Protected Land Rights, Misallocation, and Dead Capital: Evidence from India

Ankit Bhatia*

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Abstract

This paper examines the long run impact of protected land rights on structural transformation and economic development. Employing a spatial Regression Discontinuity Design, the study finds that 150 years after the policy's introduction, land transfer restrictions between targeted and out-group members led to 17% higher agricultural income share, 15% lower firm density in the non-primary sectors, and 8% lesser housing capital. The policy had disproportionately adverse effects on the targeted beneficiaries. Using high-resolution built-up data, the study shows that higher transaction costs in land markets impeded efficient land use conversion and created coordination frictions, leading to land misallocation and diminished agglomeration economies. The results underscore the need for market reforms that enhance land marketability to foster entrepreneurship and promote sustainable resource management in protected areas.

Keywords: Land Markets, Economic Development, Property Rights, Regression Discontinuity Designs

*Ph.D. Candidate, Johns Hopkins University. Email: abhati17@jhu.edu. I am deeply grateful to my dissertation committee, including Devesh Kapur, Shoumitro Chatterjee, Filipe Campante, Ritam Chaurey, and Arvind Subramanian, for their invaluable feedback. I also appreciate the insightful discussions with Adam Auerbach, Eeshani Kandpal, Randall Akee, Pravin Krishna, Mica Sviatschi, Kishore Gawande, Jonathan Dingle, Adi Dasgupta, Shing-Yi Wang, Sam Asher, Nina Pavcnik, Milan Vaishnav, Shruti Rajagopalan, Anustubh Agnihotri, Brian Levy, Alan Gelb, Namita Wahi, and Neha Gour. I extend my gratitude to the Institute for Humane Studies at George Mason University for their generous dissertation grant and residency fellowship. Any errors and omissions are my own.

1 Introduction

Efficient land allocation is crucial in facilitating structural transformation.[1] However, land market frictions, such as imperfections in land ownership, transferability, and securitization, can hinder structural transformation by misallocating land assets, locking economies into suboptimal production, and limiting welfare.[2] Property rights institutions are central to efficient land markets, yet they can be shaped by historical legacies (North, 1990). Colonial histories, in particular, have been shown to influence property rights institutions in the home countries with persistent long-run effects.[3] This paper investigates the long-term impact of protected land rights on the structural transformation and welfare of the targeted areas, highlighting the persistent effect of land market frictions in shaping contemporary development outcomes.

Special protection of land rights is a common global practice aimed at the economic development of marginalized communities (Deininger, 2003). Approximately a quarter of global land resources are managed under Protected Land Rights (PLRs) across 90 countries, directly affecting the welfare of millions (Hall and Gandolfo, 2016). However, the impact of PLRs on development outcomes, and the persistence of these effects across different regions and over time, remains largely unexplored. In principle, PLRs can shape the long-term development of targeted areas or communities through specialized governance institutions that uphold the right to self-determination and implement place-based regulations securing the land rights of targeted beneficiaries (Alcantara, 2005). However, there is theoretical ambiguity in the effects of such policies on long-term development. On one hand, protection could support local entrepreneurship and local industries, akin to the "infant industries" argument (Chang, 2002). On the other hand, protective measures could isolate targeted areas from broader market and technological integration, limiting their economic potential (Acemoglu, Johnson, and Robinson, 2005).

There is a rich history of place-based policies that provide special protection to marginalized communities. For example, the Indian reservations in the USA, established under federal laws, reserved Native tribal lands under the trust holdings until the Dawes Act of 1887 deregulated ownership structures and permitted leasing to non-Natives (Akee, 2009a). In Canada, Indian reserves provided a parallel system of governance for First Nations. Similar structures exist in Australia and New Zealand, where Aboriginal and Maori reserves support Indigenous land management. In Brazil, the Constitution guarantees Indigenous communities inalienable control over 14% of the country's land resources (Conceicao, 2021). Comparable frameworks are found in Mexico, Bangladesh, Myanmar, Indonesia, and across Africa and Asia, where land rights remain vital to cultural autonomy, self-determination, and welfare

[1] There is a rich literature that identifies the misallocation of resources as a significant driver of income differences across countries and regions. See Restuccia & Rogerson (2017) for an excellent review of the misallocation literature. In particular, Adamopoulos & Restuccia (2015); de Janvry et al. (2015); Banerjee et al. (2002); Chen et al. (2017) discuss the impact of land misallocation on economic development.

[2] See De Soto (2000) for foundational discussion on imperfect property rights and dead capital.

[3] Nunn (2023) provides an excellent commentary on the literature studying the impact of historical institutions on contemporary development.

of marginalized communities.[4]

This paper provides evidence that PLRs can hinder long-run structural transformation by restricting land transfers between targeted marginalized groups and out-groups, de-facto misallocating land into low-productivity use. I provide three main results in this paper. First, using exogenous variation in the formation of protected area boundaries in India, I show that almost 150 years after the boundaries were first created, protected areas have higher poverty, more dependency on agriculture, and lower firm density in non-primary sectors compared to nearby outside areas. Second, I show that economic stagnation persists despite decentralized governance with evidence of growing divergence between protected and outside areas. Notably, the targeted beneficiaries are harmed more by the policy. Third, I provide evidence of the mechanisms underlying these persistent negative effects. Restrictions on land transfers—including selling, leasing, and mortgaging—between targeted and out-groups within protected areas increased transaction costs and introduced coordination frictions. These land market failures hindered the efficient conversion of land from agricultural to non-agricultural uses, thereby reducing spatial transformation and diminishing area-wide agglomeration economies. Furthermore, constraints on land leasing and mortgaging, designed to prevent the indebtedness of the targeted groups, undervalued land assets and resulted in dead capital over the long term.

To show these results empirically, I examine the Fifth and Sixth Schedule Areas in India, collectively referred to as Indigenous Protected Areas (IPAs), henceforth. The IPAs were adopted as a constitutional mandate to protect the land rights of Indigenous Groups (IGs) in 1950. However, the legacy of IPAs dates back to the late 18th century when local conflicts between native populations and foreigners prompted colonial administrators to segregate disturbed territories from the mainstream through special land regulations (Dhebar, 1962). By 2011, IPAs spanned 14 states, covering approximately 16% of geographic area and home to around 130 million people. The implementation of the IPA policy is governed by state-level Land Alienation Prohibition (LAP) regulations. These regulations restrict land transfers between IGs and out-groups within IPAs and impose spatial limits alongside requiring bureaucratic prior approval for bona fide land transactions among IGs (Wahi and Bhatia, 2017). Notably, IPAs are neither exclusive zones nor have universal coverage. They feature a mixed-identity population, with IGs forming a slight majority at 52% of the population within IPAs, and only 45% of all IGs residing in these areas.[5]

To isolate the causal effects of LAP regulations, I exploit the location of IPA boundaries, which I constructed using the archival data obtained from the Ministry of Tribal Affairs, Government of India, and the state governments (See Figure 1). Geocoding historical IPA boundaries to the current census tract information was challenging. Initially, IPA territories were demarcated piecemeal in the early 19th century. In 1874, the Scheduled Districts Act formalized these tracts as a formal colonial policy (Xaxa, 2009). After independence, the Constitution adopted these tracts and incorporated additional Native territories into the Fifth and Sixth Sched-

[4]For more details on place-based protections, check out: USA; New Zealand; Canada.

[5]I discuss the implications of this quasi-random institutional design for identification strategies in greater detail in Section 2.

ule protections.[6] To ensure the geocoding accuracy, I validated the IPA boundaries map with local Indigenous elites, bureaucrats, and domain experts during my fieldwork.[7]

Given this setting, I use a geographic Regression Discontinuity Design that compares census tract villages and towns inside IPA boundaries with nearby outside areas within an optimal bandwidth determined by Calonico, Cattaneo, and Titiunik (2014). I estimate the long-run effect of LAP regulations approximately 150 years after the policy was formalized in 1874. In this regard, I collected, digitized, and geocoded data from multiple sources. For example, the firm-level microdata came from the Economic Census, while data on demographics and agriculture markets was collected from Population and Agriculture Censuses, respectively. To validate the baseline local continuity assumption before the policy, I digitized a novel dataset from the 1872 population census and collected pre-independence data on state capacity and public investments including railroads, post offices, and large irrigation projects. Further, to test mechanisms, I collected high-resolution built-up data from the Global Human Settlement Layer (1975-2020) and combined multiple geospatial datasets. I also web-scraped data on land prices from different state government portals.[8]

The main results indicate that LAP regulations had large and persistent negative effects on development outcomes in the long run. Almost 150 years after the policy, tracts under IPAs experienced nearly 6 percent higher poverty rates, on average, than outside tracts. This is a sizable effect and corresponds to about 18 percent of India's progress in poverty reduction over the 1990s.[9] At the same time, households had 17 percent higher reliance on agriculture income and firm densities were lower by 12 and 15 percent in the manufacturing and services sectors, respectively. Notably, IGs, the targeted beneficiaries were impacted twice more adversely by the policy.

What explains these enduring negative effects on development? I hypothesize that LAP regulations de facto weakened property rights by imposing limitations on land transfers. Higher transaction costs prevented IGs from participating in land markets and capitalizing on their land assets. Land market frictions hindered the conversion of land from agricultural to non-agricultural uses, effectively trapping land into low-productivity primary use and suppressing agglomeration economies. Additionally, restrictions on land leasing and land mortgaging constrained credit supply and diminished asset securitization economies, resulting in dead capital.[10]

In line with the land misallocation hypothesis, I demonstrate that built-up density in IPAs is 18% lower, with this pattern remaining highly persistent for the past 40 years. Using high-resolution 100m by 100m grid-level data, I provide evidence

[6]In Appendix Table A15, I list all the major tribal uprisings. See Supplementary Appendix C for a full description of the construction of IPA boundaries.

[7]I visited seven IPA states, namely Andhra Pradesh, Telangana, Gujarat, Jharkhand, Chhattisgarh, Assam, and Meghalaya between 2016 and 2018 as part of a research team at the Centre for Policy Research, New Delhi. See Appendix D for fieldwork images.

[8]I sourced village-level data on the Socio-Economic Caste Census and Night Lights from SHRUG. I am also grateful to Professor Devesh Kapur for sharing the historical data on post offices and irrigation projects. Pl see Section 3 for more details.

[9]This estimates is based on the imputations by Topalova (2010). See Section 5 for more details.

[10]See Besley & Ghatak (2010) for a formal proof of De Soto's "dead capital" hypothesis.

that urban agglomerations have consistently emerged outside IPA boundaries. Furthermore, comparing 100 years of urban population data, I show that urbanization rates within IPAs have been five times lower than in areas outside IPA boundaries over the last century. Additionally, I find that the share of households with access to rural credit cards is 11% lower compared to non-IPA regions and land prices are lower by 12% in IPAs, as compared to nearby areas. These findings align with the institutional design of LAP regulations and support theories on spatial transformation and agglomeration economies (Fujita, Krugman, and Venables, 1999).

I strengthen my analysis by testing for competing mechanisms. The observed negative effects in IPAs are not driven by a lack of public investment in market-integrating infrastructure. Since 1990, more public investment has been directed towards IPAs with dedicated national rural roads programs and other targeted welfare programs.[11] I find that access to core public goods and services such as schools, healthcare, post offices, power, and rural roads do not vary across IPA boundaries, discarding the isolation hypothesis. Additionally, I also ruled out alternative explanations including cultural theories, selective state discrimination in the acquisition of natural resources, and differences in the political attitudes driving the observed results.

To enhance the robustness of my results, I conduct tests by altering the core specification with different bandwidths, donut hole sizes, functional forms, and kernel weights. I also include distance to major towns and elevation as additional controls to demonstrate that the observed effects are not driven by these differences.[12] Additionally, I test for selective migration across boundaries to rule out potential violations of SUTVA. Finally, to address spatial correlation, I demonstrate robustness by estimating Conley's (2009) standard errors.

I conduct heterogeneity tests under different social, historical, and political contexts. First, I show that while decentralization and greater autonomy in Sixth Schedule Areas mitigated the adverse effects of LAP regulations on poverty, the binding effects on structural stagnation persisted and even remained larger. These results confirm the literature that argues that decentralization supports redistribution (Gulzar, 2017). However, political decentralization does not seem to fix market failure and support structural change. Second, I show that effects were almost twice as large in tracts that were historically under British colonial rule as compared to tracts under Native rulers. This is consistent with the findings of Iyer (2009) and reconfirms that colonial extractive institutions had larger negative effects on long-run welfare. Third, I find that the economic stagnation effects were larger in places with violent internal conflict. This finding is consistent with the existing literature that argues that income inequality is the primary driver of LWE conflicts (Dasgupta, Gawande, and Kapur 2018). I complement this literature by identifying the role of LAP regulations in explaining the structural inequality in IPAs.

Overall, this paper argues that land market frictions, rooted in historical property

[11] Although self-governance expanded to all IPAs eventually with the adoption of the Panchayat Extension to Scheduled Areas (PESA) in 1996, Sixth Scheduled Areas in the northeast experienced self-governance from earlier on, where Autonomous District Councils and local autonomy was more significant.

[12] The specification that controls for elevation or distance is not used to report main estimates as it may result in biased coefficients. See Calonico et al. (2019) for a discussion.

rights institutions, can partly explain long-run development trajectories in developing countries. By unlocking archival datasets, introducing a novel quasi-natural experiment, and identifying a market-based mechanism, this paper sheds light on the long-run effects of protected land rights on agglomeration dynamics and economic development.

This paper complements the extensive literature that studies the role of historical institutions in shaping long-term development in three ways.[13] First, I introduce a novel quasi-natural experiment of IPA tracts that affect contemporary development across British India (including in current-day India, Pakistan, Bangladesh, and Myanmar).[14] Second, my wide extent of RD specification with the unit of analysis at the village level adds both to the internal and external validity of the results and is more nuanced compared to the related papers (Banerjee and Iyer, 2005; Iyer, 2009). Third, while scholars have shown how extractive colonial institutions affect the political, economic, and social outcomes of home countries, my paper shows how colonial institutions remain embedded in the market institutions and affect long-run agglomeration behavior through direct and indirect effects.[15]

My findings also add to the nascent literature on Indigenous economics. Theoretically, PLRs do not guarantee poverty traps as secure land rights can induce positive investments and support structural change. Recent work studies the effect of changes in the institutional design of property rights in Indigenous Areas on economic outcomes (Alcantara, 2005; Akee, Jorgensen and Uwe, 2013). My evidence closely relates to Akee (2009a), which shows how long-term land leasing of trust lands in the USA allowed the convergence of economic benefits while preserving the land ownership rights among the Native Americans. I complement this work by unpacking the specific institutional details of IPAs in India and show how institutions once historically relevant persist across generations and fail to reform even after initial conditions have matured.

Lastly, my paper makes important policy contributions by challenging the prevailing view that the underdevelopment of IGs stems from cultural differences or self-selection into non-market activities. Instead, I argue that land market constraints are the primary cause of underdevelopment and advocate a policy shift from the security of land rights to the marketability of land assets. My paper argues that the fungibility of land rights is key to long-run spatial and structural transformations. I add to this literature by looking at a specialized natural experiment where land markets are imperfect by design. This distinction is necessary to understand the lasting effects of PLRs. If securing land rights is a sufficient condition for economic development (DeSoto, 2001), negative effects could be mitigated in the short-to-medium term by fixing state capacity. However, if development effects emerge from structural barriers to imperfect land markets, they tend to be more sticky and difficult to reform through institutional redecoration.

The findings of this paper are particularly relevant to understanding the trade-off

[13] See Acemoglu et al. (2001), Dell (2009), Nunn (2020), Acemoglu et al. (2019), Dell & Olken (2020), Lowes & Montero (2021), Nunn (2023),

[14] While this paper only examines the impact of IPA on tracts within India, in future, I aim to study the impact on tracts in the neighboring countries as well.

[15] See Redding (2023) for a review of The Economics of Cities.

between equity and efficiency in place-based policies, especially in discussions around sustainability, resource conflicts, and climate transitions. With a significant share of critical minerals located on Indigenous lands globally, emerging literature highlights the essential role of Indigenous communities in climate mitigation and resilience (World Bank, 2022). Against this backdrop, ensuring efficient and equitable land markets in protected areas is crucial to enable local communities to capitalize on new opportunities without reigniting the resource conflicts seen in the past.

2 Background

2.1 Indigenous Protected Areas in India

The Constitution of India delineates land governance primarily as a state subject, except for matters listed under the Concurrent List where both the union and state governments can legislate.[16] Besides, the Constitution also provides special provisions to protect the land rights of Indigenous Groups (IGs) under Article 244 and the Fifth and Sixth Schedules of the Constitution (collectively classified as IPAs in this text). IGs, also referred to as Scheduled Tribes or *Adivasis*, are a diverse group of 750 sub-tribes, making up 8.6% of the total population (Census India, 2011). However, there are differences in the spatial concentration, ethnic composition, and development levels of IGs across states, resulting in institutional variation in protecting their land rights. In Appendix Table A1, I present the state-wise distribution of IGs, their ethnic composition, and the applicable land rights protection.[17]

The Fifth and Sixth Schedules of the Constitution lays down the broad principles of self-determination and place-based protection of land rights for IGs. While the Fifth Schedule protections apply to the notified areas within 10 peninsular states, the Sixth Schedule covers 11 Autonomous Districts in the 4 northeastern states[18] Both constitutional schedules share similar goals of protecting and preserving the social, cultural, and economic heritage of IGs, but they have distinct institutional designs owing to their unique political and administrative histories (Xaxa, 2009).

The Fifth Schedule provides for centralized administration for "peace and good governance". The main provisions of the Fifth Schedule include prohibiting the transfer of Indigenous lands, preferential allotment of land to IGs, and regulating money lending (informal credit) markets to prevent indebtedness.[19] On the contrary, the Sixth Schedule empowers decentralized administration through locally elected Autonomous District Councils (ADCs). ADCs enjoy greater legislative, executive,

[16] Concurrent list includes 3 items namely, land acquisition, forest management, and property transfer & deed registration (excluding agricultural land). See Schedule 7 for more details.

[17] Almost three-fourths of the Indigenous population is predominantly located in the central region, with another one-fifth in the north and northeastern hilly areas, and the rest spread throughout the country. Notably, all states are multi-ethnic, with differences in social norms, cultural practices, and economic relationships with land resources.

[18] Fifth Schedule states include Himachal Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Chattisgarh, Jharkhand, and Sixth Schedule states include Assam, Meghalaya, Tripura, and Mizoram.

[19] The Governor of the state in consultation with a Tribal Advisory Council determines the applicability of central and state legislation to the Fifth Scheduled Areas.

and judicial powers over land and natural resources.[20]

The Fifth and Sixth Schedules cover about one-sixth of total land area and are home to approximately 7.5% of the total population.[21] In Table 1, I show variations in the coverage, composition, and development levels of IGs across states. Only 4 out of the 14 IPA states are IG majority. While IPAs remain predominantly rural, notably, they are neither exclusive zones nor do they have universal coverage. About 45% of all IGs live within the IPAs, and IGs form a slight majority with 52% population share.

In a nutshell, while all IGs enjoy affirmative action in education, jobs, and political representation at par with other marginalized social groups, the place-based constitutional protection of land rights extends only to a subset making their economic relationship unique and distinct compared to other marginalized groups.

2.2 Colonial Origins of IPA Boundaries

In the late 18th century, the British East India Company assumed administrative control of the Indian subcontinent and expanded state institutions to maximize land revenue. The 1792 Permanent Settlements introduced a system of landlords, intermediaries, and moneylenders, restricting IGs' freehold rights over land and forests (Dhebar, 1962). These institutional changes incited large-scale local conflicts between IGs and foreign administrators, disrupting the political and economic stability of the Company state.[22] See Appendix Table A15, where I list major tribal uprisings between 1784 and 1942.

The Company responded to these Indigenous rebellions with a three-fold strategy: a) direct military suppression, b) identity-based isolation, and c) targeted grievance redressal. Direct military actions were less ineffective due to guerrilla-style warfare and thin state capacity. The military inaction prompted the first tribal policy of semi-autonomous governance. The policy focused on creating autonomous assemblies for delivering justice and revenue collection, establishing native militia to maintain law and order, and providing rent-free lands to support settled agriculture. This integration policy proved effective in restoring peace (Bhattacharyya, 2021). However, these reforms were short-lived. Regulation I of 1796 ended the semi-autonomous governance structure and subjected IGs to general civic and criminal laws. Further, with a weakened resistance movement, the Company initiated the policy of place-based isolation by settling loyalists around disturbed areas, forming the basis of IPA boundaries.[23]

With growing conflicts through the 19th century, the Company formalized the segregation policy by enacting spatially targeted non-regulated tracts.[24] While these laws ostensibly redressed local grievances by regulating land rents, tenure, and trans-

[20] Broadly, these include powers to collect land revenues, impose property taxes, build public infrastructure, grant mining leases, and regulate moneylending licenses.

[21] They span approximately 100,000 villages and towns spanning 113 districts and 503 blocks across 14 states, as per the 2011 Census administrative classification.

[22] The Koli revolts in 1784-85 were the earliest recorded Indigenous rebellion.

[23] See Appendix Figure B1 for the historical map of initial IPAs.

[24] Non-regulated tracts were enacted by laws such as the Chotanagpur Tenancy, Visakhapatnam and Ganjam Agency Areas, and Santhal Parganas Acts in the 19th century

fers, they de-facto isolated non-regulated tracts from mainstream society (Xaxa, 2009). Following the transfer of power to the Crown, erstwhile non-regulated tracts were consolidated under the Scheduled Districts Act of 1874 (SDA). While SDA centralized governance and contained provisions for self-determination and land protection, its implementation remained contentious as it conflicted with extractive legislations (such as the Forest Rights Act of 1878 and the Land Acquisition Act of 1894) which extended state control over natural resources within IPAs.

In the early 20th century, the SDA was strongly criticized by nationalists for its identity-based division and resource extraction motives. However, the political and economic marginalization of IPAs continued through the independence movement. The Government of India Acts of 1919 and 1935 retained much of the SDA framework and reclassified Scheduled Districts as Excluded or Partially Excluded Areas, with limited civic participation. Recognizing the poor development of IPAs, the Constituent Assembly formed dedicated subcommittees (the Thakkar and Bardoli sub-committees) to determine their future. Balancing the protection and integration trade-offs, the Constitution adopted the Fifth and Sixth Schedules as protective measures and enlisted affirmative action as an integration framework. Post-independence, additional tracts, historically governed by Native rulers, were incorporated into the IPA list based on the "minimum viable administration" criterion. This approach prioritized good governance over selective targeting. The quasi-random nature of IPA targeting is also corroborated by the fact that areas with recorded tribal uprisings between 1784 and 1942 correlate strongly with the IPA boundaries (compare Appendix Figure B2 with Figure 1).

2.3 Land Alienation Prohibition Regulations

LAP regulations implement the constitutional mandate to protect the land rights of IGs. These regulations limit the transfer of Indigenous land to out groups within IPAs. Although the specific provisions of LAP regulations differ across states, they broadly impose higher land transaction costs. For instance, while some states outright ban land transfers between IGs and non-IGs, including leasing and mortgaging, others permit restricted transfers subject to administrative pre-approval. In certain states, even transfers among Indigenous groups are regulated within pre-defined spatial limits and require evidence to verify identity (Bharia, 2002).

LAP regulations, originally conceptualized during the colonial period, have persisted as a paternalistic policy despite evolving social and economic contexts.[25] While intended to protect property rights, land restrictions have paradoxically hindered economic development within IPAs. In Table 2, I compare the long-run development outcomes of IPAs. Columns 3-4 contrast the Fifth and Sixth Scheduled areas with non-protected areas. Across key development metrics—including literacy rates, poverty rates, cultivation income shares, and nighttime lights—IPAs consistently underperform relative to non-IPA areas. Even within a narrow 15-mile bandwidth across IPA boundaries, the development gaps persist, though somewhat

[25]For instance, the extremely low literacy rates in some IPA regions supported the original protections, but with broad-based development, the literacy rates between IGs and general populations have converged in recent decades.

reduced. Interestingly, there are notable differences between the Fifth and Sixth Scheduled areas. For example, poverty rates are lower in Sixth Scheduled areas, but agricultural dependency remains high. Similarly, while access to village-level roads is comparable across Fifth Scheduled and non-IPA areas, significant disparities exist in Sixth Scheduled areas. These findings suggest that, while IPAs broadly lag behind non-IPAs, variations within the IPAs themselves highlight the complex challenges faced by these protected areas.

Notably, LAP regulations do not protect IG land rights against state acquisition of land and natural resources for development projects. Despite IPAs accounting for approximately 60% of India's mineral wealth and forest resources, they remain some of the most economically backward areas in India and globally. Furthermore, since the late 1960s, IPAs have been significantly affected by violent internal conflicts, commonly referred to as "Naxalism." Mitigating these development and security challenges, while balancing resource demands for industrial development, multiple poverty alleviation programs have been targeted at IPAs. Despite these initiatives, the persistent poverty and underdevelopment in IPAs underscore the necessity for a deeper evaluation of the structural barriers hindering economic progress and sustainable resource management in these regions.

3 Data

I collected, digitized, and geocoded a wide range of archival and administrative datasets to estimate the long-term effects of LAP regulations on the economic development of IPAs. This section provides an overview of the data sources used in the study.

3.1 Novel Datasets

A) IPA Boundaries: I filed a Right to Information request and obtained the list of IPAs from the Ministry of Tribal Affairs, Government of India (MoTA). MoTA's records demarcated IPAs at various administrative levels across states, reflecting distinct social and political histories of IPAs across regions. Geocoding MoTA's administrative records onto the 2011 Census tract classifications presented several challenges. First, the official records pertained to outdated administrative classifications as per the original Constitutional Orders. Second, localized administrative nomenclatures—such as "Agency Areas" or the "Autonomous District or Regional Councils"—in official records did not align with current Census tract classifications.[26] Third, many historical village records, particularly in the states of Andhra Pradesh, Maharashtra, and Rajasthan, did not correspond to the latest Census tract classifications due to boundary changes or name alterations.

To maintain geocoding consistency across states, I mapped IPA administrative records to the Census 2011 sub-district spatial layer, treating the entire sub-district as an IPA where the original demarcation was at the village level. While this clas-

[26] For example, the IPAs in the state of Andhra Pradesh are defined as the Visakhapatnam and Godavari Agency Areas, an administrative classification originating in colonial governance.

sification strategy introduces boundary measurement errors, it is expected to underestimate the effect size, so the model estimations should be interpreted as lower bounds. Notably, although the IPA mapping is at the sub-district level, the unit of analysis is a census village or town. See Supplementary Appendix C for full details on the data construction for IPA boundaries.

B) 1872 Census: I digitized and geocoded the 1872 Population Census—the first census across British India—to validate the baseline local continuity assumption. First, I searched and compiled the archival Census records from the Census Digital Library. These records contained information on demographic and occupational distribution by caste and religion, as well as land economy data, including housing stock and land rents by various land classifications at the village and sub-district levels. Second, I used OCR technology to convert the scanned PDF texts into machine-readable text. Third, I validated the digitization accuracy by manually checking 10% of randomly selected entries. The final step involved geocoding the digitized text to match the IPA boundaries. Thus far, I have managed to digitize sub-district-level information.[27]

C) Land Prices: I collected village-level agricultural land prices from the revenue departments of state governments. Since the transaction data on land prices is not publicly available, I collected circle rates as a proxy for market prices.[28] I collected the circle rates using a mix of web scrapping and digitization techniques for 10 out of the 14 IPA states. Thus far, I have managed to clean and geocode the administrative land price data with Census tract classification for 3 states namely, Odisha, Jharkhand, and Gujarat.

3.2 Secondary Sources

In addition, I collected data from multiple secondary sources and geospatial datasets, and mapped them to SHRUG identifiers to build a comprehensive dataverse of outcome and control variables.

A) Population Census: I obtained microdata on demographics, housing facilities, and village- and town-level amenities—including access to schools, healthcare, transport, communication, power, and banking—from 1991 to 2011, along with decade-wise panel data on towns and urban clusters from 1901 to 2011, from District Census Handbook via the Office of the Registrar General & Census Commissioner, Ministry of Home Affairs. Additionally, I collected village monographs from the 1931 Census from the Census Digital Library.[29]

B) Economic Census: I obtained microdata on firm establishments from 1990

[27] I collected over 20,000 pages of archival material across 35 PDF files. The village-level records for the 1872 Census are available only for the Madras and Travancore Presidencies. While this limits the scope for testing baseline balance, these records serve as a crucial starting point for studying long-run implications of British Colonial policies in the Indian subcontinent.

[28] Circle rates are administrative floor prices for property registeration purposes. These prices are periodically updated by local land bureaucracies to reflect changes in market values. Although these records have historically underreported actual transaction prices, they remain useful for comparison, provided there is no bias across IPA boundaries. In recent years, circle rates have been updated more frequently to capitalize on rising land markets.

[29] See https://censusindia.gov.in/census.website/

to 2013 from the Ministry of Statistics and Program Implementation, Government of India (MoSPI). The Economic Census data includes information on firm characteristics such as ownership structure, nature of operation, source of finance, and employment size, disaggregated by gender, social group, and industry code according to the National Industrial Classification. For this study, I reshaped the firm-level data to village-level data and geocoded it to the IPA boundaries.[30]

C) Agriculture Census: I web-scraped sub-district level microdata on agricultural operational holdings and land leasing from 1990 to 2015 from the official Agriculture Census website. The disaggregated data by social groups is useful for inter-group comparisons. While the lack of village-level data on land leasing limits its potential for my RD framework, I exploit the data to guide broader discussion on the land leasing market.[31]

D) SHRUG: Lastly, I sourced village-level data on the Night Lights (1994-2013), GAEZ agricultural productivity, and estimates on poverty rates and income shares based on the Socio-Economic Caste Census (2012) from the SHRUG platform maintained by Data Development Lab.[32]

3.3 Geospatial Variables

a) Global Human Settlement Layer (GHSL): I downloaded high-resolution raster data on residential and non-residential built-up areas from the official GHSL website at 5-year intervals from 1975 to 2020. I aggregated the 100m by 100m data at the village and town levels using `raster` and `terra` packages in R.[33] **b) British Colonial Boundaries:** I requested historical boundaries of British and Native administered tracts from the Appraising Risk project hosted by McGill University, Canada. These boundaries were constructed based on the digitization of Indian Census Districts from 1872.[34] **c) Political Constituencies:** I obtained spatial boundaries for 541 national and 4,211 state legislature constituencies, coded by reservation status, from the Triveni Centre for Political Data at Ashoka University, India. **d) LWE Boundaries:** I collected administrative information on the Left-Wing Extremism (LWE) affected areas from the Ministry of Home Affairs.[35] **e) ESRI Living Atlas:** I obtained spatial data on railroads, highways, rivers, police stations, and conservation tracts from the Living Atlas portal of ESRI.

[30] I am grateful to Professor Ritam Chaurey for sharing the firm-level SHRID link file. For more details, see https://www.mospi.gov.in/classification/national-industrial-classification

[31] For more details, see https://agcensus1.da.gov.in/

[32] See Asher and Novasad (2020) for a technical description on the village-level interpolation of poverty estimates based on the Socio-Economic Caste Census and India Human Development Surveys.

[33] For more details, see https://human-settlement.emergency.copernicus.eu/

[34] For more details, see https://www.appraisingrisk.com/2020/10/23/digitization-of-indian-census-districts-1872-to-present/

[35] The 2018 notification classifies 90 districts as LWE affected, with 30 classified as most affected, 80% of which are under IPA regulations. Access the notification here

4 Empirical Framework

4.1 Geographic Regression Discontinuity Design

I employ a geographic Regression Discontinuity Design to estimate the long-run effects of LAP regulations on IPAs. I use the IPA boundaries illustrated in Figure 1 as the running variable for the RD estimator. The econometric specification is as follows:

$$y_{ibs} = \beta_1 IPA_{ibs} + \beta_2 f(\bar{d}_{ibs}) + \beta_3 IPA_{ibs} \times f(\bar{d}_{ibs}) + \sum \phi_{bs} + \epsilon_{ibs} \tag{1}$$

where y_{ibs} represents the economic and social development outcomes of interest observed for a village or town i along boundary segment b within state s. IPA_{ibs} is a treatment indicator equal to 1 if a village or town i is located within the IPA boundary, and 0 otherwise.

I model the running variable such that IPA boundaries within each state act as a cutoff point for a village or town in state s. In my specification, I explicitly restrict cross-border mobility, in line with the existing literature suggesting limited inter-state migration in India (Kone et. al, 2018). $\bar{d}_{ibs}$ is the minimum normalized perpendicular distance from the centroid of each village to the within-state IPA boundary. I assign positive distances to the village or town inside the cut-off (IPA) boundary, and negative distances to those outside. I illustrate the heatmap of the running variable in Appendix Figure B3. $f(\bar{d}_{ibs})$ denotes the RD polynomial function of the distance to the boundary modeling the geographic discontinuity, interacted with IPA_{ibs}. This specification controls for smoothness in the geographic location at each side of the boundary.

Since I aim to compare treatment and control units that are geographically proximate, the indicator ϕ_{bs} divides the IPA boundary with each state into equally spaced 30-mile segments and equals 1 if the census village i is closest to segment b and 0 otherwise. I include approximately 1,800 equally spaced boundary fixed effects to control for variation from unobserved confounders along the IPA boundaries.

Following Abadie, Imbens, and Wooldridge (2017), I cluster standard errors at the sub-district level. The sub-district is the lowest administrative unit for rural administrative decision-making. Clustering at the sub-district level recognizes that villages within the same sub-district are likely correlated, ensuring that the i.i.d. assumption holds. As a robustness check, I also estimate standard errors using Conley's (1999) method in Appendix Table A9 to account for spatial correlation across observational units.

In the baseline estimation, I use a local linear polynomial of the normalized distance and limit the sample to the optimal bandwidth suggested by the algorithm of Calonico, Cattaneo, and Titiunik (2014). The estimated optimal bandwidth using triangular kernel weights ranges between 12 to 17 miles for different outcomes of interest. I use the median value at 15 miles at baseline and show robustness checks under alternative bandwidths in Appendix Table A5.

Finally, ϵ_{ibs} represents the stochastic error term, capturing residual variation. For unbiased estimation, it must not be correlated with either the outcome of interest and the running variable, that is the IPA boundary.

4.2 Validation of the Local Continuity Assumption

In Section 2, I argued that IPA boundaries were influenced by political and administrative constraints of the time, resulting in quasi random placement. However, the endogeneity of IPA boundaries could threaten identification. In this section, I formally validate the local continuity assumption and show that census tracts across IPA boundaries, within the optimal bandwidth, are appropriate counterfactual.

Table 3 presents the estimates of Equation 1 testing for potential discontinuities in geographic features, state presence, productivity measures, and pre-treatment socio-economic factors across the IPA boundaries.

In Panel A, I show that time-invariant geographic factors including distance to the coastline, major rivers, rainfall, and temperature are balanced except for small discontinuity in the elevation (equivalent to about 120 meters). This is consistent with qualitative evidence and findings from my key stakeholder interviews that show the IPA boundaries were primarily defined by military strategies and thus included strategic locations that offered a topographic advantage against the colonial forces (Fernandes, 1992). In Appendix Table A10, I confirm that my main results are robust to controlling for the difference in elevation across IPA boundaries.

In Panel B, I show that long run state presence, as a measure of relative isolation—including distance to rail lines, highways, the capital city, or a major town—is balanced, on average, across IPA boundaries. Similarly, most measures of long-run productivity, such as distance to a canal or command area and potential agricultural productivity based on GAEZ data, are also balanced (Panel C). However, I find a discontinuity in average land holdings, which aligns with the policy objective of protecting land rights .

Finally, in Panel D, I present preliminary results from the digitized 1872 Census. I find that, in 1872—prior to the policy—land rents per acre (a measure of agricultural yield), housing stock per capita (an indicator of agglomeration), and the share of workers in non-farm jobs (a measure of structural transformation) were balanced across boundaries.[36] These results indicate that tracts around IPA boundaries are, on average, balanced on key socio-economic indicators.

4.3 Other Threats to Identification

Additionally, identification could be threatened by strategic manipulation of cutoff boundary and potential spillover or displacement effects. Below, I discuss the potential ambiguity in the estimation based on these threats and present results to mitigate these concerns.

A) SUTVA Test: Strategic migration across IPA boundaries is a potential concern for the stability of control and treated units. For example, low-skilled out-migration would lead to an underestimation of effects, while high-skilled out-migration would lead to an overestimation. Similarly, selective in-migration could introduce ambiguous bias into the estimates. To establish the Stable Treatment Unit

[36] It should be noted that these estimates are based on sub-district-level mapping of IPA boundaries overlapping British India tracts, which correspond to about 40% of the full sample. The village-level geocoding of the 1872 Census is a work in progress. I anticipate being able to update this segment by the end of the year with the revised data.

Value Assumption (SUTVA), I compare the population growth and composition across IPA boundaries between 1991 and 2011. Columns 1 and 2 of the Appendix Table A2 show that the average growth rates of the total and ST populations did not exhibit discontinuous jumps at the boundary. Similarly, Column 3 confirms that the population mix (share of ST to total population) also remained stable around the IPA boundaries in this period. These findings alleviate concerns about selective migration and strategic clustering across IPA boundaries.It must be noted these results do not rule out long-range migration across IPA boundaries. They only validate that selective migration across the IPA boundaries is not a concern to the identification strategy.

B) Density Test: It is crucial to have continuity in the density of the unit of analysis across the cutoff point for the validity of the RD estimator McCrary (2009). I ran the density test to validate that the village or town (unit of analysis) density does not jump discontinuously across the IPA boundaries (See Appendix Figure B3).[37]

5 Main Results

In this section, I present the main effects of LAP regulations on the long-run welfare and structural transformation of IPAs.

5.1 Poverty, Income Shares, and Capital Formation

In Table 4, I show that in 2012, census tracts within IPAs had higher poverty rates, larger share of cultivation in income, and lower per capita housing stock relative to nearby outside tracts. Approximately 150 years after the policy formulation in 1874, IPAs experienced nearly 6% higher poverty rate (see Column 1). These effects are sizable. Based on the estimates provided by Topalova, (2010), this is equivalent to about 18 percent of India's progress in poverty reduction over the 1990s.[38]

In Column 2, I show that households in IPAs had a 17% higher reliance on cultivation as a source of income, indicating that IPAs remained more dependent on the farm sector in the long run. In Column 3, I report that IPAs have 8% lower housing stock per capita, where housing stock is measured as residential built-up area over the total population. This suggests that long-term capital formation remained lower in IPAs compared to surrounding areas.

In Appendix Table A3, I measure welfare outcomes using similar indicators as a robustness check. Consistent with these negative effects, I find that locations within IPAs had lower nightlights, real income, and quality of housing compared to outside areas.[39] Together, these estimates suggest long run underdevelopment within IPAs.

[37] I used `rddensity` package in R to run the McCrary density test.

[38] Topalova (2010) estimated that the impact of trade liberalization accounted for about 2.2 percentage points or 15% of India's progress in poverty reduction over 1990. Hence, an average treatment effect of LAP regulations of about 2.6 percentage points is equivalent to 18% [(0.15/2.2)*2.6 = 0.177].

[39] I estimate real income based on Socio Economic Caste Census 2013 data, which reports the

5.2 Non-Farm Economic Activity

In Table 5, I present results on the sectoral dynamics of non-farm economic activity. While I do not find any significant differences in the the primary sector (Column 1), I find that firm density in the manufacturing and services sectors (Columns 2-3) is 7% and 6% lower, respectively, in IPAs compared to outside areas.[40] This indicates weaker entrepreneurial dynamism in the non-primary higher value-added sectors within IPAs. In Appendix Table A4, I show similar results using the employment shares as a robustness check. I find consistent results.

Next, I test similar dynamics, restricting the comparison to firms owned by Indigenous groups (STs). In Columns 4-6, I find that the differences are even more pronounced for ST-owned firms. While there are no significant differences in the primary sector, ST firm densities are 12% and 15% lower in the manufacturing and services sectors, respectively. These effect sizes are nearly double the overall average treatment effect. Overall, these results suggest that LAP regulations had a lasting negative effect on the structural transformation of IPAs, and Indigenous groups – the intended beneficiaries of the protective policies – were more adversely affected. In Figure 2, I present the RD plots for main results. Section 6 explores potential mechanisms to explain these results.

5.3 Robustness Checks

I used four approaches to test the robustness of my results: (i) the use of different bandwidths, and donut hole analysis; (ii) the use of alternative RD specifications, (iii) the estimation of Conley standard errors, and (iv) additional controls.

5.3.1 Alternative Bandwidths

Measurement errors in boundary identification and compound treatment effects are potential concerns for the main results presented in Tables 4 and 5. First, the geocoding of historical boundaries could potentially lead to imprecise measurement of where the historical border intersects current census tracts.[41] Hence, geospatial errors could lead to attenuation bias. Second, PLR borders overlap with administrative borders as I mapped historical tracts to current sub-district census tracts. This could potentially lead to the identification of compound effects due to local border dynamics.

To address these concerns, I use different bandwidths, to include observations further away from the boundary, and estimate regression discontinuity results us-

fraction of households with incomes less than 5k, between 5-10k, and above 10k. Using median income for each category, I estimated real income as a proxy for welfare.

[40] I defined sector-level firm density as the number of non-farm firms in the sector per 1,000 people. I used the Broad Activity classification in the Economic Census 2013 to define the three sectors.

[41] Initially, territories under British rule were demarcated piecemeal in the early 19th century. In 1874, these tracts were formalized as part of colonial policy. After India's independence, the Constitution adopted these protections, incorporating additional Native territories into the Fifth and Sixth Schedules Dhebar (1962). Subsequent state and district reorganizations have led to periodic re-classifications, reflecting the evolving political and administrative realities.

ing different "donut holes," to remove observations right on and proximate to the boundary. Appendix Tables A5 illustrates that the effects of LAP regulations on the main outcomes are robust to different choices of bandwidths between 10 and 20 miles. Also, the results are robust to different donut holes including 0-1 km and 0-3 miles (See Appendix Tables A6). These results suggest that effects are not driven by observations right at the boundary ruling out potential overlaps due to local border dynamics.

5.3.2 Alternative Specifications

In Appendix Tables A7, I re-estimate the main results using alternative RD polynomials (linear and quadratic). In addition, I also use different kernel choices in Appendix Tables A8. I find that the results did not change, providing evidence that the results are robust to all these alternative specifications.

5.3.3 Alternative Standard Errors

To account for spatial correlation in the data, I estimate Conley's standard errors following Conley (1999). I also show the robustness of my results to clustering standard errors at the district-level. Appendix Tables A9 shows that the statistical significance of the estimated effects remains the same.

5.3.4 Additional Controls

To address the possibility that the results could be due to differences in the elevation across IPA boundaries, in Appendix Table A10, I control for the elevation in the main specification. The results indicate that while the effect size has slightly reduced, the significance remains unchanged, suggesting that differences in elevation do not drive the observed effects. Also, following Dell et al. (2018) I control for distance to major towns and show that results remain robust.

6 Mechanisms

In this section, I test potential hypotheses to uncover the underlying mechanisms that explain the persistent poverty and structural stagnation in the IPAs.

6.1 Land Misallocation Hypothesis

I hypothesize that the LAP regulations, which de jure restricted land transfers between IGs and out-groups as a property rights security measure, de facto weakened property rights. Originally introduced during the colonial period to mitigate local conflicts, this differentiated property rights regime evolved into a paternalistic framework and fundamentally altered the economic behavior of agents across IPA boundaries. The land transfer restrictions—covering selling, leasing, and mortgaging—impacted the long-term spatial and structural transformation of IPAs through three channels: 1) High transaction costs created barriers to land-use conversion, leading to inefficient land use. 2) The coexistence of regulated and non-regulated parcels within IPAs caused market failure due to coordination frictions, obstructing area-wide agglomeration economies. 3) Restrictions on asset securitization depreciated land values, resulting in dead capital.

6.1.1 Effects on Spatial Transformation

Spatial transformation is a key driver of structural transformation, as shifting economic activity away from agriculture often requires converting land for non-primary uses. This process facilitates urbanization and industrialization, promoting economic diversification. Efficient allocation of resources depends on their transfer to the highest marginal use. Coase (1960) argued that the initial assignment of property rights should not affect resource allocation if property rights are well-defined and transaction costs are negligible. However, in developing economies with high transaction costs, the initial assignment of property rights becomes critical. It can significantly impact long-term welfare and structural change by obstructing the reallocation of resources to their most productive uses (Deininger and Feder, 2001).

In Section 2, I discussed how LAP regulations increased land market transaction costs in IPAs by restricting bona fide transactions within IG communities, imposing spatial limits on such transactions, and requiring burdensome proof of identity through bureaucratic pre-approvals. While these measures were intended to protect the alienation of land rights of IGs, they paradoxically reduced the size of land markets, impeded the conversion of agricultural land to non-agricultural uses, and disincentivized long-term capital investments.

I test this mechanism in Table 6. Column 5 shows that built-up density—measured as the share of built-up area to total area, serving as a proxy for land converted from agricultural to non-agricultural use—was approximately 18% lower in IPAs compared to areas outside IPAs in 2020. This pattern has remained highly persistent over the past 40 years, as shown in Columns 1-5. These findings suggest that land restrictions significantly constrained the potential spatial transformation of IPAs.

6.1.2 Effects on Agglomeration Economies

While spatial transformation is a necessary first step for structural transformation, it is not sufficient on its own. Cities, which generate 80% of global GDP, act as engines of growth. The densification of economic activity is essential for productivity growth (Marshall, 1920). Higher population and firm densities reduce transport costs, enhance skills specialization, and facilitate knowledge spillovers (Fujita, 1999; Venables, 2010). More recently, agglomeration gains have been linked to improved sharing, matching, and learning, driving innovation and economic expansion (Duranton and Puga, 2004). Without sufficient densification, regions risk losing the agglomeration economies necessary for sustained economic dynamism and structural transformation.

However, spatial agglomeration can be obstructed by market failures due to externalities or land use and zoning regulations (Redding, 2023). A key mechanism through which LAP regulations hinder agglomeration within IPAs is by creating coordination frictions among economic agents. Since land transfer restrictions apply only to IG parcels, IPA villages often comprise a mix of regulated and non-regulated parcels. While non-regulated parcels may trade efficiently, restrictions on regulated parcels impede area-wide transformations. These restrictions spill over to non-regulated parcels, obstructing efficient land-use conversion and limiting the spatial clustering necessary for agglomeration economies. As a result, market failures caused by coordination frictions pose a significant barrier to urbanization in IPAs.

I present evidence of this mechanism in Figure 3. The map highlights urban centers (blue triangles) as recognized by the Census of India in 2011, along with built-up densities at a 100m x 100m resolution measured in 1980 (magenta) and 2020 (green) across IPA boundaries (red). To illustrate the mechanism, I focus on two contrasting cases: Gujarat, a state with high economic growth, and Jharkhand, a state with poor economic growth, as shown in the inset figures. Interestingly, cities and towns—outcomes of spatial transformation and densification—predominantly cluster outside IPA boundaries in both cases.[42] This lopsided urbanization pattern indicates that targeted land restrictions not only hindered land-use conversion but also weakened agglomeration economies by creating coordination frictions within IPAs.

6.1.3 Effects on Asset Securitization

De Soto (2001) attributed poverty in developing countries to inefficient asset securitization resulting from weak property rights. LAP restrictions, designed to prevent the indebtedness of IGs by restricting land leasing and mortgaging, paradoxically distort leasing markets and constrain credit supply. This, in turn, limited the capitalization of land assets in IPAs, further exacerbating economic stagnation.

I test this hypothesis in Table 7. Column 2 reports that agricultural credit (measured as the share of households with *Kisan* credit cards) is approximately 11% lower in IPAs compared to outside areas. This aligns with the LAP design and suggests that IPAs remained more credit-constrained in the long run, despite having similar access to banking facilities, as shown in Appendix Table A11. In Column 3, I show that land leasing is also lower by 9% in IPAs based on sub-district level data from the Agricultural Census. Interestingly, at the all-India level, I find that while the share of total land leased has increased for "All groups" on average from 0.75% to 0.92% between 1995 and 2015, the land leased shares for STs have declined. This is also in contrast to the trends for another marginalized group, the Scheduled Castes (SCs) (see Table 8). This result indicates that while land leasing markets have expanded for All groups on average, STs have lost from this crucial market reform. Lastly, In Column 4, I show that agricultural land prices are approximately 12% lower in IPAs, even though agricultural productivity is similar.[43]

These results suggest that land restrictions hindered agents from capitalizing on productivity and amenity differences across IPA boundaries. Restrictions on land transfers not only impeded land conversions and agglomeration gains but also hindered asset securitization. This led to undervalued land assets, creating dead

[42]This pattern is consistent across IPA boundaries in other states. I am currently working with parcel-level data to test this mechanism empirically and expect to present findings in the next update by the end of December.

[43]This result is based on village-level land price data for three states, Gujarat, Jharkhand, and Chhattisgarh.

capital and trapping local communities in low-productivity activities and structural stagnation.

6.1.4 LAP regulations and Regional Development

How do LAP regulations affect regional development in the long run? Balanced regional development is crucial for sustainable growth and inclusive development. However, since liberalization in the late 1980s, India has experienced economic divergence, with some regions benefiting more than others (Lamba and Subramanian, 2020). The regions with stronger markets, institutions, and infrastructure gained disproportionately from economic liberalization (Ahluwalia, 2001).

In Figure 4, I compare long-run development across IPA boundaries within the 15-mile optimal bandwidth. In Panel A, I compare the average built-up density across the IPA boundaries between 1980 and 2020. The trend in built-up densities indicates potential divergence between IPA and outside areas. In 1980, areas within IPAs had an average built-up density of 0.22%, compared to 0.57% in outside areas, reflecting a 0.35 percentage point difference. By 2020, this gap increased to 0.48 percentage points, indicating that not only do IPAs have less built-up density, but they also experienced slower conversion of land from agricultural to non-agricultural uses in the past 40 years.

In Panel B, I compare urbanization trends using 100 years of data from the Census of India.[44] A similar pattern emerges: urbanization in IPA areas is almost five times lower than in areas outside IPAs. This disparity has increased over the past century, with the urbanization factor rising from 4.4 to 5.1 between 1910 and 2010. This finding is also confirmed by my key stakeholder interviews and fieldwork.

Overall, these findings suggest that areas outside IPAs are experiencing more agglomeration compared to areas within IPAs. Lower firm density (See Table 5) and employment shares in higher value-added manufacturing and services sectors, particularly in construction and real estate (See Appendix Table A4), indicate misallocation of land resources affected agglomeration economies and diminished structural transformation in IPAs.

6.2 Ruling Out Alternative Explanations

In this section, I examine alternative hypotheses that may explain long-run underdevelopment in IPAs. The first hypothesis, the "Isolation Hypothesis," asserts that IPAs are less developed due to their persistent isolation from mainstream society. The second hypothesis, the "Cultural Hypothesis," suggests that the distinct social and cultural practices among IGs have led to inverted attitudes toward technology adoption and market institutions. The third hypothesis, the "State Discrimination Hypothesis," posits that the state's discriminatory expropriation of natural resources increased capital risk within protected areas. Lastly, the "Political Attitudes Hypothesis" argues that differences in political ideology and preferences have hindered the growth of a market economy in protected areas.

[44] The reported urban population is normalized by base population within IPAs for the year 1980.

6.2.1 Isolation Hypothesis

The lack of core public goods is a major obstacle to the functioning of a market economy and economic development (Besley and Burgess, 2004; Banerjee and Somanathan, 2007). Scholars have argued that lower investment in public goods and services, due to historical identity-based isolation and centralized administration, are primary drivers of underdevelopment in IPAs (Mitra, 2020; Sundaram and Tendulkar, 2003).

In Appendix Table A11, I empirically test this hypothesis. The results show that within the optimal bandwidth, there is no discontinuity in village-level access to critical public goods and services, including primary schools, primary health centers, post offices, banks, roads, and electricity. These findings suggest that while physical isolation may be relevant in historical contexts, it may not be a major determinant of persistent poverty and socio-economic stagnation of IPAs in the long run.

6.2.2 Cultural Hypothesis

Cultural norms and social practices are important drivers of long-term development (Nunn, 2023). Differences in attitudes towards land ownership, technology adoption, and interaction with market institutions can generate disparities in productivity and socio-economic development over time. IGs, in particular, are identified with distinct social and cultural practices. Existing literature suggests widespread practices of communal ownership of land, shifting cultivation, and reliance on forests for subsistence among IGs (Guha, 1999; Scott, 2009).

In Appendix Table A12, I test for differences in land ownership patterns, technology adoption, and interactions with market institutions. I find no significant differences in the adoption of mechanized farm inputs, access to modern communication technologies such as broadband, or private land ownership structures across IPA boundaries.[45] This finding challenges the theory of cultural eccentricity as an explanation for long-run poverty in IPAs. This observation is also confirmed by my field trip.[46]

6.2.3 State Discrimination Hypothesis

The state's acquisition of private property under the principles of Eminent Domain can create tenure insecurity and disincentivize productive investments. While Eminent Domain is essential for development projects, its local effects are ambiguous and depend on project characteristics. For instance, transport projects often generate positive externalities, whereas mining and dam projects can produce negative externalities, such as pollution and forced displacement (Cernea, 2000; World Bank, 2001). The literature suggests that IGs and IPAs have disproportionately borne the burden of development, contributing to their underdevelopment.

[45] This is consistent with the Dhebar Commission's observation, which emphasized that only 10% of all Indigenous groups (classified as Particularly Vulnerable Tribal Groups) live in primitive ways, isolated from mainstream society.

[46] In Appendix Figure D, I show images from my fieldwork. The images from *gram sabha* meetings demonstrate visible homogeneity between Indigenous and non-Indigenous members.

I examine the state's acquisition practices in three sectors: large irrigation dams, mining, and ecological and wildlife conservation (See Appendix Figure B5). In Table Appendix Table A13, I find no evidence that the state selectively acquired more land or placed harmful projects across IPA boundaries. This dispels the argument that observed differences are due to selective state expropriation risk.

6.2.4 Political Attitudes Hypothesis

The negative development effects could also be explained by a lack of political competition or a preference for a particular political ideology, which could crowd out market institutions (Bardhan and Mookherjee, 2000). Table Appendix Table A14 presents evidence for this hypothesis. I find no differences in political competition, participation, or preferences across IPA boundaries. This rules out the possibility that elite capture or the nature of political institutions is driving the observed results.

7 Discussion

The main results suggest that LAP regulations, on average, had negative effects on the long-run welfare and structural transformation of IPAs. In this section, I discuss how LAP regulations interact with various administrative, historical, and political contexts. In Table 9, I report the heterogeneity of the average treatment effects.

7.1 Does political autonomy overcome market failure?

As described in Section 2, the Sixth Schedule Areas had a decentralized governance framework in contrast to the centralized structure in the Fifth Schedule areas, until the passage of the Panchayat Extension to Scheduled Areas (PESA) Act in 1996 (See Figure 5A). The decentralized governance in the Sixth Schedule provides greater legislative, judicial, and executive autonomy in to the local communities over land and natural resources.

Column 2 of Table 9 presents mixed results for the Sixth Schedule Areas. The findings indicate that while decentralized, semi-autonomous governance under the Sixth Schedule, on average, mitigates poverty disparities, the negative effects on structural transformation and long-term capital formation are more pronounced. Sixth Schedule Areas remain twice as dependent on farm income and have three times lower housing capital, indicating economic underdevelopment.

This result aligns with existing literature on decentralization, which suggests that greater autonomy can enhance redistribution. For instance, Gulzar (2017) finds a similar outcome for Scheduled Areas under PESA reforms. However, the positive redistributive effects of increased autonomy and decentralized governance appear insufficient to overcome land market barriers.

7.2 Did colonial legacy compound market failure?

In 1874, when the first uniform policy of Scheduled Districts was instituted, the Indian sub-continent was jointly governed by Foreign and Native rulers. Figure 5B shows the demarcation of tracts under British and Native tracts based on the 1872 Census classification.

The results in Column 3 of Table 9 indicate that IPA under British tracts had worse outcomes on all indicators. These results are broadly consistent with the findings of Iyer (2009) who found that British rule had a worse negative impact on welfare than Native rule. The All India Congress in 1937 commented that the identity-based isolation of IPA affected the economic and political consciousness of local communities. For example, discriminatory policies such as the Criminal Tribes Act which criminalized many Indigenous communities by birth systematically affected their social and economic development. Such policies potentially compounded the persistent effects of LAP regulations on the long-run development of IPAs.

7.3 Can violent conflict persist due to market failure?

Since the late 1960s, India has grappled with violent internal conflicts that have undermined national security and development goals. Left-Wing Extremism (LWE), commonly known as "Naxalism," spread across 188 districts at its peak in 2000, leading the then Prime Minister to describe it as the "single biggest security threat to India." Through improved welfare services, enhanced physical and digital connectivity, and strong retaliation from the armed forces, the conflict has gradually shrunk to 90 districts by 2018. Figure 5C shows LWE-affected areas in 2018, based on data from the Ministry of Home Affairs. There is a strong overlap between IPA and LWE tracts, with over 60% of the most severely affected areas located within IPAs.

The results in Column 4 of Table 9 highlight that IPAs overlapping the LWE tracts had almost twice larger poverty differences. These results are consistent with the existing literature which has attributed LWE conflict to structural income inequality (Dasgupta, Gawande, and Kapur, 2017). My results, while confirming the earlier findings, identify a novel mechanism to explain structural income inequality rooted in the land market restrictions.

8 Conclusion

This paper attempted to show how colonial property rights institutions have persisted in former colonies like India. The study demonstrates that LAP regulations, while intended to protect local communities, have created market inefficiencies, particularly in land-use conversion and agglomeration economies, adversely affecting the development of targeted beneficiaries. The paper challenges the existing view based on cultural theories and instead argues that market frictions caused by restrictive land policies are the primary barrier to development in IPAs.

The findings of this study highlight a trade-off between equity and efficiency in place-based policies governing IPAs. While LAP regulations are designed to safeguard Indigenous land rights and prevent dispossession, they inadvertently hinder economic growth by restricting land transactions, distorting leasing markets, and limiting credit access. This protectionist framework, while achieving equity in land ownership, creates inefficiencies in land allocation and restricts spatial and structural transformation, ultimately affecting livelihoods and welfare.

Recent studies indicate that IPAs have a positive impact on forest conservation (Gulzar, Lal, and Pasquale, 2024). However, this research underscores the trade-off between equity and efficiency. This trade-off is particularly significant in discussions surrounding sustainability, climate transitions, and job creation. These constraints gain urgency with the increasing demand for critical minerals located on Indigenous lands, which are vital for climate transitions and economic opportunities.

Effective property rights governance is crucial for achieving efficient and equitable land allocation. The growing pressures of urbanization and industrialization have increased land demand, leading to grey market practices such as dubious marriages, bureaucratic rent-seeking, and even criminal intimidation to bypass restrictions on land transfers. These challenges are further exacerbated by institutional frictions, including poor land records, bureaucratic inefficiencies, and corruption, which hinder long-term development, particularly in regions with complex property rights systems and weak state capacity.

Establishing efficient and fair land markets is essential to ensure Indigenous communities can capitalize on these opportunities while avoiding past conflicts over resources. Addressing these institutional frictions and balancing the trade-offs between equity and efficiency is vital for sustainable resource management. Strengthening property rights governance and allowing marketability of land rights can unlock the potential of land markets to support structural transformation and promote inclusive growth in IPAs.

As the next step, I aim to conduct a welfare analysis to evaluate the aggregate cost of this policy. Additionally, I plan to complete the digitization of the 1872 Census and work with parcel-level data to empirically test the coordination friction mechanism contributing to poor agglomeration in IPAs. I welcome any questions and feedback!

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9 Tables

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Table 1: Area and Population Distribution in IPAs

State	Scheduled Area to Total State Area (%)	SA Population to Total State Population (%)	State ST Population within SA (%)	ST Population to Total SA Population (%)	Rural Population to Total SA Population (%)
PANEL A: FSA					
Chhattisgarh	67.5	38.1	74.0	59.5	90.8
Jharkhand	52.8	38.5	67.5	45.9	81.1
Odisha	42.5	27.3	63.8	53.4	84.2
Himachal Pradesh	41.9	2.5	31.5	71.2	100.0
Madhya Pradesh	31.6	24.8	61.1	52.0	82.8
Andhra Pradesh	15.1	5.8	30.4	36.7	83.1
Gujarat	14.8	10.4	54.2	76.7	92.9
Maharashtra	14.7	8.1	37.9	43.7	73.1
Rajasthan	6.3	8.5	45.2	71.9	94.3
PANEL B: SSA					
Meghalaya	98.7	82.0	85.2	89.5	90.6
Tripura	70.9	45.1	60.1	42.4	94.1
Assam	31.2	27.7	50.5	22.2	90.0
Mizoram	18.7	15.4	15.6	95.6	72.8
India	15.6	7.5	45.1	52.1	85.4

Notes: The table presents the distribution of area and population across Fifth and Sixth Schedule Area states. FSA refers to Fifth Schedule Areas; SSA refers to Sixth Schedule Areas. All the estimates are based on the Census 2011 statistics collected from the Office of the Registrar General of Census, Government of India. Source: Author's analysis combining archival records with Census of India data.

Table 2: Descriptive Statistics

	All India	IPA States			Bandwidth		
		NSA	FSA	SSA	NSA	FSA	SSA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Villages/ Town	649618	253366	84624	13957	30764	23452	7138
Literacy Rate (%)	57.3	59.7	46.0	55.3	56.6	49.7	58.2
	(15.0)	(14.2)	(17.2)	(16.5)	(15.5)	(17.1)	(15.5)
Poverty Rate (%)	35.5	33.0	53.9	50.7	41.5	50.3	43.3
	(22.1)	(21.4)	(22.6)	(22.2)	(22.1)	(23.2)	(21.4)
Cultivation Share in Income (%)	38.0	37.3	43.0	56.3	33.2	40.4	51.3
	(29.2)	(28.1)	(33.8)	(32.9)	(28.4)	(32.7)	(34.1)
Villages Access to Road (%)	62.5	61.9	62.6	27.3	64.6	68.1	17.4
	(48.4)	(48.6)	(48.4)	(44.5)	(47.8)	(46.6)	(37.9)
Night Light (log)	5.7	5.9	3.4	3.0	5.5	3.8	3.9
	(5.7)	(5.1)	(3.4)	(2.5)	(6.4)	(3.7)	(4.2)

Notes: The table presents the descriptive statistics for key variables in 2011. FSA refers to Fifth Schedule Areas; SSA refers to Sixth Schedule Areas. Column 1 shows the all-India results. Columns 2-4 show results for 14 IPA states disaggregated protection status. Columns 5-7 show the results for IPA states conditional on 15 miles optimal bandwidth determined by the algorithm of Calonico, Cattaneo and Titiunik (2014). All the estimates are based on the 2011 Census collected from the Office of the Registrar General of Census, Government of India. Figures in parentheses indicate the standard deviation.

Table 3: Local Continuity Balance Test

Variable	**IPA**	**SE**	**N**
Panel A: Geographic Features			
Distance to Coastline	0.003	(0.002)	60833
Distance to Riverline	−0.001	(0.009)	60833
Rainfall	0.025	(0.018)	60833
Temperature	0.018	(0.011)	60833
Elevation*	0.041	(0.013)	60833
Panel B: State Presence			
Distance to Railline	0.013	(0.016)	60833
Distance to Highway	0.011	(0.018)	60833
Dist to State Capital	0.012	(0.015)	60833
Distance to Major Town (100k+)	0.019	(0.029)	60833
Panel C: Productivity			
Distance to Canal	0.010	(0.008)	60833
Distance to Command Area	0.012	(0.007)	60833
Potential Agri Productivity (GAEZ)	−0.029	(0.019)	60549
Average Land Holding*	0.017	(0.006)	60833
Panel D: 1872 Baseline			
Land Rents per Acre	−0.021	(0.022)	132
Housing Stock per Capita	−0.014	(0.016)	129
Share of Non-Farm Jobs	−0.011	(0.008)	114

Notes: The table presents the results of Equation 1. All the dependent variables are scale-transformed, and the unit of analysis is a village or town, otherwise specified. The pre-treatment baseline estimates are at the sub-district level based on the Census 1872 administrative classification. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at sub-district level are in parentheses.

Table 4: Poverty, Income Shares, and Capital Formation

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
IPA	0.061	0.165	−0.081
	(0.026)	(0.037)	(0.035)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Control Mean	36.1 (%)	34.2 (%)	32.4 (sq. mt)
Num. obs.	52184	50537	52215
N Clusters	884	830	889

Notes: The table presents the main results of Equation 1. All the dependent variables are log transformed. Column 1 uses estimates of the poverty rate in 2012 based on the Tendulkar method, and Column 2 uses the cultivation share in 2012 from the Socio-Economic Caste Census, 2013. Column 3 shows the effects of IPA boundaries on residential floor area per capita in 2010. The data for the poverty rates and cultivation share is obtained from SHRUG, while raster residential floor data was collected from the Global Human Settlement Layer. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table 5: Sectoral Distribution of Economic Activity (by Social Group)

	Dependent Variable: Firm Density					
	Primary	Manufacturing (All)	Services	Primary	Manufacturing (ST)	Services
	(1)	(2)	(3)	(4)	(5)	(6)
IPA	0.060	−0.073	−0.060	0.101	−0.124	−0.148
	(0.051)	(0.034)	(0.031)	(0.066)	(0.048)	(0.045)
Fixed Effects	Boundary	Boundary	Boundary	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	46611	46611	46611	25782	25782	25782
N Clusters	884	884	884	847	847	847

Notes: The table presents the results of Equation 1. Firm density is defined as the number of non-farm firms per 1,000 population. All the dependent variables are log transformed. Columns 1–3 show the effects of IPA on the firm density for all groups, while Columns 4-5 show the effect conditional on firms owned by the Indigenous groups (STs). The unit of observation in all columns is the census village or town. The micro data on firms come from the Economic Census, 2013, while the estimates on population come from Population Census, 2011. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses..

Table 6: Land Restrictions and Change in Land Use

	Dependent Variable: Built Up Density				
	1980	1990	2000	2010	2020
IPA	-0.162	-0.169	-0.178	-0.176	-0.177
	(0.052)	(0.055)	(0.058)	(0.061)	(0.059)
Fixed Effects	Boundary	Boundary	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	60833	60833	60833	60833	60833
N Clusters	907	907	907	907	907

Notes: The table presents the main results of Equation 1. Builtup density is defined as the total built up area per total geographical area. All the dependent variables are log-transformed. Columns 1-5 show the effects of IPA on the built density for each decade starting 1980. The unit of observation in all columns is the census village or town. Built up raster data at 100m by 100m resolution is obtained from Global Human Settlement Layer. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table 7: Land Restrictions and Dead Capital

	Agri Credit (1)	Agri Land Leasing (2)	Agri Land Prices (3)
IPA	−0.105	−0.091	−0.121
	(0.042)	(0.056)	(0.026)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	49233	830	9184
N Clusters	801	830	134

Notes: The table presents the main results of Equation 1. All the dependent variables are log-transformed. The unit of observation in all columns is the census village or town, otherwise specified. Column 1 shows the effect of IPA boundaries on access to agricultural credit. Column 2 measures effects on land leasing based on tehsil-level data from Agriculture Census. Column 3 examines agricultural land prices using data scraped from state land revenue portals. The village-level land price data is limited to Odisha, Jharkhand, and Gujarat. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table 8: Land Leasing by Social Group (1995-2015)

Social Group	1995	2015	**% Change**
All	0.75	0.92	23.1
STs	0.80	0.72	-9.9
SCs	1.80	2.29	27.3

Notes: The table presents summary results for land leasing by social group. Columns 1 and 2 show the percentage of total land holdings that were wholly or partially leased, as defined by the Agriculture Census. Column 3 measures the percent change in the share of total land leased by social groups between 1995 and 2015. The data indicate that the land leasing market has expanded for the "All" and "SC" groups, but has declined for the "ST" group over the same period.

Table 9: Heterogeneous Treatment Effects

	Full Sample	Sixth Schedule Tracts	British Colonial Tracts	Internal Conflict Tracts
	(1)	(2)	(3)	(4)
Panel A: Poverty Share				
IPA	0.061	0.009	0.112	0.107
	(0.026)	(0.062)	(0.037)	(0.048)
Num. obs.	52184	11116	31688	16273
N Clusters	884	150	542	304
Panel B: Cultivation Share				
IPA	0.165	0.385	0.235	0.178
	(0.037)	(0.081)	(0.050)	(0.077)
Num. obs.	50537	9592	31281	16170
N Clusters	830	104	532	301
Panel C: Housing Stock				
IPA	−0.081	−0.222	−0.086	−0.032
	(0.035)	(0.097)	(0.045)	(0.062)
Num. obs.	52215	11604	11604	17347
N Clusters	889	151	547	305
Panel D: Firm Density				
IPA	−0.183	−0.292	−0.298	−0.160
	(0.040)	(0.102)	(0.074)	(0.099)
Num. obs.	25782	5453	14250	7286
N Clusters	847	146	506	280
Fixed Effects	Boundary	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist

Notes: The table presents the heterogeneous results of Equation 1. Panels A, B, C, and D present results for poverty share, cultivation share, per capita housing stock, and ST firm density in the combined manufacturing and services sectors, respectively. Column 1 shows the long-run average treatment effects of IPA boundaries. Column 2 reports the results for autonomous Sixth Schedule Area tracts. Column 3 provides results for British colonial tracts, and Column 4 displays results for internal conflict-affected LWE tracts. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

10 Figures

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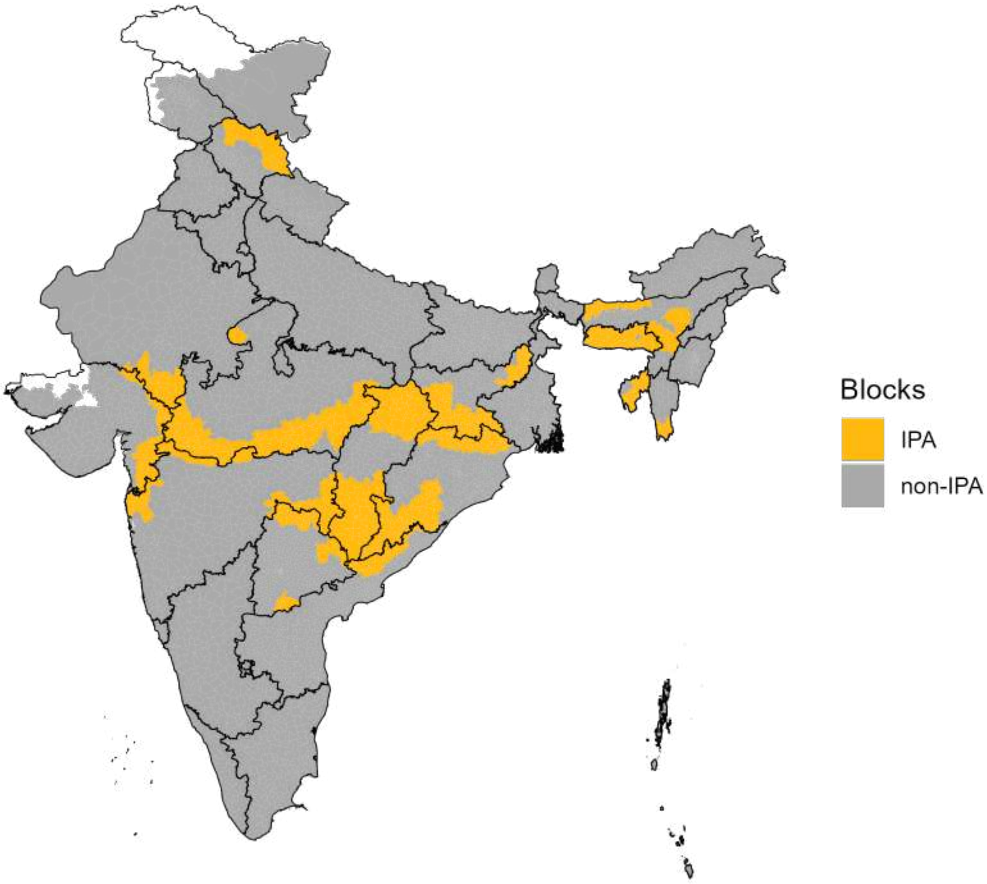
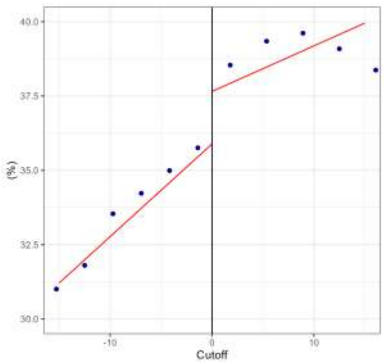
Figure 1: Indigenous Protected Areas in India

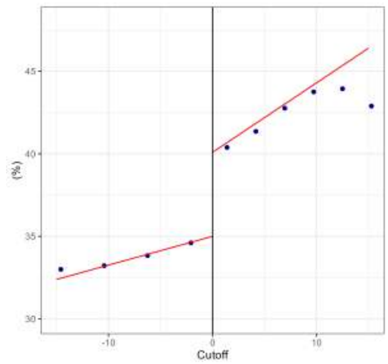


Notes: Tracts highlighted in yellow represent constitutionally recognized Indigenous Protected Areas (IPAs) under the Fifth and Sixth Schedules of the Constitution of India. The IPA boundaries correspond to administrative boundaries as classified in the Census of India 2011. For further details on the construction of IPA boundaries, see the Supplementary Appendix. Source: Author's GIS analysis, combining colonial-era archival data with administrative data from the Ministry of Tribal Affairs, Government of India.

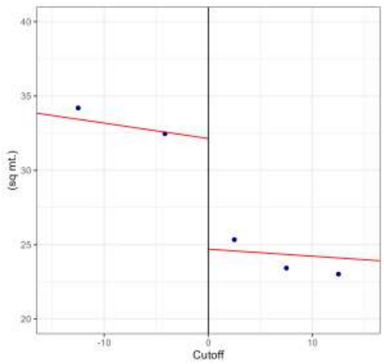
Figure 2: RD Plots



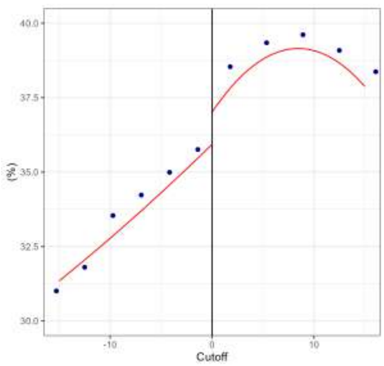
A1: Poverty Share (p=1)



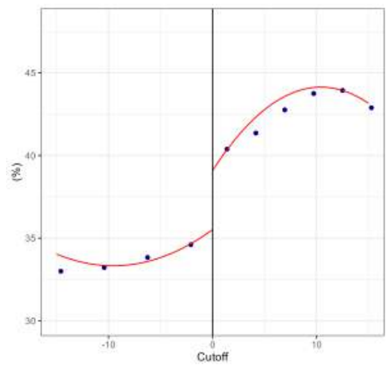
B1: Cultivation Share (p=1)



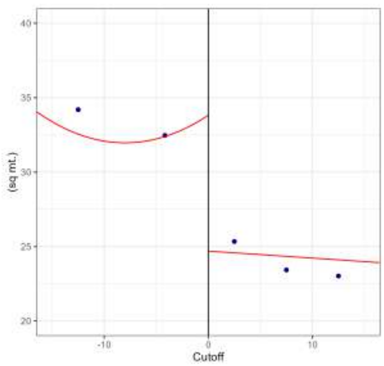
C1: Housing Stock (p=1)



A2: Poverty Share (p=2)



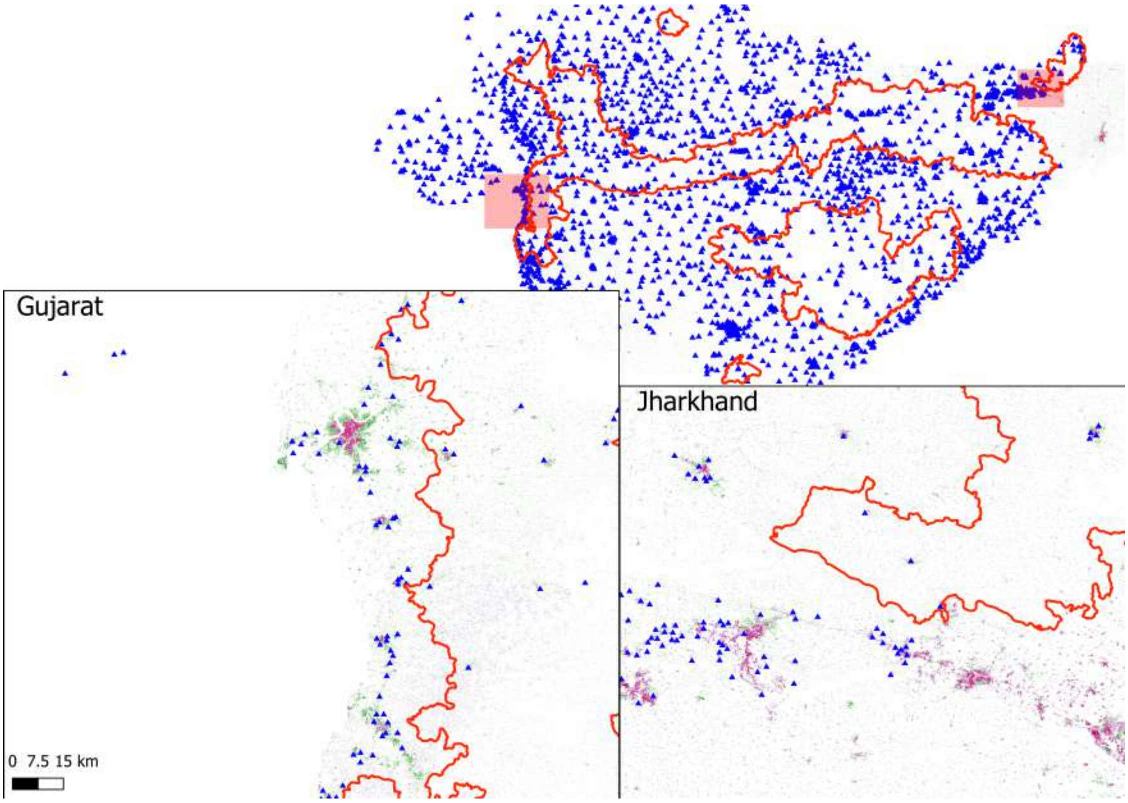
B2: Cultivation Share (p=2)



C2: Housing Stock (p=2)

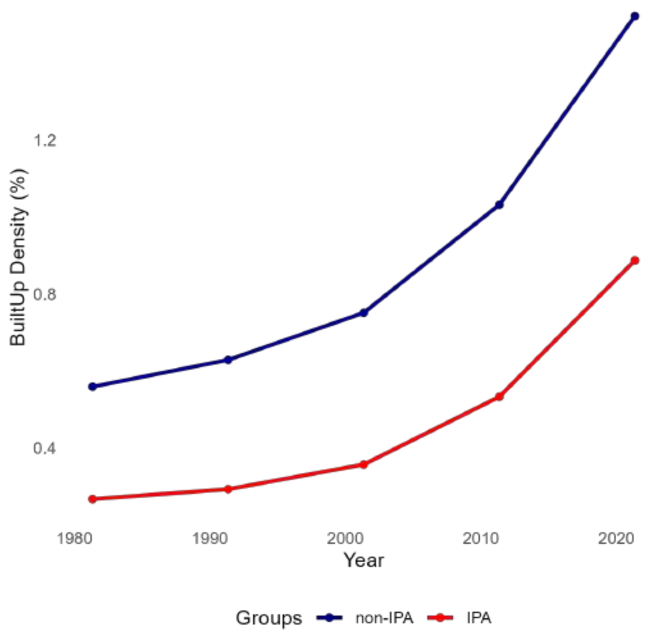
Notes: The figure presents RD plots for main results using the `rdrobust` package in R. Controls not shown include a linear polynomial of the distance to the IPA boundary, its interaction with an indicator of whether the tract is within the IPA, and boundary fixed effects corresponding to the closest evenly spaced break of 30 miles along the IPA boundary. The optimal bandwidth of 15 miles was determined using the algorithm by Calonico, Cattaneo, and Titiunik (2014), with parametric triangular kernel weights applied to the estimates. Clustered standard errors at the sub-district level are provided in parentheses.

Figure 3: Agglomeration across IPA boundaries (1980-2020)

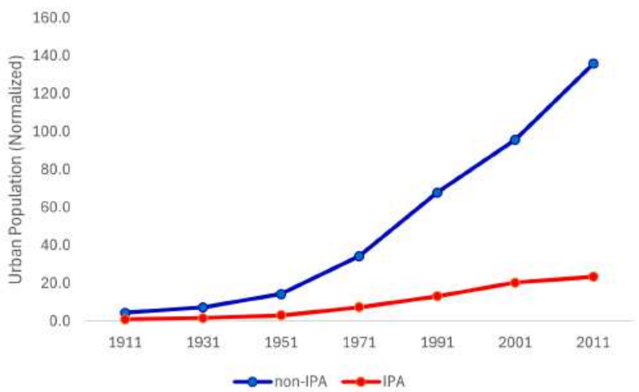


Note: The graph compares urbanization trends across IPA boundaries (red line). The main graph shows the distribution of urban clusters as defined by the Census of India. The two inset maps show Gujarat and Jharkhand on the left and right, respectively. The inset graph depicts urban clusters (blue triangles) and built-up areas at 100m by 100m resolution in 1980 (magenta) and 2020 (green). Source: Author's analysis in Arc-GIS using Census of India and GHSL data.

Figure 4: Urbanization Trends (1911-2020)



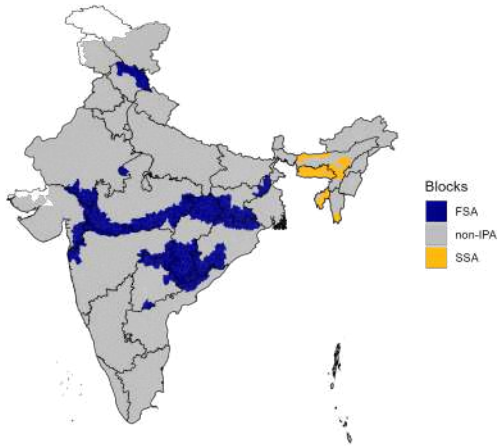
A: Builtup Density (%)



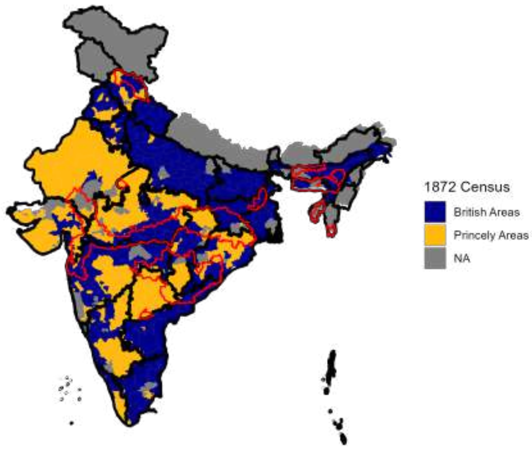
B: Urban Population (normalized)

Notes: The figure presents urbanization trends between 1910 and 2020 within the optimal bandwidth of 15 miles, determined using the algorithm by Calonico, Cattaneo, and Titiunik (2014). In Panel A, the blue line represents the mean built-up density for areas outside IPAs, while the red line shows the mean built-up density for areas inside IPAs. Panel B displays similar trends using urban population data from the Census of India.

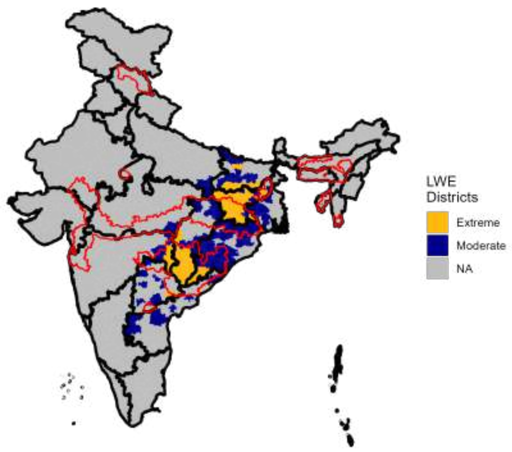
Figure 5: Tract Types



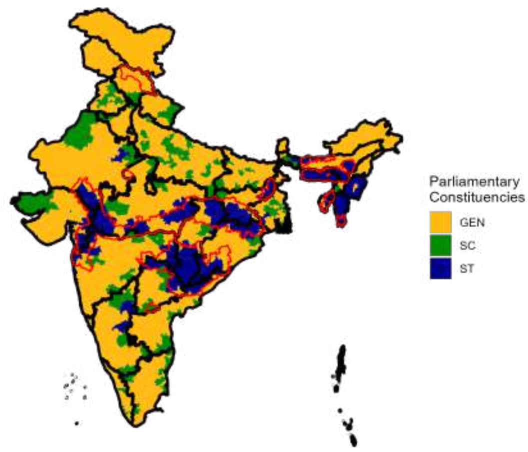
A: Fifth v. Sixth Schedule Tracts



B: British v. Native Tracts



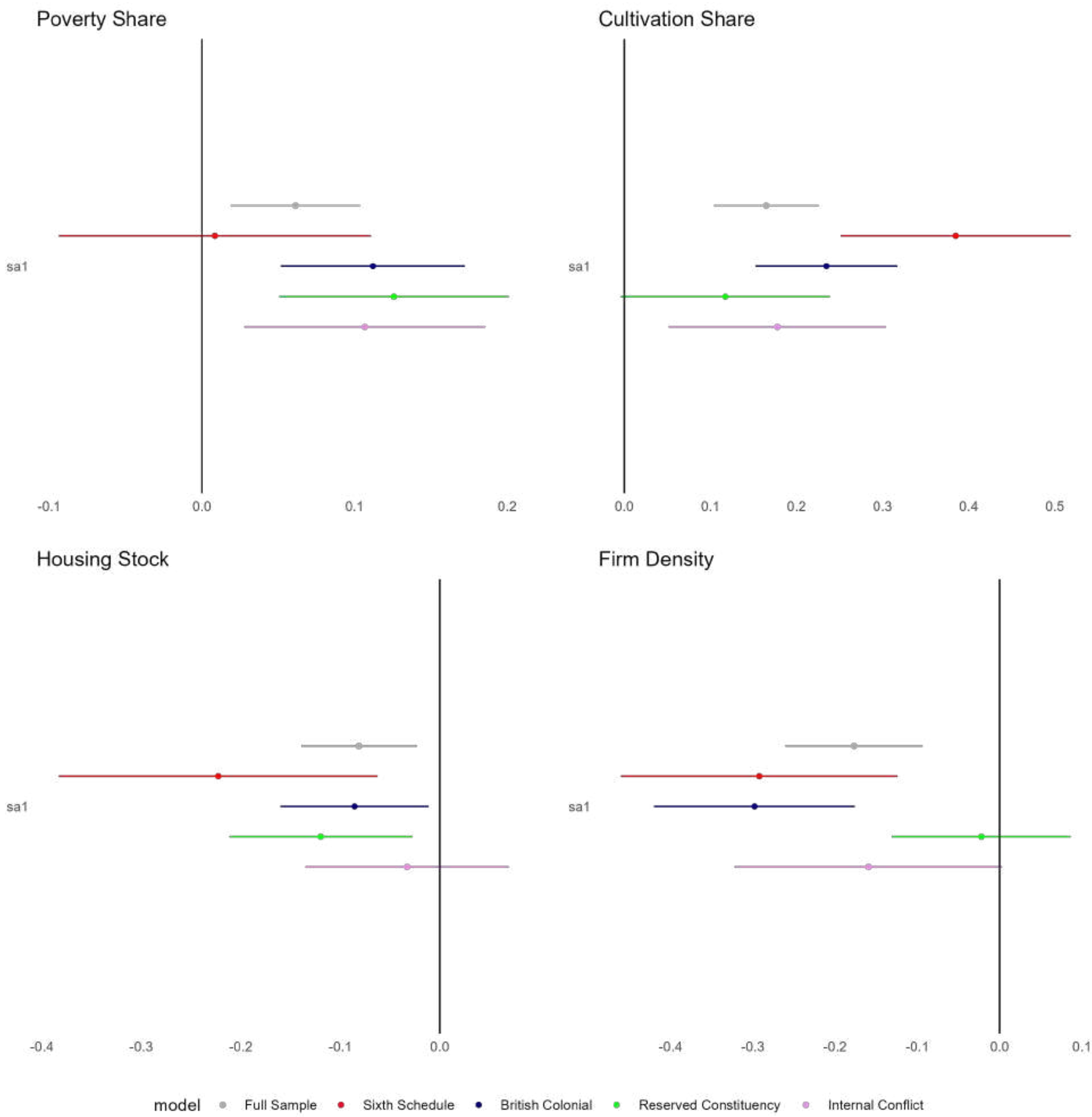
C: LWE v. Non-LWE Tracts



D: Reserved v. Non Reserved Tracts

Notes: The figure shows different tract types used to assess heterogeneous treatment effects. Regions within the red boundary are Indigenous Protected Areas (IPAs). Panel A presents Fifth and Sixth Schedule areas, based on data from the Ministry of Tribal Affairs, Government of India. Panel B shows British and Native tracts, based on data from the Appraising Risk project, McGill University. Panel C highlights LWE-affected areas, based on data from the Ministry of Home Affairs, Government of India. Panel D illustrates ST reserved constituencies, with data from the Triveni Centre for Political Data, Ashoka University. Source: Author's analysis using GIS.

Figure 6: Heterogeneous Treatment Effects



Notes: The figure shows heterogeneous treatment effects by tract types. Panel A reports the results for poverty share. Panel B provides results for cultivation share. Panel C shows the outcomes for housing stock and Panel D displays results for ST firm density.

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A Appendix Tables

Table A1: Statewise Indigenous Population and Land Rights Protections

State	Total ST Population (mn)	ST % of Total ST Pop	ST % of State Pop	Notified Tribes	Land Rights Protection
Madhya Pradesh	15.3	14.7	21.1	46	FSA
Maharashtra	10.5	10.1	9.4	47	FSA
Odisha	9.6	9.2	22.8	62	FSA
Rajasthan	9.2	8.8	13.5	12	FSA
Gujarat	8.9	8.5	14.8	32	FSA
Jharkhand	8.6	8.3	26.2	32	FSA
Chhattisgarh	7.8	7.5	30.6	42	FSA
Andhra Pradesh	5.9	5.7	7.0	66	FSA
West Bengal	5.3	5.1	5.8	40	LAP, ADC
Karnataka	4.2	4.1	7.0	50	
Assam	3.8	3.6	12.2	29	SSA, ADC
Meghalaya	2.6	2.4	86.1	17	SSA
Nagaland	1.7	1.6	86.5	5	ILP
Jammu Kashmir	1.5	1.4	11.9	12	ADC
Bihar	1.3	1.3	1.3	33	
Tripura	1.2	1.1	31.8	19	SSA
Manipur	1.2	1.1	40.8	34	ILP, ADC
Uttar Pradesh	1.1	1.1	0.6	15	LAP
Mizoram	1.0	1.0	94.4	15	SSA
Arunachal	1.0	0.9	68.8	16	ILP
Tamil Nadu	0.8	0.8	1.1	36	
Kerala	0.5	0.5	1.5	43	
Himachal Pradesh	0.4	0.4	5.7	10	FSA
Uttarakhand	0.3	0.3	2.9	5	
Sikkim	0.2	0.2	33.8	4	LAP
Dadra Nagar	0.2	0.2	52.0	7	
Goa	0.1	0.1	10.2	8	
Lakshadweep	0.1	0.1	94.8	2	
Andaman	0.03	0.03	7.5	6	
Daman Diu	0.02	0.01	6.3	5	
Chandigarh	0.0	0.0	0.0	0	
Haryana	0.0	0.0	0.0	0	
Delhi (NCT)	0.0	0.0	0.0	0	
Puducherry	0.0	0.0	0.0	0	
Punjab	0.0	0.0	0.0	0	
India	104.4	100.0	8.6	750	-

Note: The table shows the state wise distribution of Indigenous population along with the applicable constitutional land rights protections where FSA refer to Fifth Schedule Areas; SSA refers to Sixth Schedule Areas; LAP refers to Land Alienation Prohibition laws; ADC refers to Autonomous District Councils; and ILP refers to Inner Line Permit regulations. Source: Author's analysis using archival data from government reports.

Table A2: Stable Unit Treatment Value Assumption

	Population Growth (1991-2011)	ST Population Growth (1991-2011)	Population Mix (1991-2011)
	(1)	(2)	(3)
IPA	0.011	0.027	0.008
	(0.014)	(0.020)	(0.017)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	59355	59355	59355
N Clusters	895	895	895

Notes: The table presents the main results of Equation 1. All the dependent variables are log transformed. Columns 1-2 shows the growth of total and ST population between 1991 and 2011. Column 3 shows the change in population mix between 1991 and 2011. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A3: Night Lights, Real Income, and Housing Quality

	Night Lights	Real Income	Housing Quality
	(1)	(2)	(3)
IPA	−0.042	−0.079	−0.089
	(0.024)	(0.020)	(0.047)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	59355	46781	55737
N Clusters	895	817	830

Notes: The table presents the main results of Equation 1. All the dependent variables are log transformed. Column 1 uses average estimates of the night lights between 1994 and 2013, and Column 2 uses the real income estimates from the Socio-Economic Caste Census, 2013. Column 3 shows the effects of IPA boundaries on access to high-quality permanent residential housing in 2010. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A4: Employment Shares (by sector)

	Dependent Variable: Employment Shares		
	Construction	Manufacturing	Services
	(1)	(2)	(3)
IPA	−0.056	−0.113	−0.156
	(0.018)	(0.040)	(0.055)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	60833	60833	60833
N Clusters	907	907	907

Notes: The table presents the main results of Equation 1. All dependent variables are log-transformed. Columns 1-3 show the employment shares in non-farm sectors: construction, manufacturing, and services. Employment shares data are from the Economic Census 2013. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm by Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A5: Robustness Tests: Bandwidth Selection

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
Panel A: Bandwidth 10 miles			
IPA	0.055	0.173	−0.033
	(0.024)	(0.039)	(0.027)
Num. obs.	33087	32039	34851
N Clusters	753	706	753
Panel B: Bandwidth 15 miles			
IPA	0.061	0.165	−0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52184	50537	55203
N Clusters	884	830	889
Panel C: Bandwidth 20 miles			
IPA	0.060	0.172	−0.107
	(0.026)	(0.037)	(0.036)
Num. obs.	69679	67559	73777
N Clusters	1036	977	1043
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist

Notes: The table presents the robustness tests for the main results of Equation 1. Panels A, B, and C show the results for different bandwidth selections. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A6: Robustness Tests: Donut Hole Selection

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
Panel A: Donut Hole 0-1 miles			
IPA	0.069	0.167	-0.097
	(0.028)	(0.041)	(0.038)
Num. obs.	49790	48221	52694
N Clusters	883	829	889
Panel B: Donut Hole 0 miles			
IPA	0.061	0.165	-0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52184	50537	55203
N Clusters	883	829	889
Panel C: Donut Hole 0-3 miles			
IPA	0.089	0.180	-0.141
	(0.036)	(0.048)	(0.048)
Num. obs.	44526	43094	47179
N Clusters	883	829	889
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist

Notes: The table presents the robustness tests for the main results of Equation 1. Panels A, B, and C show the results for different donut hole selections. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A7: Robustness Tests: Functional Form Selection

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
Panel A: Linear			
IPA	0.062	0.165	−0.082
	(0.025)	(0.037)	(0.035)
Num. obs.	52184	50537	55203
N Clusters	883	829	889
Panel B: Linear x Interaction			
IPA	0.061	0.165	−0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52184	50537	55203
N Clusters	883	829	889
Panel C: Quadratic			
IPA	0.046	0.156	−0.061
	(0.026)	(0.043)	(0.040)
Num. obs.	52184	50537	55203
N Clusters	883	829	889
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist

Notes: The table presents the robustness tests for the main results of Equation 1. Panels A, B, and C show the results for different functional form selections. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A8: Robustness Tests: Kernel Selection

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
Panel A: Uniform			
IPA	0.060	0.161	−0.079
	(0.024)	(0.032)	(0.034)
Num. obs.	52184	50537	52215
N Clusters	884	830	889
Panel B: Triangular			
IPA	0.061	0.165	−0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52184	50537	52215
N Clusters	884	830	889
Panel C: Epanechnikov			
IPA	0.062	0.166	−0.082
	(0.027)	(0.038)	(0.035)
Num. obs.	52184	50537	52215
N Clusters	884	830	889
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist

Notes: The table presents the robustness tests for the main results of Equation 1. Panels A, B, and C show the results for different kernel selections. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A9: Robustness Tests: Standard Erros Selection

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
Panel A: Conley SE (30 mile decay)			
IPA	0.061	0.165	−0.081
	(0.021)	(0.032)	(0.027)
Num. obs.	52184	50537	55203
N Clusters	884	830	889
Panel B: Sub-District SE			
IPA	0.061	0.165	−0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52184	50537	55203
N Clusters	884	830	889
Panel C: District SE			
IPA	0.061	0.165	−0.081
	(0.027)	(0.040)	(0.041)
Num. obs.	52184	50537	55203
N Clusters	884	830	889
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes

Notes: The table presents the robustness tests for the main results of Equation 1. Panels A, B, and C show the results for different standard error selections. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A10: Robustness Tests: Additional Controls

	Population Share below Poverty Line	Cultivation Share in Income	Housing Stock per Capita
	(1)	(2)	(3)
Panel A: Distance to State Capital			
IPA	0.061	0.163	−0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52182	50535	55201
N Clusters	884	830	889
Panel B: No Additional Controls			
IPA	0.061	0.165	−0.081
	(0.026)	(0.037)	(0.035)
Num. obs.	52184	50537	55203
N Clusters	884	830	889
Panel C: Elevation			
IPA	0.057	0.164	−0.075
	(0.027)	(0.038)	(0.036)
Num. obs.	46360	45330	49055
N Clusters	811	763	822
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist

Notes: The table presents the robustness tests for the main results of Equation 1. Panels A, B, and C show results for different control selections. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo, and Titiunik (2014) was used to set the optimal bandwidth to 15 miles, and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A11: Alternative Hypothesis: Persistent Isolation

	Dependent Variable: Access to Public Goods					
	Primary School	Primary Hospital	Post Office	Bank	Rural Road	Power
	(1)	(2)	(3)	(4)	(5)	(6)
IPA	0.001	−0.003	0.006	0.002	0.004	0.004
	(0.008)	(0.003)	(0.007)	(0.006)	(0.010)	(0.005)
Fixed Effects	Boundary	Boundary	Boundary	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	43677	43677	43677	43677	43677	43677
N Clusters	758	758	758	758	758	758

Notes: The table presents the estimates of Equation 1 discussing the potential isolation of IPAs. Columns 1-6 show the village level access to core public goods. The data for the analysis is obtained from the 2011 Village Directories of the Census Of India. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A12: Alternative Hypothesis: Cultural Eccentricity

	Dependent Variable: Access to Technology		
	Pvt Land Ownership	Mechanized Irrigation	Broadband Access
	(1)	(2)	(3)
IPA	−0.016	−0.031	−0.150
	(0.018)	(0.055)	(0.224)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	60833	60833	1594
N Clusters	907	907	462

Notes: The table presents the main results of Equation 1. All the dependent variables are log transformed. Column 1 shows the share of privately held land. Columns 2-3 use different measures of technology adoption. The unit of observation in all columns is the census village or town. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A13: Alternative Hypothesis: State Discrimination

	Dependent Variable: Land Acquisition		
	Irrigation Projects	Mining Projects	Conservation Projects
	(1)	(2)	(3)
IPA	−0.043	0.061	−0.011
	(0.062)	(0.052)	(0.024)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	46781	46780	46781
N Clusters	817	817	817

Notes: The table presents the estimates of Equation 1 discussing the risk of state acquisition of land for development projects. All the dependent variables are log-transformed. Columns 1-3 show whether the land was acquired for large irrigation or dam project, mining purposes, and ecological or wildlife conservations, respectively. The data for the analysis is obtained from the Ministry of Water Resources, Ministry of Mines, and ESRI Living Atlas. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A14: Alternative Hypothesis: Political Attitudes

	Dependent Variable		
	Political Parties	Voting Share	Wining Margin
	(1)	(2)	(3)
IPA	−0.131	−0.051	−0.075
	(0.211)	(0.045)	(0.062)
Fixed Effects	Boundary	Boundary	Boundary
Controls	Yes	Yes	Yes
Std Errors	Sub-Dist	Sub-Dist	Sub-Dist
Num. obs.	46781	46780	46781
N Clusters	817	817	817

Notes: The table presents the estimates of Equation 1 discussing the political attitude and preferences. All the dependent variables are log-transformed. Column 1 measures number of effective political parties. Columns 2-2 shows the effects on voting share and winning share, respectively. The data for the analysis is obtained from the Triveni Centre for Political Data, Ashoka University. Controls not shown include a linear polynomial of the distance to the boundary of IPA, its interaction with an indicator of whether the tract was under IPA or not, and boundary fixed effects representing the closest evenly spaced break of 30 miles in the IPA boundary. The algorithm of Calonico, Cattaneo and Titiunik (2014) was used to set the optimal bandwidth to 15 miles and the estimates use parametric triangular kernel weights. Clustered standard errors at the sub-district level are shown in parentheses.

Table A15: Major Tribal Uprisings by Year and Location

Year(s)	**Location**	**Details**
1784–1785	Maharashtra	Koli disturbances involving local resistance.
1789	Chhota Nagpur	Disturbances suppressed with armed forces.
1801, 1807, 1808	Chhota Nagpur	Continued tribal unrest requiring armed intervention.
1803	East Godavari	Rampa rebellion by Koya tribes against local oppression.
1803, 1862, 1879, 1922	Andhra Agency area	Koya Fituri uprisings against Muttadars and petty officials.
1809–1828	Gujarat	Bhil tribe uprisings against British oppression.
1818	Maharashtra	Koli revolt against British authorities.
1825	Assam	Singhpo rebellion against British forces.
1827	Assam	Mishmi tribal resistance.
1829	Assam	Khasi tribe rebellion and Termt Singh uprising, which massacred British generals and sepoys.
1831–1832	Chhota Nagpur	Kol insurrection caused by tribal land settlement issues with non-tribals.
1835	Assam	Dafla raid on British subjects.
1842	Arakan, Sylhet	Lushai raids on British territories, defeating British forces.
1842	Bastar	Tribal uprising in Bastar.
1843	Assam	Singhpo attack on British garrison.
1846	Gujarat	Bhil tribal revolt.
1850	Orissa	Chakra Bisoi rebellion led by Kond leader.
1855	Bengal, Jharkhand	Santhal rebellion against moneylenders and landlords.
1857–1858	Gujarat	Bhil tribe participation in the Indian Rebellion.
1861	Orissa	Juang rebellion.
1887	Chhota Nagpur	Sardar agitation against land alienation.
1895–1900	Chhota Nagpur	Birsa Munda movement against landlords, moneylenders, and missionaries.
1911	Bastar	Continued tribal uprising in Bastar.
1913–1921	Bihar	Tana Bhagats civil disobedience movement.
1942	Orissa	Lakshman Naik rebellion during the Quit India Movement.

Source: Bhuria Committee Report, 2002 (pg. 19-23)

B Appendix Figures

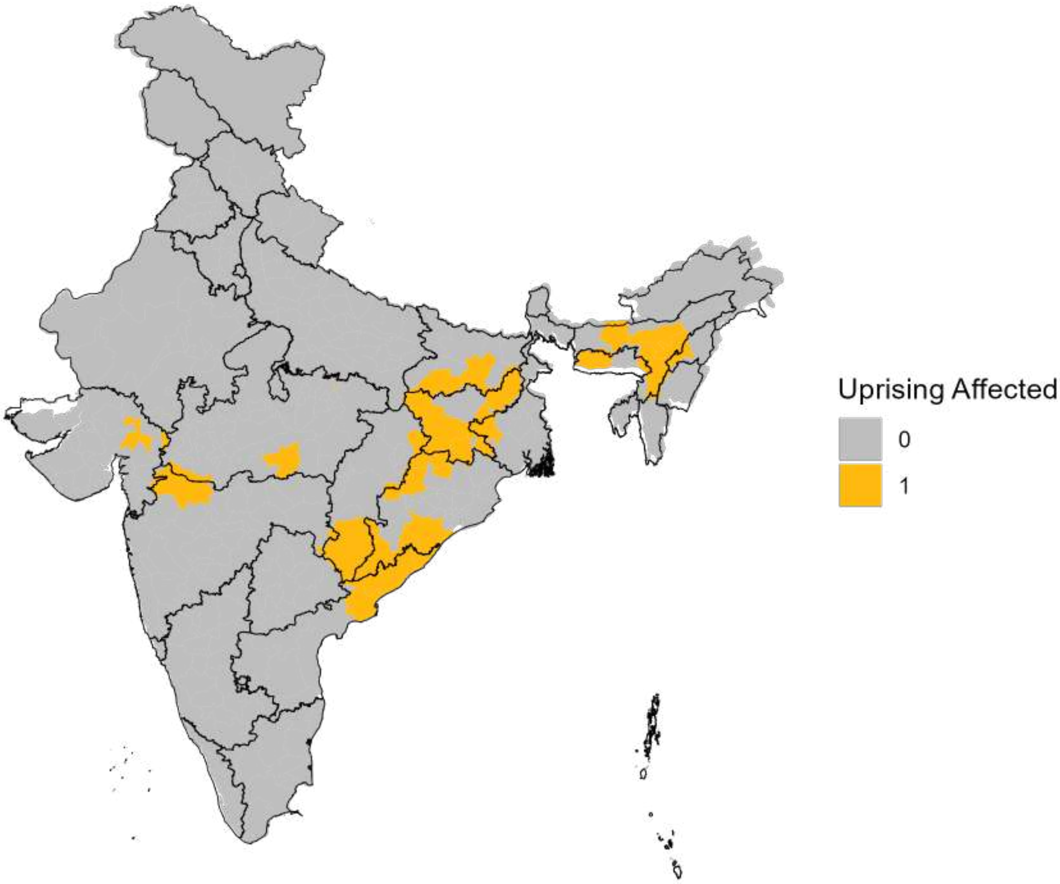
Figure B1: Historical Map

A: Santhal Parganas Region

C: Chotanagpur Region

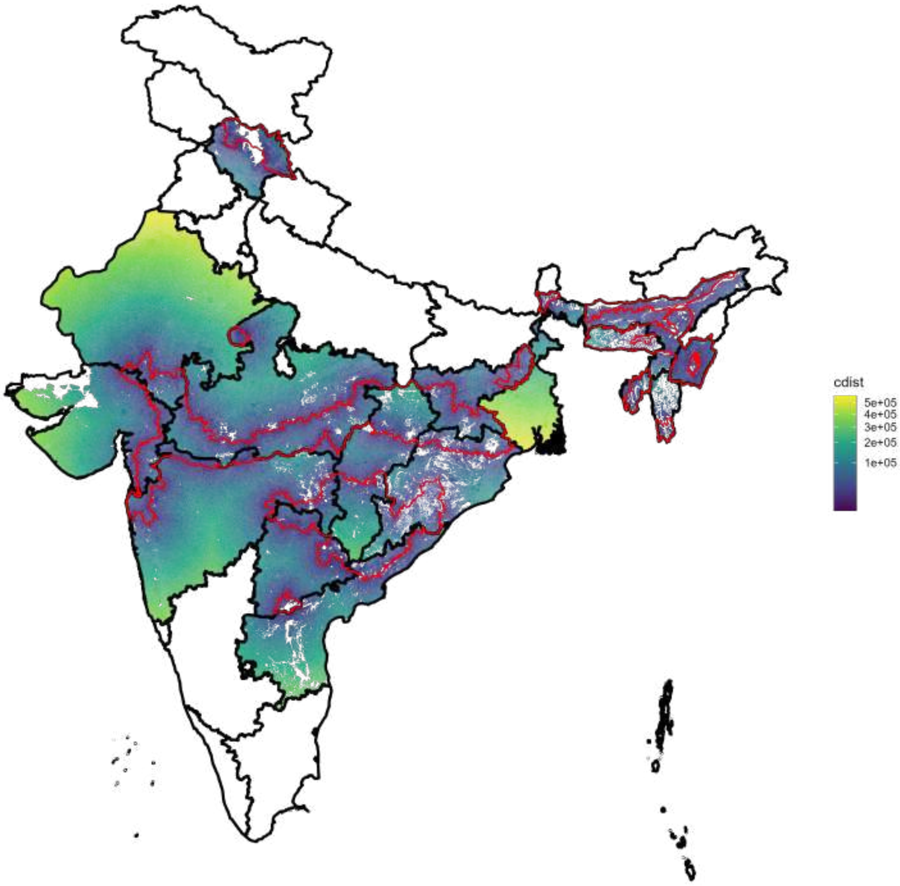
Note: The figure shows historical imagery of the Bengal Presidency in 1907. Areas highlighted in yellow represent the distribution of Indigenous Protected Areas (IPAs), including the portions of Santhal Parganas and the Chotanagpur Region.

Figure B2: Tribal Uprising Affected Areas (1784-1942)



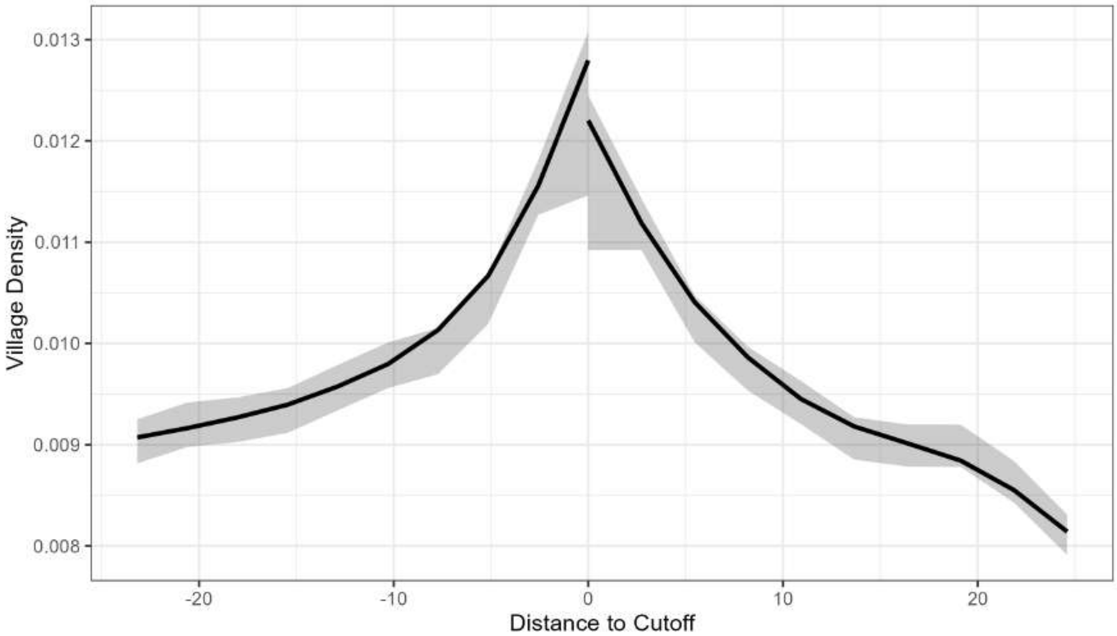
Note: The figure illustrates tribal uprising affected areas between 1790 to 1860. Source: Author's analysis using R and ArcGIS based on the information available in Bhuria Committee Report, 2002

Figure B3: Running Variable



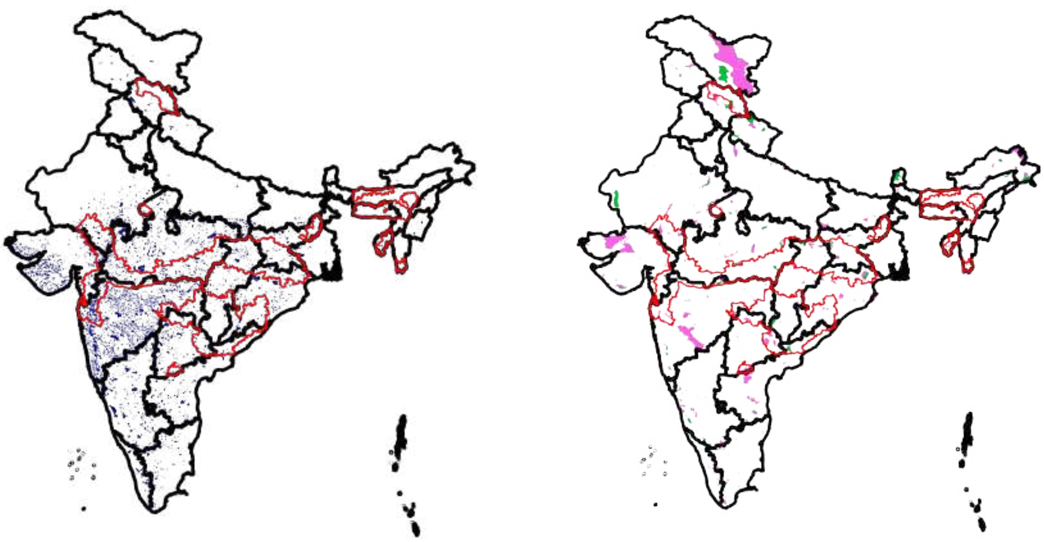
Notes: The figure shows the heatmap (blue to yellow) of running variable. The running variable is defined as the minimum normalized perpendicular distance from the village or town centroid to the within state IPA boundary such that IPA boundaries act as a cutoff point. Source: Author's analysis using R and ArcGIS.

Figure B4: Density Test



Note: The figure shows the results of the McCrary test. The density of villages is estimated within the optimal bandwidth optimal bandwidth of 15 miles across the cutoff boundary using the algorithm by Calonico, Cattaneo, and Titiunik (2014), with parametric triangular kernel weights. Source: Author's analysis using `rddensity` package in R.

Figure B5: Land Acquisition by Project Type



A: Large Irrigation Dams C: Ecological Zones

Note: The figure shows spatial distribution of large public projects that require state acquisition of land. Regions within the red boundary are Indigenous Protected Areas (IPAs). Panel A shows large irrigation and dam projects, based on data from WRIS, Ministry of Water Resources, Government of India. Panel B presents ecological conservation areas, based on data from ESRI's Living Atlas. Source: Author's analysis using Arc-GIS.

C Supplementary Data Appendix

C.1 IPA Boundaries

I obtained a comprehensive list of the Scheduled Areas from the Ministry of Tribal Affairs, Government of India, in response to a Right to Information (RTI) request. The RTI response list can be accessed here. While the principles of Scheduled Areas are enshrined as constitutional provisions, the actual territories were demarcated through successive Constitutional Orders. See the original Fifth and Sixth Schedules to the Constitution.

Based on the RTI response and information from the Ministry of Tribal Affairs' Annual Report 2020 (Annexure 5-C), I provide a brief history of the state-wise declaration of the Fifth Scheduled Areas below. The information highlights how the Scheduled Areas notifications have undergone a series of changes, reflecting shifts in political and administrative classifications over time. The original Constitutional Orders can be accessed here.

However, a significant challenge remains: while the notifications were responsive, they were often based on historical data that did not align with the current census tract information. To address this inconsistency, I employed the district mapping methodology proposed by Kumar and Somantahn (2009) to estimate the correspondence between historical notifications and modern census tracts.

For the Sixth Scheduled Areas, I relied on the administrative information available on the official websites of the respective Autonomous Councils, as detailed below.

Table C1: List of Fifth Schedule Constitutional Orders

State Name	**Details**
Andhra Pradesh (including Telangana)	The Scheduled Areas in the State of Andhra Pradesh were originally specified by the Scheduled Areas (Part A States) Order, 1950 (C.O.No.9) dated 26.01.1950 and the Scheduled Areas (Part B States) Order, 1950 (C.O.No.26) dated 7.12.1950 and have been modified vide the Madras Scheduled Areas (Cesser) Order 1951 (C.O. No.30) and the Andhra Scheduled Areas (Cesser) Order, 1955 (C.O.No.50).
Gujarat	The Scheduled Areas in the State of Gujarat were originally specified by the Scheduled Areas (Part A States) Order, 1950 (Constitution Order No. 9) dated 26.01.1950 and have been respecified as above by the Scheduled Areas (States of Bihar, Gujarat, Madhya Pradesh and Odisha) Order, 1977 (Constitution Order No. 109) dated 31.12.1977 after rescinding the Order cited first so far as that related to the State of Gujarat.
Himachal Pradesh	Specified by the Scheduled Areas (Himachal Pradesh) Order, 1975 (Constitution Order No.102) dated 21.11.1975.

(Continued)

State Name	Details
Maharashtra	The Scheduled Areas in the State of Maharashtra were originally specified by the Scheduled Areas (Part A States) Order, 1950 (C.O.9) dated 26.01.1950 and the Scheduled Areas (Part B States) Order, 1950 (C.O. 26) dated 7.12.1950 and have been respecified under the Scheduled Areas (Maharashtra) Order, 1985 (C.O. 123) dated 2.12.1985 after rescinding the Orders cited earlier in so far as they related to the State of Maharashtra.
Odisha	The Scheduled Areas in the State of Odisha were originally specified by the Scheduled Areas (Part A States) Order, 1950 (Constitution Order, 9) dated 26.01.1950 and the Scheduled Areas (Part B States) Order, 1950, (Constitution Order, 26) dated 7.12.1950 and have been respecified as above by the Scheduled Areas (States of Bihar, Gujarat, Madhya Pradesh and Odisha) Order, 1977, (Constitution Order, 109) dated 31.12.1977 after rescinding the Orders cited earlier in so far as they related to the State of Odisha.
Rajasthan	The Scheduled Areas in the State of Rajasthan were originally specified under the Scheduled Areas (Part B States) Order, 1950 (C.O. 26) dated 7.12.1950 and have been respecified vide the Scheduled Areas (State of Rajasthan) Order, 1981 (C.O. 114) dated 12.2.1981. The Schedule Area of Rajasthan specified in the Scheduled Areas (State of Rajasthan) Order, 1981 (C.O. 114) dated 12.2.1981, have been rescinded vide the Scheduled Areas (State of Rajasthan) Order, 2018 (C.O. 270) dated 19.5.2018.

(Continued)

State Name	Details
Jharkhand	The Scheduled Areas in the composite State of Bihar were originally specified by the Scheduled Areas (Part A States) Order, 1950 (Constitution Order, 9) dated 26.01.1950 and thereafter they had been respecified by the Scheduled Areas (States of Bihar, Gujarat, Madhya Pradesh and Odisha) Order, 1977 (Constitution Order, 109) dated 31.12.1977 after rescinding the Order cited first so far as that related to the State of Bihar. Consequent upon the formation of the new State of Jharkhand vide the Bihar Reorganisation Act, 2000, the Scheduled Areas which were specified in relation to the composite State of Bihar stood transferred to the newly formed State of Jharkhand. The Scheduled Areas of Jharkhand have been specified by the Scheduled Areas (States of Chhattisgarh, Jharkhand and Madhya Pradesh) Order, 2003 (Constitution Order, 192) dated 20.2.2003 after rescinding the order dated 31.12.77 so far as that related to the State of Bihar. The Schedule Area of Jharkhand specified in the Scheduled Areas (States of Chhattisgarh, Jharkhand and Madhya Pradesh) Order, 2003 (Constitution Order, 192) have been rescinded vide the Scheduled Areas (State of Jharkhand) Order, 2007 (C.O. 229) dated 11.04.07.
Madhya Pradesh	The Scheduled Areas in the State of Madhya Pradesh were originally specified by the Scheduled Areas (Part A States), Order, 1950 (Constitution Order, 9) dated 26.01.1950 and the Scheduled Areas (Part B States) Order, 1950. (Constitution Order 26) dated 7.12.1950 and had been respecified as above by the Scheduled Areas (States of Bihar, Gujarat, Madhya Pradesh and Odisha) Order, 1977, (Constitution Order, 109) dated 31.12.1977 after rescinding the Orders cited earlier in so far as they related to the State of Madhya Pradesh. Consequent upon for the formation of new State of Chhattisgarh by the Madhya Pradesh Reorganisation Act, 2000 some Scheduled Areas stood transferred to the newly formed State of Chhattisgarh. Accordingly, the Scheduled Areas have been respecified by the Scheduled Areas (States of Chhattisgarh, Jharkhand and Madhya Pradesh) Order, 2003 (Constitution Order, 192) dated 20.2.2003 after rescinding the Order dated 31.12.77 so far as that related to the State of Madhya Pradesh.

Table C2: List of Sixth Schedule Autonomous Councils

Sl. No.	Autonomous Council	State/UT	HQ	Year	Website
1	Bodoland Territorial Council	Assam	Kokrajhar	2003	bodoland.gov.in
2	North Cachar Hills	Assam	Haflong	1951	nchac.in
3	Karbi Anglong	Assam	Diphu	1952	karbianglong.co.in
4	Garo Hills	Meghalaya	Tura	1973	
5	Jaintia Hills	Meghalaya	Jowai	1973	jhadc.nic.in
6	Khasi Hills	Meghalaya	Shillong	1973	khadc.nic.in
7	Chakma	Mizoram	Kamalanagar	1972	cadc.gov.in
8	Lai	Mizoram	Lawngtlai	1972	ladc.mizoram.gov.in
9	Mara	Mizoram	Siaha	1972	madc.mizoram.gov.in
10	Tripura Tribal Areas	Tripura	Khumulwng	1982	ttaadc.gov.in

D Field Work

Figure D1: Field Research

A: Telangana

B: Gujarat

Notes: The figure shows images from Gram Sabha meetings in Tribal areas in Telangana and Gujarat during my fieldwork in 2017-19 as part of a research team at the Centre for Policy Research, New Delhi. I am forever grateful to Ravi Rebbapragada (SAMTA) and Ambrish and Trupti Mehta (ARCH- Vahini) for facilitating the discussions.