Long-Run Impacts of Land Regulation: Evidence from Tenancy Reform in India [1]

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Abstract

Agricultural tenancy reforms have been widely enacted, but evidence on their long-run impact remains limited. In this paper, we provide such evidence by exploiting the quasi-random assignment of linguistically similar areas to different South Indian states that subsequently varied in tenancy regulation policies. Given imperfect credit markets, the impact of tenancy reform should vary by household wealth status, allowing us to exploit historic caste-based variation in landownership. Thirty years after the reforms, land inequality is lower in areas that saw greater intensity of tenancy reform, but the impact differs across caste groups. Tenancy reforms increase own-cultivation among middle-caste households, but render low-caste households more likely to work as daily agricultural laborers. At the same time, agricultural wages increase. These results are consistent with tenancy regulations increasing land sales to relatively richer and more productive middle-caste tenants, but reducing land access for poorer low-caste tenants.

1 Introduction

The institutional arrangements that shape access to land are central to the functioning of an agricultural economy and have a first-order impact on aggregate poverty. In much of the rural developing world, colonial policies reshaped these relationships, increasing inequality in land ownership and rendering tenurial arrangements more insecure (Binswanger, Deininger & Feder 1995). In conjunction with imperfections in other key markets (e.g. the market for credit), historic inequalities in land ownership remain a significant constraint on long-run economic growth and the transfer of land towards higher return uses.[1] This fact, together with the political salience of the rural sector, has driven significant land reform in much of the developing world during the post-colonial era – and a prominent goal has been increased tenurial security for farmers who do not own land.

However, there is little solid empirical evidence of the long-run impact of tenancy reforms, and limited understanding of whether economic actors use land markets to reduce or amplify the intended impact of these regulations. Using a unique natural experiment in India, this paper provides this evidence in the context of tenancy reforms. India has a long history of state-level land reform (Appu 1996), and we employ village- and household-level data collected in 2002 to trace the impact of land reforms that unfolded in four Southern Indian states (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) between roughly 1940 and 1970.

We have three key findings. First, in the long run, tenancy reform continues to reduce within-village land inequality, predominantly by enabling the transfer of land from upper-caste landowners to middle-caste tenants. Second, landlessness among the historically disadvantaged scheduled caste and scheduled tribe (SC/ST) households increases. Third, agricultural wages rise after tenancy reform.

These findings are consistent with a model in which large landlords rely on tenants for agricultural production but farmer effort is non-contractible. Tenancy reforms unambiguously lower landlord returns from land rental; thus it is logical to expect less use of tenancy and more land sales, particularly to those with access to the credit market. This will lead, in turn, to a change in the distribution of land ownership. Whether the agricultural wage rises or falls with tenancy reform depends on whether the marginal owner-cultivator is more or less productive than the marginal tenant which, in turn, depends on the technology which a landlord has for extracting surplus from tenants.

Tracing through these equilibrium effects complicates the overall welfare impact. Cul-

[1] See for example Pande & Udry (2006), Banerjee & Iyer (2005), and Acemoglu, Johnson & Robinson (2001). Banerjee (2003) provides an overview of the importance of credit market imperfections in development.

tivators who remain as tenants will gain, but marginal tenants will lose out as they become landless laborers. However, their opportunities in the labor market should improve. These are the predictions that we bring to the data.

Our empirical analysis exploits the 1956 reorganization of state boundaries, designed to transform the administrative units inherited from the British colonial government into linguistically coherent states. The reorganization generally allocated sub-district units called blocks to states on the basis of linguistic composition. However, the requirement that states possess a contiguous territory sometimes led to very similar blocks being assigned to different states. These blocks were analogous both in historical experience and caste structure – two factors which, as we describe in Section 2, were significant determinants of landownership patterns – but subsequently experienced significantly different programs of land reform. We seek to exploit this variation in land reform intensity within matched block-pairs.

To do so, we identified six pairs of adjacent border districts for the four states of interest. Within each pair we matched blocks across districts and, therefore, across state boundaries, using a linguistic index based on census data on the population proportion speaking each one of the 18 languages reported spoken in the region. In 2002, we conducted household surveys in a random sample of 259 villages in the 18 best matched blocks; these villages were also linked to data in the 1951 census prior to the state reorganization.

Our analysis, therefore, exploits variation in land reform across block pairs matched on linguistic characteristics. We provide evidence consistent with the assumption that the assignment of different blocks to different states along the border is quasi-random conditional on observable characteristics. In addition, we interact variation in land reform with households' presumed land ownership prior to the reform, proxied by their caste status. This interaction both tests the key theoretical predictions about the differential impact of land reform on households with different baseline characteristics, and allows for the estimation of a causal effect of land reform under the weaker identification assumption of no systematic variation in between-caste group differences across state borders.

Our findings contribute to a large literature on institutional persistence (Acemoglu, Johnson & Robinson 2001, Banerjee & Iyer 2005). While the relationship between institutional patterns and economic outcomes has been widely analyzed, the focus on aggregate outcomes makes it challenging to explore specific mechanisms through which the two are linked. Detailed household survey data allows us to examine changes in household landholdings and labor market behavior that are generated by reforms.

Our paper also employs an innovative empirical strategy. While several recent papers have exploited the random assignment of borders for institutional variation (Michalopoulos

& Papaioannou 2011), sampling blocks that are linguistically similar but not immediately geographically adjacent allows us to use an innovative empirical strategy to address the concern raised by Bubb (2011) that there is little de facto variation in property rights across state borders, even if there is de jure variation.

This paper is organized as follows. Section 2 provides background on tenancy reform, a brief review of the literature on the economic impact of land reform, and a description of the natural experiment. Section 3 presents a theoretical framework used to generate predictions about tenancy reform. Section 4 introduces the data and discusses the empirical strategy. Section 5 provides the empirical results, and Section 6 concludes.

2 Background

This section provides relevant historical background, including an overview of the history of land reform in India and existing evidence about its effectiveness. We also describe the language-based state reorganization policy exploited by our identification strategy.

2.1 Land Relations in India

The social and economic structure of rural India is intrinsically tied to the caste system. Hindus, who make up over 80% of India's population, are born into castes, endogamous groups defined by closed marriage and kinship circles. Historically, the caste system also defined household occupation, with landownership restricted among lower castes. At Independence, India's large landowners were typically drawn from the upper castes, and there were two primary categories of tenants.

First, occupancy tenants enjoyed permanent heritable rights on land and relative security of tenure, and could claim compensation from landlords for any improvement on the land. These households were typically drawn from the middle and lower castes (often grouped as Other Backward Castes or OBCs). Second, tenants at will lacked security of tenure and could be evicted at the will of the landlord. They were largely drawn from the lowest castes and tribal households (grouped as Scheduled Castes and Tribes or SC/ST).

Quantitative and qualitative evidence from India's early post-independence period emphasized that lower castes were largely landless laborers, servants, or tenants for the upper castes: e.g., in Tamil Nadu, 59% of the members of one upper caste were reported to be either landlords or rich peasants, while only 4% of the untouchable caste were landlords (Srinivas 1966, Sharma 1984). This translated into widespread landlessness – by 1956, estimates suggest that roughly one in every three rural household was landless, with the prevalence much higher among lower castes (Kumar 1962, Shah 2004).

At independence, the Constitution declared land reform to be a state subject, and state-level legislation followed rapidly. This wave of legislative activity included several major initiatives: the abolition of intermediaries, the imposition of land ceilings, and tenancy reforms. The first class of reforms abolished the zamindari system under which landlords were responsible for tax payments on behalf of their tenants, instead moving tenants to a regime of direct taxation by the state. These reforms afforded relatively few immediate benefits, and even worse, often led to large-scale ejecting of "tenants-at-will, undertenants and sharecroppers" since the laws abolishing zamindari allowed for retention of land for personal cultivation (Appu 1996).

Ceiling reforms, by contrast, sought to place a limit on legal landholdings but were weakened by provisions that set a high ceiling, established multiple exceptions to the stated limit on landholdings, and offered no clear process to identify and proceed against holders of surplus land (Rajan 1986, Radhakrishnan 1990).[2] Moreover, redistributed land was often in small plots and of poor quality, requiring substantial (and likely unaffordable) investments prior to cultivation (Herring 1991).

The final set of reforms – tenancy reforms that regulated relationships between tenants and landlords or, in some cases, rendered tenancy illegal – are widely identified as the best implemented form of legislation, characterized by more limited manipulation and fewer administrative bottlenecks (Eashvaraiah 1985, Herring 1991). However, even in this case, several authors note that larger tenants were the primary beneficiaries of tenancy provisions and differential eviction of informal tenants was common (Appu 1996).

The historical literature has elaborated extensively on the challenges encountered in implementing tenancy reform. Eashvaraiah (1985) in his analysis of Andhra Pradesh argues that the 1950 tenancy reform in effect created two classes of tenants, since those who were already evicted to avoid previous reforms were not reinstated and remained landless. Similarly, Pani (1983) argues that the implementation of land reform in Karnataka led to a large number of former tenants becoming agricultural laborers. Das (2000) contends that land reform resulted in tenants with substantial rights obtaining freehold occupation, while "inferior tillers," defined as inferior tenants, sharecroppers, contract farmers or paid laborers, lost access to cultivable land entirely. When tenants were evicted in anticipation of or in violation of tenancy reforms, the land they formerly occupied was cultivated directly, sold to other buyers operating outside the framework of the land reform, or redistributed to friends and family – a method of evasion also employed in response to ceiling reforms (Herring 1970, Ghatak & Roy 2007).

Two reasons motivate our focus on tenancy reform. First, the previous literature

[2]Mearns (1999) also argues that ceiling reforms achieved little because of the prevalence of loopholes and the bribing of record keepers or falsification of land records; see also Herring (1970) and Bandyopadhyay (1986).

generally suggests this was the only successful type of land reform, though certainly not without challenges. Second, this emphasis is consistent with the recent re-orientation of the broader land reform agenda towards a focus on the potential of land rental markets, appropriately regulated, to increase land access (Deininger & Binswanger 1999).

Third, the design of tenancy laws implied that their impact would vary systematically with a household's initial tenurial security and access to credit. In almost every state, tenancy laws granted landowners rights of resumption for "personal cultivation," while tenants who remained on non-resumable tenanted land were eligible for ownership rights. In setting the land price, states either directly established a price or, on occasion, subsidized the market price; while some financing was made available, access to credit was certainly not universal (Pani 1983). The design of the legislation thus generated a high probability that the impact of land reform would be heterogeneous across pre-reform landownership status, which is closely linked to the historic caste structure.

Data on tenancy reform in Southern India is assembled from a variety of historical sources and summarized in Appendix Tables D1 to D3. Kerala undertook the most extensive land reform, and by the end of the period had prohibited tenancy. Andhra Pradesh and Tamil Nadu both experienced intermediate levels of land reform, while Karnataka saw a more limited land reform agenda. In all four states, provisions on maximum rent and tenants' rights to purchase land disincentivized tenancy arrangements (Appu 1996). Appendix Table D4 provides a summary of the number of tenancy reforms before and after the 1956 reorganization of state boundaries discussed in the next section.

We conclude with a review of quantitative studies on land reform in India. Banerjee, Gertler & Ghatak (2002) analyze Operation Barga, a program that encouraged tenancy registration in West Bengal, and find that it led to significant increases in agricultural productivity. However, Bardhan, Luca, Mookherjee & Pino (2011) find no clear evidence of reductions in inequality. A broader literature uses state-level variation in land reform to estimate its effect. Using cross-state evidence, Besley & Burgess (2000) find significant correlations between land reform and poverty reduction, while Conning & Robinson (2007) show that tenancy rates did fall as a result of land reform. Ghatak & Roy (2007), by contrast, find no significant impact of land reform on land inequality as measured by the Gini coefficient.

Several recent studies examine the political economy of land reform. Mookherjee & Bardhan (2010) find evidence that the intensity of political competition (rather than party ideology) drives the local incidence of land reform in West Bengal. At the same time, Anderson, Francois & Kotwal (2011) argue that even post-land reform, landowners benefit from clientelist structures that they use to maintain political power and limit the implementation of policies that would redistribute income away from them. By

documenting the pattern of gainers and losers, our analysis provides evidence that is useful in analyzing these political economy questions.

2.2 State Reorganization in South India

Our identification strategy seeks to exploit the 1956 reorganization of state boundaries in South India. At the founding of India in 1947, its administrative structure reflected the history of expansion of the British East India Company and subsequently the British colonial government. Southern India was composed of five states: Hyderabad and Mysore had been princely states under British rule, governed by local rulers with indirect colonial control,[3] Travancore and Cochin were progressive princely states located on the southwest coast, and the remainder of South India was directly ruled under the Madras presidency.

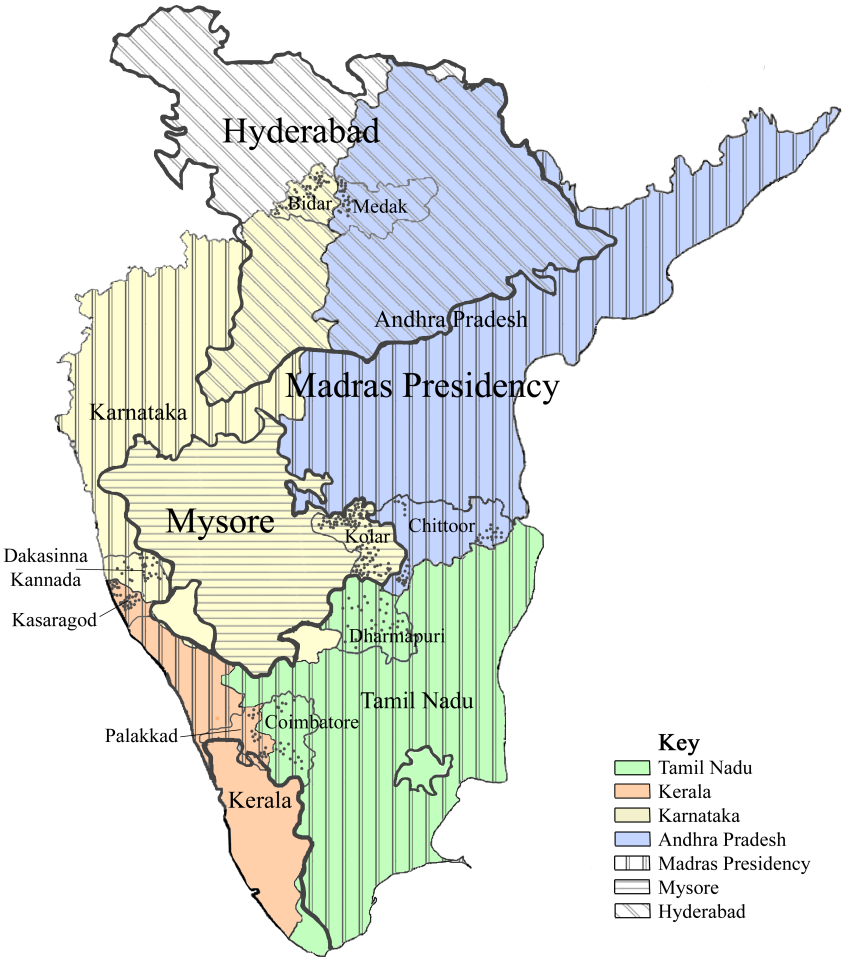
In the post-independence period, a movement grew to redraw state borders along linguistic lines. Based on the recommendations of a national commission, South India was divided into four linguistically unified states in 1956: Andhra Pradesh (AP), a largely Telugu-speaking state, was created from Hyderabad and the Telugu-majority areas of the Madras presidency. Karnataka (KA), intended to be predominantly Kannada-speaking, was created by the merger of Mysore and Kannada-speaking areas of Hyderabad and the Madras and Bombay presidencies. Kerala (KE), predominantly Mayalayam-speaking, encompassed the princely states of Travancore and Cochin and parts of the Madras presidency. Tamil-majority areas of the Madras presidency constituted Tamil Nadu (TN).

Districts were assigned to states primarily on the basis of the majority language spoken, but also in order to fairly assign valuable cities and ports, reasoning that was explained in great detail in the report produced by the commission (Government of India 1955). Figure 1 shows the borders of the new South Indian states overlaid on the previous state borders, also highlighting the sample districts.

The state reorganization commission largely maintained the sub-state administrative units of districts and blocks unchanged, but in some cases blocks were reassigned across districts. Inevitably, there were a number of cases on the borders of the new states in which two blocks with similar climate, geography and linguistic composition were separated into different states. Our identification strategy seeks to identify block-pairs in border districts matched along linguistic dimensions and with shared political history, and exploit variation in the intensity of land reform within these matched block-pairs. The assumptions under which estimating the impact of land reform within a block-pair leads to unbiased estimates will be outlined further in Section 4.

[3]Hyderabad had originated as the territory of a Mughal governor who established control over part of the empire's territory in the Deccan plateau. Mysore emerged out of the defeat of the kingdom of Tipu Sultan in the early 19th century.

Figure 1: Southern Indian States



Notes: This map shows the borders of the historical princely states as well as the four modern states of South India. The colors denote modern states, while the patterns denote princely states. The labeled districts are the sampled districts of interest. Six district pairs will form the primary sample. There are three simple pairs of districts (Bidar and Medak, Kasaragod and Dakasinna Kannada, and Palakkad and Coimbatore). In addition, three adjoining districts are compared pairwise, yielding three additional pairs (Kolar and Chittoor, Chittoor and Dharmapuri, and Kolar and Dharmapuri).

3 Conceptual Framework

Tenancy reforms can best be conceptualized as strengthening the rights of tenants. To capture the impact of this reform, we develop a simple model in which landowners lack skill to farm land directly and thus choose whether to sell or rent their land. Tenancy reform reduces the fraction of the surplus that a landlord can capture, and therefore may lead them to choose to sell more land, thus altering patterns of land ownership, labor demand and wages. The model makes predictions about when wages will increase as a consequence of an improvement in the rights of tenants.

3.1 Basics

There are three groups in the population: a single landlord who owns all of the land and two groups of potential cultivators.[4] The landlord owns a measure of land $L < 1$ which we assume he cannot farm directly. The technology matches one unit of land to one cultivator. The group of potential cultivators/laborers is equal to 1: in other words, land is scarce.

The first group of cultivators, a fraction γ, have access to the capital market or some other form of wealth so that they can offer to buy land. In our data, this group will mainly consist of OBC households, but it could include some SC/ST households. The second group of cultivators, a fraction of $(1-\gamma)$, cannot buy land but can be engaged as tenants.[5]

We suppose that the cultivator can exert effort at cost c. If he does so, then output is produced with probability one. Without effort, output is produced with probability $q < 1$. The production function is:

$$\theta \frac{1}{\eta} \ell^{\eta}$$

where $\eta < 1$ and $\theta \in \left[\underline{\theta}, \overline{\theta}\right]$ is an idiosyncratic productivity parameter which can be thought of as a cultivator's ability or access to relevant human capital. This is a standard Lucas span of control model (Lucas 1978). For simplicity, we assume that the

[4] Although this is the most extreme assumption and is made to keep things simple, monopoly power by landlords within a locality is not implausible.

[5] Empirical evidence is consistent with the assumption that access to credit is greater for OBC households in this region. Village-level data from the India Human Development Survey (IHDS) in 2005 reports both the number of credit-granting institutions (bank branch office or credit cooperative, credit or savings group, or NGOs) present in a sample of rural villages and the breakdown of the village population by caste group. Data is reported for 309 villages in the four South Indian states of interest. There is a strong positive correlation between the proportion of the population that is OBC and the presence of credit-granting institutions, conditional on the village's accessibility by road. The correlation between the proportion of the population that is SC/ST and the presence of credit-granting institutions, by contrast, is negative, though marginally insignificant at conventional levels.

cummulative distribution function of ability is the same for both groups of farmers. We denote this by $G(\theta)$ with the corresponding probability density function being $g(\theta)$.[6]

Cultivators hire labor in a competitive labor market at a wage of w. Labor is supplied by all individuals. Let:

$$\pi(\theta, w) = \arg\max_{\ell} \left\{ \theta \frac{1}{\eta} \ell^{\eta} - w\ell \right\} = \frac{1-\eta}{\eta} \theta^{\frac{1}{1-\eta}} w^{-\frac{\eta}{1-\eta}}.$$

be the surplus generated by the land when it is cultivated by an individual with ability θ and the wage rate is w. Labor demanded by a type θ cultivator is $(w/\theta)^{-\frac{1}{1-\eta}}$.

There are two institutions: owner-cultivation and tenancy. With owner cultivation, the cultivator exerts effort if $(1-q)\pi(\theta, w) > c$. We will suppose that this condition holds for all cultivators in the equilibrium described below. Since the landlord is a monopolist, he will earn $\pi(\theta, w) - c$, i.e. the landlord captures all of the surplus.

Now consider what happens with a tenancy reform. We will suppose that the landlord has access to a sanction, $\sigma (\leq c)$, such as an eviction threat, which can be used if the tenant does not produce. We will suppose that tenancy reform affects the availability of sanctions by lowering σ. The tenant will exert effort, given that he has to pay R to the landlord, if and only if $(1-q)[\pi(\theta, w) - R] \geq c - \sigma$. This being the case, the maximum amount that the landlord can extract from the tenant is defined by the level of R which makes this condition hold with equality, i.e.

$$R^{\max}(\theta) = \pi(\theta, w) - \frac{c-\sigma}{(1-q)}.$$

In this case, the landlord's surplus from tenancy is therefore increasing in σ, i.e. a higher sanction reduces the surplus that the tenant needs to receive to put in effort. Given the landlord is a monopolist, he will earn $R^{\max}(\theta)$ from a tenancy arrangement. He will compared this with selling where he can earn $\pi(\theta, w) - c$.

3.2 Equilibrium Land Allocation

In this section, we study the equilibrium allocation of land for a fixed wage. The landlord must decide how to divide his land between parcels that he wishes to sell and those that he wishes to rent out to tenants. There is a strict ordering within each group about who is most profitable as a tenant or owner-cultivator, and the landlord chooses a pair of cutoff "abilities" such that the surplus extraction from a unit of land to marginal owner-cultivator and tenant is equalized.

[6] None of our results hinge therefore on differences in the distribution of human capital by group.

To define the equilibrium land allocation, it is useful to define $\Delta \equiv \frac{cq-\sigma}{(1-q)}$, the sign of which will determine whether the marginal cultivator is more or less productive than the marginal tenant. We will write the equilibrium as a function of Δ, but since this depends on σ, it provides a means of studying how changes in legal sanctions on tenants affect land allocation decisions.

Let $\left\{x^T(\Delta, w), x^O(\Delta, w)\right\}$ be the cutoff levels in the ability distribution as a function of w and Δ. Any individual whose productivity is above this cutoff level is either a tenant if she cannot buy land or becomes an owner is she can buy land. The equilibrium values of these cutoff levels are determined by two equations. The first is a market clearing condition which says that all land is either sold or cultivated by tenants and is given by:

$$L = (1-\gamma)\left[1 - G\left(x^T(\Delta, w)\right)\right] + \gamma\left[1 - G\left(x^0(\Delta, w)\right)\right]. \tag{1}$$

The second says that the marginal tenant and the marginal owner-cultivator must yield the same surplus to the landlord. This is given by equating $R^{\max}\left(x^T(\Delta, w)\right)$ and $\pi\left(x^O(\Delta, w)\right) - c$ and is given by:

$$\Delta = \frac{1-\eta}{\eta} w^{-\frac{\eta}{1-\eta}} \left(\left[x^T(\Delta, w)\right]^{\frac{1}{1-\eta}} - \left[x^O(\Delta, w)\right]^{\frac{1}{1-\eta}}\right). \tag{2}$$

As noted above, the parameter Δ determines the relative surplus that can be extracted from tenants and owner-cultivators and reflects the value of σ. Note also that Δ can be positive or negative.

The following result derives a comparative static which shows how the mix of landlord and tenants depend on the sanctions that are available to the landlord when employing a tenant. The proof is given in the Appendix.

Proposition 1 *Tenancy reforms that reduce σ will increase the productivity of the marginal tenant relative to the productivity of the marginal owner-cultivator. Hence there is a switch from tenancy towards owner-cultivation, specifically $\partial x^T/\partial\Delta > 0$ and $\partial x^O/\partial\Delta < 0$.*

This result links the extent of owner-cultivation to σ which determines the relative profitability of the two types of cultivators, recalling that $\Delta = \frac{cq-\sigma}{(1-q)}$.

3.3 Endogenous Wages

We now allow wages to adjust by analyzing the labor market equilibrium, specifically considering how labor demand is affected by changes in the sanctions that landlords can legally impose on tenants. To do this, we assume that the whole population supplies

labor, regardless of whether they are tenants or owner-cultivators. Equating labor supply and labor demand (derived from Shephard's lemma), the equilibrium wage, which depends on σ via Δ, solves:

$$\begin{aligned} 1 &= (1-\gamma)\int_{x^T(\Delta,w)}^{\bar{\theta}} -\pi_w(\theta,w)\,dG(\theta) + \gamma\int_{x^O(\Delta,w)}^{\bar{\theta}} -\pi_w(\theta,w)\,dG(\theta) \\ &= w^{-\frac{1}{1-\eta}}\tilde{\theta}(\Delta,w)\ , \end{aligned} \tag{3}$$

where $\tilde{\theta}(\Delta,w) = \left[(1-\gamma)\int_{x^T(\Delta,w)}^{\bar{\theta}} \theta^{\frac{1}{1-\eta}}dG(\theta) + \gamma\int_{x^O(\Delta,w)}^{\bar{\theta}} \theta^{\frac{1}{1-\eta}}dG(\theta)\right]$ is a measure of average productivity given $\left(x^T(\Delta,w), x^O(\Delta,w)\right)$ among farmers. It is straightforward to show that $\tilde{\theta}(\Delta,w)$ is decreasing in w, i.e. the labor demand function slopes downwards (see the Appendix).

How changes in the equilibrium wage respond to tenancy reform can be studied by seeing how labor demand depends on Δ, employing equation (3). We show in the Appendix that:

$$\frac{\partial\tilde{\theta}(\Delta,w)}{\partial\Delta} = \gamma g\left(x^O(\Delta,w)\right)\frac{\partial x^0(\Delta,w)}{\partial\Delta}\left[\frac{\eta}{1-\eta}w^{\frac{\eta}{1-\eta}}\Delta\right] \tag{4}$$

after employing equations (1) and (2). Whether or not aggregate labor demand shifts out following an increase in Δ thus depends on the sign of Δ. It shifts outwards if Δ is negative, i.e. the marginal tenant is more productive than the marginal owner-cultivator. Observing that $\Delta < 0$ when σ is large enough implies that the aggregate labor demand curve will shift out when σ is initially high enough. We state this in the following result, proven formally in the Appendix:

Proposition 2 *Tenancy reforms that reduce σ will increase the equilibrium wage when landlords can initially impose strong sanctions on tenants.*

Intuitively, this is the case because when $\Delta < 0$, the marginal tenant is less productive than the marginal owner-cultivator. Hence reducing σ puts land in the hands of cultivators who are more productive and therefore demand more labor, leading to the wage being bid up.

Note though that if $\Delta > 0$, the effect goes in the opposite direction: since the marginal tenant is now more productive than the marginal cultivator, reducing tenancy reduces labor demand. Thus, it is ultimately an empirical question which way the wage effect goes in practice.

3.4 Tenancy Reform

The model makes multiple predictions about the impact of this shift on landholding and wages, summarized as follows.[7]

Model Predictions: *Suppose that tenancy reform reduces Δ. The model predicts the following equilibrium responses:*

1. *An increase in landholding among the sub-group of the population with better capital market opportunities.*
2. *A reduction in tenancy.*
3. *An ambiguous effect, in general on the agricultural wage depending on whether Δ is positive or negative.*

As we have already noted, all of these effects of tenancy reform follow intuitively from the analysis above. By making tenancy less attractive, landlords sell more land creating a larger group of owner-cultivators who have the resources to purchase land.

The model can also be used to explore the impact of tenancy reform on land inequality. A fraction

$$\beta_L(\Delta) \equiv \left[(1-\gamma) + \gamma G\left(x^O(\Delta, w(\Delta))\right)\right]$$

are landless among whom $(1-\gamma)\left[1 - G\left(x^T(\Delta, w(\Delta))\right)\right]$ are tenants. A fraction $\gamma\left(1 - G\left(x^O(\Delta, w(\Delta))\right)\right)$ of the population owns land as owner-cultivators.

Putting this together, it is straightforward to see that an increase in Δ leads to a new land distribution which Lorenz dominates the initial distribution. Hence, a wide variety of inequality measures, such as the Gini coefficient, should show a reduction in land inequality after tenancy reform.

To map the model further onto the data, note that we expect caste membership to map crudely onto our two cultivator sub-groups. Specifically, suppose that $\gamma = \gamma_{SC/ST} + \gamma_{OBC}$, then we would expect that $\gamma_{OBC} > \gamma_{SC/ST}$. While land ownership should rise in both groups, we expect this to be a larger effect for OBC households. Moreover, reductions in tenancy should be larger for SC/ST households, with a greater increase in participation as agricultural laborers. Land inequality between castes may increase as result of tenancy reform, since OBC households will benefit disproportionately. Average income among the cultivator group J is:

$$\mu_J(\Delta) = w(\Delta) + \frac{1-\eta}{\eta}\left[(1-\gamma_J)\left[1 - G\left(x^T(\Delta, w(\Delta))\right)\right]\frac{c-\sigma}{1-q}\right]$$

[7] These are all shown formally in the Appendix.

where we have used the fact that the landlord extracts all of the owner-cultivators surplus and leaves a rent to the tenant as a means of encouraging effort. The effect of a change in Δ on this expression is ambiguous when it comes from a fall in σ. However, we expect it to increase when Δ is initially negative.

4 Data and Empirical Strategy

Our analysis makes use of multiple datasets. In this section we describe each dataset in detail, and outline the empirical strategy employed in the primary analysis.

4.1 Data

4.1.1 Tenancy Reform Data

Section 2.2 provided background on tenancy reform in the states of interest. A complete index of specific provisions enacted as part of tenancy reforms includes minimum terms of lease; the right of purchase of nonresumable lands; the right to mortgage land for credit; mandatory recording of tenant names; limitations on the landlord's right of resumption; caps on rent; temporary protection against eviction or prohibition of eviction; prohibition of eviction for public trusts; the establishment of a system of processing land titles; the extension of formal tenancy to more classes of tenants; and the extension of full ownership rights to tenants.

Our primary definition of land reform follows Besley & Burgess (2000) and assumes that each piece of legislation represents a separate land reform event, and therefore is presumed to have an additional, cumulative impact on the distribution of land. We term this measure tenancy index A. The assumption underlying construction of this index may be violated if passage of additional legislation reflects simply the fact that earlier legislation was incomplete or ineffective, or if some states enact land reform incrementally while others enact only a few broad pieces of legislation.

To address this concern, we also report results for a second measure of tenancy reform denoted tenancy index B. This measure directly indexes the provisions enacted within the broad set enumerated above. Each district is assigned a dummy variable equal to one if the district experienced this type of reform, and the total score for tenancy is equal to the sum of these dummy variables.

In theory, it might be useful to measure tenancy reform using underlying continuous measures of tenant rights that are altered by legislation: for example, the maximum percent of the harvest that can be charged as rent. However, as will become evident, there are relatively few reforms that can be characterized using continuous parameters,

and there is no obvious case in which there are comparable reforms in different states that can be described using is the same continuous scale.[8] In addition, the quality of data on implementation by state may itself be correlated with political commitment to land reform.

For this reason, these summary measures of land reform must be used to approximate the relative intensity of land reform in different jurisdictions. Clearly, these reform indices may mask significant heterogeneity in implementation in different states. We see our empirical strategy as analogous to an intent-to-treat analysis: while some reforms are poorly implemented, our estimates should provide an idea of the average effect of reforms enacted. This is still a parameter of policy interest, and arguably the primary parameter of policy interest given that the underlying bureaucratic or political processes that shape the quality of implementation are often hard to change.

4.1.2 Household and Village Survey

Our sample includes nine boundary districts in four Southern Indian states. Three sets of two adjacent districts constitute three separate pairs, and three adjacent districts (Kolar, Chittoor and Dharmapur) are compared pairwise, generating three additional pairs. Thus in total, there are six pairs of districts. Within each district pair, blocks were matched on linguistic similarity using a linguistic index based on 1991 census data on the proportion of the population speaking each one of the 18 languages reported spoken in the region (for further details, see Appendix B).

The language match index sought to identify block pairs separated by the post-1956 state boundaries where the difference across blocks in proportion to population speaking each language is minimized. Within a district pair, the three independent (i.e., non-overlapping) pairs of blocks that were linguistic best matches were selected, yielding 18 matched pairs of blocks (three pairs of blocks for each of six pairs of districts). The match quality indices for these block pairs are, on average, one and a half standard deviations lower (i.e., a closer match) than the mean.[9] Further data on the linguistic compatibility of matched blocks in each district-pair can be found in Table B1 in the Appendix. In South India, kinship structures and caste groups are defined within linguistic groups (Trautman 1981); accordingly, blocks with similar linguistic comparison may plausibly

[8]Ceiling reforms might be more easily characterized by the level of mandated ceiling, which varies more or less continuously. However, many historians have argued that equally important dimensions of ceiling reform include the mandated exceptions, or lack thereof, and the process by which excess land is identified and seized. Regardless, the evidence presented here will suggest that ceiling reforms do not have any significant impact on landownership patterns.

[9]However, the language match is not, on average, as close for matched pairs across state lines (mean language match index of 0.27, standard deviation 0.21) as for within-state block-pairs (mean 0.15, standard deviation 0.13).

be considered to have similar caste structures.

The outcome variables were measured in a series of interlinked surveys conducted in the sampled villages in 2002. In each of a randomly selected 259 villages, 20 household surveys were conducted, yielding a sample of 5180 households. Households were randomly selected, with the requirement that at least four households were SC/ST households. The survey collects data on familial structure, occupation, landholdings, and assets, as well as political knowledge and participation.

The second data set comprises data collected in a larger set of 522 villages at a village-wide participatory rural appraisal (PRA) meeting at which attendees were asked to provide information about the caste and land structure in their villages, including the name of all castes represented and whether they were SC/ST, the number of households that belong to each caste, and the number of households falling into each one of a number of landowning categories. The same meeting was also used to obtain information from villagers about prevailing agricultural and construction wages.[10]

The sampled villages are then linked to 1951 census data at the block and village level. The 1951 census reported the number of households in several land-owning/occupational categories (landlords, independent cultivators, tenants and landless laborers, as well as households working in manufacturing, commerce, transportation and services), as well as data about literacy and the male and female population in the village.

We are able to match 302 of the 522 villages in the village-level sample, and 287 of these villages also have complete topographic data as described in the next paragraph. Of these villages, 138 had household data collected. We restrict ourselves to examining non-Muslim households in these villages for whom caste identity is clearly established, yielding a sample of 2597 households for the household-level analysis.[11] The 287 villages for which a full set of historical and topographic controls are available are the primary sample for the village-level analysis. Table B2 in the Appendix provides a detailed description of the district composition of the main sample and the village and household subsamples.

In addition, a range of topographic variables at the village level are compiled. Village elevation and slope is drawn from the ASTER dataset, and precipitation data from the India Meteorological Department.[12] Data on soil quality is obtained from the Harmonized World Soil Database; principal component analysis is executed on a large set of soil

[10]For another example of the use of this methodology, see Duflo, Chattopadhyay, Pande, Beaman & Topalova (2009).

[11]The full sample of household surveys in these 138 villages is 2760; 163 households, or 6%, are Muslim and are thus excluded from the analysis.

[12]Precipitation at the village level is calculated by interpolating rainfall from stations using the inverse distance weighting method, employing only stations within 100 kilometers of the village of interest. Data from the years 1998–2003 is used to construct the mean and standard deviation of rainfall.

characteristics to generate two summary indices of soil quality.[13]

4.2 Identification Strategy

To examine the impact of tenancy reform we will employ two primary specifications:

$$Y_{ivp} = \beta_1 R_{vp} + \beta_2 R_{vp} \times O_{ivp} + \beta_3 R_{vp} \times S_{ivp} + \beta_4 O_{ivp} + \beta_5 S_{ivp} + \beta_6 X_{vp} + \beta_7 \chi_{ivp} + \gamma_p + \epsilon_{ivp} \tag{5}$$

$$Y_{vp} = \beta_1 R_{vp} + \beta_2 X_{vp} + \gamma_p + \epsilon_{vp} \tag{6}$$

Y_{ivp} denotes an economic outcome for household i in village v and block-pair p, and Y_{vp} denotes a inequality measure for village v in pair p. R_{vp} is an index of land reform for village v in block-pair p. O_{ivp} and S_{ivp} are indicators for the household's OBC or SC/ST caste status, and X_{vp} and χ_{ivp} denote village- and household-level controls respectively. All regressions include a block-pair fixed effect γ_p.

The key identifying assumption is that, conditional on block-pair fixed effects and other observable characteristics, villages are quasi-randomly assigned to states and thus to alternate regimes of land reform. To test this assumption, we implement a simple specification check to evaluate whether assignment to different post-1956 land reform regimes is correlated with village topography as well as pre-period village characteristics within block-pairs. The absence of systematic assignment based on time-unchanging or pre-reform covariates would suggest that state assignment is plausibly quasi-random within block-pairs.[14] The estimating equation of interest is:

$$\tilde{R}_{vp} = \beta X_{vp} + \gamma_p + \epsilon_{vp} \tag{7}$$

where X_{vp} denotes covariates measured at the village level, $\tilde{R}_{vp}$ denotes the number of tenancy reforms in village v of pair p post-1956 and γ_p are block-pair fixed effects .

Topographic measures employed include village elevation and slope; the mean and standard deviation of rainfall, as well as dummy variables for a village having unusually high or low mean rainfall (above/below the 75th/25th percentile); and the two indices of soil quality already described. Village demographic covariates include total population, the male and female literate population, and the number of households engaged in eight specified occupational categories, both agricultural and non-agricultural, all as measured

[13]The soil characteristics included are the proportion of clay, silt, sand, gravel and organic carbon in the topsoil and subsoil respectively; the topsoil and subsoil Ph; and the proportion of calcium carbonate in the subsoil.

[14]The identification strategy also requires that the primary channel through which state assignment affects landownership patterns is land reform; this assumption will be discussed in more detail later.

in the 1951 census. The primary language spoken in the household and whether the household speaks a second language are measured in the 2001 survey conducted by the authors.[15] Given that linguistic patterns in rural areas are expected to be relatively time-invariant, this will serve as a useful additional test of language-matching.

As land reform varies at the level of the princely state (the pre-independence unit of administration) and the state, standard errors should be clustered at that level, yielding seven clusters. Given that inference employing clustered standard errors with a low number of clusters can be more unreliable than inference using standard heteroskedasticity-robust standard errors, we employ a wild bootstrap to bootstrap the T-statistics within each princely state-state cluster, following Cameron, Gelbach & Miller (2008). The wild bootstrap is implemented following best practices summarized in the same paper, in which estimation requires imposing the null hypothesis and employing Rademacher weights.[16] The sample is restricted to the villages reported all village-level covariates of interest, the 287 villages included in the subsequent village-level results.

The results are reported in Table 1. In general, there is no systematic pattern of assignment of villages with different characteristics to states with different regimes of land reform. There is some evidence of correlations between the tenancy indices employed and elevation and one measure of soil quality, as well as the overall population. There is also some evidence of a correlation between the population of cultivators and tenancy index B that is marginally insignificant at conventional levels, but there is, importantly, no evidence of a significant correlation between the population of tenants or landless laborers and the subsequent history of land reform. In all specifications, the pair fixed effects have significant explanatory power (the p-value for their joint significance is not reported but available on request), demonstrating that within-pair comparisons do effectively control for unobserved heterogeneity across blocks.

Our analysis is premised on the assumption that state assignment of the block pair members is independent of the state's subsequent propensity to undertake land reform. On average, a block makes up a very small fraction of the population of a state, suggesting that a block's economic characteristics are unlikely to drive those of the state.[17] Thus, the main threat to identification is whether (in violation of our assumption) blocks with, say, lower initial land inequality or better credit markets were more likely to be assigned to states that undertook greater land reform.

No additional data on land inequality or distribution within villages is available in the

[15] In this specification, the household-level variable is collapsed to the village-level mean.

[16] The bootstrap is implemented using code adapted from that made public by Douglas Miller in conjunction with the 2009 paper, including code that constructs the empirical examples analyzed by the authors in that paper.

[17] Using the modern-day administrative boundaries, Andhra Pradesh has 1128 blocks, Tamil Nadu has 385, Karnataka has 176, and Kerala has 152.

1951 census, other than the population shares for the specified agricultural classes (landlords, own-cultivators, tenants and landless laborers). These shares provide a general summary of inequality, with a higher share of tenants and landless laborers presumably correlated with greater inequality.[18] The only observed correlation that is close to significant at conventional levels is between the fraction of owner-cultivator population and tenancy index B. However, given that this correlation is not fully robust and only exists for one tenancy measure and one occupational category, it seems reasonable to conclude that within a block pair, assignment of blocks to states was largely independent of their subsequent reform intensity.

As an additional robustness check, we also re-estimate equation (7) for each covariate and each of the six pairs of districts used in the main analysis. These results are reported in Table B3 in the Appendix. The results show that the district pairs with the greatest number of covariates for which a significant difference is observed are the pair comprising Kasaragod (Kerala) and Dakasinna Kannada (Karnataka) and the pair comprising Dharmapuri (Tamil Nadu) and Kolar (Karnataka); two covariates differ significantly comparing across districts in each of these two district pairs. No other district pair has more than one covariate for which the difference is significant, and there is no covariate where more than one pair of districts exhibits a significant difference.[19] The main results are robust to eliminating either of these district pairs.

Taken together, the evidence is consistent with the assumption that village assignment to states is quasi-random with respect to pre-reform or time-invariant characteristics. All subsequent specifications control for the full set of 1951 census variables and topographic measures reported in specification checks, which serves to reduce bias introduced by variation in observable characteristics across blocks assigned to different states.[20]

[18] In the 2002 survey of these sample villages, there is a strong correlation (around 0.5) between the fraction of households reporting landless status and measures of inequality in landownership such as the Gini coefficient and general entropy measures.

[19] The results are comparable when employing tenancy index B, but omitted for concision.

[20] Primary language and a dummy for whether the household speaks a second language are only included as controls in household-level regressions, since those variables are measured at the household level. The soil quality controls are also only included in the household-level regressions since they are missing for a subset of 32 villages and further shrinking the sample for the village-level analysis limits power.

Table 1: Balance of characteristics pre-reform

	Tenancy index A	Tenancy index B	Obs.	Mean
Elevation	-52.507 [.035]**	-100.708 [.244]	287	
Slope	-.193 [.622]	-.636 [.264]	287	
Precip.	.057 [.751]	.075 [.816]	287	
Std. precip.	-.067 [.448]	-.133 [.473]	287	
High precip.	.001 [.408]	.001 [.706]	287	
Low precip.	-.032 [.791]	-.037 [.965]	287	
Soil index 1	-.273 [.030]**	-1.024 [.114]	264	
Soil index 2	.024 [.831]	.065 [.746]	264	
Population	458.772 [.159]	1031.453 [.095]*	287	
Male lit.	82.344 [.100]	180.447 [.239]	287	
Female lit.	38.378 [.398]	85.323 [.219]	287	
Manu.	67.278 [.239]	142.763 [.308]	287	
Commerce	41.521 [.269]	93.788 [.209]	287	
Transportation	18.692 [.383]	41.212 [.373]	287	
Services	135.751 [.269]	301.432 [.214]	287	
Cultivator	32.364 [.388]	86.941 [.139]	287	
Laborer	53.753 [.104]	121.648 [.214]	287	
Tenant	114.88 [.154]	256.353 [.144]	287	
Landlord	7.391 [.398]	18.042 [.194]	287	
Primary language	.317 [.005]***	.643 [.129]	147	
Reports second language	.097 [.040]**	.238 [.025]**	147	

Notes: Wild bootstrap p-values are reported in brackets; asterisks indicate significance at 1, 5 and 10 percent levels. All regressions include block-pair fixed effects. The topographic dependent variables are elevation and slope; mean precipitation, standard deviation of precipitation and dummy variables for high and low precipitation; and soil indices. The demographic dependent variables are measured in the 1951 census; the language variables are reported in the 2002 household survey. The sample includes all villages that will subsequently be included in the main village results reported in Table 4.

5 Results

5.1 Land ownership by caste group

We first employ household data to examine the impact of land reform on differential land ownership by caste group. The specification of interest is equation (5), where the primary coefficients β_2 and β_3 capture the heterogeneity of the effect of land reform across caste groups; upper-caste households are the omitted base category. The dependent variables employed are dummy variables for whether a household owns or leases land, and dummy variables capturing whether the primary source of income for the household is own-cultivation or agricultural labor.

The sample is restricted to the households and villages for which a full set of topographic and 1951 demographic controls are available.[21] Table 2 reports summary statistics for the independent variables and the dependent variables of interest for the primary sample.

In Table 3, we estimate equation (5) employing tenancy index A and tenancy index B in sequence for each outcome. In this table, and in all subsequent reporting of results, wild-bootstrap p-values are reported in brackets; the bootstrap procedure does not generate an estimated standard error. Column (1) indicates that upper-caste and OBC households experience a significant increase in the probability that they own land as a result of tenancy reform, while the interaction term for SC/ST households is negative and narrowly insignificant. This is consistent with higher-status or higher-income tenants successfully purchasing land as a result of tenancy reforms, while lower-status tenants are evicted.[22]

A one standard deviation increase in tenancy reform in this sample, or three additional episodes of tenancy reform, would lead to a relative increase in the probability of non-SC/ST households owning land of around 8 percentage points on a base probability of 70%. This is a proportional increase of around 11%. (Though the point estimate for OBC households is larger than that for upper-caste households, the difference is not statistically significant.) There is no change in the probability that SC/ST households own land. In Column (2), the shifts in the probability of land ownership for upper-caste and OBC households are of similar magnitude though noisily estimated, and the point estimates suggest a significant decline in the probability of landownership for SC/ST households.

[21] The primary results capturing the heterogeneous impact of tenancy reform on household occupational outcomes are robust to employing the full sample and adding dummy variables for villages missing topographic controls.

[22] The increase in landownership probability for upper-caste households could also reflect sales implemented in advance of tenancy reform in an attempt to evade it where the buyers were other upper-caste households, or the redistribution of land by upper-caste landlords to extended family members in order to evade reform provisions.

Table 2: Summary statistics

Variable	Mean	St. dev.	Obs.
Independent variables			
Tenancy index A	5.822	3.014	287
Tenancy index B	5.711	1.385	287
Household-level variables			
Land dummy	.702	.458	2597
Leased dummy	.119	.324	1844
Own cultivation	.463	.499	2597
Agricultural labor	.388	.487	2597
Village-level variables			
Wage	41.747	17.449	286
Prop. landless	.288	.227	287
Gini	.515	.144	287
GE(1)	.615	.317	287
GE(2)	.936	1.082	287
BC(1)	.215	.182	287
WC(1)	.399	.245	287

Notes: This table reports the mean, standard deviation and number of observations for the primary independent variables of interest, two indices of tenancy reform, and the dependent variables in Tables 3 and 4. A large number of households gave no response to the question on leasing, leading to a large number of missing variables in that regression.

The dependent variable in Columns (3) and (4) is a dummy for whether a household leases land in or out. For tenancy index A, a small but statistically significant decline in rates of participation in the land rental market is evident for upper-caste households. A one standard deviation increase in tenancy reform would lead to a decline in the rate of leasing of around .3 percentage points, compared to a base probability of 10%. However, OBC households experience the opposite pattern: their participation in land rental markets seems to have increased by about 2 percentage points, a proportional effect of over 20%. The increase in leasing for OBC households is also evident in Column (4), where the coefficient implies a one standard deviation increase in tenancy index B leads to an even larger increase in the probability of leasing land. There are no significant changes for SC/ST households.

The coefficients on the dummy variables for the primary source of household income reported in Columns (5) through (8) reinforce the finding of differential impacts on land

ownership by caste group. Column (5) shows that tenancy reform leads to relatively greater owner-cultivation among OBC households. A one standard deviation increase tenancy reform leads to an increase in the probability of own-cultivation of 7 points on a base probability of 46%, a proportional increase of 15%. A similar result is evident in Column (6), though the coefficient is twice as large in magnitude and more noisily estimated.

By contrast, Columns (7) and (8) suggest that SC/ST households are more likely to be dependent on agricultural labor. The coefficients in Column (7) indicate that a one standard deviation increase in tenancy reform leads to an increase in the probability of dependence on agricultural labor of 4 percentage points on a base probability of 38%, a proportional effect of around 10%. There is a strong correlation between landlessness and dependence on agricultural labor. Thus these coefficients capture the same underlying phenomenon of increasing landlessness for SC/ST households, while employing different data. There is also evidence of a decline in the probability that SC/ST households are primarily dependent on own-cultivation, though it is not significant.

While varying the definition of tenancy reforms leads to noisier estimates for some outcomes, the overall pattern of increased access to land for OBC households (via ownership, tenancy or both) and declining access to land for SC/ST households is consistent across multiple variables capturing closely related dimensions of land access. These results reinforce the importance of examining the heterogeneous impact of tenancy reform at the household level, and suggest the effects plausibly depend on the extent to which potential cultivators can benefit from the possibility of becoming landowners as reform reduces the attractiveness of tenancy to landlords.[23]

[23]These results are also robust to various restrictions of the sample. If the sample is narrowed to those district-pairs previously in the same princely state, the overall decline in tenancy, the increase in dependence on agricultural labor for SC/ST households and the increase in dependence on own-cultivation for OBC households are all significant or close to significant at conventional levels. If the sample is narrowed to exclude Kasaragod and Dakasinna Kannada, the district-pair that showed greatest evidence of differing covariates prior to reform, the increase in access to land and increased dependence on own-cultivation for OBC households and the increased dependence on agricultural labor for SC/ST households are significant or close to significant.

Table 3: Impact of tenancy reform on land ownership

	Land dummy		Leased dummy		Own cult.		Agri. labor		Wage	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tenancy reform	.026	.023	-.001	.010	-.004	-.020	.015	.027	2.211	2.233
	[.100]*	[.348]	[.015]**	[.363]	[.622]	[.652]	[.960]	[.940]	[.070]*	[.547]
SC/ST x Tenancy	-.034	-.075	.002	-.002	.005	-.001	.014	.027		
	[.124]	[.015]**	[.786]	[.925]	[.552]	[.990]	[.030]**	[.000]***		
OBC x Tenancy	.012	.026	.008	.030	.023	.053	-.011	-.049		
	[.284]	[.522]	[.030]**	[.090]*	[.060]*	[.279]	[.134]	[.343]		
Tenancy index	A	B	A	B	A	B	A	B	A	B
Mean	.702	.702	.119	.119	.463	.463	.388	.388	41.747	41.747
Obs.	2597	2597	1844	1844	2597	2597	2597	2597	286	286

Notes: For each outcome, regressions are estimated first for tenancy index A and second for tenancy index B. Wild bootstrap p-values are calculated using clustering at the princely state-state level and reported in brackets; asterisks indicate significance at 1, 5 and 10 percent levels. All regressions include block-pair fixed effects. The dependent variables are reported at the household level: a dummy for owning land, a dummy for leasing land, a dummy for being primarily dependent on own cultivation, and a dummy for being primarily dependent on agricultural labor. The wage is reported at the village level. A large number of households gave no response to the question on leasing, leading to a large number of missing variables in that regression. Controls include all topographic and demographic measures reported in Table 1. The sample is thus restricted to households in villages for which data is available for all topographic and demographic measures, and the the mean reported corresponds to the mean in this sample.

5.2 Labor demand and wages

The model explored the conditions under which tenancy reform would lead to a transfer of land to more productive farmers, raising labor demand and increasing wages. Column (9) of Table 3 shows the impact on land reform on the agricultural wage, employing specification (6).[24] The results show that the daily agricultural wage increases by about 5% with each episode of land reform, or 15% given a one standard deviation increase in tenancy reform.[25]

This increase in the wage is consistent with the case where landlords initially could use strong sanctions against tenants ($\Delta < 0$ in the model) and also consistent with the results reported by Besley & Burgess (2000). In addition, the magnitude of the effect is in line with previous literature: Banerjee, Gertler & Ghatak (2002) estimate a positive effect of land reform on productivity of between 50% and 60%, implying an increase of comparable magnitude in the agricultural wage if the rural labor market is efficient.

To assess the magnitude of this effect, it is useful to note that the household-level results suggested a proportional increase in land ownership of 10% for non-SC/ST households, who constitute 70% of the population of the villages of interest. This suggests around 11% of all households are new landowners, and presumably more productive; there may also be an increase in labor demand from households who owned land prior to reform, but increased their holdings. Given this pattern, a 15% increase in wages does not seem implausibly large.

In interpreting this coefficient, it is also helpful to highlight that the household-level results suggest both a shock to labor demand – as new, more productive households own land and seek to hire labor – and a shock to labor supply, as newly landless, predominantly SC/ST households become dependent on agricultural labor. A priori it is not obvious which effect would dominate, but the increase in labor supply would be consistent with a decline in wages, especially if the new entrants into the labor market are disproportionately lower-skilled. Accordingly, the evidence of an increase in wages suggests that the labor demand effect is dominant.

[24] The wage variable is the mean of the reported wage for male and female agricultural work.

[25] One potential challenge to these results would arise if tenancy reform was correlated with other state-level policies in the labor market that led to increased wages. State-level data is available on the minimum wage, one obvious policy that could generate this pattern, in Belser & Rani (2010). The minimum wage is nearly identical in Andhra Pradesh, Karnataka and Tamil Nadu, but nearly double the observed level in the other three states in Kerala. If we exclude Kerala from the dataset, leaving very little residual variation in the minimum wage, and re-estimate the primary results, we still find evidence of an increase in land ownership and decreased dependence on agricultural labor for OBC households, and increased dependence on agricultural labor for SC/ST households. This suggests that variation in labor market policies is unlikely to be driving the observed pattern.

5.3 Overall land inequality

Next we examine whether, as predicted by the model, tenancy reform reduced overall land inequality. To do so, we make use of data on land distribution collected in participatory rural appraisal (PRA) meetings. These data are potentially noisier than household data but provide a valuable, supplementary account of shifts in overall land distribution.

In the PRA meeting, assembled villagers were asked to name for each caste the number of households that holds no land, between 0 and 1 acres of land, 1 to 5 acres, 5 to 10 acres, 10 to 25 acres, or 25 or more acres. To calculate measures of inequality in landholdings we assume that each household in a given category possesses the mean amount of land (e.g., a household holding between 1 and 5 acres is assumed to hold 3 acres).[26] The measures we examine include the proportion of households that are landless, the Gini coefficient, the generalized entropy measures of inequality with α equal to 1 and 2, and the GE(1) measures for between-caste and within-caste land inequality. Details about the construction of the land inequality measures can be found in the Appendix.

The results in Table 4 show that tenancy reform generally reduces overall inequality in land distribution, and the impact is substantial in magnitude. Again, the regression of interest is estimated employing tenancy index A and tenancy index B in sequence for each outcome. The decline in the proportion of landless households is not statistically significant, though the implied effect is of reasonable magnitude (around 12% given a one standard deviation increase in tenancy reform for tenancy index A). The same increase in tenancy reform leads to a decline in the Gini coefficient of around 9%, and even larger and statistically significant reductions in the GE(1) and GE(2) indices and in the between-caste and within-caste GE(1) measures, where a one standard deviation increase in tenancy reform employing tenancy index A leads to declines in measured inequality of up to 30%. The coefficients estimated are of comparable magnitude for the two tenancy indices, and are significant employing both indices for three out of the six outcomes.

The decline in both between-caste and within-caste inequality is also consistent with the household-level results previously discussed. The increase in the probability of owning land for upper-caste households is consistent with redistribution among the caste (perhaps as part of a strategy to evade enforcement), and thus a decline in within-caste inequality. The increase in the probability of land ownership for OBC households is consistent with a decline in inequality in landownership between castes.[27]

[26] As our variables assume no dispersion within landholding categories they likely represent a lower bound on the true level of inequality. See the Appendix for definitions of all measures.

[27] When the sample is restricted to districts previously in the same princely state, the decline in the Gini coefficient and the GE(1) and GE(2) indices remain significant; the decline in between-caste and within-caste measures of inequality are close to significant at conventional levels. If the sample is narrowed to exclude Kasaragod and Dakasinna Kannada, the district-pair that showed greatest evidence of differing

These results should be interpreted with caution, given that data obtained from the participatory rural appraisal may be error-prone, and is likely to underestimate the true extent of inequality in land by virtue of binning households in categories of landholding. However, the substantial magnitude of the effects estimated suggests that it is plausible to conclude that land reform did lead to a decrease in within-village inequality in land.

covariates prior to reform, the estimated declines in the proportion of households that are landless, the Gini coefficient, the GE(1) coefficient, and the between-caste GE(1) coefficient are all significant.

Table 4: Impact of tenancy reform on inequality in land distribution

	Prop. landless		Gini		GE(1)		GE(2)		BC(1)		WC(1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Tenancy reform	-.014	-.013	-.015	-.017	-.040	-.043	-.090	-.094	-.021	-.016	-.019	-.026
	[.214]	[.572]	[.050]*	[.090]*	[.035]**	[.025]**	[.045]**	[.333]	[.020]**	[.279]	[.065]*	[.095]*
Tenancy index	A	B	A	B	A	B	A	B	A	B	A	B
Mean	.288	.288	.515	.515	.615	.615	.936	.936	.215	.215	.399	.399
Obs.	287	287	287	287	287	287	287	287	287	287	287	287

Notes: For each outcome, regressions are estimated first for tenancy index A and second for tenancy index B. Wild bootstrap p-values are calculated using clustering at the princely state-state level and reported in brackets. Asterisks indicate significance at 1, 5 and 10 percent levels. All regressions include block-pair fixed effects. Outcome variables are the proportion of households that are landless, the Gini coefficient, the general entropy coefficients with $\alpha = 1$ and $\alpha = 2$ and the GE(1) coefficient for between-caste and within-caste inequality in land. A full set of demographic variables from the 1951 census as well as topographic measures are included as controls; this includes all variables for which balance tests are reported in Table 1, excluding the linguistic variables. The sample is thus restricted to villages for which data is available for all topographic and demographic measures, and the mean reported corresponds to the mean in this sample.

5.4 Robustness checks

Alternative specifications In order to check the robustness of these results, the primary equation of interest (5) can be re-estimated employing an index of total land reform, rather than tenancy, as the independent variable. This index is constructed analogously to tenancy index A, by summing the number of legislative events. The objective of this regression is to evaluate whether the observed pattern of effects for tenancy reform is also evident for overall land reform.

The results are shown in Table 5, and the coefficients are entirely consistent with the previous results; there are no significant differences between the coefficients estimated using tenancy reform and total reform. This suggests that, as concluded by the previous qualitative literature, tenancy reforms are the only legislative measures that are effective in altering land ownership patterns. In fact, the estimated impacts of tenancy legislation and all land reform legislation are statistically indistinguishable.[28]

Table 5: Impact of land reform on land ownership

	Land dummy	Leased dummy	Own cult.	Agri. labor
	(1)	(2)	(3)	(4)
Total reform	.020	-.001	-.013	.020
	[.149]	[.015]**	[.751]	[.970]
SC/ST x Total reform	-.042	.002	.005	.015
	[.015]**	[.766]	[.622]	[.030]**
OBC x Total reform	-.0001	.009	.020	-.006
	[.920]	[.000]***	[.199]	[.751]
Mean	.680	.117	.448	.395
Obs.	2597	2597	1844	2597

Notes: Wild bootstrap p-values are calculated using clustering at the princely state-state level and reported in brackets. All regressions include block-pair fixed effects. The dependent variables are reported at the household level: a dummy for owning land, a dummy for leasing land, a dummy for being primarily dependent on own cultivation, and a dummy for being primarily dependent on agricultural labor. A large number of households gave no response to the question on leasing, leading to a large number of missing variables in that regression. Controls include all topographic and demographic measures reported in Table 1.

[28] An alternative robustness check defines a variable for all types of non-tenancy reform and tests whether these reforms have a significant impact on the primary outcomes of interest. In fact, none of the main results of interest are replicated in this specification.

Placebo tests A key challenge for the identification strategy is that tenancy reform may proxy for other state-level policies, and particularly for policies that differentially affect caste groups, benefiting middle castes at the expense of SC/ST households. Undeniably, the four states of interest did implement a variety of other different policies in this period. To provide some evidence about this variation, two regressions are estimated measuring the effect of assignment to a state with higher or lower levels of land reform on various measures of village- and household-level provision of public goods, and the interaction between land reform and caste dummies.

First, the following specification is estimated to test for variation in the provision of village-level public goods. G_{vp} is a dummy for whether the local government, denoted the gram panchayat or GP, provides a certain public good in the village, and $R_{vp} \times Pr_{vp}$ is an interaction term with the proportion of SC/ST households in the village, denoted Pr_{vp}. Block-pair fixed effects γ_p are again employed, and T-statistics are estimated using the wild bootstrap.

$$G_{vp} = \beta_1 R_{vp} + \beta_2 R_{vp} \times Pr_{vp} + \beta_3 Pr_{vp} + \gamma_p + \epsilon_{vp} \tag{8}$$

The results are shown in Columns (1) through (4) of Table 6. For each outcome, regressions are estimated first employing tenancy index A and then tenancy index B. We observe no significant coefficients on either total reform or the interaction between reform and the proportion of SC/ST households. This suggests that differential provision of public goods to villages with a higher or lower proportion of SC/ST households in states with more or less land reform is not a source of bias.

Next, we estimate the following equation at the household level:

$$G_{ivp} = \beta_1 R_{vp} + \beta_2 R_{ip} \times O_{ivp} + \beta_3 R_{vp} \times S_{ivp} + \beta_4 O_{ivp} + \beta_5 S_{ivp} + \gamma_p + \epsilon_{ivp} \tag{9}$$

where G_{ivp} is a dummy for the provision of governmental assistance to that household or the colony in which the household resides. The results are shown in Columns (5) through (10), using as the dependent variable a dummy for whether the household received government aid for construction or electricity, whether the colony received infrastructure investment from the government, and whether the household is eligible for a BPL card. The estimated coefficients are generally insignificant, though there is some evidence that states with more intense land reform are less likely to provide household-level assistance in infrastructure (Columns 5 and 6) and more likely to provide colony-level assistance (Columns 7 and 8).

If we examine the coefficients on the caste group interaction terms, the coefficients on the SC/ST interaction term are generally positive and the coefficients on the OBC inter-

action term negative, though none are statistically significant. The pattern in terms of sign is exactly the opposite of that found in the main results, where we observe generally adverse outcomes for SC/ST households and increased welfare for OBC households. The inversion of sign on the caste-group interaction coefficients suggests that differential provision of governmental assistance is unlikely to be a major source of bias in the primary results.

Table 6: Placebo tests

	School repair		Health assistance		Hh infra.		Colony infra.		BPL card	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Village-level measures										
Tenancy reform	-.010	-.058	-.005	-.008						
	[.841]	[.403]	[.622]	[.682]						
SC/ST x Tenancy	-3.80e-06	.007	2.85e-06	-.004						
	[.602]	[.950]	[.826]	[.866]						
Panel B: Household-level measures										
Tenancy reform					-.019	-.025	.047	.085	.020	.028
					[.03]**	[.03]**	[.02]**	[.02]**	[.522]	[.612]
SC/ST x Tenancy					.010	.013	.010	.009	.038	.036
					[.333]	[.423]	[.119]	[.249]	[.363]	[.761]
OBC x Tenancy					-.002	-.011	-.010	-.008	.031	.056
					[.920]	[.940]	[.612]	[.821]	[.448]	[.498]
Tenancy index employed	A	B	A	B	A	B	A	B	A	B
Obs.	287	287	287	287	2597	2597	2229	2229	2597	2597

Notes: Wild bootstrap p-values are calculated using clustering at the princely state-state level and reported in brackets. Asterisks indicate significance at 1, 5 and 10 percent levels. In Columns (1)–(4), the dependent variables are dummies for whether the panchayat provided any funds toward the specified educational or health public good, and SC/ST prop. int. is an interaction between the proportion of the village population that is SC/ST and the tenancy variable. In Columns (5)–(7), the dependent variables are dummies for whether a household received assistance in improving their home from a public assistance scheme, whether the colony in which the household lives received such assistance, and whether the household is eligible for a BPL card.

6 Conclusion

Poor rural economies are second-best in many ways. It is no surprise, then, that tracing the impact of a single dimension of reform can be complex. The analysis in this paper has exploited a natural experiment brought about by the 1956 state reorganization in India in order to evaluate the impact of tenancy reform at the village and household level over a long time horizon.

While tenancy reforms were implemented with the goal of strengthening the position of tenants, several equilibrium responses need to be considered. In this context, the reforms did produce significant and highly persistent shifts in land distribution and a fall in overall inequality in landholdings. However, the benefits were lopsided and favored relatively wealthy tenants, while SC/ST households saw a decrease in land holdings and generally became more reliant on agricultural labor.

On the other hand, there is evidence of a large increase in agricultural wages due to an increase in demand for hired labor. This phenomenon could be due to large landholders ceasing to rely on tenant labor, a shift in the labor supply curve, or both. Thus, while the welfare impacts of tenancy reforms were substantial and long-lasting, their impact was heterogeneous between types of cultivators. These results can best be understood through the lens of a fairly standard model where owners are seeking the best opportunities for exploiting their land and there is a reduction in landlords' ability to extract surplus from tenants due to the reform.

The question of how best to regulate the land market is still a pressing one in many developing economies. Mexico has embarked on major experiments in rural land titling over the last decade (de Janvry, Gonzalez-Navarro & Sadoulet 2011). Rural land rights remain extremely limited in China, where the role of property rights in rural development is hotly contested and has become an increasing source of political unrest. In addition, many other developing countries face challenges in how to appropriately negotiate compensation for rural landowners when industrialization requires the purchase or expropriation of land (Bardhan 2011). In all such cases, it is essential to understand in detail, as we have done here, the equilibrium responses to reform and the way that these responses create winners and losers. This can only be done employing a sufficiently long time horizon over which the full effects of reform become visible.

In a broad sense, our findings offer a stark reminder of the hazards of piecemeal policy reform in a second-best world. If tenancy persists in part due to a lack of credit market opportunities to become an owner-cultivator, then increasing the power of tenants may result in some of them being forced to become landless laborers; the ultimate welfare impact for these tenants will depend on the strength of factor market shifts in equilibrium,

primarily the wage response. The complexity of these general equilibrium effects should contribute to a recognition by policymakers that, while short-run political imperatives may provide the impetus for reform, the long-run economic changes are what matter for development.

A Additional Model Derivations

Proof of Proposition 1: First not that our two core equations are:

$$L = (1-\gamma)\left[1 - G\left(x^T(\Delta, w)\right)\right] + \gamma\left[1 - G\left(x^0(\Delta, w)\right)\right] \tag{10}$$

and

$$\Delta = \frac{1-\eta}{\eta} w^{-\frac{\eta}{1-\eta}} \left(\left[x^T(\Delta, w)\right]^{\frac{1}{1-\eta}} - \left[x^O(\Delta, w)\right]^{\frac{1}{1-\eta}}\right). \tag{11}$$

Totally differentiating these holding w fixed yields

$$\begin{bmatrix} -(1-\gamma)\, g\left(x^T(\Delta, w)\right) & -\gamma g\left(x^O(\Delta, w)\right) \\ \left[\frac{1}{\eta}\right] w^{-\frac{\eta}{1-\eta}} \left[x^T(\Delta, w)\right]^{\frac{\eta}{1-\eta}} & -\left[\frac{1}{\eta}\right] w^{-\frac{\eta}{1-\eta}} \left[x^O(\Delta, w)\right]^{\frac{\eta}{1-\eta}} \end{bmatrix} \begin{bmatrix} \partial x^T \\ \partial x^O \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \partial\Delta.$$

Define

$$\Omega = \left[\frac{1}{\eta}\right] w^{-\frac{\eta}{1-\eta}} \left[(1-\gamma)\, g\left(x^T(\Delta, w)\right)\left[x^O(\Delta, w)\right]^{\frac{\eta}{1-\eta}} + \gamma g\left(x^O(\Delta, w)\right)\left[x^T(\Delta, w)\right]^{\frac{\eta}{1-\eta}}\right] > 0.$$

Now by Kramer's rule

$$\frac{\partial x^T}{d\Delta} = \frac{\gamma g\left(x^O(\Delta, w)\right)}{\Omega} > 0$$

and

$$\frac{\partial x^O}{\partial\Delta} = -\frac{(1-\gamma)\, g\left(x^T(\Delta, w)\right)}{\Omega} < 0.$$

The signs of these imply the result as claimed. ■

Before proceeding to the proof of Proposition 2, we consider the impact of a change in the wage on the equilibrium cutoff levels. Differentiate the pair of equations (10) and (11) holding Δ fixed yields:

$$\begin{bmatrix} -(1-\gamma)\, g\left(x^T(\Delta, w)\right) & -\gamma g\left(x^O(\Delta, w)\right) \\ \left[\frac{1}{\eta}\right] w^{-\frac{\eta}{1-\eta}} \left[x^T(\Delta, w)\right]^{\frac{\eta}{1-\eta}} & -\left[\frac{1}{\eta}\right] w^{-\frac{\eta}{1-\eta}} \left[x^O(\Delta, w)\right]^{\frac{\eta}{1-\eta}} \end{bmatrix} \begin{bmatrix} \partial x^T \\ \partial x^O \end{bmatrix} = \begin{bmatrix} 0 \\ \frac{\Delta\eta}{w(1-\eta)} \end{bmatrix} \partial w.$$

By Kramer's rule

$$\frac{\partial x^T}{\partial w} = \frac{\gamma g\left(x^O(\Delta, w)\right)\frac{\Delta(1-\eta)}{w\eta}}{\Omega}$$

and

$$\frac{\partial x^O}{\partial w} = -\frac{(1-\gamma)\, g\left(x^T(\Delta, w)\right)\frac{\Delta(1-\eta)}{w\eta}}{\Omega}$$

So the effect of a change in w on x^T and x^O is opposite and depends on the sign of Δ. Specifically if $\Delta < 0$ then x^T increases and and x^O falls with w.

Observe also that

$$\begin{aligned}\frac{\partial\tilde{\theta}(\Delta,w)}{\partial w} &= -\left[(1-\gamma)\,g\left(x^T(\Delta,w)\right)x^T(\Delta,w)^{\frac{1}{1-\eta}}\frac{dx^T}{dw}\right.\\ &\left.+\gamma g\left(x^O(\Delta,w)\right)x^O(\Delta,w)^{\frac{1}{1-\eta}}\frac{dx^O}{dw}\right]\\ &= \frac{(1-\gamma)\,g\left(x^T(\Delta,w)\right)\gamma g\left(x^O(\Delta,w)\right)}{\Omega}\left[-x^T(\Delta,w)^{\frac{1}{1-\eta}}+x^O(\Delta,w)^{\frac{1}{1-\eta}}\right]\frac{\Delta(1-\eta)}{w\eta}\\ &= -\frac{(1-\gamma)\,g\left(x^T(\Delta,w)\right)\gamma g\left(x^O(\Delta,w)\right)}{\Omega}\frac{\Delta^2}{w^{\frac{1}{1-\eta}}} < 0.\end{aligned}$$

Thus, the labor demand function slopes downwards as claimed in the text. We will also use the fact that

$$\begin{aligned}\frac{\partial\tilde{\theta}(\Delta,w)}{\partial\Delta} &= -(1-\gamma)\left[x^T(\Delta,w)\right]^{\frac{1}{1-\eta}}g\left(\left[x^T(\Delta,w)\right]\right)\frac{\partial x^T(\Delta,w)}{\partial\Delta}\\ &\quad-\gamma\left[x^O(\Delta,w)\right]^{\frac{1}{1-\eta}}g\left(x^O(\Delta,w)\right)\frac{\partial x^0(\Delta,w)}{\partial\Delta}\\ &= \gamma g\left(x^O(\Delta,w)\right)\frac{\partial x^0(\Delta,w)}{\partial\Delta}\left[\left[x^T(\Delta,w)\right]^{\frac{1}{1-\eta}}-\left[x^O(\Delta,w)\right]^{\frac{1}{1-\eta}}\right]\\ &= \gamma g\left(x^O(\Delta,w)\right)\frac{\partial x^0(\Delta,w)}{\partial\Delta}\left[\frac{\eta}{1-\eta}w^{\frac{\eta}{1-\eta}}\Delta\right].\end{aligned}$$

Since $\frac{\partial x^0(\Delta,w)}{\partial\Delta} < 0$, this has the opposite sign to Δ. Now, totally differentiating (3), we have that

$$\frac{dw}{d\Delta}\left[w^{-\frac{1}{1-\eta}}\frac{\partial\tilde{\theta}(\Delta,w)}{\partial w}-\frac{1}{1-\eta}w^{\frac{\eta-2}{1-\eta}}\tilde{\theta}(\Delta,w)\right]+\frac{\partial\tilde{\theta}(\Delta,w)}{\partial\Delta}w^{-\frac{1}{1-\eta}} = 0.$$

Hence:

$$\frac{dw}{d\Delta} = \frac{-\frac{\partial\tilde{\theta}(\Delta,w)}{\partial\Delta}}{\left[\frac{\partial\tilde{\theta}(\Delta,w)}{\partial w}-\frac{1}{(1-\eta)w}\tilde{\theta}(\Delta,w)\right]}. \tag{12}$$

The demoninator in (12) is negative.

Proof of Proposition 2: From (4), note that if σ is high then $\Delta < 0$ which implies that $\frac{\partial\tilde{\theta}(\Delta,w)}{\partial\Delta} > 0$. Now from (12) the wage increases with Δ for large enough σ as claimed. ■

B Sampling Methods and Identification

We selected four pairs of districts formerly in the same princely state that were incorporated into two different states. Bidar and Medak in Hyderabad were incorporated into Karnataka and Andhra Pradesh, respectively. In the Madras presidency, there are three

pairs: South Kanara (Karnataka) and Kasaragod (Kerala), Pallakad (Kerala) and Coimbatore (Tamil Nadu), and Dharmapuri (Tamil Nadu) and Chittoor (Andhra Pradesh).

Given that Mysore was completely incorporated into Karnataka, there are no district-pairs in which both districts were formerly part of Mysore state. However, Kolar district in Mysore / Karnataka was also surveyed, and matched on the basis of language, as detailed below, with Chittoor district in Andhra Pradesh and Dharmapuri in Tamil Nadu. All three districts form a contiguous geographic region, and they are matched pair-wise to generate three additional district pairs.

In order to select the block pairs employed in this analysis, blocks within the paired districts were matched on the basis of linguistic compatibility. For each block pair of block i and block j, a measure of linguistic compatibility $L_i(v_i, v_j)$ was constructed using the following formula. P_{li} denotes the proportion of the population in block i speaking a given language,[29] and N_i denotes the population in a given block. Thus L_i equals the sum of the difference in the proportion of population speaking each language across the two blocks, each weighted by the proportion of the population that speaks that language in both blocks taken as a whole. The minimum possible value of the index of linguistic compatibility, indicating the best possible match, is zero; the maximum is one.

$$L_i(v_i, v_j) = \sum_{l=1}^{18} (P_{li} - P_{lj}) * \frac{P_{li} * N_i + P_{lj} * N_j}{N_i + N_j} \tag{13}$$

For each district pair, the set of all possible block pairs is ranked and the top three unique pairs are chosen. Table B1 shows summary statistics for the quality of match for all possible block pairs for each pair of districts. On average, block pairs show the highest degree of linguistic compatibility across Kolar and Chittoor districts, and the lowest degree of compatibility in Coimbatore and Palakkad districts. The other four district pairs have similar levels of language matching. The high quality of the matches between Kolar and Chittoor and Kolar and Dharmapuri districts indicates that despite the fact that these district pairs were not previously part of the same princely state, their ethnolinguistic composition is comparable.

Blocks are divided into village government units or gram panchayats (GPs), consisting of one to six villages. In the states of Andhra Pradesh, Tamil Nadu, and Karnataka, six gram panchayats were randomly sampled from each block selected. Gram panchayats in Kerala are larger than those in other states, and thus three GPs were sampled in each block in Kerala. All villages in each GP were sampled in AP, TN and KA if the GP had three or fewer villages; if there were more than three villages, then the village

[29] The languages reported are Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Konkani, Marathi, Mayalayam, Manipuri, Nepali, Oriya, Punjabi, Sanskrit, Sindhi, Tamil, Telugu, and Urdu.

that was the home of the president of the gram panchayat was sampled in addition to two other randomly selected villages. (For the purposes of the sampling frame, villages with a population of less than 200 were excluded; all hamlets with a population over 200 are considered independent villages.) In Kerala, villages are again much larger and thus wards, the subunit of villages, were directly sampled. Six wards in each GP were randomly selected. This generates a total sample of 527 villages; the household survey is conducted in 259 of those villages.

Table B2 shows a detailed breakdown of the number of villages and households in each district and state in the primary samples that are used in the household-level and village-level regressions reported in Tables 3 and 4.

In the section on the identification strategy above, we present evidence that blocks assigned to states of more or less intense land reform are balanced on preexisting characteristics. As an additional robustness check, we also re-estimate equation (7) for each covariate and each of the six pairs of districts used in the main analysis; these results are reported in Table B3 below. The results show that the district pair with the greatest number of covariates for which a significant difference is observed is the pair comprising Kasaragod (Tamil Nadu) and Dakasinna Kannada (Karnataka); four covariates differ significantly across villages in these two districts. No other district pair has more than one covariate for which the difference is significant, and there is no covariate where more than one pair of districts exhibits a significant difference.[30] The main results are robust to the exclusion of Kasaragod and Dakasinna Kannada.

[30]The results are comparable when employing tenancy index B, but omitted for concision.

Table B1: Linguistic compatibility across district-pairs

District pair	Mean L_i	Median L_i	Std. dev.
Bidar-Medak	0.47	0.46	0.09
Chittoor-Dharmapuri	0.58	0.65	0.20
Dakasinna-Kasaragod	0.47	0.43	0.21
Coimbatore-Palakkad	0.74	0.73	0.13
Chittoor-Kolar	0.28	0.27	0.16
Dharmapuri-Kolar	0.52	0.57	0.19

Notes: This table presents summary statistics on the quality of the linguistic match between blocks within each district-pair.

Table B2: Sample size

Household-level regressions

	Subsample		Full sample	
Observations by district				
Bidar	350	(13%)	460	(9%)
Chittoor	365	(14%)	420	(8%)
Coimbatore	100	(4%)	380	(7%)
Dakasinna Kannada	139	(5%)	260	(5%)
Dharmapuri	319	(12%)	1040	(20%)
Kasaragod	64	(2%)	720	(14%)
Kolar	977	(38%)	1080	(21%)
Medak	159	(6%)	220	(4%)
Palakkad	124	(5%)	600	(12%)
Total villages represented in household sample	138		259	
Total households	2597		5180	

Village-level regressions

	Subsample		Full sample	
Observations by district				
Bidar	44	(15%)	47	(9%)
Chittoor	36	(13%)	38	(7%)
Coimbatore	13	(5%)	27	(5%)
Dakasinna Kannada	13	(5%)	106	(20%)
Dharmapuri	29	(10%)	72	(14%)
Kasaragod	27	(9%)	106	(20%)
Kolar	92	(32%)	23	(4%)
Medak	21	(7%)	23	(4%)
Palakkad	39	(4%)	54	(10%)
Total	287		522	

Notes: This table reports the number of villages and households per district and state in the original samples and the samples employed in the primary analysis, for which a full set of control variables are available.

Table B3: Balance of characteristics pre-reform: Tests by district-pair

	Tenancy index A					
	(1)	(2)	(3)	(4)	(5)	(6)
Elevation	[.244]	[.010]***	[.274]	[.249]	[.224]	[.731]
Slope	[.705]	[.264]	[.239]	[.612]	[.214]	[.821]
Precipitation	[.224]	[.701]	[.299]	[.239]	[.254]	[.692]
Precip. st. dev.	[.269]	[.303]	[.289]	[.239]	[.239]	[.836]
Soil index 1	[.308]	[.294]	[.711]	[.711]	[.229]	[.264]
Soil index 2	[.294]	[.010]***	[.721]	[.289]	[.755]	[.831]
Population	[.647]	[.721]	[.249]	[.269]	[.706]	[.766]
Male lit.	[.716]	[.234]	[.274]	[.716]	[.264]	[.687]
Female lit.	[.214]	[.284]	[.284]	[.806]	[.756]	[.652]
Manufacturing	[.841]	[.229]	[.323]	[.010]***	[.229]	[.249]
Commerce	[.219]	[.244]	[.289]	[.010]***	[.284]	[.697]
Transportation	[.781]	[.274]	[.269]	[.811]	[.274]	[.652]
Services	[.239]	[.677]	[.179]	[.751]	[.602]	[.706]
Cultivator	[.010]***	[.771]	[.199]	[.214]	[.259]	[.607]
Laborer	[.279]	[.826]	[.249]	[.234]	[.299]	[.806]
Tenant	[.204]	[.244]	[.259]	[.244]	[.706]	[.811]
Landlord	[.249]	[.667]	[.219]	[.776]	[.667]	[.612]

Notes: This table reports the p-values for a regression of post-1956 tenancy reform employing tenancy index A on the specified covariate, conditional on block-pair fixed effects, for villages in each of the six district pairs used in the primary analysis. All p-values are estimated using a wild bootstrap. Asterisks indicate significance at 1, 5 and 10 percent levels. The first district pair is Bidar and Medak; the second is Dakasinna Kannada and Kasaragod; the third is Palakkad and Coimbatore; the fourth is Dharmapuri and Kolar; the fifth is Dharmapuri and Chittoor; the sixth is Chittoor and Kolar. Four indicators are omitted: the dummies for high and low precipitation given that there is very limited variation within some district-pairs, and the variables capturing language composition given the smaller sample available for these variables.

C Inequality Measures

The Gini measure is defined as follows, where l_i denotes the land owned by household i, r_i is the ranking of household i according to land holdings among all households in the village, $\bar{l}$ is mean land held in a village and n is the total number of households:

$$Gini = 1 + \frac{1}{n} - \frac{2}{\bar{l}n^2} \sum_{i=1}^{n} (n - r_i + 1)(l_i) \tag{14}$$

The general entropy measures with a=1 and a=2 are calculated using the following equations:

$$GE(a) = \frac{1}{a(a-1)} \left[\left[\frac{1}{n} \sum_{i=1}^{n} \left(\frac{l_i}{\bar{l}} \right)^a \right] - 1 \right] \tag{15}$$

D Land Reform in Southern India

Table D1: Land reform prior to state reorganization

Year	Title	Description	Type
		Hyderabad	
1950	Telegana Agency Tenancy and Agricultural Lands Act	Tenants received protected tenancy status; tenants to have minimum terms of lease; right of purchase of nonresumable lands; transfer of ownership to protected tenants in respect of nonresumable lands; as a result 13,611 protected tenants declared owners.[31] Also gave tenants ability to mortgage rented land for credit.[32]	Tenancy
1954	Amendment of Telegana Agency Tenancy and Agricultural Lands Act	Limits a landlord's right of resumption.[33]	Tenancy
1956	Tenancy Act (amended 1974)	Tenancy continues up to 2/3 of ceiling area; law does not provide for conferment of ownership rights on tenants except through right to purchase; confers continuous right of resumption on landowners.[34]	Tenancy
		Madras	
1929	Malabar Tenancy Act	Confers a qualified fixity of tenure on cultivation and a right to demand a renewal of lease. Also prescribed rates of "fair" rent. Since this act only took effect in the Malabar region of Madras Presidency, in our sample it only applies to Palakkad district.[35]	Tenancy
1954	The Malabar Tenancy Amendment Act	Prohibits eviction of tenants who have had land possession for 6 years; lowered the amount of maximum rent that could be paid.[36]	Tenancy
1955	The Madras Cultivating Tenants Protection Act	Prohibits any cultivating tenant from being evicted, except in the case of non-payment, but allows for resumption of up to one-half land if land leased out to tenant.[37]	Tenancy
1956	The Madras Cultivating Tenants (Payment of Fair Rent) Act	Abolishes usury and rack-renting.[38] Fixes the percentage of produce that can be charged as rent.[39]	Tenancy
		Mysore	
1952	Mysore Tenancy Act (Mysore Act XIII of 1952)	Restricted rent to 1/3 of crop; granted permanent tenancy rights to those who had occupied the land for 12 years or more. Also provided for the eviction of tenants for non-payment of rent and for resumption for self cultivation by landlord.[40]	Tenancy

Notes: This table reports land reform acts in the princely states of Hyderabad, Madras, and Mysore, including whether each piece of legislation was categorized as a tenancy, abolition or ceiling reform.

Table D2: Land reform in Karnataka and Andhra Pradesh

Year	Title	Description	Type
		Karnataka	
1961	Land Reforms Act Amended 32 times (1965-2001)	Provides fixed tenure subject to landlord's right to resume one-half leased area; grants tenants optional right to purchase land on payment of 15-–20 times the net rent; imposition of ceiling on land holders.[41]	Tenancy, Ceiling
1974	The Mysore Land Reforms Amendment Act	Imposition of ceiling on landholdings of 4.05-21.85 hectares (after 1972); removal of all but one of the exemptions from tenancy regulations;[42] reduces the landlord's right of resumption.[43]	Tenancy, Ceiling
		Andhra Pradesh	
1957	The Andhra Tenancy Act	A stop-gap measure to stay evictions of tenants in the Andhra area until new state-wide legislation could be drafted.[44] In our sample this act, and its amendment (listed below), only applies to Chittoor.	Tenancy
1971	Andhra Pradesh Record of Rights in Land Act	Provides for the recording of names of all occupants and tenants.[45]	Tenancy
1974	Amendment of Tenancy Act	Applied the 1956 tenancy laws to the whole state; reduced the maximum rent tenants paid; limits a landlord's right of resumption.[46] (In our sample this amendment only applies to Chittoor.)	Tenancy

Notes: This table reports land reform acts in Karnataka and Andhra Pradesh, including whether each piece of legislation was categorized as a tenancy, abolition or ceiling reform.

Table D3: Land reform in Kerala and Tamil Nadu

Year	Title	Description	Type
		Kerala	
1957	Kerala Stay of Eviction Act	Provides temporary protection to tenants, kudikidappukars and persons cultivating land on minor sub tenures.[47]	Tenancy
1963	Kerala Land Reforms Act	Concedes tenants right to purchase land from landowners.[48] Amended 9 times (1969–1989)	Tenancy
1963	Kerala Tenants and Kudikidappukars Protection Act	Provides temporary protection to tenants in the matter of eviction,[49] and recovering of arrears of rent.	Tenancy
1966	The Kerala Prevention of Eviction Act (Kerala Act 12 of 1966)	Protected tenants against eviction; stopped recovery of rent arrears[50] from before April 1966.	Tenancy
1968	The Kerala Records of Rights Acts	Establishes records of land/tenancy rights.[51]	Tenancy
1969	The Kerala Land Reforms Amendment Act (Kerala Act 35 of 1969)	Conferment of full ownership rights on tenants; 2.5 million tenants could become land owners; right of resumption expires; imposition of ceiling on land holdings of 6.07–15.18 hectares (1960-1972) and of 4.86–6.07 hectares (after 1972); abolition of intermediary rights.[52]	Tenancy, Abolition, Ceiling
1972	The Kerala Land Reforms Amendment Act (Kerala Act 17 of 1972)	Changes the way the government processed land-titles; requires that statements be filed by large land holders.[53]	Tenancy
1976	The Kanam Tenancy Abolition Act (Kerala Act 16 of 1976)	Abolishes a form of intermediary.[54]	Tenancy
1989	The Kerala Land Reforms Amendment Act	Extends the benefits of tenancy and security of tenure to two more classes of tenants.	Tenancy
		Tamil Nadu	
1961	Madras Public Trusts Regulation of Administration of Agricultural Lands Act	Provides that no public trust can evict its cultivating tenants.[55] Limits the amount of land a public trust can personally cultivate.[56]	Tenancy
1969	Agricultural Land-Records of Tenancy Right Act	Provides for preparation and maintenance of complete record of tenancy rights.[57]	Tenancy
1971	Occupants of Kudiyiruppu Act	Provides for acquisition and conferment of ownership right on agriculturists, agricultural laborers, and rural artisans.[58]	Tenancy
1995	Amendment to the Tamil Nadu Cultivating Tenants Protection Act	Provides former cultivating tenants who had possession of land on Dec 1, 1953 the right to resume that land on the same term as held in 1953.[59]	Tenancy

Notes: This table reports land reform acts in Kerala and Tamil Nadu, including whether each piece of legislation was categorized as a tenancy, abolition or ceiling reform.

Table D4: Summary statistics on land reform

State	District	Total reform	Total reform	Abolition		Ceiling		Tenancy	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
KA	Bidar	6	3	3	1	0	2	3	2
AP	Medak	6	6	3	1	0	2	3	3
AP	Chittoor	5	6	0	1	0	2	5	3
TN	Dharmapuri	5	7	0	1	0	2	5	4
KA	Dakasina Kannada	5	3	0	1	0	2	5	2
KE	Kasaragod	5	10	0	2	0	1	5	9
TN	Coimbatore	5	7	0	1	0	2	5	4
KE	Palakkad	5	10	0	2	0	1	5	9
KA	Kolar	3	3	2	1	3	2	1	2

Notes: the total number of reforms for Karnataka and Kerala, all post-1956, differs from the sum of the categories given that they incorporate legislation that can be jointly categorized. For Karnataka, the 1961 and 1974 acts include both tenancy reforms and land ceilings. For Kerala, the 1969 Kerala Land Reforms Act includes all three types of provisions.

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