more conservative approach.³⁶ In line with that, social reform and capitalist transformations of the Indian countryside were mostly discouraged with the protection of peasant land from moneylenders by the British administra-

³⁴See R. Sharma and Mukerji (1988, p. 379).

³⁵The Kaisar-i-Hind medal was granted to "any person without distinction of race, occupation, position, or sex, [...] who shall have distinguished himself (or herself) by important and useful service in the advancement of the public interest in India." *The London Gazette. Issue 27191. Page 2996.*

³⁶On officers' ideology before the revolt see Stokes (1959). On the post-mutiny conservative policies see T. Metcalf (1961) and Washbrook (1981).

tion, fearing that land dispossession could lead to another mass revolt (Washbrook, 1981, p. 684-686). Another example of these policy changes is the establishment of taluqdars in Oudh.³⁷ The EIC acquisition of Oudh through the Doctrine of Lapse led to the introduction of a mostly non-landlord system following that introduced in the western districts of the United Provinces. The annexation and the loss of land rights by most pre-colonial tax collectors -taluqdars- partly motivated the uprising of 1857, which was led by taluqdars as well as former rajas and had the support of most peasants, who viewed the taluqdars as the true and rightful landowners. In the end, despite suppressing the revolt, the British acknowledged the importance of having the taluqdars on their side by making most of them landowners, valuing their favour over social reform (T. Metcalf, 1961, p. 156). Hence, after the revolt land was either given to rebellious taluqdars who unconditionally surrendered -recognizing the British as overlords- or granted to landowners and other natives that remained loyal and actively aided the British during the revolt.³⁸

Overall, landlords had incentives to show their allegiance using private subscriptions and donations while the British were encouraged to look and report for such allegiance signs. The former had incentives to show their allegiance by making private donations and subscriptions, not only to preserve their landownership rights -specially after the 1857 revolt-, but also to obtain certain privileges. Private donations and subscriptions could materialize in the form of a personal message from Queen Victoria, some title, state gift or *simply* the good will of the local Collector or Resident (Arnold, 1993, p. 270-271). Nonetheless, providing donations and subscriptions whilst, at the same time, lobbying to reduce the land revenue demand -as argued in Section 4.4.2- could be contradictory behaviours by the landlords. However, previous research has pointed at the preference of landowners to finance public goods through donations rather than taxation, specially in anglophone countries -see for instance (Goñi, 2021)-. In fact, paying for land revenue was the *de facto* and *de*

³⁷Taluqdars were the tax collectors in Oudh before the EIC annexation.

³⁸See T. Metcalf (1961) and *Bahraich: A Gazeteer being volume XLV of the District Gazetteers of the United Provinces of Agra and Oudh (1921). Page 144, Unao: A Gazeteer being volume XXXVIII of the District Gazetteers of the United Provinces of Agra and Oudh (1903).*

Table 4.4.9: OLS estimates testing the alignment mechanism

	Revolt MP		Native subscriptions revenue		
	(1)	(2)	(3)	(4)	(5)
Non-landlord prop. (BI)	0.712*** (0.190)				
Distance to Indian mutinied posts		-0.974*** (0.119)	-0.409*** (0.124)	-0.312** (0.133)	-0.385** (0.151)
Constant	4.605*** (0.125)	6.784*** (0.622)	-13.187*** (1.898)	-266.730 (526.456)	-513.290 (570.978)
Observations	1675	1675	1675	1675	1493
R-Squared	0.065	0.120	0.362	0.381	0.372
District Population	NO	YES	YES	YES	YES
Hospital and dispensary controls	NO	NO	YES	YES	YES
District controls	NO	NO	NO	YES	YES
SE Clustered at district level	YES	YES	YES	YES	YES

Sources and notes: OLS estimates testing the need to show alignment as a mechanism driving the link between landlord areas and native subscriptions revenue. Native private subscriptions revenue transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. (1) estimates the relation between the distance to a 1857 revolt mutinied posts (in natural logarithms) for each hospital and dispensary and its non-landlord proportion. (2), (3) and (4) show the link between the distance to a 1857 revolt mutinied posts (in natural logarithms) and the revenue from native private subscriptions for each hospital and dispensary. (5) adds district-level wage/income ratios (W/I) for 1916 from Caum-Julio (2022) to control for agricultural incomes being more concentrated in landlord areas. Data sources are pointed out in Section 4.3.1 and Section 4.4.2.

jure condition to hold landownership. This means that landlords received a return for paying the land revenue -landownership- which was independent of the amount paid. Therefore, it would make sense for them to minimize land revenue demands and use private subscriptions and donations to show allegiance, as these donations were voluntary and sent a clearer message. From the British perspective, the policy changes after the revolt of 1857 show the huge shadow that such event had on British administration, and point at the need and eagerness of such administration to formalize alliances with the Indian society and its elites.

To test the role of allegiance driving larger private subscriptions in landlord areas, I look at the distance of hospitals and dispensaries from the closest mutinied post during the 1857 revolt. I also test whether landlord areas were more prone to have Indian military posts mutinied during the revolt. The data on the mutinied posts comes from Schwartzberg (1978) map on the 1857 revolt.³⁹ Results from Table 4.4.9 show how hospitals and dispensaries in landlord districts were significantly closer to mutinied posts from the 1857 revolt -see column (1)-. Also, the further away from a 1857 mutinied post, the lower the revenue from native subscriptions -see columns (2) to (5)-. Last but not least, it might be that hospitals and dispensaries in landlord districts presented more private subscriptions and donations simply because landlord-based systems led to a larger concentration of agricultural income. Controlling for the urbanization rate could deal with this concern, since most rich landowners were absentees that lived in urban areas. Moreover, column (5) includes district-level wage/income ratios (W/I) for 1916⁴⁰ -an estimate of agricultural income inequality- as a control and shows that the coefficient for the distance to mutinied posts remains significant and virtually the same. Briefly, the W/I ratio estimates how much poor labourers earned relative to per capita income. Arguably, a measure of income concentration for top incomes, which are usually obtained from income tax records, would better capture agricultural income concentration.

³⁹This data and all maps from Schwartzberg (1978) are available *online*. For a map representing the mutinied posts with the non-landlord proportion of each district see Figure 4.I.1 from Section 4.I in the Appendix.

⁴⁰For more on this estimate of agricultural income inequality see Section 3.3.

However, agricultural incomes were exempted from the income tax in colonial India (Alvaredo et al., 2017). Overall, this evidence suggests that differences in private subscriptions between hospitals in landlord and non-landlord districts are better explained by landowners' need to show allegiance rather than by agricultural income inequality being more acute in landlord areas.

4.5 Conclusions

In this chapter I analyse the impact of land revenue systems on the funding of hospitals and dispensaries in colonial India. I present the following results: First, there were important differences in the resources available to hospitals and dispensaries, which can be partially explained by the introduction of certain land revenue systems. Second, hospitals and dispensaries in non-landlord districts received significantly more revenue from district and local boards and overall revenue. Alternatively, hospitals and dispensaries in landlord districts had significantly more revenue from native subscriptions. Finally, the effect of land revenue systems was driven by their interaction with local landlords, who influenced land revenue collection and the revenue from private subscriptions and donations. These findings are robust to various checks and alternative estimations.

Such evidence complements the literature on the determinants of public goods provision -e.g. (Chaudhary, 2009; Galor et al., 2009)- looking at the determinants of health provision, which have mostly been overlooked in the literature. Also, these findings contribute to the literature exploring institutions as drivers of development by highlighting how local agency can drive the effect of colonial institutions on public goods provision and development in general. Hence, the impact of a colonial institution -land revenue systems- on development is not only dependent on colonial agency but also on the influence and actions of the natives. These results also contribute to previous literature on elite capture and decentralization (Chaudhary, Musacchio, et al., 2012; Lindert, 2004): in landlord districts, local landlords were

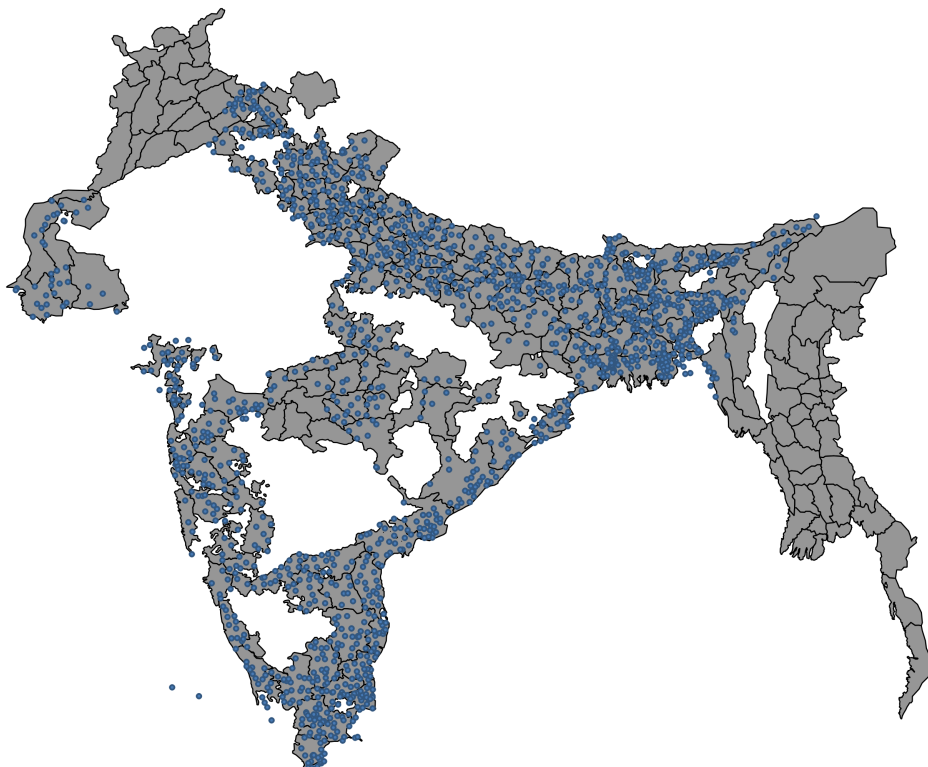
powerful enough to lower the resources available to the district and local boards while providing private donations and subscriptions to show allegiance. Additionally, the results presented in this chapter are in line with the literature on the evolution of western medicine in colonial India. Finally, this chapter provides an explanation for the differences in colonial healthcare provision that might relate with persistent effects on health outcomes and trust on western medicine observed in India and other former colonies.

In a nutshell, colonial institutions -e.g. land revenue systems- can explain differences in the funding of hospitals and dispensaries, and do so through their interaction with the agency of local landowners -i.e. their capacity to limit tax collection and their need to show allegiance-. Exploring the impact of the agencies of other social groups on health and the provision of other public goods could be a productive avenue for future research. Finally, the effect of these hospitals and dispensaries on the way Indian people perceived western medicine and its potential long-lasting effects might also be an interesting research topic.

Appendix

4.A Distribution of hospitals and dispensaries in 1901

Figure 4.A.1: Georeferenced hospitals and dispensaries in 1901



Sources and notes: Map showing the georeferenced hospitals and dispensaries in 1901. I have no data on the Pakistani part of Punjab -top left corner-, Berar -in between the Central Provinces and Bombay- and Burma -right hand side-.

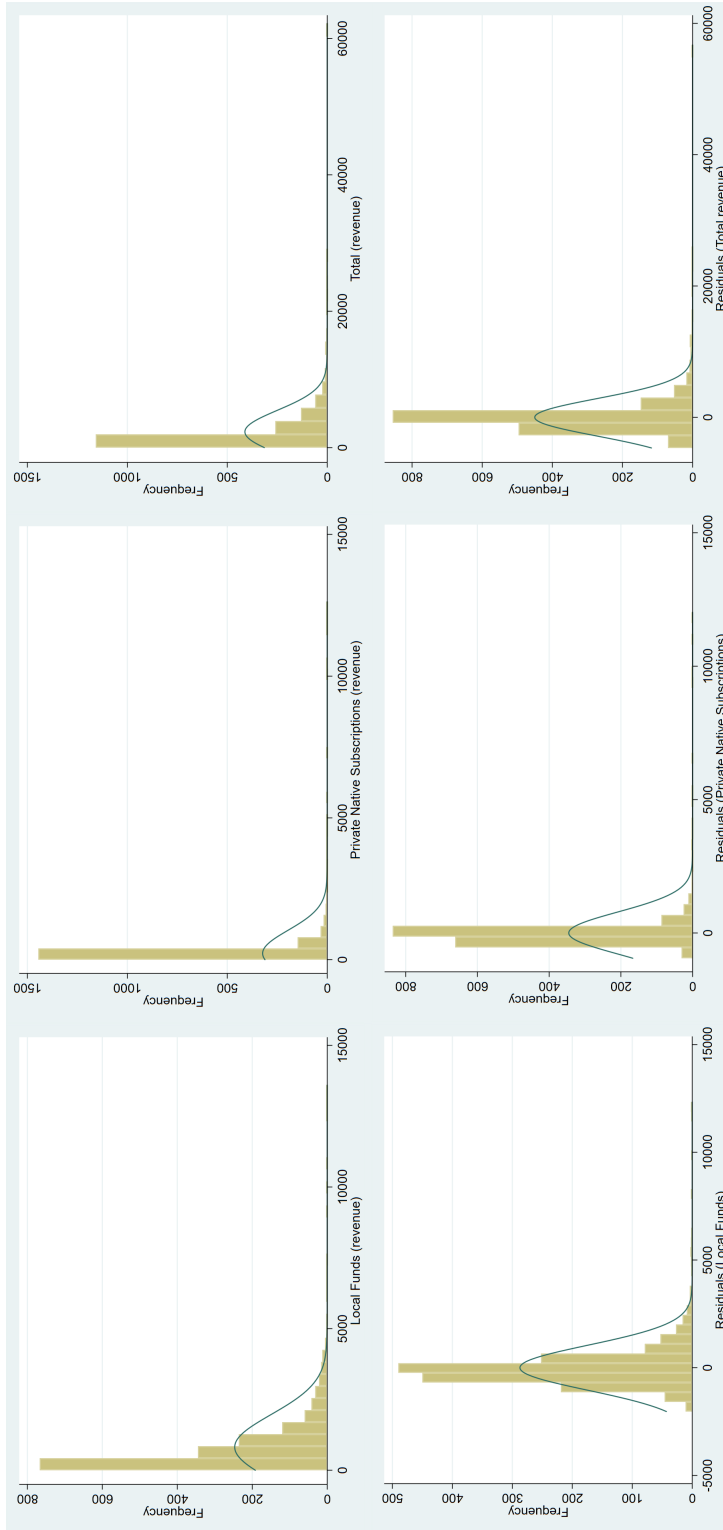
4.B Distribution of revenue sources and residuals (untransformed)

4.C Infant mortality rates and per capita revenue for hospitals and dispensaries

In this section I provide some preliminary evidence on the link between infant mortality rates and per capita revenue for hospitals and dispensaries clustered at the district level. To measure infant mortality, I use the number of male and female children that died with less than a year and divide that by the number of male and female births respectively. This data was collected from the provincial *Annual Sanitary Reports* for years 1901 and 1910. Data on total revenue for hospitals and dispensaries comes from 1901 provincial *Reports on the civil hospitals and dispensaries* whilst the population data to convert these revenues on per capita terms comes from *Census of India (1901)*. Table 4.C.1 shows the link between infant mortality rates in 1901 and 1910 with per capita revenue of hospitals and dispensaries clustered at the district level.

Results show a negative but weak link between the two, which is significant only for 1910. More specifically, a 1 standard deviation increase in the district total revenue for hospitals and dispensaries per capita in 1901 resulted in a reduction of 0.01 standard deviations of the male infant mortality rate in 1910. These results would suggest that whilst there might have been some effect of more revenue for hospitals and dispensaries on short-term infant mortality rates, such effect was not large nor systematically significant. Finally, it is also worth mentioning that the coefficient becomes more negative in all specifications for 1910 infant mortality rates. This could be due to the fact that 1901 was a year with famines but it could also be that the link strengthened over time as more people engaged with hospitals and dispensaries and changed to more healthy habits.

Figure 4.B.1: Histograms for untransformed revenue sources and residuals



Sources and notes: Top figures are histograms for untransformed revenue sources (from left to right): local and district revenue, private native subscriptions and donations revenue and total revenue. Bottom figures are histograms for residuals from baseline regressions using untransformed revenue sources for (from left to right) local and district revenue, private native subscriptions and donations revenue and total revenue.

Table 4.C.1: Infant mortality rates and per capita revenue for hospitals and dispensaries

	1901 infant mortality rate by sex			
	Male	Female	Male	Female
Total revenue per capita per district	-0.084 (0.057)	-0.024 (0.061)	-0.043 (0.071)	0.058 (0.077)
Constant	0.215*** (0.004)	0.203*** (0.005)	0.220*** (0.083)	0.283*** (0.087)
	1910 infant mortality rate by sex			
	Male	Female	Male	Female
Total revenue per capita per district	-0.104* (0.054)	-0.111* (0.062)	-0.140** (0.069)	-0.066 (0.062)
Constant	0.225*** (0.004)	0.214*** (0.004)	0.164* (0.087)	0.183** (0.086)
Observations	169	169	169	169
Geographic controls	NO	NO	YES	YES
Economic controls	NO	NO	YES	YES
Caste and religious controls	NO	NO	YES	YES

Sources and notes: Infant mortality rates and per capita revenue for hospitals and dispensaries. Data sources for controls are pointed out in Section 4.3.1.

4.D Local funds as a viable estimate for revenue from district and local boards

I use the revenue from local funds from the *Reports on the civil hospitals and dispensaries* to estimate the revenue from district and local boards for each hospital and dispensary. Revenue from local funds included revenue from institutions which were vested in Local Boards and guaranteed or maintained by local funds.⁴¹ For the most part, this meant district and local boards although revenue from public

⁴¹*Annual returns (Triennial Report) on the Civil Hospitals and Dispensaries in The Madras Presidency (1901)*. Statement n°1. Note.

institutions other than district or local boards -such as Port Commissioners or Improvement Funds- were also included. However, the contribution of these other local institutions seems to have been minimum. In fact, all but 4 hospitals and dispensaries managed and financed by local bodies were directly managed and financed by District Boards in Bengal.⁴² Hence, it would appear that most revenue classified as local funds came from district and local boards. This is in line with the responsibility of district and local boards to provide medical services and the introduction and generalization of these boards since the 1880s signalled in Section 4.2.

Nonetheless, to mitigate concerns on the impact of this potential measurement error on my results, I collected data on 1901 medical expenditure by district boards from *District Gazetteers*. District boards' medical expenditure was not only devoted to hospitals and dispensaries, but also to sanitation works and vaccination campaigns.⁴³ However, hospitals and dispensaries was usually the main head of medical expenditure.⁴⁴ I test my results using the medical expenditure by district boards as an alternative measure of hospitals and dispensaries revenue from district boards. My IV coefficient is positive and significant in all specifications -see Table 4.D.1 in Appendix 4.D-. This is in line with my results when using local funds as funds from district and local boards in Table 4.4.2. Finally, Figure 4.D.1 graphically presents the relation between district boards medical expenditure and revenue from local funds clustered by district. This figure shows how the district boards medical expenditure is similar to local funds available for hospitals and dispensaries within each district, although systematically larger. This means that district and local boards could have provided most -if not all- of the local funds to hospitals and dispensaries.

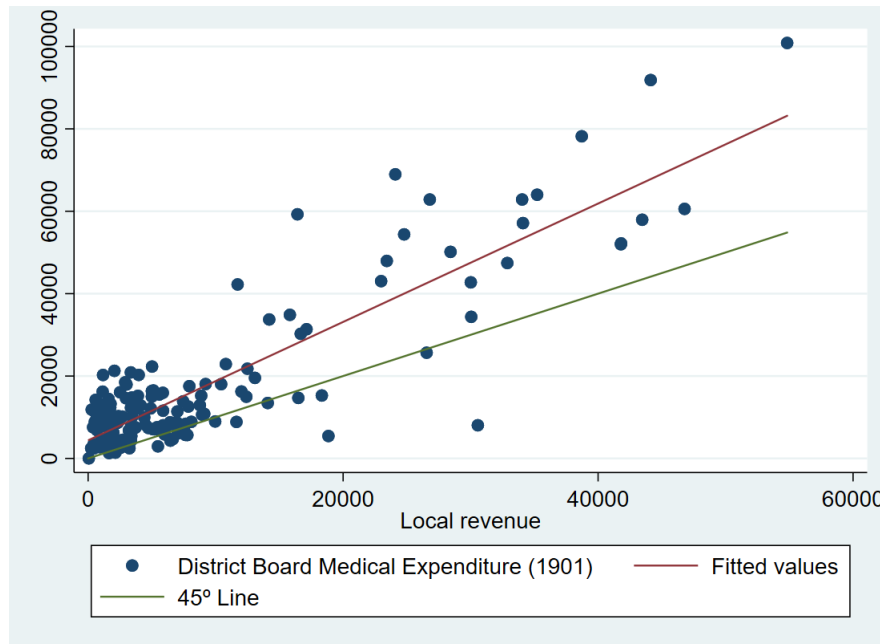
Despite most revenue reported as local funds seems to be from district and local boards, these local funds are not perfectly capturing revenue from district and local

⁴² *Triennial Report on the working of the Charitable Dispensaries under the Government of Bengal (1901)*. Page 16, Paragraph 33.

⁴³ *Madras District Gazetteers. Statistical Appendix (1915)*.

⁴⁴ *Agra: A Gazetteer, being Volume VIII of the District Gazetteers of the United Provinces of Agra and Oudh (1905)*. Pages 129-30. *Madras District Gazetteers. Statistical Appendix (1915)*.

Figure 4.D.1: District Board Medical Expenditure vs local funds for hospitals and dispensaries clustered at the district level



Sources and notes: District Board Medical Expenditure vs local funds for hospitals and dispensaries clustered at the district level. Data from *District Gazetteers* and provincial *Reports on the civil hospitals and dispensaries*. Solid line is the regression line while the red dashed line is the 45 degree line.

boards. To mitigate concerns on the impact of this noise, I introduce Table 4.D.1, which regresses my IV with the per capita medical expenditure by district boards in 1901. This is also not a perfect measure of expenditure of district and local boards on hospitals and dispensaries, as other expenditures -e.g. vaccination- are also included. After including all controls, a non-landlord district has a district board per capita medical expenditure 0.87 standard deviations larger than a landlord district. This effect is almost identical to my IV estimate including all controls -1.06 standard deviations-. Overall, it seems like the potential measurement error from using revenue from local funds reported in the 1901 provincial *Reports on the civil hospitals and dispensaries* as revenue from district and local boards should not affect my results.

Table 4.D.1: IV using District Board per capita medical expenditure in 1901

	District Board pc medical expenditure			
	(1)	(2)	(3)	(4)
Non-landlord proportion (B&I)	1.190*** (0.261)	0.785** (0.357)	0.707* (0.372)	0.868** (0.354)
Constant	-5.035*** (0.149)	-2.101 (2.073)	-3.848* (1.970)	-8.612*** (2.337)
Observations	155	155	155	155
Kleibergen-Paap rk Wald F statistic	58.804	31.675	31.935	29.177
R-Squared	0.318	0.381	0.403	0.441
Geographic controls	NO	YES	YES	YES
Economic controls	NO	NO	YES	YES
Caste and religious controls	NO	NO	NO	YES

Sources and notes: District Board per capita medical expenditure in 1901 in natural logarithms is the dependent variable in all specifications. Data comes from the different *District Gazetteers*. Geographic controls include district longitude, latitude, mean altitude, maximum altitude, rainfall and a coastal dummy. Economic controls include railway miles in the district and the urbanization rate. Finally, caste and religious controls include the CRFI, the share of Hindus and the share of Muslims. Data sources are pointed out in Section 4.3.1.

4.E District and local board funds over land revenue collected

4.F OLS regressions with untransformed revenue sources

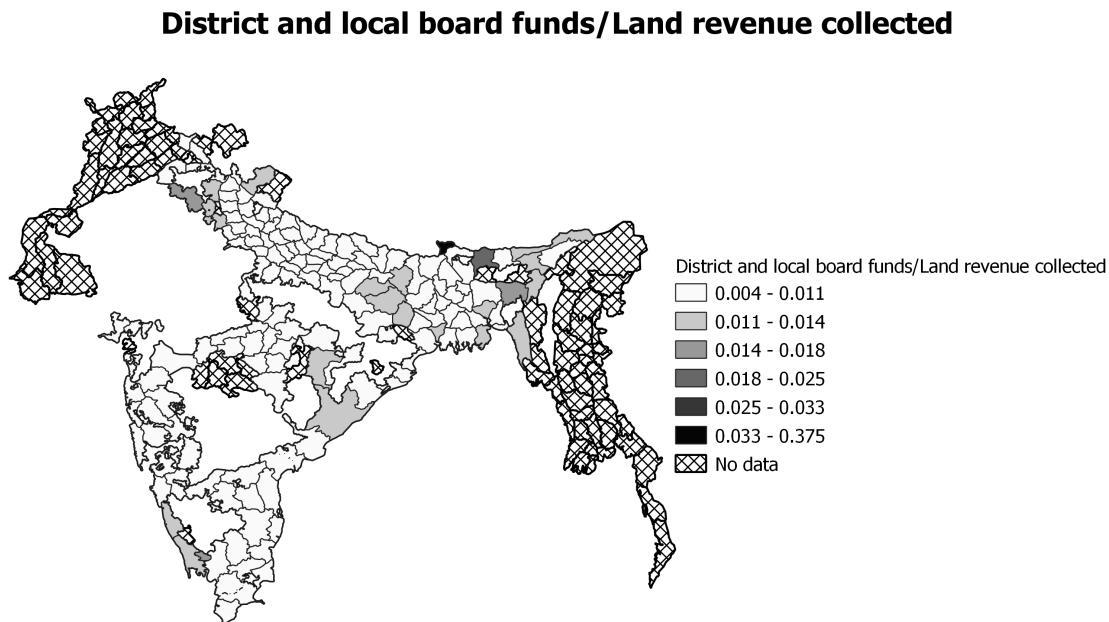
4.G Dropping potential outliers

Determining a threshold to consider observations as outliers -and drop them from the analysis- is subjective. Therefore, in Table 4.G.1, I provide for several thresholds

Table 4.F.1: OLS regressions using untransformed revenue sources

	District and local boards revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	591.930*** (95.334)	557.889*** (89.469)	601.182*** (89.314)
Constant	71.086 (116.710)	-198.189 (547.611)	-1622.413** (728.061)
	Native subscriptions revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	-346.652*** (54.453)	-214.247*** (44.508)	-214.975*** (43.782)
Constant	361.035*** (49.864)	-277.407 (250.912)	174.167 (332.477)
	Total revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	459.305** (195.504)	627.199*** (216.841)	722.914*** (237.565)
Constant	2106.873*** (188.695)	1456.278 (1589.948)	414872.911 (361447.3)
Observations	1675	1675	1675
District Population	YES	YES	YES
Hospital and dispensary controls	NO	YES	YES
District controls	NO	NO	YES
SE Clustered at district level	YES	YES	YES

Sources and notes: OLS estimates for each revenue source. Revenue sources untransformed. (1) shows the effect of non-landlord proportion on revenues from district and local boards, native subscriptions and total revenue controlling for district population. (2) shows the same estimates but controlling also for hospital and dispensary features. Finally, (3) shows the different estimates including all controls as defined in Section 4.3.1.

Figure 4.E.1: District and local boards revenue over land revenue collected

Sources and notes: District and local boards revenue over land revenue collected. Data on revenue for hospitals and dispensaries from 1901 provincial *Reports on the civil hospitals and dispensaries*. Data on land revenue collected from *Reports on the (land) revenue administration*.

from which I could consider observations as outliers and drop them. From there, it is clear how my results are not sensitive to the threshold I chose to consider observations as outliers.

4.H Alternative measures of spatial correlation

A part from using Conley standard errors, I estimate my IV baseline results using Spatial Autoregressive Models (SAR). These models are estimated using Generalized Spatial Two Stage Least Squares (GS2SLS) and include a spatial weighted matrix W_n representing the inverse of the distances between the different district centroids. Interacting this spatial weighted matrix W_n allows these models to account for spatial lags of the dependent variable and spatial correlation within the error term -see

Table 4.G.1: IV dropping potential outliers with high values of district and local boards, native subscriptions and total revenue

	District and local boards revenue			
	(1)	(2)	(3)	(4)
Non-landlord proportion (B&I)	2.219*** (0.840)	2.212*** (0.853)	2.112** (0.874)	2.141** (0.893)
Constant	252.199 (530.823)	193.925 (559.827)	90.910 (588.376)	1.430 (633.214)
	Native subscriptions revenue			
	(1)	(2)	(3)	(4)
Non-landlord proportion (B&I)	0.516*** (0.872)	0.504*** (0.846)	0.499*** (0.834)	0.509*** (0.755)
Constant	-1481.546** (596.985)	-1383.155** (574.323)	-1232.455** (550.683)	-1328.703*** (494.367)
	Total revenue			
	(1)	(2)	(3)	(4)
Non-landlord proportion (B&I)	0.516*** (0.183)	0.504*** (0.187)	0.499*** (0.186)	0.509*** (0.175)
Constant	281.400*** (95.134)	274.712*** (95.534)	228.228** (94.127)	216.901** (93.276)
Observations	1465	1434	1394	1338
District Population	YES	YES	YES	YES
Hospital and dispensary controls	YES	YES	YES	YES
District controls	YES	YES	YES	YES
SE Clustered at district level	YES	YES	YES	YES

Sources and notes: IV estimates dropping observations within the highest (1) octile, (2) septile, (3) sextile and (4) quintile for every revenue source. Revenue sources transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. Data sources are pointed out in Section 4.3.1.

equations 4.2 and 4.3-:

$$\begin{aligned}
 Revenue_{\delta,i} = \beta_0 + \beta_1 NonLandlord_r + \beta_2 Population_r + \beta_3 X_i \\
 + \beta_4 \Gamma_r + \lambda W_n Revenue_{\delta,i} + u_i
 \end{aligned}
 \tag{4.2}$$

$$u_i = \rho W_n u + \epsilon_i
 \tag{4.3}$$

λ in equation 4.2 represents the spatial lag coefficient for the dependent variable. ρ in equation 4.3 is the coefficient representing spatial dependence of the error term. In other words, it estimates the effect of an exogenous shock on one hospital to neighbouring hospitals.

Estimations in Table 4.H.1 show how after including all my controls -see column (3)-, the IV coefficient remains significant for all revenue sources and with a similar magnitude to that reported in Table 4.4.2.

Finally, I look at the significance of my IV estimation for the non-landlord proportion using a different way to cluster standard errors than the one suggested by Conley (1999). I follow Colella et al. (2019) estimating a variance-covariance matrix accounting for the spatial autocorrelation in the error term through arbitrary clustering structures with different sizes. Table 4.H.2 shows these estimations which suggest that the non-landlord proportion remains a significant factor explaining the revenue received by hospitals and dispensaries from district and local boards, native subscriptions as well as total revenue.

Table 4.H.1: Spatial Autorregressive Models (SAR)

	District and local boards revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	2.001*** (0.629)	2.270*** (0.495)	2.967*** (0.529)
λ	-1.049 (0.882)	-0.556 (0.441)	-0.625 (0.433)
ρ	1.867** (0.875)	1.362*** (0.454)	1.418*** (0.498)
Constant	3.772*** (0.477)	2.838 (2.265)	563.767 (369.102)
	Native subscriptions revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	-2.602*** (0.574)	-3.011*** (0.427)	-3.197*** (0.460)
λ	0.295 (0.524)	-0.335 (0.450)	-0.516 (0.442)
ρ	0.138 (0.437)	0.359 (0.638)	0.458 (0.789)
Constant	4.513*** (0.436)	-3.551* (1.957)	-935.157*** (323.615)
	Total revenue		
	(1)	(2)	(3)
Non-landlord prop. (BI)	0.398** (0.176)	0.528*** (0.123)	0.613*** (0.135)
λ	0.147** (0.067)	0.125*** (0.047)	0.134*** (0.047)
ρ	0.365 (0.234)	0.137 (0.360)	0.166 (0.358)
Constant	7.777*** (0.134)	7.009*** (0.566)	270.356*** (98.024)
Observations	1675	1675	1675
District Population	YES	YES	YES
Hospital and dispensary controls	NO	YES	YES
District controls	NO	NO	YES
SE Clustered at district level	NO	NO	NO

Sources and notes: (1) shows the SAR controlling only for district population for all revenue sources. (2) introduces hospital and dispensary controls for all revenue sources. Finally, (3) presents the SAR with all controls for all revenue sources. Revenue sources transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. Data sources are pointed out in Section 4.3.1.

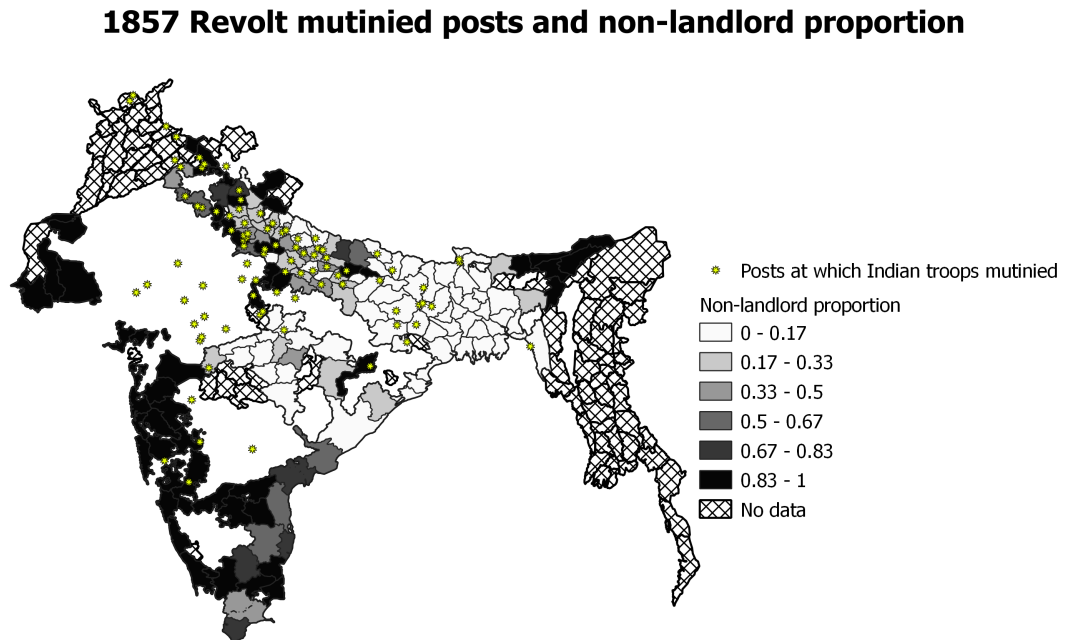
Table 4.H.2: IV estimates considering arbitrary clustering structures

	District and local boards revenue			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	3.190*** (0.664)	3.190*** (0.650)	3.190*** (0.687)	3.190*** (0.719)
Constant	574.182 (394.451)	574.182 (450.006)	574.182 (426.810)	574.182 (386.154)
	Native subscriptions revenue			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	-3.432*** (0.770)	-3.432*** (0.897)	-3.432*** (0.856)	-3.432*** (0.786)
Constant	-867.333* (482.353)	-867.333 (545.412)	-867.333 (568.776)	-867.333 (552.357)
	Total revenue			
	(1)	(2)	(3)	(4)
Non-landlord prop. (BI)	0.782*** (0.186)	0.782*** (0.198)	0.782*** (0.200)	0.782*** (0.221)
Constant	259.824*** (99.725)	259.824** (114.110)	259.824** (123.823)	259.824** (126.209)
Observations	1675	1675	1675	1675
District Population	YES	YES	YES	YES
Hospital and dispensary controls	YES	YES	YES	YES
District controls	YES	YES	YES	YES
SE Clustered at district level	NO	NO	NO	NO

Sources and notes: IV estimates considering arbitrary clustering structures with various distances (in km) which spatial dependence is likely to reach. Revenue sources transformed using the inverse hyperbolic sine to avoid biased results from right-skewed distribution of residuals and observations with value 0 being dropped. (1) shows the results for an arbitrary cluster distance of 25km. (2) shows the results for an arbitrary cluster distance of 50km. (3) shows the results for an arbitrary cluster distance of 75km. Finally, (4) shows the results for an arbitrary cluster distance of 100km. Data sources are pointed out in Section 4.3.1.

4.I 1857 revolt mutinied posts

Figure 4.I.1: Georeferenced 1857 mutinied posts and non-landlord proportion at the district level



Sources and notes: Map showing the georeferenced 1857 mutinied posts and the non-landlord proportion at the district level. Data on the mutinied posts from Schwartzberg (1978).

4.J Summary statistics

Table 4.J.1: Summary statistics

Output variables					
	Obs	Mean	Std. dev	Min	Max
District & local boards rev. (asinh)	1675	5.646054	3.0324	0	10.211
Native subscriptions rev. (asinh)	1675	2.737014	3.10340	0	10.137
Total revenue in asinh	1675	8.037986	.84290	2.687375	11.731
Variables of interest and instruments					
	Obs	Mean	Std. dev	Min	Max
Non-landlord proportion (BI)	1675	.4758093	.419436	0	1
Non-landlord proportion (IPS)	1675	.4918135	.412110	0	1
Districts conq. between 1820 & 1856	1675	.1307463	.337223	0	1
Distance from Plassey battle site	1675	1022.092	637.31	21.87218	2345.7
Population controls					
	Obs	Mean	Std. dev	Min	Max
District population	1675	1482392	798508	82434	3.92M
Hospital and dispensary controls					
	Obs	Mean	Std. dev	Min	Max
Hospital dummy	1675	.4316418	.495453	0	1
Female institution dummy	1675	.0197015	.139014	0	1
Hospital or dispensary longitude	1675	81.73214	5.97663	67.16514	95.629
Hospital or dispensary latitude	1675	21.83282	5.97582	8.266022	32.537
Hospital or dispensary altitude	1675	179.5317	271.720	0	2258
Distance to railway	1675	21.68464	26.005	.0007121	228.75
<i>Type of soil dummies</i>					
Cambisols dummy	1675	.1934328	.395107	0	1
Fluvisols dummy	1675	.1140299	.317942	0	1
Luvisols dummy	1675	.2364179	.425009	0	1
Nitosols dummy	1675	.0561194	.230221	0	1
District controls					
	Obs	Mean	Std. dev	Min	Max
Mean rainfall	1675	53.38664	32.5431	3	215.5
Coastal dummy	1675	.32	.466616	0	1
Urbanization rate	1675	.0951132	.073456	0	.36891
Caste and religious frag. (CRFI)	1675	.7480754	.184893	.027702	.9317
Hindu share	1675	.7346475	.239595	.0264722	1
Muslim share	1675	.2120882	.231887	.0019228	.90152
Date of conquest	1675	1796.651	29.0404	1750	1861
Date of conquest ²	1675	3228797	104636	3062500	3.46M

Chapter 5

Concluding remarks

A common yet crucial question in the fields of development economics and economic history asks why some regions are (were) more developed than others (Acemoglu et al., 2005). Recently, researchers have presented convincing arguments suggesting that institutions are fundamental to understand these differences (Acemoglu et al., 2001; Acemoglu et al., 2005; Banerjee and Iyer, 2005; Dell, 2010). Colonial institutions are often used to test this hypothesis; however, the role played by local agency monitoring the effect of colonial institutions on development has mostly been overlooked (Austin, 2008; Bayly, 2008). Similarly, while plenty of evidence has been gathered on institutions explaining development, not much is known on how institutions affect the distribution of the benefits of such development.

This dissertation introduces novel databases and estimates that allow to present insights on how institutions affected the distribution of the benefits of development as well as to disentangle the paramount role of local agency driving the effect of colonial institutions. Particularly, this work provides the first comparative regional estimates of agricultural income inequality for colonial India: a panel series from 1880 to 1910 using the wage/land price (W/LP) ratio at the provincial level and a cross-section of wage/income ratios (W/I) to estimate district-level income in-

equality in 1916. These estimates are the result of collecting data from a variety of primary sources, from the yearly reports on *Agricultural Statistics of India* to the *Prices and Wages in India* and the various provincial volumes of the *Reports on the (land) revenue administration*. Similarly, to study the role of local agency driving the effect of colonial institutions on the revenue sources and overall revenue available to hospitals and dispensaries, a new georeferenced database including data at the hospital level has been presented. This database includes the complete revenue structure of 1901 hospitals and dispensaries using the unexplored provincial *Reports on the civil hospitals and dispensaries*.

With these new resources, I find that institutions can explain not only differences in development, but also how the benefits of such development are distributed. In other words, this dissertation presents evidence on colonial institutions -i.e. land revenue systems- being connected to *changes* and affecting the *levels* of agricultural income inequality in colonial India. Following the introduction of tenancy acts by the late 19th century, provinces with landlord-based land revenue systems experienced more egalitarian changes in their distributions of agricultural income. Economic factors also correlate with changes in inequality, but there were important differences in these correlations when looking at them from the national or provincial levels. On the other hand, I present evidence claiming that land revenue systems affected the *levels* of agricultural income inequality in colonial India. Despite the reduction of inequality observed in landlord regions from the late 19th century, this did not compensate for the significantly larger levels of inequality in such regions, which were in place in the early 20th century. This was probably due to the larger rents and presence of under-tenure rights in landlord regions.

Finally, this dissertation also signals the relevance of local agency to understand the outcomes of colonial institutions. Particularly, it shows how colonial land institutions affected the provision of healthcare through their link with the agency of local landowners. I argue that hospitals and dispensaries presented larger revenues from

district and local boards in non-landlord areas. That was the case because land revenue assessment and collection was smaller in landlord areas due to the influence of local landlords in such processes. On the other hand, the rebellious activities in landlord areas during the 1857 revolt led landlords to invest more in hospitals and dispensaries -through private subscriptions and donations- to show allegiance to the colonial government, protect their property rights and gain prestige.

These results have a number of implications for economic history, development economics and political economy. The findings signal the importance to study the evolution of income inequality below the national level and point at the need to consider institutions, even in pre-colonial societies with stagnant mean incomes (Milanovic, 2016). Moreover, this work contributes to the theoretical relation between institutions and income distribution with empirical evidence on this link for colonial times (Acemoglu et al., 2005; Engerman and Sokoloff, 2000). This empirical relation and the IV results suggests that institutions do not only explain development, but also how its benefits are distributed.

This work also connects with the literature on the effect of colonialism in India (Banerjee and Iyer, 2005; Iyer, 2010; Jha and Talathi, 2021; Ratnoo, 2022; Verghese, 2018) which, to the best of my knowledge, has not yet shown evidence on the link between colonial land revenue systems and inequality in the subcontinent. This was probably due to the lack of comparative regional estimates on agricultural income inequality. Results from this dissertation also contribute to works on the link between institutions and development by providing mechanisms for this link where local agency plays a central role. Finally, these results present evidence on the determinants of public goods provision (Chaudhary, 2010a; Cvrcek and Zajicek, 2019; Galor et al., 2009; Goñi, 2021; Lindert, 2004) for an understudied yet relevant public good: healthcare.

Ultimately, this dissertation opens various avenues for future research. Testing the link between colonial institutions and inequality for other colonies and different

institutional settings would unveil alternative mechanisms explaining this relation and situations where institutions may or may not explain inequality. Following the results from this thesis, the role of pre-colonial conditions explaining colonial outcomes -such as inequality- and institutions might also be a fertile topic in my research agenda. Additionally, exploring the impact of the agencies of other social groups on health and the provision of other public goods could be a productive avenue for future research. Finally, the persistence of the differences in the revenue structures of these hospitals and dispensaries and its potential long-lasting effects on Indian's health outcomes might also be an interesting research topic.

Bibliography

Primary sources

Agricultural Statistics of India

Agricultural statistics of [british] india, 1884/85-1893/94. (n.d.). *India Office Records & Private Papers.*

Agricultural statistics of [british] india, 1894/95-1896/97. (n.d.). *India Office Records & Private Papers.*

Agricultural statistics of [british] india, 1897/98-1899/1900. (n.d.). *India Office Records & Private Papers.*

Agricultural statistics of [british] india, 1900/01-1902/03. (n.d.). *India Office Records & Private Papers.*

Agricultural statistics of [british] india, 1903/04-1904/05. (n.d.). *India Office Records & Private Papers.*

Agricultural statistics of [british] india, 1905/06-1906/07. (n.d.). *India Office Records & Private Papers.*

Agricultural statistics of [british] india, 1907/08-1908/09. (n.d.). *India Office Records & Private Papers.*

Census

Census of bombay and its feudatories, 1891. part ii. imperial tables. (n.d.). *India*

- Office Records & Private Papers.*
- Census of india, 1901. imperial tables for the punjab. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1901. volume ixa. bombay. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1901. volume via. the lower provinces of bengal and their feudatories. part ii. the imperial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1901. volume viiia. berar. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1901. volume xiiia. central provinces. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1901. volume xva. madras. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume iv. assam. part ii. tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume ix. burma. part ii. tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume v. bengal. part ii. tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume v. bihar and orissa. part iii. tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume vii. bombay. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume x. central provinces & berar. part ii. tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume xii. madras. part ii. imperial and provincial tables. (n.d.). *India Office Records & Private Papers.*
- Census of india, 1911. volume xiv. punjab. part ii. tables. (n.d.). *India Office*

Records & Private Papers.

Census of india, 1911. volume xv. united provinces of agra and oudh. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*

Census of india, 1931. volume vii. bihar & orissa. part i. report. (n.d.). *India Office Records & Private Papers.*

Census of the central provinces, 1881. volume i tables, imperial and supplementary. (n.d.). *India Office Records & Private Papers.*

Census of the north-western provinces and oudh. volume xvii. part ii. imperial tables. (n.d.). *India Office Records & Private Papers.*

Imperial census of 1881. operations and results in the presidency of bombay, including sind. volume ii-tables. (n.d.). *India Office Records & Private Papers.*

Imperial census of 1881. operations and results in the presidency of madras. volume ii-final census tables-imperial series. (n.d.). *India Office Records & Private Papers.*

Report on the census of bengal, 1881. volume iii. (n.d.). *India Office Records & Private Papers.*

Report on the census of punjab taken on the 17th of february 1881. volume ii appendix a. (n.d.). *India Office Records & Private Papers.*

Report on the census of the n.-w. p. and oudh, taken on the 1th february, 1881. a preliminary dissertation, with appendices. (n.d.). *India Office Records & Private Papers.*

Prices and Wages in India

Prices and wages in india, 1917-1921. (n.d.). *India Office Records & Private Papers.*

Reports on the civil hospitals and dispensaries

Annual/triennial report on hospitals and dispensaries in the central provinces and berar, 1900-1910. (n.d.). *India Office Records & Private Papers.*

Report on the civil hospitals and dispensaries in assam, 1894-1910. (n.d.). *India*

Office Records & Private Papers.

Report on the civil hospitals and dispensaries under the government of bombay, 1900-1909. (n.d.). *India Office Records & Private Papers.*

Report on the hospitals and dispensaries in bengal, 1900-1910. (n.d.). *India Office Records & Private Papers.*

Report on the working of civil hospitals and dispensaries, 1900-1910. (n.d.). *India Office Records & Private Papers.*

Report on the working of hospitals and dispensaries in the punjab, 1900-1910. (n.d.). *India Office Records & Private Papers.*

Reports on the (land) revenue administration

Land revenue administration report of the bombay presidency, 1880/81-1881/82. (n.d.). *India Office Records & Private Papers.*

Land revenue administration report of the bombay presidency, 1882/83-1883/84. (n.d.). *India Office Records & Private Papers.*

Land revenue administration report of the bombay presidency, 1884/85-1887/88. (n.d.). *India Office Records & Private Papers.*

Land revenue administration report of the bombay presidency, 1888/89-1895/96. (n.d.). *India Office Records & Private Papers.*

Land revenue administration report of the bombay presidency, 1896/97-1902/03. (n.d.). *India Office Records & Private Papers.*

Land revenue administration report of the bombay presidency, 1903/04-1909/10. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1879/80-1881/82. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1882/83-1884/85. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1885/86-1887/88. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1888/89-1890/91. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1891/92-1895/96. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1896/97-1901/02. (n.d.). *India Office Records & Private Papers.*

Report by the board of revenue on the revenue administration of the united provinces of agra and oudh, 1902/03-1911/12. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1877/78-1880/81. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1881/82-1883/84. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1884/85-1887/88. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1888/89-1892/93. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1893/94-1897/98. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1898/99-1903/04. (n.d.). *India Office Records & Private Papers.*

Report on the land revenue administration of the punjab, 1904/05-1911/12. (n.d.). *India Office Records & Private Papers.*

- Report on the revenue administration of the presidency of bengal, 1876/77-1880/81.
(n.d.). *India Office Records & Private Papers*.
- Report on the revenue administration of the presidency of bengal, 1881/82-1885/86.
(n.d.). *India Office Records & Private Papers*.
- Report on the revenue administration of the presidency of bengal, 1886/87-1890/91.
(n.d.). *India Office Records & Private Papers*.
- Report on the revenue administration of the presidency of bengal, 1891/92-1894/95.
(n.d.). *India Office Records & Private Papers*.
- Report on the revenue administration of the presidency of bengal, 1895/96-1898/99.
(n.d.). *India Office Records & Private Papers*.
- Report on the revenue administration of the presidency of bengal, 1899/1900-1903/04.
(n.d.). *India Office Records & Private Papers*.
- Report on the revenue administration of the presidency of bengal, 1904/05-1909/10.
(n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1880/81. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1881/82. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1882/83. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1883/84. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1884/85. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1885/86. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1886/87. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presi-

- gency, 1887/88. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1888/89. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1889/90. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1890/91. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1891/92. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1892/93. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1893/94. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1894/95. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1895/96. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1896/97. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1897/98. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1898/99. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1899/1900. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1900/01. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1901/02. (n.d.). *India Office Records & Private Papers*.

- Report on the settlement of the land revenue of the districts in the madras presidency, 1902/03. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1903/04. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1904/05. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1905/06. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1906/07. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1907/08. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1908/09. (n.d.). *India Office Records & Private Papers*.
- Report on the settlement of the land revenue of the districts in the madras presidency, 1909/10. (n.d.). *India Office Records & Private Papers*.
- Reports on the land revenue administration and on the operations of the land records and settlement departments in the central provinces, 1876/77-1880/81. (n.d.). *India Office Records & Private Papers*.
- Reports on the land revenue administration and on the operations of the land records and settlement departments in the central provinces, 1881/82-1885/86. (n.d.). *India Office Records & Private Papers*.
- Reports on the land revenue administration and on the operations of the land records and settlement departments in the central provinces, 1886/87-1891/92. (n.d.). *India Office Records & Private Papers*.
- Reports on the land revenue administration and on the operations of the land records and settlement departments in the central provinces, 1892/93-1897/98. (n.d.). *India Office Records & Private Papers*.
- Reports on the land revenue administration and on the operations of the land records

and settlement departments in the central provinces, 1898/99-1903/04. (n.d.).

India Office Records & Private Papers.

Reports on the land revenue administration and on the operations of the land records

and settlement departments in the central provinces, 1904/05-1909/10. (n.d.).

India Office Records & Private Papers.

Secondary sources

Acemoglu, D., Johnson, S., & Robinson, J. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review*, 91(5), 1369–1401. <https://doi.org/10.1257/aer.91.5.1369>

Acemoglu, D., Johnson, S., & Robinson, J. (2002). Reversal of Fortune : Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics*, 117(4), 1231–1294. <https://doi.org/10.1162/003355302320935025>

Acemoglu, D., Johnson, S., & Robinson, J. (2005). Institutions as a fundamental cause of long-run growth. In P. Aghion & S. N. Durlauf (Eds.), *Handbook of economic growth* (pp. 386–464). Elsevier B. V.. [https://doi.org/10.1016/S1574-0684\(05\)01006-3](https://doi.org/10.1016/S1574-0684(05)01006-3)

Alavi, H. (1975). India and the colonial mode of production. *Economic and Political Weekly*, 1235–1262.

Alvaredo, F., Bergeron, A., & Cassan, G. (2017). Income concentration in British India, 1885–1946. *Journal of Development Economics*, 127(February), 459–469. <https://doi.org/10.1016/j.jdeveco.2017.01.005>

Andersson, J., & Berger, T. (2019). Elites and the expansion of education in nineteenth-century sweden. *The Economic History Review*, 72(3), 897–924. <https://doi.org/10.1111/ehr.12738>

Andrabi, T., & Kuehlwein, M. (2010). Railways and price convergence in british india. *The Journal of Economic History*, 70(2), 351–377.

- Angeles, L., & Elizalde, A. (2016). Pre-colonial institutions and socioeconomic development: The case of Latin America. *Journal of Development Economics*, *124*, 22–40. <https://doi.org/10.1016/j.jdeveco.2016.08.006>
- Arnold, D. (1993). *Colonizing the Body: State Medicine and Epidemic Disease in Nineteenth-Century India*. University of California Press.
- Arroyo-Abad, L. (2013). Persistent Inequality? Trade, Factor Endowments, and Inequality in Republican Latin America. *Journal of Economic History*, *73*(1), 38–78. <https://doi.org/10.1017/S0022050713000028>
- Austin, G. (2008). The ‘Reversal of fortune’ thesis and the compression of history: Perspectives from African and comparative economic history. *Journal of International Development*, *20*(8), 996–1027. <https://doi.org/10.1002/jid.1510>
- Baden-Powell, B. H. (1892a). *The Land-Systems of British India (Volume I)*. Clarendon Press.
- Baden-Powell, B. H. (1892b). *The Land-Systems of British India (Volume II)*. Clarendon Press.
- Baden-Powell, B. H. (1892c). *The Land-Systems of British India (Volume III)*. Clarendon Press.
- Bagchi, A. K. (1982). *The political economy of underdevelopment*. Cambridge University Press.
- Balboni, C., Bandeira, O., Burgess, R., Ghatak, M., & Heil, A. (2022). Why do people stay poor? *The Quarterly Journal of Economics*, *137*(2), 785–844. <https://doi.org/10.1093/qje/qjab045>
- Bandyopadhyay, S. (2004). *From plassey to partition : A history of modern india*. Orient Longman.
- Banerjee, A., & Iyer, L. (2005). History, Institutions, and Economic Performance: The Legacy of Colonial Land Tenure Systems in India. *The American Economic Review*, *95*(4), 1190–1213. <https://doi.org/10.1257/0002828054825574>
- Banerjee, A., & Iyer, L. (2013). Response to ‘A Re-Examination of Banerjee and

- Iyer' by Iversen, Palmer-Jones and Sen. *Journal of Development Studies*, 49(12), 1647–1650. <https://doi.org/10.1080/00220388.2013.810850>
- Banerjee, A., & Somanathan, R. (2007). The political economy of public goods: Some evidence from India. *Journal of Development Economics*, 82(2), 287–314. <https://doi.org/10.1016/j.jdeveco.2006.04.005>
- Barrios, T., Diamond, R., Imbens, G., & Kolesár, M. (2012). Clustering, Spatial Correlations, and Randomization Inference. *Journal of the American Statistical Association*, 107(498), 578–591. <https://doi.org/10.1080/01621459.2012.682524>
- Baten, J., & Hippe, R. (2018). Geography, land inequality and regional numeracy in europe in historical perspective. *Journal of Economic Growth*, 23(1), 79–109. <https://doi.org/10.1007/s10887-017-9151-1>
- Bayly, C. (2008). *Indigenous and Colonial Origins of Comparative Economic Development: The Case of Colonial India and Africa*, World Bank Group. <https://doi.org/10.1596/1813-9450-4474>
- Beale, C., Lennon, J., Yearsley, J., Brewer, M., & Elston, D. (2010). Regression analysis of spatial data. *Ecology Letters*, 13(2), 246–264. <https://doi.org/10.1111/j.1461-0248.2009.01422.x>
- Bellemare, M., & Wichman, C. (2020). Elasticities and the inverse hyperbolic sine transformation. *Oxford Bulletin of Economics and Statistics*, 82(1), 50–61. <https://doi.org/10.1111/obes.12325>
- Berger, R. (2013). *Ayurveda Made Modern: Political Histories of Indigenous Medicine in North India, 1900–1955* (1st). Palgrave MacMillan.
- Bértola, L., Castelnovo, C., Rodríguez, J., & Willebald, H. (2010). Between the colonial heritage and the first globalization boom: On income inequality in the Southern Cone. *Journal of Iberian and Latin American Economic History*, 28(2), 307–341. <https://doi.org/10.1017/S021261091000011X>
- Bhaduri, A. (1973). A Study in Agricultural Backwardness Under Semi-Feudalism. *The Economic Journal*, 83(329), 120–137. <https://doi.org/0.2307/2231104>

- Bhaduri, A. (1976). The Evolution of Land Relations in Eastern India under British Rule. *Indian Economic And Social History Review*, 13(1), 45–53. <https://doi.org/10.1177/001946467601300102>
- Blyn, G. (1966). *Agricultural Trends in India, 1891-1947: Output, Availability, and Productivity*. University of Pennsylvania Press.
- Bohlin, J., & Larsson, S. (2007). The Swedish wage-rental ratio and its determinants, 1877-1926. *Australian Economic History Review*, 47(1), 49–72. <https://doi.org/10.1111/j.1467-8446.2006.00196.x>
- Bose, S. (1993). Peasant Labour and Colonial Capital: Rural Bengal Since 1770. In G. Johnson, C. A. Bayly, & J. F. Richards (Eds.), *The new cambridge history of india* (p. 197). Cambridge University Press.
- Brandt, L. (1989). *Commercialization and agricultural development: central and eastern China, 1870-1937*. Cambridge University Press. <https://doi.org/10.2307/2760371>
- Calvi, R., & Mantovanelli, F. (2018). Long-term effects of access to health care: Medical missions in colonial India. *Journal of Development Economics*, 135, 285–303. <https://doi.org/10.1016/j.jdeveco.2018.07.009>
- Caprettini, B., & Voth, H.-J. (2022). New deal, new patriots: How 1930s government spending boosted patriotism during world war ii. *The Quarterly Journal of Economics*. <https://doi.org/10.1093/qje/qjac028>
- Caum-Julio, J. (2022). *Can Colonial Institutions Explain Income Distribution? Evidence from Rural Colonial India*, SSRN. <https://doi.org/10.2139/ssrn.4082827>
- Chakravarty, G. (2005). *The Indian Mutiny and the British Imagination* (1st). Cambridge University Press.
- Chand, G. (1947). *Local finance in India* (1st ed.). Dehli University Library.
- Charlesworth, N. (1985). *Peasants and Imperial Rule: Agriculture and Agrarian Society in the Bombay Presidency, 1850-1935*.
- Chaudhary, L. (2009). Determinants of Primary Schooling in British India. *The*

- Journal of Economic History*, 69(1), 269–302.
- Chaudhary, L. (2010a). Land revenues, schools and literacy: A historical examination of public and private funding of education. *Indian Economic and Social History Review*, 47(2), 179–204. <https://doi.org/10.1177/001946461004700202>
- Chaudhary, L. (2010b). Taxation and educational development: Evidence from British India. *Explorations in Economic History*, 47(3), 279–293. <https://doi.org/10.1016/j.eeh.2009.08.005>
- Chaudhary, L., Gupta, B., Roy, T., & Swamy, A. V. (2016). *A new economic history of colonial India* (1st). Routledge.
- Chaudhary, L., Musacchio, A., Nafziger, S., & Yan, S. (2012). Big brics, weak foundations: The beginning of public elementary education in brazil, russia, india, and china. *Explorations in Economic History*, 49(2), 221–240. <https://doi.org/10.1016/j.eeh.2012.02.001>
- Chaudhary, L., & Swamy, A. (2017). Protecting the borrower: An experiment in colonial India. *Explorations in Economic History*, 65, 36–54. <https://doi.org/10.1016/j.eeh.2016.07.004>
- Chaudhary, L., & Swamy, A. (2020). A policy of credit disruption: the Punjab Land Alienation Act of 1900. *The Economic History Review*, 73(1), 134–158. <https://doi.org/10.1111/ehr.12908>
- Chaudhry, F. (2016). A Rule of property right for British India: From revenue settlement to tenant right in the age of classical legal thought. *Modern Asian Studies*, 1(June 2015), 345–384.
- Cohn, B. (2012). Representing Authority in Victorian India. In E. Hobsbawm & T. Ranger (Eds.), *The invention of tradition* (pp. 165–210). Cambridge University Press.
- Colella, F., Lalive, R., Sakalli, S., & Thoenig, M. (2019). *Inference with arbitrary clustering*, HEC University of Lausanne.
- Conley, T. (1999). Gmm estimation with cross sectional dependence. *Journal of Econometrics*, 92(1), 1–45. [https://doi.org/10.1016/S0304-4076\(98\)00084-0](https://doi.org/10.1016/S0304-4076(98)00084-0)

- Cvrcek, T., & Zajicek, M. (2019). The rise of public schooling in nineteenth-century imperial austria: Who gained and who paid? *Cliometrica*, 13(3), 367–403. <https://doi.org/10.1007/s11698-018-0180-6>
- Darling, M. (1978). *The punjab peasant in prosperity and debt* (Reprinted). South Asia Books.
- De Zwart, P., & Lucassen, J. (2020). Poverty or prosperity in northern india? new evidence on real wages, 1590-1870s. *The Economic History Review*, 73(3), 644–667. <https://doi.org/10.1111/ehr.12996>
- Dell, M. (2010). The Persistent Effects of Peru’s Mining Mita. *Econometrica*, 78(6), 1863–1903. <https://doi.org/10.2139/ssrn.1596425>
- Dewey, C. (1979). Patwari and Chaukidar: Subordinate Officials and the Reliability of India’s Agricultural Statistics. In C. Dewey & H. A.G. (Eds.), *The imperial impact in africa and south asia* (pp. 280–397).
- Dincecco, M., Fenske, J., Menon, A., & Mukherjee, S. (2022). Pre-colonial warfare and long-run development in india. *The Economic Journal*, 132(643), 981–1010. <https://doi.org/10.1093/ej/ueab089>
- Donaldson, D. (2018). Railroads of the raj: Estimating the impact of transportation infrastructure. *American Economic Review*, 108(4-5), 899–934.
- Easterly, W., & Levine, R. (1997). Africa’s growth tragedy: Policies and ethnic divisions. *The Quarterly Journal of Economics*, 112(4), 1203–1250.
- Engerman, S. L., & Sokoloff, K. L. (2000). History Lessons: Institutions, Factor Endowments, and Paths of Development in the New World. *Journal of Economic Perspectives*, 14(3), 217–232. <https://doi.org/10.1257/jep.14.3.217>
- Fenske, J., Kala, N., & Wei, J. (2021). *Railways and Cities in India*, CAGE Center (University of Warwick).
- Frankema, E. (2010). The colonial roots of land inequality: geography, factor endowments, or institutions? *The Economic History Review*, 63(2), 418–451.
- Frisancho, V. (2022). Is school-based financial education effective? immediate and long-lasting impacts on high school students. *The Economic Journal*. <https://doi.org/10.1093/ej/ueab089>

[//doi.org/10.1093/ej/ueac084](https://doi.org/10.1093/ej/ueac084)

- Galli, S., & Rönnbäck, K. (2020). Colonialism and rural inequality in sierra leone: An egalitarian experiment. *European Review of Economic History*, 24(3), 468–501. <https://doi.org/10.1093/ereh/hez011>
- Galor, O., Moav, O., & Vollrath, D. (2009). Inequality in landownership, the emergence of human-capital promoting institutions, and the great divergence. *The Review of Economic Studies*, 76(1), 143–179. <https://doi.org/10.1111/j.1467-937X.2008.00506.x>
- Goñi, M. (2021). *Landed Elites and Education Provision in England and Wales. Evidence from School Boards, 1870–99*.
- Grafe, R., & Irigoin, A. (2012). A stakeholder empire: The political economy of spanish imperial rule in america. *The Economic History Review*, 65(2), 909–951. <https://doi.org/10.1111/j.1468-0289.2010.00581.x>
- Gupta, B. (2014). Where have all the brides gone? son preference and marriage in india over the twentieth century. *The Economic History Review*, 67(1), 1–24. <https://doi.org/10.1111/1468-0289.12011>
- Habib, I. (1975). Colonialization of the Indian Economy, 1757 - 1900. *Social Scientist*, 3(8), 23–53. <https://doi.org/10.2307/3516224>
- Hansen, G. D., & Prescott, E. C. (2002). Malthus to Solow. *The American Economic Review*, 92(4), 1205–1217.
- Harnetty, P. (1977). Crop trends in the central provinces of india, 1861–1921. *Modern Asian Studies*, 11(3), 341–377.
- Harrison, M. (1994). *Public Health in British India: Anglo-Indian preventive medicine 1859-1914* (1st). Cambridge University Press.
- Harrison, M., & Pati, B. (2009). *The social history of health and medicine in colonial India*. Routledge. <https://doi.org/10.4324/9780203886984>
- Heston, A. W. (1989). National Income. *The cambridge economic history of india* (pp. 376–462). Cambridge University Press.
- Hong, J. Y., & Paik, C. (2018). Colonization and education: Exploring the legacy of

- local elites in korea. *The Economic History Review*, 71(3), 938–964. <https://doi.org/10.1111/ehr.12538>
- Hurd, J. (1975). Railways and the expansion of markets in India, 1861-1921. *Explorations in Economic History*, 12(3), 263–288. [https://doi.org/10.1016/0014-4983\(75\)90004-2](https://doi.org/10.1016/0014-4983(75)90004-2)
- Islam, M. M. (1983). Some aspects of the problem of subinfeudation in undivided bengal. *The Indian Economic and Social History Review*, 20(2), 205–216. <https://doi.org/10.1177/001946468302000204>
- Iversen, V., Palmer-Jones, R., & Sen, K. (2013). On the Colonial Origins of Agricultural Development in India: A Re-examination of Banerjee and Iyer, 'History, Institutions and Economic Performance'. *Journal of Development Studies*, 49(12), 1631–1646. <https://doi.org/10.1080/00220388.2013.807502>
- Iyer, L. (2010). Direct versus indirect colonial rule in India: Long-term consequences. *The Review of Economics and Statistics*, 92(4), 693–713. https://doi.org/10.1162/REST_a.00023
- James, S. (1909). *Smallpox and vaccination in british india*. Thacker, Spink & Co.
- Jedwab, R., Meier zu Selhausen, F., & Moradi, A. (2022). The Economics of Missionary Expansion: Evidence from Africa and Implications for Development. *Journal of Economic Growth*. <https://doi.org/10.1007/s10887-022-09202-8>
- Jha, P., & Talathi, K. (2021). *Impact of colonial institutions on economic growth and development in india: Evidence from night lights data*.
- Jorgenson, D. W. (1963). Capital Theory and Investment Behavior. *The American Economic Review*, 53(2), 247–259.
- Kapur, S., & Kim, S. (2007). *British Colonial Institutions and Economic Development in India* (December).
- Kelly, M. (2020). *Understanding persistence*, University College Dublin. School of Economics.
- Klein, I. (1973). Death in India, 1871–1921. *The Journal of Asian Studies*, 32(4), 639–659. <https://doi.org/10.2307/2052814>

- Kumar, D. (1965). *Land and Caste in South India: Agricultural Labour in the Madras Presidency during the nineteenth century*. Cambridge University Press.
- Kunju, A. (1960). Relations between Travancore and Mysore in the 18th Century. *Proceedings of the Indian History Congress*, 23(2), 56–61. <https://www.jstor.org/stable/44137497>
- Lee, A. (2018). Land, State Capacity, and Colonialism: Evidence From India. *Comparative Political Studies*, 00(0). <https://doi.org/10.1177/0010414018758759>
- Lindert, P. H. (2004). *Growing Public: Social Spending and Economic Growth Since the Eighteenth Century Growing* (1st, Vol. 1). Cambridge University Press.
- Lowes, S., & Montero, E. (2021). The legacy of colonial medicine in central africa. *American Economic Review*, 111(4), 1284–1314. <https://doi.org/10.1257/aer.20180284>
- Ludden, D. (1993). Orientalist Empiricism: Transformations of Colonial Knowledge. In C. A. Breckenridge & P. Van der Veer (Eds.), *Orientalism and the post-colonial predicament: Perspectives on south asia* (pp. 250–313). University of Pennsylvania Press.
- Maloney, W. F., & Valencia Caicedo, F. (2016). The Persistence of (Subnational) Fortune. *Economic Journal*, 126(598), 2363–2401. <https://doi.org/10.1111/eoj.12276>
- McAlpin, M. (1975). The effects of expansion of markets on rural income distribution in nineteenth century india. *Explorations in Economic History*, 12(3), 289–302. [https://doi.org/10.1016/0014-4983\(75\)90005-4](https://doi.org/10.1016/0014-4983(75)90005-4)
- McAlpin, M. (1983). Price Movements and Fluctuations in Economic Activity (1860-1947). *The cambridge economic history of india* (pp. 878–904). Cambridge University Press.
- Metcalf, T. (1961). The influence of the mutiny of 1857 on land policy in india. *The Historical Journal*, 4(2), 152–163. <https://www.jstor.org/stable/3020412>
- Metcalf, T. R. (1962). The Struggle Over Land Tenure in India, 1860-1868. *The*

- Journal of Asian Studies*, 21(3), 295–307. <https://doi.org/10.2307/2050675>
- Milanovic, B. (2016). *Global Inequality: A new approach for the age of globalization* (1st). Harvard University Press.
- Milanovic, B., Lindert, P. H., & Williamson, J. G. (2011). Pre-Industrial Inequality. *Economic Journal*. <https://doi.org/10.1111/j.1468-0297.2010.02403.x>
- Narain, B. (1929). *Indian economic life, past and present*. Uttar Chand Kapur; sons.
- North, D. C. (1991). Institutions. *Journal of Economic Perspectives*, 5(1), 97–112. <https://www.jstor.org/stable/1942704>
- Nunn, N. (2008). The long-term effects of Africa's slave trades. *Quarterly Journal of Economics*, 123(1), 139–176. <https://doi.org/10.1162/qjec.2008.123.1.139>
- O'Rourke, K. H., Taylor, A. M., & Williamson, J. G. (1996). Factor Price Convergence in the Late Nineteenth Century. *International Economic Review*, 37(3), 499–530. <https://doi.org/10.2307/2527439>
- O'Rourke, K. H., & Williamson, J. G. [Jeffrey G.]. (2005). From Malthus to Ohlin: Trade, industrialisation and distribution since 1500. *Journal of Economic Growth*, 10(1), 5–34. <https://doi.org/10.1007/s10887-005-1111-5>
- Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business & Economic Statistics*, 37(2), 187–204. <https://doi.org/10.1080/07350015.2016.1227711>
- Patel, S. (1952). *Agricultural labourers in modern india and pakistan* (1st). Current Book House.
- Patnaik, U. (1983). Classical Theory of Rent and its Application to India: Some Preliminary Propositions, with Some Thoughts on Sharecropping. *The Journal of Peasant Studies*, 10(2-3), 71–87.
- Piketty, T. (2014). *El capital al segle XXI* (1st). RBA Libros.
- Ramasubban, R. (2008). History of public health in modern India 1857-2005. In M. Lewis & K. MacPherson (Eds.), *Public health in asia and the pacific* (pp. 87–105). Routledge.

- Ratnoo, V. D. (2022). *Persistent Effects of Colonial Land Tenure Institutions: Village-Level Evidence from India*, SSRN. <https://ssrn.com/abstract=4075622>
- Ray, R. K. (1973). The crisis of bengal agriculture, 1870-1927—the dynamics of immobility. *The Indian Economic & Social History Review*, 10(3), 244–279.
- Ray, S. C. (1915). *The Permanent Settlement in Bengal* (P. Mukherjee, Ed.). Bahadur; Sons.
- Roy, T. (2005). *Factor Markets in the Transition to Colonialism: India 1750-1900* (June).
- Roy, T. (2006). *The economic history of India, 1857-1947* (2nd). Oxford University Press.
- Roy, T. (2007). Globalisation, factor prices, and poverty in colonial India. *Australian Economic History Review*, 47(1), 73–94. <https://doi.org/10.1111/j.1467-8446.2006.00197.x>
- Roy, T. (2013). *An Economic History of Early Modern India* (1st). Routledge. <https://doi.org/10.4324/9780203380918>
- Roy, T. (2014). Geography or politics? Regional inequality in colonial India. *European Review of Economic History*, 18(3), 324–348. <https://doi.org/10.1093/ereh/heu009>
- Roy, T. (2016). The growth of a labour market in the twentieth century. In L. Chaudhary, B. Gupta, T. Roy, & A. Swamy (Eds.), *A new economic history of colonial india* (1st, pp. 179–194). Routledge.
- Roy, T., & Swamy, A. (2016). *Law and the economy in colonial India*. University of Chicago Press.
- Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. *European Economic Review*, 45(4-6), 827–838. [https://doi.org/10.1016/S0014-2921\(01\)00125-8](https://doi.org/10.1016/S0014-2921(01)00125-8)
- Schwartzberg, J. (1978). *A historical atlas of south asia* (2nd).
- Shanahan, M. P., & Wilson, J. K. (2007). Measuring inequality trends in colonial australia using factor-price ratios: The importance of boundaries. *Australian*

- Economic History Review*, 47(1), 6–21. <https://doi.org/10.1111/j.1467-8446.2006.00194.x>
- Sharma, R., & Mukerji, A. (1988). Collaborators of the british rule: The durbaris of the agra division. *Proceedings of the Indian History Congress*, 49, 378–386. <https://www.jstor.org/stable/44148414>
- Sharma, S. (2019). Poorhouses and gratuitous famine relief in colonial North India. In A. Mukherjee (Ed.), *A cultural history of famine* (pp. 129–148). Routledge.
- Som, R. K. (1960). Agricultural labour in india: Its characteristics as revealed by national sample survey. *The Economic & Political Weekly*, 12(42-43), 1543–1552.
- Stokes, E. (1959). *The English Utilitarians and India*. Oxford University Press.
- Stokes, E. (1980). *The peasant and the Raj : studies in agrarian society and peasant rebellion in colonial India*. Cambridge University Press,
- Stowe, A. (1910). *Cattle and dairying in the punjab*. Lahore, Department of Agriculture.
- Suryanarayan, P. (2021). *Status politics hollows out the state: Evidence from Colonial India*.
- Swamy, A. (2011). Land and Law in Colonial India. In D. Ma & J. L. Van Zanden (Eds.), *Law and long-term economic change: A eurasian perspective* (1st, pp. 138–157). Stanford University Press.
- Tinker, H. (1967). *The Foundations of Local Self-Government in India, Pakistan and Burma* (First Indian Edition). Lalvani Publishing House.
- Trairatvorakul, P. (1984). The effects on income distribution and nutrition of alternative rice price policies in thailand.
- Van Zanden, J. L. (2010). Colonial state formation and patterns of economic development in java, 1800–1913. *Economic History of Developing Regions*, 25(2), 155–176. <https://doi.org/10.1080/20780389.2010.527689>
- Verghese, A. (2018). Colonialism, Landlords, and Public Goods Provision in In-

- dia: A Controlled Comparative Analysis. *Journal of Development Studies*, 00(00), 1–19. <https://doi.org/10.1080/00220388.2018.1487057>
- Washbrook, D. (1981). Law, State and Agrarian Society in Colonial India. *Modern Asian Studies*, 15(3), 649–721. <https://doi.org/10.1017/S0026749X00008714>
- Washbrook, D. (1994). The commercialization of agriculture in colonial india: Production, subsistence and reproduction in the ‘dry south’, c. 1870-1930. *Modern Asian Studies*, 28(1), 129–164.
- Whitcombe, E. (1971). *Agrarian conditions in northern india* (Vol. 1). University of California Press.
- Willebald, H. (2011). *Natural resources, settler economies and economic development during the first globalization: Land frontier expansion and institutional arrangements* (Doctoral dissertation). Universidad Carlos III de Madrid.
- Willebald, H. (2015). Distributive patterns in settler economies: Agricultural income inequality during the first globalization (1870-1913). *Historia Agraria*, 11200(66), 75–104.
- Williamson, J. G. [Jeffrey G.]. (2002). Land , Labor and Globalization in the Third World , 1870-1940. *The Journal of Economic History*, 62(1), 55–85.
- Williamson, J. G. [Jeffrey G.]. (2007). Relative factor prices in the periphery during the first global century: Any lessons for today? *Australian Economic History Review*, 47(2), 200–206. <https://doi.org/10.1111/j.1467-8446.2007.00201.x>
- Wilson, J. (2016). *The Chaos of Empire: The British Raj and the conquest of India* (1st). Public Affairs.
- Yang, A. (1992). *The Limited Raj: Agrarian Relations in Colonial India, Saran District, 1793-1920* (1st). University of California Press.