Democratization, Elite Capture and Economic Development

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We show using a theoretical framework that embeds a voting model in a general-equilibrium model of a rural economy with two interest groups defined by land ownership that the effects of democratization - a shift from control of public resources by the landed elite to a democratic regime with universal suffrage - on the portfolio of public goods is heterogeneous, depending the population landless. In accord with the model and empirical findings from micro data on the differing material interests of the two land classes, we find, based on 30-year panel data describing the democratization of Indian villages, that democratization in villages with a larger landless population share shifted resources away from public irrigation, secondary schools, and electrification and towards programs that increase employment. When the landed farmers have a large population share, public resources were shifted towards irrigation, secondary schools and electrification and away from employment programs.

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Goods allocated by governments ("public goods") can potentially play a significant role in accelerating economic development. For example, infrastructure variables such as roads, power grids, irrigation, communication as well as schools are recognized to at least potentially affect real income growth. The level, composition, and allocation of public goods depend, however, on who is making public goods decisions and their motivations. Thus, the form of governance - rule by the wealthiest, by owners of capital, by land owners, by all members of the community - can matter for economic development. The understanding of how the form of governance affects the economy therefore requires an understanding of the differing interests as well as the influence of different groups that reside in a community on public-goods decisions .

In this paper, we assess how democratization - the shift to a form of government in which all community members have a vote from one in which only a subset effectively control public resource allocations - affects the composition of public goods. Focusing on democratization in a rural economy, we construct a general-equilibrium model in which there are two major interest groups - landowners and the landless - that reap differential benefits from specific public goods. In this setting, the governance regime transitions from one in which the landed are the sole public-goods decision-makers to one in which all members of the landed and the landless classes vote in contested elections that determine which political platforms defining public goods composition wins out. The principal implication is that the relative size of the two interest groups affects in predictable ways how democratization affects the composition of public goods. In particular, the model illuminates how the relative population shares affect directly the magnitude and distribution of the returns to specific public goods and how the relative influence of the two groups differs under the two political regimes. Thus, the framework can be also used to assess whether nominal democratization is *de facto* captured by the elite, in our case the landed.

Our empirical analysis based on the model uses village-level panel data from India describing

the change to democratic governance at the village level over a 30-year period, spurred by state and federal constitutional amendments. We obtain empirical results that show, in accord with the model, that the effect of democratization on the composition of public programs and infrastructure is heterogeneous, depending on both the composition in the population of economic interest groups and the type of and disparities in their interests. In particular we find that in villages under control by landed households there is more investment in public irrigation infrastructure, public secondary schools, and electrification, while a shift to democracy when the landless are in the majority leads to a shift away from those public programs towards programs that increase employment. We show evidence based on micro data that these shifts are in accord with the differing interests of the two groups. Our findings thus suggest that democratization's effects on economic growth may be negative or positive depending on the composition and interest disparities of economic classes.

There is a vast existing literature in economics and political science focused on the question of whether democracy positively or negatively affects economic growth. It is fair to say that the results are mixed. For example, Acemoglu *et al.* (2019) using a panel of 170 countries from 1960-2010 find that democratization increases economic growth. However, when the observations are restricted to the time series covering the years 2001-2019 for the same countries and using the same methodology, democracy appears to reduce economic growth (Narita and Sudo, 2021). A common characteristic of this cross-country literature directly estimating the causal effects of democratization on growth, whatever the data used or the identification strategy employed, is the assumption that the effect of democracy is the same across all countries. Our analysis suggests that this homogeneity assumption is likely incorrect. It also provides insights into the mechanisms by which the form of governance affects economic development via shifting the composition of public goods in response to the interests of economic classes in the economy depending on which have more control over public resources.

Our work is also closely related to studies focusing on how heterogeneity in groups - fractionalization or fragmentation - affects the level and composition of public goods (Alesina *et al.,* 1999 and 2003) under democracy. In that literature, the greater are disparities in preferences between groups and the greater is fragmentation, the lower is the level of non-excludable public goods. Thus, fragmentation affects public goods composition to the extent that some public goods can be targeted. In the empirical work within this literature, groups are principally defined by ethnicity. The advantage of this focus is that ethnicity is exogenous - it is a not a choice variable. A weakness of the focus on ethnicity and race, however, is that the alignment of these divisions with economic interests is not always transparent. Our group definition that is based on landholdings we show in the Indian context is also exogenous. However, we also make explicit and test for the specific interests of the groups defined by land ownership and show how they translate into the composition of public goods under democracy and when landowners dominate public decisions.

Our framework in which the proportion of the population landless affects economic growth via the mechanisms of public goods allocations is also related to the literature that focuses on how fundamental endowments, including crop endowments that affect the scale of operation in farming and the population shares of landowners, affects economic growth by shaping governance institutions (Sokoloff and Engerman, 2000; Easterly and Levine, 2003; Easterly, 2007). In our model, the landless share both affects the shift to democracy from rule by the landed and the economic outcomes that emanate from the democratic process.[1]

Bardhan and Mookerhjee (2010) also focus on how public programs are affected by the interests of landowners under democracy in Indian villages. Employing a similar model of

[1]Easterly (2007) uses crop endowments as an instrument for income inequality to explain the cross-country relationship between economic growth and inequality. In our framework, the proportion landless is 1:1 with inequality because, for given total land, the greater is the proportion landless the larger are average land sizes. Inequality affects total output directly as well as the portfolio of public goods, but differentially under democracy and under rule by the landed.

democracy as we use, they show that the share of landowners in the village importantly affected polices on land reform and that party allegiances were substantially less important than economic interests. They did not, however, extend the analysis to the portfolio of public goods, nor compare policy outcomes prior to democratization.

A number of studies have examined the role of governance in the spatial allocation of public goods. In this literature geography in part defines interest groups. The closest study to ours that looks directly at democratization and it relationship to public goods is by Burgess *et al.* (2015). They examined how the shift in governance regime from autocracy to democracy in Kenya led to a more efficient spatial allocation of roads. In particular, they showed that new road construction was more concentrated in locations dominated by the ruler's own ethnic group under autocracy than under democracy. A limitation of this study is that there is no attention to the total level of road expenditures relative to other public goods spending under the two regimes nor clarity as to why the regimes shifted.[2]

Studies using Indian data on democratized villages have also showed that leader characteristics matter even under democracy for the spatial allocation of public goods. Besley *et al.* (2011) find that presidents of local councils with representatives from multiple villages allocate more total public goods to their home village net of electoral power and relative to the pre-democracy allocations. Brown *et al.* (2021) find that lame duck landed village council presidents allocate more public total resources to streets with more landed households but allocate more public resources to

[2]An issue in the literature comparing rule under democracy with other governance regimes is that the definition of democracy is somewhat amorphous. In cross-country studies, "democracy" is typically an index that bundles a number of factors, including voting, freedom of association, and press freedoms (the most popular one in cross-country studies is the electoral democracy index from the *Varieties of Democracy* Project). In the Kenya case, there were increases in press freedom that were correlated with the holding of elections, making somewhat unclear the mechanisms by which autocratic rule was tempered. In our setting in which we examine the democratization of villages in the last 30 years of the Twentieth Century in India, press freedom was high and constant. Thus, we strictly identify the changes in the composition of public goods that emanate from the shift to holding elections in which voter rights are not defined by landholdings and suffrage is universal.

streets where there are more votes to be obtained when eligible for re-election. In both of these studies, however, there is no attempt to assess the optimality of the public goods distributions. Indeed, when the public goods are itemized, there are some goods that are allocated less to the overall favored groups. It is also not possible to rule out that the favoritism identified reflects underlying spatial differences in economic returns. In our model, we compare the portfolio of public goods under democracy and aristocracy to that which maximizes per-capita income.

Finally, Martinez-Bravo *et al.* (2020) exploit panel data on villages in China that democratized to examine how elections affect public goods outcomes. Unlike in India in the period we study, the move to village democracy in China was from top-down governance by a central authority.[3] In their framework, the interests of the national government and local-population preferences are in conflict, and they show evidence, consistent with their organizational view of local political regimes, that locally-popular policies relative to locally-unpopular policies favored by the central authority are more likely when there are local elections. Because the study by design focuses on consensus policies at the village level (less control of fertility choices, more overall spending on local public goods, less corrupt government), it is silent as to the determination of the composition of local public goods spending, and thus the implications of elections for economic growth and their relationships to socioeconomic divisions with competing interests.

In section 1, we set out the general-equilibrium model with communities consisting of two groups, the landed and landless, with output a function of land, public irrigation assets and labor, which is supplied inelastically by every household. There is a fixed public goods budget that can be used to allocate expenditures to investments in irrigation assets, schools, and employment programs that hire a fixed amount of labor at the equilibrium wage. We embed in the model two forms of

[3]Our data indicate that less than one percent of the Indian villages that democratized transitioned from rule by a central government official. The mode pre-democracy form of government was a local headman.

governance - one in which decisions about public resource allocations are made by the landed to maximize their own utility and a two-party, stochastic voting model in which all households have equal weight in decisions, regardless of land status, and outcomes reflect the weighted (by population shares) average of the preferences of the two groups. We compare the public goods portfolios arising from the two forms of government and show that neither delivers a portfolio that maximizes income per-capita as long as both classes co-exist in the community. We go on to show that if (I) landed households are net hirers of labor, (ii)the "trickle down" of investments in irrigation to the landless in terms of increased employment is small, and (iii) schooling investment augments agricultural productivity but not that of wage labor, when there is a large share of landless in the population a shift from control of public goods exclusively by the landed to the democratic governance regime results in less resources allocated to the productivity-enhancing goods (schools, irrigation) and more to wage-increasing employment programs.

In section 2, we describe the panel data characterizing village governance forms, program initiations by type, and outcome variables for 253 villages over the period 1971 to 1999. A key feature of the data is that the dates of the shifts of governance form are provided along with governance types. Our definition of democratization is a shift to governance by a village council with members chosen by election. The principal form of governance pre-democracy is "village headman," usually the largest landowner or his relative. Section 3 contains tests, based on household data, assessing whether irrigation assets and schooling, by level, augments agricultural productivity but does not increase wages, key assumptions of the model needed to deliver precise predictions. We find that across plots for the same farmer, thereby eliminating issues of heterogeneity in farmer ability and credit constraints, more irrigated plots command higher rents and profits but do not have larger wage bills. We also find that that farmers with secondary schooling earn higher per-acre profits than primary schooled or illiterate farmers but when the same farmers work in the

agricultural wage labor market, net of unobserved selectivity of wage-labor participation, wages are not higher for any schooling level. We also show that schooling does not also affect permanent out-migration from villages and that electrification predominantly benefits landed households, based on data describing which households are electrified within villages and the importance of electrification for irrigation.

In section 4 we set out our identification strategy, which uses the time series of state-level amendments mandating village democratization interacted with the cross-village landless shares as instruments for the transitions to village level democracies net of village fixed effects and state-specific time trends. Our estimates reject the hypothesis that democratization shifts the portfolio of public goods homogeneously across villages, with the coefficient for the landless population share interacted with the democratization variable always statistically significant for each public good. We use the estimates to compute counter-factuals under different values for the landless populations share. These indicate that when a super-majority of households are landless, democratization reduces investments in public irrigation, secondary schools, and electrification while increasing the incidence of employment programs,. When the landed dominate numerically, we find the opposite outcomes from the shift to democracy. These results are consistent with the model and the empirically-supported assumptions about land class-specific material interests. We also find, using three rounds of household- and village-level panel data covering the same period, that when the landless dominate numerically, democratization results in lower levels of public irrigation assets, less enrollment in public schools, but reduced disparities in consumption per-capita across landed and landless households. The last section contains a conclusion.

1. Model

a. Interest groups in the village economy.

We assume a setting in which there are two classes of otherwise identical households in a

community - those who own land, designated by A (the rich), who make up 1- ρ of all households, and those who do not, designated by N (the poor). Each household is endowed with l family workers. Land per-household in the village A is evenly distributed among the landed farmers so each landed household has a farm size of $A/(1-\rho)$. There is one industry - farming - producing an agricultural output that is consumed by all agents in the economy. All workers are employed on the land, with workers paid a wage w, the only source of income for the landless.[4] Labor is geographically immobile, but agricultural output is a traded good.

The community (village) is allocated a fixed amount of public funds, externally financed, that can be allocated to three public goods/programs whose direct benefits differ across the landed and landless households. First, there is an employment program that employs r workers per household at the local equilibrium wage w to produce a good or service φ_r that is equally valued by the landless and landed.[5] Because the income of the landless consists solely of wage income, employment programs directly benefit the landless, at the expense of the landed if the landed are net hirers of labor. A second public good is a facility h constructed using external inputs (no local labor), whose benefits are also equal across all households; e.g., a literacy program, a health facility.

The third public good on which public funds are spent is an asset q that directly augments the productivity of agricultural production but not directly the productivity of the landless. Examples of agricultural infrastructural assets might include a public irrigation facility such as a tank or a canal. Another example would be schools, if schooling augments agricultural productivity by

[4]We will apply the model to nationally-representative rural Indian household data covering the period 1971 to 1999. The data indicate that agriculture was the primary or secondary occupation of 82.1% of rural household heads in 1971 and 74.8% in 1999. Thus, land ownership is a key dividing line defining interest groups.

[5]Employment programs may also offer a fixed minimum wage that is below the average equilibrium wage. As long as the minimum wage is binding in a least some years, due to adverse weather for example, our results are unaltered.

increasing the skills of farmers but has no direct effect on the wages earned by agricultural workers. A third example is electrification, which facilitates irrigation. We will in the empirical section provide evidence on the distribution of the direct benefits of these three type of public goods across the landed and landless classes.

The per-household public budget constraint is thus

(1) $P(r,q,h)=B-wr-qA^{\gamma}-h=0$,

where B is per-household public revenue, h = per-household health or literacy facility expenditures, and q = per-household public investment in assets that exclusively contribute to agricultural productivity, where if $\gamma=1$, q represents the per-household expenditure on irrigation assets per-acre and if $\gamma=0$, q represents per-household school expenditures or expenditures on electrification.[6] Prices of public facilities benefitting agricultural production and health facilities are normalized to one.

Agricultural production thus has three inputs - land, per-acre labor l_e, and q. The production function is constant returns to scale in labor and land. Thus, the per-acre production function is $g(q,l_e)$ and per-acre profits are

$$\max_{l_e} g(q,l_e)-wl_e$$

Farmers are price takers in the labor market so

$$\frac{\mathrm{d}g(q,l_e)}{\mathrm{d}l_e}-w=0.$$

The labor market clears so the per-acre demand for workers l_e must equal the per-acre supply of workers after accounting for the workers who are recruited into work programs $(l-r)/A$. As a consequence we can define equilibrium profit and wage functions:

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[6]We are treating the total budget as fixed and exogenous. The 2006 round of the panel data we use indicates that of the total *panchayat* budgets in the sample villages, only 12% of revenues is raised from local taxes. We thus ignore revenue decisions, focusing on the allocation of public funds across activities and programs.

(2) $\pi(q,r,A) = g(q,(l-r)/A) - w(q,r,A)(l-r)/A$

and

(3) $w(q,r,A) = \frac{\partial}{\partial l} g(q,(l-r)/A)$,

respectively.

Households are endowed with utility functions that depend on own consumption and on the presence of the two non-agricultural public goods in the village:

(4) $u(c,h,r) = c_t + \phi_h h + \phi_r(r)$.

Note that with a utility function linear in goods, we shut down any social returns to the redistribution of income across the two classes. We thus are focusing on the productivity and distributional effects of public goods, to the exclusion of transfer programs.

Earnings in landed households are the sum of profits and the value of family labor so the budget constraint for landed households is

(5) $c_A = A/(1-\rho)\pi(t,r,A) + w(t,r,A)l = y_A$

Earnings in landless households are just the value of family labor and depend exclusively on the equilibrium wage

(6) $c_N = w(t,r,A)l = y_N$.

b. Aristocratic governance.

We first consider the case in which the determination of the allocation of public goods is in the hands of one interest group, landed households, who allocate public goods to maximize their own welfare. The well-being per landed household in equilibrium is

(7) $w(r,q,A)l + \frac{A}{1-\rho}\pi(r,q,A) + \phi_h(B - A^{\gamma}q - w(r,q,A)r) + \phi_r(r)$,

or, substituting in for profits per acre and the public budget constraint, is

(8) $w(r,q,A)(l - \frac{l-r}{1-\rho}) + \frac{A}{1-\rho} g(q,(l-r)/A) + \phi_h(B - A^{\gamma}q - w(r,q,A)r) + \phi_r(r)$.

The first order necessary conditions for the allocation of funds to the agricultural asset q and the

scope of the employment program *r* are:

$$(9) \qquad \frac{\partial}{\partial q} w(r,q,A)(l-\frac{l-r}{1-\rho})+\frac{A}{1-\rho}\frac{\partial}{\partial q} g(q,(l-r)/A)-\phi_h(A^{\gamma}+\frac{\partial}{\partial q} w(r,q,A)r) \;=0$$

$$(10) \qquad \frac{\partial}{\partial r} w(r,q,A)(l-\frac{l-r}{1-\rho})-\phi_h(w(r,q,A)+\frac{\partial}{\partial r} w(r,q,A)r)+\phi_r{}'(r) \;=0,$$

from which it can be seen that the allocations of the two public goods depend on how *q* and *r* affect equilibrium wages as well as agricultural output. In the case, for example, in which the agricultural asset does not affect the demand for labor, so that the equilibrium wage is unchanged when *q* is increased, then expression (9) just says that the allocation of public goods to the public agricultural asset equates the marginal increase in agricultural output to the marginal utility of the *h* public good.

How does the "aristocratic" allocation of public goods compare to the allocation that maximizes GDP per household? In Appendix A we compare the allocation of public goods that maximizes GDP per household with that determined by the landed. The key difference is that the landed care about agricultural profits and not overall output. We show that in the case in which the landed are net hirers of labor and the agricultural asset does not strongly increase the demand for labor, the aristocratic allocation will be biased towards the productivity-enhancing agricultural good (irrigation, electrification, schools) relative to the allocation in the GDP-maximizing benchmark.

c. Democratic governance.

We now consider the allocation of public goods under democracy. The key feature of the democratic regime is that the decision-makers are elected from a competition between candidates who must appeal to the interests of all of the members of the community, in this case both the landed and the landed classes. Under democracy, the relative size of the populations in the two groups, ϱ, now plays a direct role in the determination of the public good composition because it shifts the relative influence of the two sub-groups in determining public goods allocations.

We assume that there are two parties that compete for public office and for simplicity that the household is the voter. Households vote based on the relative value they assign to the two

parties, where the value assigned to a particular party reflects the welfare that the household will achieve given the proposed allocation of public expenditures plus a random term that reflects idiosyncratic preferences for that party. Thus voter *I* in land class *k*, *k*=*A*,*N*, will vote for party *X* if

$$(11) \qquad v_K^*(q_X,r_X,h_X) - v_K^*((q_Y,r_Y,h_Y) + \delta\varepsilon_{Ki} - \delta\varepsilon_{Ki} \geq 0$$

where $v_K^*(t,r,h)$ denotes utility for household *K* given *t*, *r*, and *h*. Note that if δ=0, the classes vote homogeneously based strictly on their preferences for the public goods and the group with a population share greater than 0.5 would always determine public goods allocations. In that case variation in ϱ would have no effect on public goods allocations when ϱ is above the 0.5 threshold. If, however, δ>0 then there are other attributes of parties or candidates unrelated to class interests such as caste affiliation, gender, charisma, that attract votes and variation in ϱ will affect voting even it does not cross the threshold of 0.5.

When the ε have an extreme value distribution and are independent across households, the fraction of land-class *K* households voting for party *X* is

$$(12) \qquad 1/(1+Z_k)$$

where $Z_k = \exp(-(v_K^*(q_X,r_X,h_X) - v_K^*(q_Y,r_Y,h_Y))/\delta)$. The expected proportion of votes received by party *X* given the respective policy choices of the parties, is

$$(13) \qquad (1-\varrho)\frac{1}{1+Z_A} + \varrho\frac{1}{1+Z_N}$$

Each party chooses its own proposed public goods allocation to maximize its chance of winning given the policy choice of the other party.[7] For a sufficiently large population of voters this corresponds to constrained maximization of (13) subject to the public budget constraint. Thus, for example, the first-order condition with respect to the agricultural public good promised by party *X*, q_x, is

[7]Given the nature of the game this is equivalent to the maximization of the expected vote probability (Hinich 1977; Patty 2001).

(14) $$\frac{1-\varrho}{\delta}\frac{\partial v_A^*}{\partial q_X}\frac{Z_A}{(1+Z_A)^2}+\frac{\varrho}{\delta}\frac{\partial v_N^*}{\partial q_X}\frac{Z_N}{(1+Z_N)^2}+\mu\frac{\partial P}{\partial q_x}=0$$

where μ is the Lagrange multiplier associated with the budget constraint (1). Assuming $(1-\varrho)v_A^*(q,r,h)+\varrho v_N^*(q,r,h)$ is concave with bounded second and third derivatives over the relevant range, there exists a sufficiently large δ such that (14) is concave in the policy variables of party X and thus there is a unique Nash equilibrium of this game in which both parties offer the same policy.[8] The Z_k terms (14) are therefore one and (14) reduces to

(15) $$(1-\varrho)\frac{\partial v_A^*}{q_X}+\varrho\frac{\partial v_N^*}{q_X}+4\delta\mu\frac{\partial P}{\partial q_X}=0,$$

with analogous expressions for each of the other public allocations. Thus, in a two-party democracy, the allocation of each public good is such that the weighted marginal contributions to the utility of the two classes is equal to the product of the shadow price of public funds[9] and the marginal cost of the good, where the weights are the population proportions of the two land classes. This is equivalent to maximization of a utilitarian welfare function.

How do the allocations of q and r under democracy compare with those that maximize per-household GDP? We show in appendix A that the democratic first-order condition for the allocation of r has an extra term compared with that characterizing the allocation that maximizes GDP per household, $w(r,q,A)r$, which is always positive. Thus, under democracy there will be excessive spending on public employment programs using as a benchmark the public-goods composition that maximizes per-household GDP. For the allocation of public funds to q relative to that which maximizes GDP per household, the answer depends on whether the agricultural

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[8] A first-order Taylor expansion in $1/\delta$ of the second-order conditions yields a negative semi-definite matrix for large δ.

[9] The Lagrange multiplier μ is the effect on the winning probability of additional income and the 4δ converts this to the effect on welfare.

investments raise or lower the demand for labor in equilibrium. The democratic first order condition for q has the extra term $\frac{\partial}{\partial q} w(r,q,A)r$, which biases the democratic allocation to agricultural productivity assets negatively (positively) if those investments lower (raise) the equilibrium wage. In the case in which investments in agricultural productivity do not change the demand for labor the allocation of q under democracy conforms to that which maximizes GDP. The effect of q investments on labor demand also plays a key role in identifying the effects of democratization, as we show below, because it sharply distinguishes in equilibrium the interests of the two classes.

d. Aristocratic versus democratic public good allocations.

The GDP-maximizing conditions are a benchmark. Democratization is not a change in regime to one that maximizes GDP, but one that is a *de jure* move away from a regime in which one interest group controls public resources. Alternatively, democratization may be in name only, with no real change in who dominates decisions determining the allocation of public funds - "elite capture." We now consider whether it is possible to identify a true shift to democracy from aristocratic rule. To do this we consider an objective function

(16) $\quad (1-d\varrho)v_A^*(t,r,h)+d\varrho v_N^*(t,r,h)$,

which embeds the two forms of governance. For d=0, (16) reflects solely the welfare of the landed households, corresponding to the full capture of the local authority by the local elite and thus the objective function given by (7) after accounting for the public budget constraint. For d=1 the objective function corresponds to that of the democracy model. To see this, note that the first-order condition for r, for example, is

(17) $\quad d\varrho\frac{\partial v_N^*}{\partial r}(t,r,h)+(1-d\varrho)\frac{\partial v_A^*}{\partial r}(t,r,h)+\mu\frac{\partial P}{\partial r}=0,$

which corresponds to (15) for d=1.

From (16) it is clear that under democracy, *ceteris paribus*, the allocation of public expenditures will depend directly on the share of landless households ϱ - in particular democracy gives weight to

the interests of the landless in proportion to their share in the population. And, given that under aristocratic rule the interests of the landless are not considered at all, it would seem that a simple test of whether democratic rule is in effect, relative to aristocratic rule, is to see if increases in ϱ allocate resources more towards public goods allocations that favor the landless, given the identification of the differing interests of the two groups. However, as seen in (9) and (10), ϱ also enters the first-order conditions determining the allocation of public goods in the aristocratic regime due to general-equilibrium effects.[10] That is, shifts in ϱ affect the interests of the two classes and not just their voting power under democracy. Thus, a test of whether true democratization has occurred and aristocratic governance is no longer in effect requires examining *differences* in the effects of the landless share in the population on the public goods allocations across the two regimes taking into account the general-equilibrium effects of shifts in the proportion of landless households. We thus embed the governance regimes in the village economy structure set out above.

The voting equilibrium given the level of democracy d will yield expenditures to maximize (16) given the public budget constraint and the labor-market clearing condition, which yields the maximand nesting the two canonical forms of governance at d=0, fully aristocrat, and d=1, fully democratic:

$$(18) \qquad \frac{(1-\rho d)A}{1-\rho}\pi(r,q,A) + w(r,q,A)l + \phi_h(B - A^\gamma q - w(r,q,A)r) + \phi_r(r).$$

The first order necessary conditions for q and r are:

$$(19) \qquad \begin{aligned} &\frac{\partial}{\partial q}w(r,q,A)(l - \frac{1-\rho d}{1-\rho}(l-r)) + \frac{(1-\rho d)A}{1-\rho}\frac{\partial}{\partial q}g(q,(l-r)/A) \\ &-\phi_h(A^\gamma + \frac{\partial}{\partial q}w(r,q,A)r) = 0 \end{aligned}$$

and

[10] An increase in the proportion landless for fixed A and l increases the landholdings of the landed and increases their reliance of hired labor with no effect on the equilibrium wage for given r. The change in landholding size increases the returns to q and the cost of increases in r for the landed.

(20) $$\frac{\partial}{\partial r} w(r,q,A)(l-\frac{1-\rho d}{1-\rho}(l-r)) - \phi_h(w(r,q,A)+\frac{\partial}{\partial r} w(r,q,A)r) + \phi_r'(r) = 0$$

From (19) and (20) we see that under democracy (d=1), shifts in ϱ have no effect on the allocation of public goods once we take into account how shifts in ϱ affect interests. This is because an increase in the landless share has two effects which exactly offset each other: an increase in ϱ increases the relative votes of the landless but also affects the size of landholdings among landed households, given fixed total land in the village, and thus proportionally increases the returns to profitability for those households given the constant returns to scale assumption. The benefits to the landed from public goods that increase profits per acre thus rise at the same rate that their share of vote declines.

The share of the landless class and thus land per landed household ϱ affects the allocation of q and r, however, when the landed class controls public resources. We now show the conditions under which it is possible to test whether democratization, a move from aristocratic to democratic public goods allocations, has occurred or has not occurred ("elite capture") by examining the accompanying change, if any, in how the proportion landless affects public goods allocations. We get the following proposition:

Proposition: *If the landed are net hirers of labor, ϱ<0.5, the landless are net beneficiaries of wage increases, and increases in agricultural assets do not increase the demand for labor, then under democracy increases in the landless share will shift public resources more strongly towards employment programs and away from infrastructural agricultural investment programs relative to their effects under aristocracy.*

Proof:

From (19) and (20), the difference in the effects of ϱ on q and r are given by

(21) $$\left.\frac{\mathrm{d}q}{\mathrm{d}\rho}\right|_{d=1} - \left.\frac{\mathrm{d}q}{\mathrm{d}\rho}\right|_{d=0} = -\frac{1}{(1-\rho)^2}\left(-A\frac{\partial}{\partial l} g\left(q, \frac{l-r}{A}\right) z_{11} + (l-r)\frac{\partial}{\partial r} w(q,r,A)\, z_{12}\right)$$

and

(22) $$\left.\frac{\mathrm{d}r}{\mathrm{d}\rho}\right|_{d=1} - \left.\frac{\mathrm{d}r}{\mathrm{d}\rho}\right|_{d=0} = \frac{1}{(1-\rho)^2}\left(-A\frac{\partial}{\partial l} g\left(t, \frac{l-r}{A}\right) z_{21} + (l-r)\frac{\partial}{\partial r} w(t,r,A)\, z_{22}\right)$$

where the z_{ij} are the elements of the inverted Hessian, with $z_{11} < 0$ and z_{22} <0 for an interior maximum, and

(23) $$z_{12} = z_{21} = \frac{1}{|D|}\left(\left(-\phi_1 r + l - \frac{(l-r)}{1-\rho}\right)\frac{\partial^2}{\partial q \partial r} w(q,r,A) - \phi_h \frac{\partial}{\partial q} w(q,r,A)\right),$$

$|D| > 0$ is the determinant of the Hessian.

The signs of (21) and (22) thus depend on the sign of z_{12}. The term in the inside parentheses in the expression for z_{12} is negative if landed households are net purchasers of labor - the per household family labor endowment l is less than the number of workers (inclusive of family workers) per landed household, $(l-r)/(1-\rho)$ l in equilibrium. If $z_{12} > 0$, then

(24) $$\left.\frac{dq}{d\rho}\right|_{d=1} - \left.\frac{dq}{d\rho}\right|_{d=0} < 0$$

and

(25) $$\left.\frac{dr}{d\rho}\right|_{d=1} - \left.\frac{dr}{d\rho}\right|_{d=0} > 0$$

Sufficient conditions for $z_{12} > 0$ are that increases in wages from an increase in the size of the public employment program r benefit landless welfare and that increases in public-goods that directly raise agricultural productivity do not increase the demand for labor. These conditions are derived in Appendix B.

2. Data

a. Measuring village democratization.

As noted, India initiated in the last two decades of the Twentieth Century at both the national and state levels reforms aimed at transforming village governing authorities into democratic organizations. In recognition of the importance of these activities, we incorporated a set of questions on village governance in the 1999-2000 re-survey of rural households administered by the National Council of Economic Research (NCAER). This survey was a continuation of the Rural Economic Development Survey (REDS) that was last undertaken in the 1981-82 crop year. The survey is meant to be representative of the rural population in 16 of the major states of India and

consists of a core stratified random sample of approximately 5000 households located in 261 villages based on a sample frame designed in 1968, the first round of the panel. For this study we use the 1971, 1982 and the 1999 rounds of the survey, and the survey sampling weights where relevant, to construct time-series of village governance, public programs, and infrastructure.

A key feature of the data is that the 1999 round included a village-level questionnaire that elicited the history of changes in the village governance structure, defined as the individual or group that "makes decisions about common resources." There were six governance classifications information on which was provided by a set of knowledgeable village informants. - 'traditional *panchayat*', 'elected *panchayat*', 'village headman', 'wealthy individual', 'regional government official', and 'none'- plus a miscellaneous category. We will consider a village as 'democratic' in a given year if it falls in the category of 'elected *panchayat*.' From this information we constructed an annual time-series of village democratization covering the .30-year period from 1971 to 1999 for the 250 sample villages represented in both the 1982 and 1999 survey rounds.

The shifts in village governance to democracy were not random events but were in large part responses to state-level amendments mandating village councils and elections. To identify the shifts in the effects of variation in the landless share by governance regime we use the state level timing in these governance amendments as instruments, as described below. These sets of state-level amendments can be roughly classified in three stages, the first being efforts in Rajastan and Andrha Pradesh in the late 1950's and early 1960's to democratize local community development organizations, following the recommendations of the Balawantray Mehta Committee of 1957. The second-stage is demarked by the Asoka Mehta Committee of 1977, which was followed by legislation in four states - West Bengal, Karnataka, Andhra Pradesh and Jammu and Kashmir - encouraging the transformation of local *panchayats* from democratic development organizations to democratic political institutions. The third stage is distinguished from the second in that there were

amendments added to the national constitution that went into full effect in 1996 formalizing the role of elected *panchayats* at various aggregates (blocks, *tehsils*, villages).[11] All states, except Bihar, enacted legislation to make their own Panchayat Acts conform to the national provisions.

Figure 1 provides by year the fraction of villages in our data subject to the three stages of amendments from 1971 to 1999, along with the fraction of the villages that democratized. As can be seen, while there was a growing and significant amount of legislation at the state and national levels over the 30-year time period designed to institutionalize local democratization, democratization at the village level, given our strict definition emphasizing elections, level did not advance as rapidly - 76% of the survey villages had elected *panchayats* in 1999, up from 62% in 1982, a rise of 23%.[12]

Data were also collected in 1999 on the characteristics of the membership of the elected governing bodies. These data support the assumption of our model of democracy, that there are two parties. Figure 2 plots the cumulative distribution of the share of seats on the local elected governing body that was held by the top two parties in that village. As can be seen, in a third of the villages 100% of the council members are members of one of two parties. And in 75% of the villages the top two parties have at least 60% of the seats. Interestingly, the information on the characteristics of the members of the governing body indicated that there was a positive correlation (0.25) between the proportion of landless households in the village and the proportion of landless members of the elected council.

b. Measuring public program initiations and landlessness.

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[11]The 73rd and 74th Constitution Amendment Acts went into effect in 1993, but the provisions became applicable to the entire population of India in 1996 with the passage of the *panchayats* (Extension to the Scheduled Areas) Act of 1996.

[12]Of the villages that had shifted to governance by a democratically-elected *panchayat*, 55% had transitioned from ruling by a headman, typically the largest landowner in the village or one of his sons; 37% from a non-elected council; and only 1% from a higher-level government official. Thus, unlike in China, village democratization in India in the period we study was not a transition from top-down to local governance.

In the equilibrium model of governance, we highlighted four sets of public goods: irrigation assets, schools, electrification, and employment programs. We did so because we can adduce evidence, discussed below, on how these public goods differentially affect the welfare of the two interest groups defined by landed status. The 1999 and 1982 rounds provide, in addition to the histories of village governance, retrospective histories on the initiation of public programs and projects in the villages going back to 1971. These include the dates of construction of government schools in the village, by level; the initiation of an employment program "for general welfare," a professional training program, and a pre-NREGA guaranteed employment scheme; the initiation of a food-for-work (FWP) program building irrigation facilities and roads; and village electrification. Based on the data on the initiation dates of these programs and projects, we constructed a consistent annual time-series of these variables covering the 250 villages over the period 1971 through 1999.[13] Figures 3-5, respectively, display the growth in the proportion of villages (1) with public primary and secondary schools, (2) that are electrified and have irrigation construction programs, and (3) that have employment programs, by type. These indicate that while there has been a continuous trend upward in schools (Figure 3) and in electrification (Figure 4) at least since 1971, general employment programs seem to have grown faster in incidence starting in 1981, with the irrigation employment programs accelerating in 1988.

As indicated in the theory section, identifying whether there is democratic rule, which by design distributes influence across interest groups solely by their relative size, requires that there be groups with well-defined and differing interests. In the equilibrium model of governance, we defined

[13]In Foster and Rosenzweig (2003b) we carried out investigations of the accuracy of recall data pertaining to village infrastructure based on comparisons of the overlapping years for the histories of electrification that were obtained in the 1999 and 1981-82 surveys. The results, to the extent that they carry over to the similarly-obtained school and employment program histories, suggest that the histories of programs and projects accurately reflect the changes in programs and infrastructure in the villages. There is one caveat - if there are schools that have been destroyed over the period these would not be reflected in a school-building history based on schools in existence in the villages in 1999.

interest groups based on land ownership. The REDS household survey data provide sampling weights for all households (Vashishtha, 1989), thus permitting construction of village population characteristics from the household survey information. Based on the population weights and the household data on landholdings, we constructed for each village the proportion of households that do not own land. These proportions have basically remained the same within villages over the 1971-1999 time period (there have been no significant land reforms during the period), but vary significantly across villages, the standard deviation of the distribution of proportions landless being almost as large as the mean. We will use the initial 1971 landless proportions is our analysis so that the subsequent changes in regime do not affect this village characteristic.[14]

It is important to note that landed status is not a proxy for status associated with caste (Besley *et al.*, 2004; Brown *et al.* (2021). In the 1999 survey round in which caste status is reported, there is an approximately equal proportion of upper castes and lower castes among the landed (and landless), with 81% of upper castes and 80% of backward castes owning land. Among the scheduled castes and tribes, landlessness is more prevalent, with a 58% rate of land ownership, but these groups make up less than 10% of the village populations. Religion is also not aligned with landownership, the proportion of Muslim households owning land, at 80%, is the same as that for upper and lower castes among Muslims.[15]

A possibly important issue in using local public activities to infer local governance decisions

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[14]There are few sales and purchases of land in rural India, as we document in Foster and Rosenzweig (forthcoming). As a consequence, land status does not change significantly over time. We used the household-level panel feature of the data linking 1982 to 1999 households to quantify mobility (4,386 households). Using the 1982 sampling weights, we found that in that 17-year period of those households owning 0.5 acres or more in 1982, only 2.5% owned less than 0.5 acres in 1999 (including zero). Of those owning less than 0.5 acres in 1982 (including zero), only 7.5% owned 0.5 acres or more in 1999.

[15]This does not mean that castes play no role in democratic governance in India. Election rules set aside council seats for scheduled castes and tribes randomly across elections and caste networks play a role in determining who among candidates run for office, which affects the quality of representatives to the councils (Munshi and Rosenzweig, 2019).

is the extent to which projects are determined by local authorities. The 1982 and 1999 REDS village surveys provide comprehensive information on the set of public activities in the village in two categories: self-help public programs largely initiated and funded by the village and public programs funded through central-government Food-for-Work Program (FWP) grants to the village. These data on local public activities indicated that irrigation installation and school building, highlighted in the model, constitute 73% of all of the activities of the local governing body. Table 1 provides the proportion of villages in each survey year with projects in each of the two areas classified by whether they were initiated by the village or via the FWP. As can be seen, for each of these activities and in both pre-survey decades, a higher proportion of villages initiated their own projects compared to those funded via FWP. However, villages can apply for FWP grants and have at least some ability to shift funds between projects, so the distribution of program activities funded either locally or from state or national funds likely reflects the decisions of local decision-makers.

c. Measuring outcomes.

In addition to the retrospective histories from the 1982 and 1999 rounds on program and project initiations we can also examine the outcomes of local public resource allocations as measured by the public infrastructure in place at the time of the 1982 and 1999 REDS surveys.[16] Both the 1982 and 1999 REDS village-level surveys provide an inventory of irrigation assets classified by type and by whether they are public or private. We assembled the public irrigation assets by type (pump, well, tank) in each village for each year.[17] The household survey data from 1971, 1982 and 1999 also enable us to look at changes in the share of land that was irrigated, the changes in school enrollment rates among 10-14-year olds, by gender, and household food expenditures in landless and landed

[16]The 1982 survey did not include households residing in Assam. The 1999 survey excluded households in Jammu and Kashmir.

[17]One reason for looking at infrastructure in place rather than just at infrastructure construction program initiation is that facilities may deteriorate if not maintained.

households. Based on the relevant round-specific sampling weights, we can use these household-level data to assess how variation in the fraction of the landless population differentially affects irrigation and human capital investments as well as consumption across the two land classes in the villages under the two forms of governance.

Figure 6 displays the changes in the village-level irrigated land share, school enrollment rates, and the ratio of landless to landed consumption expenditures over the 30-year span as seen in each of the three survey years. Notable are the rise in school enrollment rates and the shrinkage in the gap between landed and landless food expenditures especially after 1982. We combined the round- and type-specific irrigation assets, irrigated land share, school enrollment and food-expenditure variables with the histories of village governance obtained from the 1982 and 1999 surveys to construct an additional three-year village-level panel data set based on the 1971, 1982, and 1999 survey rounds.

3. Testing for the Differential Interests of the Landed and Landless

In this section we test if the landed and landless differentially benefit from public programs allocating resources to the four highlighted public goods categories: irrigation assets, schools, electrification, and employment in accord with the identification assumptions of the model.

a. Irrigation.

In the model we assumed that irrigation increases the productivity of land and showed that a sufficient condition for the landless and landed having opposing interests in public irrigation programs is that increases in irrigation do not significantly increase labor demand. We test both of these assumptions using the latest rounds (2009-2014) of the India Village Level Studies (VLS) International Crop Research Institute of the Semi-arid Tropics (ICRISAT) plot-level survey data. These data provide inputs and outputs at the plot level, collected every three weeks, for 819 farmers and 2,015 plots in 20 villages in six states. The data set contains highly accurate and comprehensive measures of agricultural production, including land characteristics such as size, quality, and irrigation

status. The ICRISAT data thus allows us to identify the relationship between the profitability or value of land, the wage bill (labor demand), and the share of the land that is irrigated net of a number of confounding factors.

The assignment of irrigation across farms is not random. The key threat to the identification of the value of irrigation to farmers is that unobserved characteristics of the farmer and the land may jointly affect plot profitability and the choice of irrigation. In particular, farmers who are more capable or more able to obtain credit or face lower transaction costs in hiring labor (Foster and Rosenzweig, forthcoming) may be more able to afford to invest in irrigation and/or will hire more labor, creating spurious positive correlations between profits, the wage labor bill and the presence of irrigation assets. To remedy this we first control for all of the soil characteristics available in the data - for each plot there are 24 different characteristics, including soil depth, soil degradation, soil fertility, soil types, plot slope, and distance from the homestead. Second, we use land rent (farmers were asked what each plot would fetch in the rental market) rather than profits as the dependent variable because the rental value of land - the amount other farmers are willing to pay to rent the land, based on its profitability to them - should not reflect any of the characteristics of the land owner. Finally, we estimate the relationship between the rental value of a plot and its irrigation share using farmer fixed effects. Variations in profitability and irrigation across plots for the same farmer are net of all attributes at the farm level, including credit-worthiness, wealth, and skill, that could jointly affect profitability and investments in irrigation.

The first column in Table 2 presents the estimate of the relationship between a plot's irrigation share and the log of its rental value, net of village-year fixed effects. The estimate is positive, statistically significant, and large - the point estimate indicates that, net of plot size, a fully-irrigated plot commands a 55% higher rent than an unirrigated plot. In the second column we add the set of plot characteristics. This only marginally reduces the irrigation value point estimate, which

retains its statistical significance. Finally, in the third column, which includes farmer fixed effects in the specification as well as the set of plot characteristics, we see that the rental (expected profitability) premium for a farmer's fully irrigated plots is 50% higher than his unirrigated plots. Irrigation assets that are subsidized or provided by government thus would appear to be highly valued by land owners.

The last three columns of Table 2 provide estimates of the relationships between the irrigation status of a plot, plot size and labor use on the plot with the different sets of controls. The sixth column estimate, which controls for plot characteristics and the all farmer characteristics via the fixed effect well as village-year fixed effects, indicates that there is no more labor used on irrigated than on non-irrigated plots, net of plot size - a fully irrigated plot is associated with only a statistically insignificant 1.2% higher level of labor use compared with the same farmer's non-irrigated plots. The estimates in Table 2 thus indicate that landed voters would favor public funds for irrigation but not landless laborers, who do not indirectly benefit from the increased presence of irrigation. As indicated in proposition 1, a shift to democratic from aristocratic governance should thus decrease investments in irrigation the greater the share of the landless in the population.

b. Schooling.

In the model, schooling is also treated as an agricultural asset that increases farm productivity but not the wages of workers, so that democratization shifts public resources away from building schools in villages with a larger share of landless households. In this section we use the VLS ICRISAT and the 1999 REDS data to provide evidence on these assumptions.

We aggregated the plot information from the ICRISAT panel data, including real farm output and profits in the *kharif* season, to create a data set at the farm-year level. This aggregation is appropriate because one of the potential mechanisms by which schooling increases profits is via the efficient allocation of resources across plots within a farm. And, of course, farmer schooling does

not differ across plots. For each farm household we identify the male who has the highest level of schooling and use that schooling level to estimate the returns to schooling in farming. In previous work (Foster and Rosenzweig, 1996) we found that the farm household's maximum schooling rather than the head's schooling was more important in farming decisions, consistent with the fact that often the household head is merely the oldest male rather than the principal decision-maker, and the head typically has lower schooling than any co-resident adult sons. We divided up the maximum-schooled males into two categories - those with only primary schooling and those with secondary schooling and above - relevant to the data on village public school construction, which is by primary and secondary.

The first column of Table 3 reports estimates of the relationship between schooling and the log of per-acre farm output, with controls for the farmer's age, farm size, irrigation share and village-year fixed effects. The estimates indicate that secondary schooling, but not primary schooling contributes significantly and positively to output per acre, with the point estimate of the latter indicating that secondary-schooled farmers have 37% higher output than farmers with no schooling, net of farm size. This result is robust to controls for land quality, as shown in the second column of the table. In the third and fourth columns of Table 3, we report estimates of the relationship between the two schooling measures and real (2009) farm profits per acre. Again, it is only secondary schooling that matters, but the gain in profits per acre associated with secondary schooling is more modest - a statistically significant increase of 778 rupees, about a 12% gain relative to the sample profit mean.

The positive associations between secondary schooling, output and profits could also reflect reverse causation - on more productive and profitable farms secondary schooling is desired for its members as a consumption good. However, what matters is the relative profitability of schooling in farming and in wage work. If secondary schooling augments farm productivity but not the

productivity of manual wage work we would expect that among the males with the maximum household schooling, those with secondary schooling should be less likely to engage in wage work relative to the less-schooled. In the fifth column of Table 3 we report maximum-likelihood probit estimates of the determinants of the probability of casual wage work among all the maximum-schooling males in the farm households using the same specification as we used for the output and profit outcomes. The estimates indicate that both the primary-schooled and the secondary-schooled farmers are significantly less likely to engage in wage work, net of the land size and quality of the farm, with the negative effect of secondary schooling on engaging in wage work more than double in absolute value that of primary schooling.

The finding that more schooled farmers are less likely to participate in the wage labor market is consistent with schooling being more productive in farming than in wage work. In columns six and seven we directly estimate the effects of schooling on the log of hourly wage rates among the subset of the (maximum-schooled) farmers who earned wages in casual (daily) wage jobs in the same season (24% participated). Who among the farmers participates in the casual labor market may be selective, and the estimates of the determinants of wage rates may be biased if there are unobservables affecting both wage rates and the choice to participate. To take into account this potential selectivity we use a control function approach (Heckman, 1979) and jointly estimate using maximum likelihood the determinants of wage participation and the log of real hourly wage rates. The probit estimates of wage-market participation in column five thus constitute the selection equation for the wage determinants in column seven.

In column six of Table 3 we report the OLS estimates of the determinants of log hourly wage rates among the subset of farmers who participate in the wage labor market that do not take into account selectivity. Column seven contains the maximum-likelihood control function estimates of the determinants. Both estimation procedures yield results that are similar - neither primary nor

secondary schooling significantly affect wages. The similarity in results across the columns is consistent with the non-rejection of the null hypothesis that there is no significant correlation between the unobservables influencing participation and influencing wages (Wald test: χ^2 (1) = 0.94, p= 0.3317). This result implies that farming ability is not rewarded along with schooling in manual labor jobs.[18]

The estimates in Table 3 are for those members of the farm households who stayed in their home village. It is possible that there is a return to schooling associated with out-migration. In the 1999 REDS round we collected information, including schooling, on all the immediate relatives of the heads of households regardless of where they were residing at the time of the survey. We can thus test whether schooling affected the probability of the permanent migration of men using the sample of all head's sons. We selected a sample of sons of the household head aged 20-59 in 1999; of these 15.8% in landed and 16.7% in landless households had left the village at the time of the survey.[19]

Table 4 reports estimates of the determinants of a son aged 20-59 having migrated from his village of birth by 1999. The estimates are obtained separately for landed and landless households. Whether estimated by household fixed effects or not, for neither level of schooling does schooling affect the probability of out-migration by the men born in landless households. In landed

[18]Our estimates of the effects of schooling on agricultural output or profits cannot rule out that ability plays no role in augmenting farming productivity, and thus that our estimates of secondary schooling effects may contain ability bias. However, in previous work (Foster and Rosenzweig, 1996) we showed that during the early stages of the green revolution, in areas where the returns to schooling had risen school enrollments among children in landed households increased, while those in landless households decreased. Farm households thus appeared to have believed that the elevated schooling returns would be captured by increasing schooling and were not just a return to pre-existing ability. The fall in school enrollment rates in landless households is consistent with the green-revolution induced increases in (unskilled) agricultural wages rates, which increased (decreased) the opportunity costs of (returns to) schooling for them.

[19]The 1999 round also provided the wages of all workers residing in the sample villages. In Appendix Table A1 we report estimates of the relationship between primary and secondary schooling attainment and log agricultural wages for male workers aged20-59. As in the ICRISAT data, there is no statistically significant relationship between schooling and agricultural wage rates.

households, while secondary schooling does not affect the migration probability, the estimates suggest that primary-school educated sons are less likely to leave the village. There is thus no evidence that primary or secondary schooling facilitates migration for either landed or landless households. In sum, we can find benefits of secondary schooling for landed households in terms of farming productivity, but no earnings or mobility benefits from primary or secondary schooling for landless households. The landed should have an interest in public funds going to secondary schools; the landless should not, so democratization will decrease school infrastructure development, particularly for secondary schools, more strongly the higher the share of the landless population.

c. Electrification.

While the supply of electricity to a village can in principle benefit all households (e.g. street lights), in fact electrical power is unevenly distributed within a village. The 1982 round of REDS obtained information on the electrification use in each sample. Figure 7 displays from the 1982 data the fraction of electrified villages in four categories of electrification use (there can be more than one use) - for households, for street lights, for agriculture, and for industry. As can be seen, while in only 24% of electrified villages was electrification used for industry, in over sixty percent of the villages, agriculture was the beneficiary, mainly for irrigation. In 82% of the villages households were a main beneficiary. However, when we look at the household survey data in 1999, we see that a significantly larger fraction of landed households (68%) within electrified villages were in fact electrified compared with landless households (42%) - a gap of 62 percent. The gap may be explained by the higher return to electricity in landed households, given its advantages for irrigation, but also the landless may be less able to afford electricity costs. These data suggest that the landed are likely to prefer electrification relative to the landless.

d. Employment programs.

In the model we also assumed that employment programs, by increasing jobs for workers,

would raise wages and thus be favored by the landless and opposed by the landed who are net hirers of labor. This assumes that there is not substantial unemployment in the labor market. For evidence on the wage-increasing effect of employment programs, we rely on the randomized control trial carried out by Breza *et al.* (2021) in India. In that project, the demand for labor was increased across agricultural seasons in a randomly-chosen set of villages by creating new jobs for a limited period of time. The result was a significant increase in agricultural wages *in the main growing season* in treatment versus control villages during the period of the experiment. Given that land owners who are net hirers of labor lose profits in that case, we are confident that based on this evidence public employment programs will be favored by the landless and opposed by the landed. From proposition 1, therefore, democratization should increase the likelihood of such programs being put in place as the share of the landless in the population increases.

4. Democratization and public goods

a. Specification and identification strategy.

As implied by the model our primary interest is in the question of whether the transition to democracy has different consequences for the portfolio of public expenditures by type depending on the share of the landless in the population. To test this key implication, we estimate an approximation to public expenditure equations of the form:

$$y_{itk} = \beta_{0k} + \beta_{1k} d_{it} + \beta_{2k} d_{it} \rho_{i0} + \beta_{3k} d_{it} A_{i0} + \tau_t + \psi_i + \sigma_{s_k t} + \varepsilon_{it} \quad (26)$$

where *I* denotes the village, *t* denotes time and *k* denotes the public expenditure. The τ_t are time dummies, the ψ_i are village dummies, and the $\sigma_{s_i t}$ are state-year dummies. The primary coefficient of interest is β_{2k}, the interaction between democracy and the village landless share. We condition on the initial landless share ρ_{i0} rather than the share at a particular point in time, to avoid possible concerns about endogenous changes to landless share over time, although, as noted, transitions between landless and landed status are, in fact, quite uncommon. Migration and, in particular,

differential migration over this period (except for marital migration), is also small so observed changes largely reflect household division and inheritance (Foster and Rosenzweig, forthcoming). The initial landless share can thus be thought of as reflecting the landless composition of family descendent groups. Note also that the level effect for the landless share is thus absorbed in the village dummy.

The inclusion of the A_{i0} term is necessary, given the theory, for the proper interpretation of the effect of democracy for different landless shares. Recall that in our model the comparative statics involve shifting the landless share but holding land per household fixed. That is, β_{2k} corresponds to the cross derivative of public expenditures with respect to democracy and the landless share given land per household. The concern is that some cross-village variation in the landless share may arise because the number of landed households and the average landholding per landed household is fixed, with the variation coming only from variation in the number of landless households. In this case, the landless share would be correlated with A_{i0} and we could thus obtain biased estimates of the coefficient β_{2k}. In short, different effects of democracy in villages with different amounts of land would otherwise be incorrectly interpreted as effects arising from the landless share.

A potential concern with (26) is that the timing of democracy in particular villages may in part be a choice. Landed households in villages with a relatively large landless share and an emerging perceived need for public irrigation, for example may be especially resistant to democratization because they suspect that this will lead to a move away from irrigation expenditures towards expenditures that benefit the landless. But it could also work the other way. Villages with more landless might see more benefit from pushing for a transition to democracy if wages are especially low. But ultimately, democratization is constrained by state legislation. In such a setting we would anticipate that the state amendments would predict whether democracy takes place in a village and that the timing would be affected by the individual village landless share. Thus, while the timing of

laws at the state level may be correlated with the demand for public goods by type in the villages of the state, they cannot alone affect the differences in the timing of democratization across the villages. Thus, controlling for state year fixed effects we can use the state laws interacted with the village landless shares as instruments for democratization at the village level.[20]

To assess visually whether state-wide amendment effects of village-specific adoptions of democratic governance differ by initial landless population shares we created event study graphs for the second and third rounds of state amendment legislation. The vertical axis in Figures 8 and 9 are the share of villages that are democratized among those states that passed the relevant legislation and the horizontal axis denotes the deviation from the year the relevant amendment took effect. The graphs have a time window of 8 years around the timing of the legislation and are balanced (e.g., we only include states that are not truncated by the range of our data). In both graphs we see that democracy is more common in villages with a higher landless share, suggesting that the higher incentives of the landless to move away from democracy in these settings are leading to a more rapid transition. But both graphs also show a break at or near the timing of the state legislation. For stage 2 there is a fairly clear trend break and the break is higher for villages that lie above the state median in terms of the landless share. An alternative interpretation is that it took about two years for the state policy to translate into democracy (or for elections to be implemented) as there is a bit of a jump in year 3. For stage-3 amendments we also see a clear jump, but the jump is again somewhat larger for the villages with a landless share above the state median.

b. Results for public program initiatives.

Table 5 presents IV-FE estimates of (26) using the retrospective histories from the 1982 and 1999 REDS village survey rounds covering the period 1971-99. The *F*-tests for the excluded

[20]This is similar to the idea in Acemoglu *et al.* (2019) in which regional waves of democratization were used as instruments for an individual country's conversion to democracy.

instruments are reported in the table and show ample power. The first three columns of estimates relate to public programs and goods that we have shown to favor landed households - irrigation, electrification and secondary schools. We also include public primary schools as a dependent variable, although our empirical results do not indicate that primary schooling differentially affects the groups defined by land status. The remaining outcome variables are those that are hypothesized to differentially favor the landless - primary schools and employment programs, the latter in large part through their impacts on the equilibrium wage.

The signs of the interaction coefficients are consistent with the model and with our empirical findings on the differential benefits of the programs by land status - the interaction terms between democracy and the landless share are negative and significantly different from zero for the landed-favored programs and positive for primary schools and the employment programs. Interestingly, the estimates indicate that the landless favor public investments in primary schools, despite the lack of evidence that primary schools provide earnings benefits to them or to the landed, consistent with the possibility that primary schooling providing benefits that go beyond productivity in the labor market.

To get a better sense of the magnitude of the coefficient estimates we computed the predicted effects of democracy under different landless shares. The results for the landed-preferred expenditures are presented in the first three rows of Table 6. These conform to the predictions of the model, showing that the signs of the effects of democratization on public programs differ by which interest group has greater population representation and by public goods type. Contrasting the extreme cases in the data we find that in an egalitarian village in which all households own equal amounts of land (landless share is zero) so that the interests of the landed are paramount, democracy results in a 21 percentage point increase in irrigation work programs. However, when the landless are the majority there is a reduction of 36 percentage points in these programs. The effects on

electrification and secondary schooling, the other "infrastructure" programs and structures favoring the landed, are of roughly similar magnitude, with democratization increasing electrification and secondary schooling when the landed predominate in the population and decreasing it when the landless are in the majority. In contrast, when the landed are in control without opposition there is a decline of 24 percentage points in employment guarantee schemes but when the landless are in the majority there is a 34 percentage point increase in these programs. General welfare employment programs and professional training programs, follow the same pattern, reflecting the returns to such programs favoring the landless, with the landless also favoring primary schooling.

c. Robustness checks.

One concern is that the democratization effects are not time invariant. This can lead to biased estimates given the staggered implementations of democracy across villages over time and the difference in difference methodology. To assess whether this is a problem, we separated out effects within 5 years of democratization (one term length for an elected *panchayat*) and effects after 5 years. These results are reported in Appendix Table A2, which contain the coefficient estimates, and Table A3, which show the within 5-year democratization effects for landed dominance, a landless majority and at the mean. The within-5-year estimates are almost identical to those obtained using the specification assuming temporal constancy beyond five years.

We also carried out a more stringent test, which does not requires any assumptions about the constancy of effects over time. We created a sub-sample of villages in which there was only one switch to democracy at single date, in 1990, and in which control villages are restricted to villages that never switched from 1971 through 1992. In this sub-sample, which includes 32 switcher villages and 64 control villages, there was no variation in the institution of the professional training program, so that outcome variable is excluded. The results, reported in Appendix Tables A4 and A5, replicate those obtained from the full sample, with the exception that the estimates for secondary school are

not statistically significant.

d. Results for infrastructure, schooling and relative consumption by land status.

The village-level data on the timing of programs enabled us to construct a continuous time-series data set describing the timing of public program initiations. As noted, from each the multiple rounds of the REDS data we also have information on the outcomes of some of these programs - the actual presence of government irrigation facilities (wells and pumps) for the 1982 and 1999 rounds, and the share of village landholdings that are irrigated and school enrollment rates for boys and girls aged 10-14 for three rounds - 1971, 1982 and 1999. The first three columns of Table 7 report the estimates of democratization on the irrigation facilities and the share of irrigated village land using the same specification (26) to estimate the effects of democratization. While the first-stage test statistics are weaker than for the continuous panel, as expected given that we only have two or three observations for each village, the results for irrigation, favored by the landed, are similar to that in Table 5 for the irrigation construction program, with in particular a negative statistically-significant coefficient for the interaction between democracy and the landless share for each of the three irrigation variables. The fact that the share of land irrigated in the third column shows the same pattern as those for the publicly-provided irrigation assets and the irrigation work program is consistent with incomplete public-private irrigation substitutability; public irrigation expenditures on net increase irrigation.

Rows 4-5 of Table 7 reports estimates of democratization on schooling outcomes, namely the enrollment rates for boys and girls aged 10-14 constructed from the three rounds of the REDS household survey. As for the irrigation outcomes, we see that there is a statistically-significant negative democracy-landless share interaction coefficient. Finally, in the last column of the table we report the estimates of democratization on the log of the ratio of the landless food expenditure to that of the landed households constructed from the three household survey rounds. The estimate of

the interaction coefficient, positive and statistically significant, for this relative consumption measure indicates that when the landless are more numerous a transition to democracy likely differentially benefits the welfare of landless households.

To examine the implications of the estimates for the outcomes reported in Table 7 at different levels of landless shares, we again computed the effects of democratization when the there are no landless, when the landless have a majority share, and at the mean proportion landless in Table 8. It is notable that at the mean landless share of 0.29, there is no statistically significant effect of democratization for any of the five outcomes. These estimates thus suggest that if the heterogeneity of democratization on public goods allocations, related to the shares of competing interest groups, is ignored, it would be incorrectly concluded that democratization does not matter for public goods allocations and has no effect on the relative welfare of the landed and landless. For example, the estimates indicate that moving to democracy results in an insignificant 0.15 increase in the share of land irrigated, but the estimates also indicate that when all villagers are landholders, democratization is predicted to generate a statistically significant increase in the irrigation share by 0.79. By contrast where the landless have a majority at a 60 percent share there is a significantly-significant decrease in the irrigated share of 0.53. For the enrollment of boys 10-14 we see a comparable pattern with little increase at the average landless share but an increase of 0.49 for the egalitarian village and 0.49 decrease for villages in with the landless are in the majority. Finally, the estimates indicate that democracy leads to a 0.30 decrease in relative landless expenditure at the mean landless share but a statistically significant increase of 0.45 when landless are in the majority.

5. Conclusion

One important goal for the public sector is to ensure that public investments are allocated in such a way as to maximize economic output. Such an outcome will obtain in general if the marginal returns to public investment in the productivity of different private assets are equalized. But whether

this outcome is realized may depend on the nature of local political institutions. In a setting in which different assets are distributed unequally across households, a change in political institutions may make the public sector more or less effective in enhancing economy-wide productivity. Households holding a relatively high concentration of one asset, for example, may prefer public investment in the productivity of that asset even if that leads to less than optimal output from the standpoint of the economy as a whole. Landowners, for example, may especially value investments in land productivity while landless laborers may prefer investments that increase labor productivity or at least their wages and income. In such a setting a shift from governance by the landed to democracy is likely to lead to a shift away from investment in land productivity toward labor productivity.

Put more generally, in a world in which each household is autarchic and political institutions are such that total population consumption was maximized then democratization would indeed serve to maximize economic output. In practice, however, households are not autarchic and the relative investments in different assets affects the terms of trade between different households. Under such circumstances it is no longer clear that democracy will maximize growth. Households may prefer policies that shift the terms of trade in their favor even at the expense of aggregate output.

In this paper, we have looked at the effects of democratization at the village level in rural India on the composition of public goods within a general-equilibrium framework. We model democratization as a shift from a political regime in which the interests of the landed are maximized to one in which landless and landed households are proportionately represented. We show using a simple model of two-party competition that this latter scenario maximizes population-weighted consumption and derive implications for public investments from a shift to democracy among villages with different landless shares. A central role in our model is played by the equilibrium wage, which is directly affected by the share of the population that is landless as well as through public

programs. If landed households are net-hirers of labor and, by implication, landless households are net sellers, then landless households may favor public expenditures that raise wages even if the productivity returns to that public investment are relatively low. Similarly, the interest of the landed in the productivity of agricultural investment is importantly determined by the effects of that investment on labor utilization and thus the equilibrium wage. *Ceteris paribus* they will prefer investments that do not raise the wage even if those investments result in lower increases in land productivity.

We test the model using village-level panel and household data from rural India over a thirty-year period describing changes in village governance and local public programs and infrastructure. This setting proves especially useful because transitions to democracy in different villages happened at different times and were largely governed by changes in national and state laws mandating local elections. There is also substantial cross-sectional variation in the share of landless households across villages.

Estimates of public good investment decision rules support the predictions of the model, whose assumptions about the land-based beneficiaries of specific public goods are supported by evidence from a variety of survey data sources. We find that democratization shifts public investment towards goods that differentially benefit landless households when the landless share is higher, controlling for the total assets of land and labor in the economy, and conversely. Accordingly, we find that democratization in villages with a large landless population share shifted public resources away from investments in irrigation, secondary schools, and electrification and towards employment programs and primary school investments, with a net result of decreasing income inequality by land ownership class. Because asset stocks (land ownership) are held fixed we would not expect this variation by landless share to affect the portfolio of public goods if democracy were simply maximizing total productivity.

We have abstracted in this paper from other potential roles of the public sector. For example, if the public sector seeks to maximize total welfare and there is diminishing marginal utility then one might expect for the public sector to trade off investment in public goods with direct private transfers. In such cases, of course, an expansion of the vote to poorer households may have an additional consequence of reducing growth by decreasing the funds available for public investments in asset productivity. But this sort of transfer would achieve other public ends and thus, we believe, should be treated separately. Incorporating direct transfers into a model of democratic decision-making with respect to public investments in a setting with heterogeneous interest groups, inclusive of modeling the potential productivity effects of such transfers, is a goal for future work.[21]

In summary, our analysis has provided a new perspective on the age-old question of whether a shift to democracy increases economic growth. And, in short, our results suggest that it depends. But this conclusion does not mean, as some would have it, that this is simply an "empirical question." In fact, there are key features of the economy that are subject to economic analysis that can help inform the conditions under which democracy may or may not improve economic productivity. The questions of whether agricultural investments, or more generally any public capital investments, are labor-saving, whether or not landed households are on average net hirers of labor, and the size of the class of workers without significant productive assets are, in fact, knowable. We anticipate that gaining a better understanding of the economic divisions based on ownership of assets, or ethnic and racial divides where relevant, along with identifying group-specific material interests that characterize an economy is the best way forward for understanding the likely productivity effects of democratization.

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[21]We also have abstracted from the possibility that voters may be misinformed about the consequences of various decisions.

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Appendix A

The gross domestic (village) product per household (GDP) is the total of agricultural output, the per household expenditures on health centers and the per-household value of the output of the work program. Substituting from the village public budget constraint (1) yields

(A1) GDP = $Ag(q,(l-r)/A)+\phi_h(B-A^{\gamma}q-w(r,q,A)r)+\phi_r(r)$.

To assess the effects of the form of village governance on GDP, we start with the benchmark case in which the public funds are allocated to maximize GDP. In that case, the allocations satisfy the first order conditions for *q* and *r*, respectively:

(A2) $A\frac{\partial}{\partial q}g(q,(l-r)/A)-\phi_h(A^{\gamma}+\frac{\partial}{\partial q}w(r,q,A)r)=0$

(A3) $-w(r,t,A)-\phi_h(\frac{\partial}{\partial l}w(r,t,A)r+w(r,t,A))+\phi_r'(r)=0$.

That is (i) the marginal product of agricultural investment equals the marginal benefit of investment in health centers after accounting for any rise in costs due to changes in the equilibrium wage and (ii) the marginal benefit of the work programs minus the decrease in agricultural output from removing workers from agricultural production equals the marginal benefit of investment in health centers again after accounting for any rise in costs due to changes in the equilibrium wage.

The difference between the aristocratic maximand and that for GDP is thus

(A4) $w(r,q,A)(l-\frac{l-r}{1-\rho})+\frac{A\rho}{1-\rho}g(q,(l-r)/A)$.

As can be seen, expression (A4) reflects the fact that the landed care about their own per-household profits rather than per-household total income where household profits are output per landed household net of the wages paid out if they are net hirers of labor, in which case the first term in parentheses is negative.

From the maximization of (A4), we can derive the difference between the first-order conditions for the allocation of funds to the agricultural asset between the GDP-maximizing allocation, given by (A1), and that chosen by the landed households:

(A5) $$A(\frac{\rho}{1-\rho})\frac{\partial}{\partial q}g(q,(l-r)/A)+\frac{\partial}{\partial q}w(r,q,A)(l-\frac{l-r}{1-\rho})\ .$$

The first term in (A5), which is positive, reflects the fact that the landed benefit directly from investments in *q* and thus they would bias public funds towards such investments. But whether governance by the landed leads to an overinvestment in agricultural public goods relative to the allocation that maximizes GDP per household also depends crucially on whether investments in public agricultural assets lower or increase the equilibrium wage, the conditions for which we describe below. If the landed are net hirers of labor, then the second term in (A5) will also be weakly positive if additions to *q* do not increase the equilibrium wage. In that case the landed will always overinvest in *q* relative to the GDP-maximizing allocation. However, an aristocratic regime may underinvest in *q* if investments that increase agricultural productivity also strongly increase the demand for labor and thus the wage bill paid out by farmers.

The difference between the GDP-maximizing first order condition determining the allocation of public funds to employ workers in public works activities and that describing the corresponding aristocratic allocation is less clear:

(A6) $$\frac{\partial}{\partial r}w(r,q,A)(l-\frac{l-r}{1-\rho})+w(r,q,A)\frac{1}{1-\rho},$$

The first term is negative if landed households are net hirers but the second term is positive - the increase in the equilibrium wage may increase or decrease total hired labor costs depending on how elastic the demand for labor is. Which term dominates thus depends on the structure of the production function.

Appendix B

We establish here sufficient conditions for $z_{12} > 0$ and also provide a numerical illustration that depicts these relationships for one particular case. To capture the idea that agricultural technology increases productivity but may partially substitute for labor we write

(B1) $g(q,l) = f_0(q)\, f_1(\nu q + l)$

with $f_1(l) = \sigma_1 l - \sigma_2 l^2$. Note that technology enters the production function in two places: it raises overall productivity but it also serves as a substitute for labor, depending on the coefficient ν. Irrigation may allow one to increase yields but it also may mean that less labor is needed for watering crops.

We also require that

(B2) $\frac{\partial^2}{\partial q^2} g(q,l) = f_0''(q)\, f_1(\nu q + l) + \nu f_0'(q)'\, f_1(\nu q + l) + \nu^2 f_0(q)\, f_1''(\nu q + l) < 0$

We also impose four additional technical conditions that assist in ensuring a local maximum:

1) $l > r / \rho$

2) $\frac{dl_e}{dq} = 0$

3) $l > \phi_h r$

4) $\rho < 1/2$

The first condition ensure that landed households are net hirers of labor as discussed in the main text. The second indicates that agricultural technology does not increase employed labor in landed households – a result that we establish empirically for irrigation. The third condition indicates that an increase in the wage increases the well-being of landless households. An increase in the wage does raise household income of landless households for fixed *r* and *q*, but it also increases the cost of work programs and thus diminishes investment in health services. This assumption says that latter effect is not too large. Finally, the fourth conditions ensures that landless are not a majority.

Under these conditions,

(B3) $$\frac{\partial}{\partial q} w(q,r,A) = 0$$

(B4) $$\frac{\partial}{\partial r} w(q,r,A) > 0$$

(B5) $$\frac{\partial^2}{\partial q^2} w(q,r,A) < 0$$

(B6) $$\frac{\partial^2}{\partial r^2} w(q,r,A) = 0$$

and

(B7) $$\frac{\partial^2}{\partial r \partial q} w(t,r,A) > 0$$

Thus if the objective function is

(B8) $$\Omega(r,q) = \left(l - \phi_h r + l\right) w\left(q,r,A\right) + \frac{\left(1-\rho d\right) A \pi\left(q,r,A\right)}{1-\rho} + \phi_h\left(B - t\right) + \phi_r\left(r\right)$$

and the elements of the Hessian can be signed using the above conditions:

(B9) $$\frac{\partial^2}{\partial q^2} \Omega(q,r) = \left(l - \phi_h r\right) \frac{\partial^2}{\partial q^2} w\left(q,r,A\right) + \frac{\left(1-\rho d\right) A}{1-\rho} \frac{\partial^2}{\partial q^2} g(q, \frac{l-r}{A}) < 0$$

(B10) $$\frac{\partial^2}{\partial r^2} \Omega(q,r) = \left(-\phi_h r + l - \frac{\left(1-\rho d\right)\left(l-r\right)}{1-\rho} \right) \frac{\partial^2}{\partial q \partial r} w\left(q,r,A\right) + \phi_r''(r) < 0$$

and

(B11) $$\frac{\partial^2}{\partial q \partial r} \Omega(q,r) = \left(-\phi_h r + l - \frac{\left(1-\rho d\right)\left(l-r\right)}{1-\rho} \right) \frac{\partial^2}{\partial q \partial r} w\left(q,r,A\right) - \phi_h \frac{\partial}{\partial q} w(q,r,A)$$

It follows that the inverted Hessian will be signed as follows $z_{11} < 0$, $z_{12} = z_{21} > 0$ and $z_{22} < 0$.

To illustrate the predicted comparative statics in the main text we assign parameteric values as follows:

$$f_0(t) = t^{1/4},\ f_1(l) = 20l - .02l^2,\ \phi_h = 2,\ \phi_r(r) = 3r - r^2, A = 10\ l = 5,\ \nu = 1/10.$$

In Figure B1 we plot optimal t for different values of ρ and d. As is evident, for democracy (*d*=1) the curve is flat but aristocratic rule (*d*=0) the level of agricultural technology increases in inequality. This corresponds to the idea that the negative effect of democracy on agricultural technology is greater if there is a greater poor fraction.

In Figure B2 we plot optimal *r* for different values of ρ and d. Correspondingly, we see that under democracy there is no effect of inequality, but work programs are increasing in inequality in the aristocratic state. Thus the positive effects of democracy on food for work is greater if there is

greater poor fraction.

Figure B1: Optimal *t* by landless share and democratization

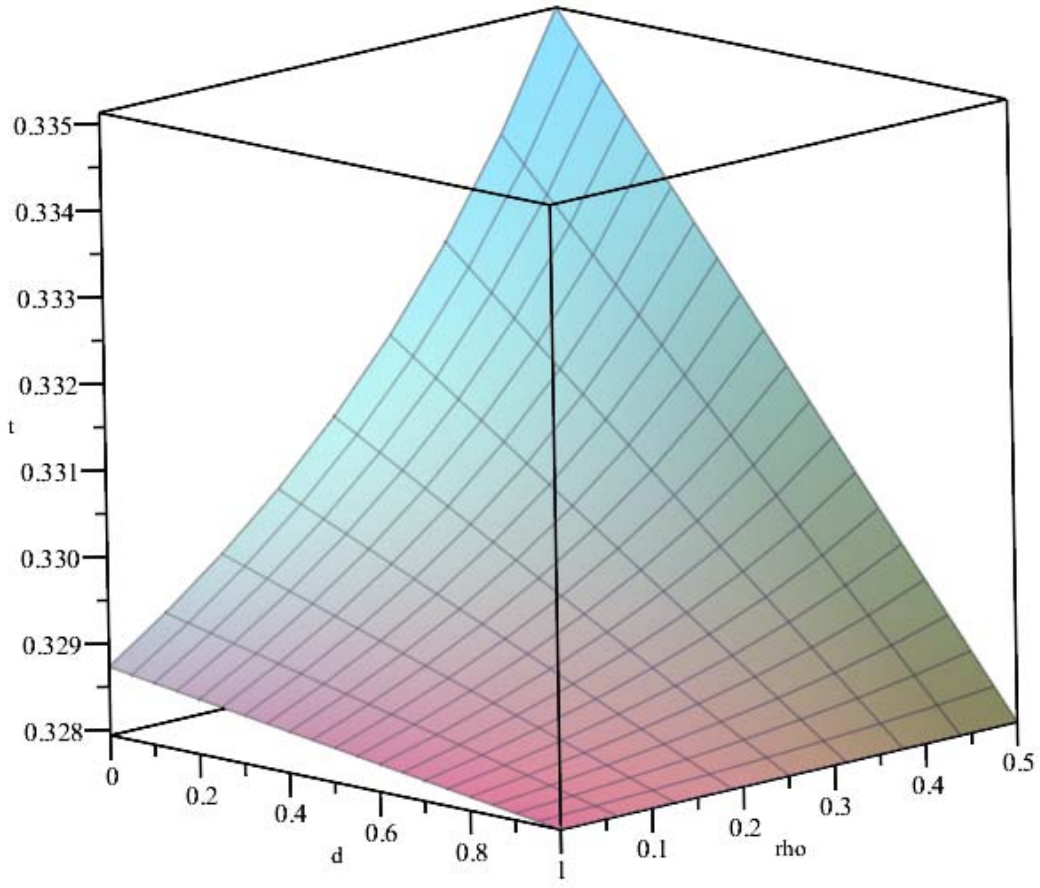

Figure B2: Optimal *r* by landless share and democratization

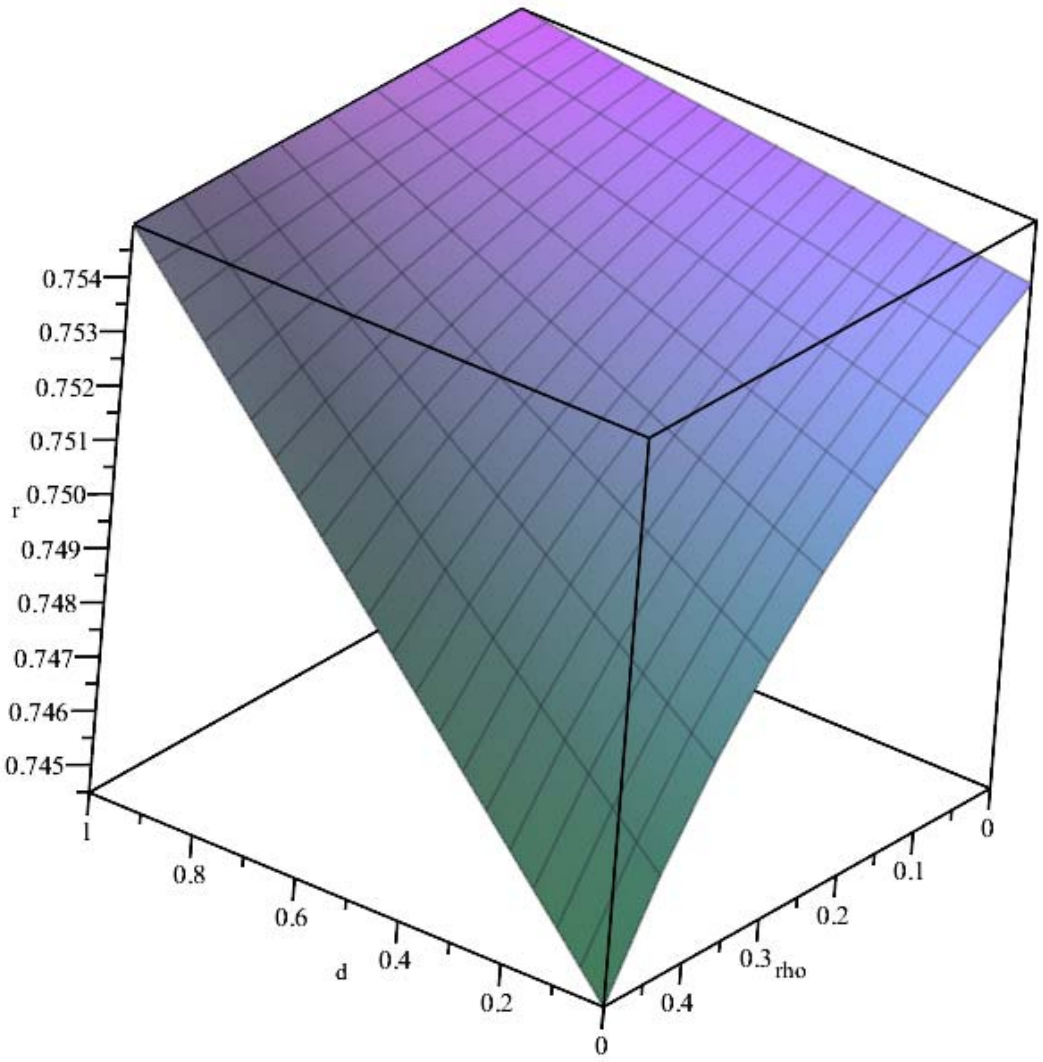

Figure 1. Fraction of REDS Villages Under State Stage 2 and 3 Amendments and with an Elected Panchayat

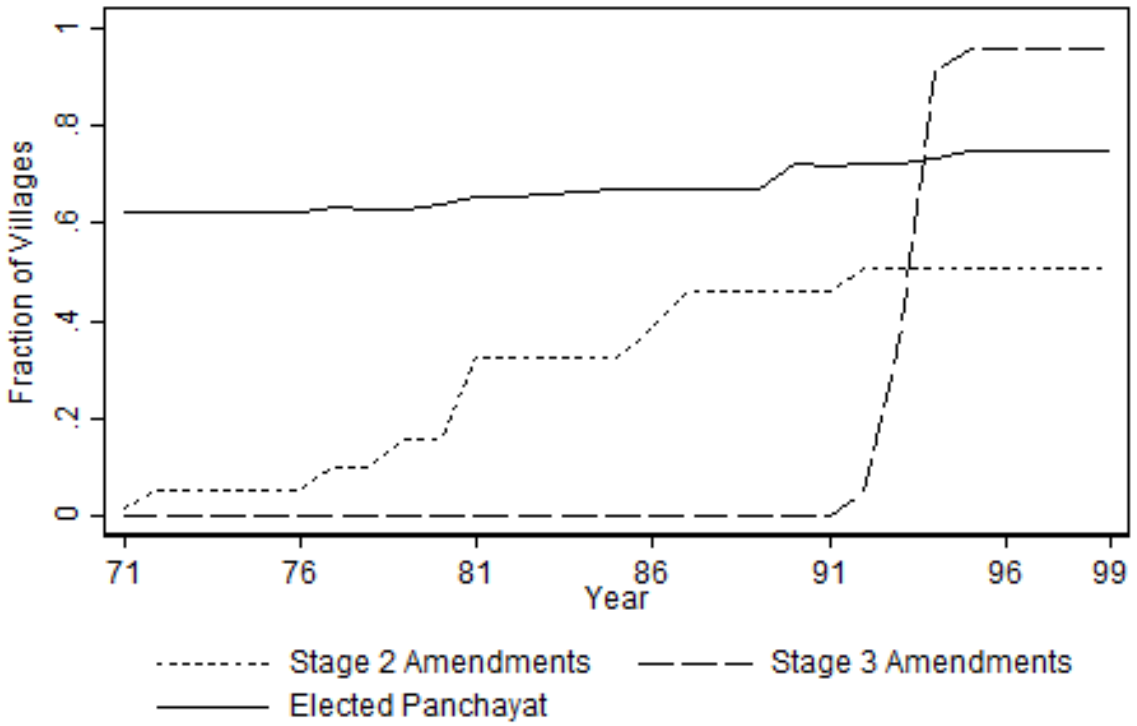

Figure 2. Cumulative Distribution of the Top-Two Party Shares of Village Council Members, Democratic Councils in 1999

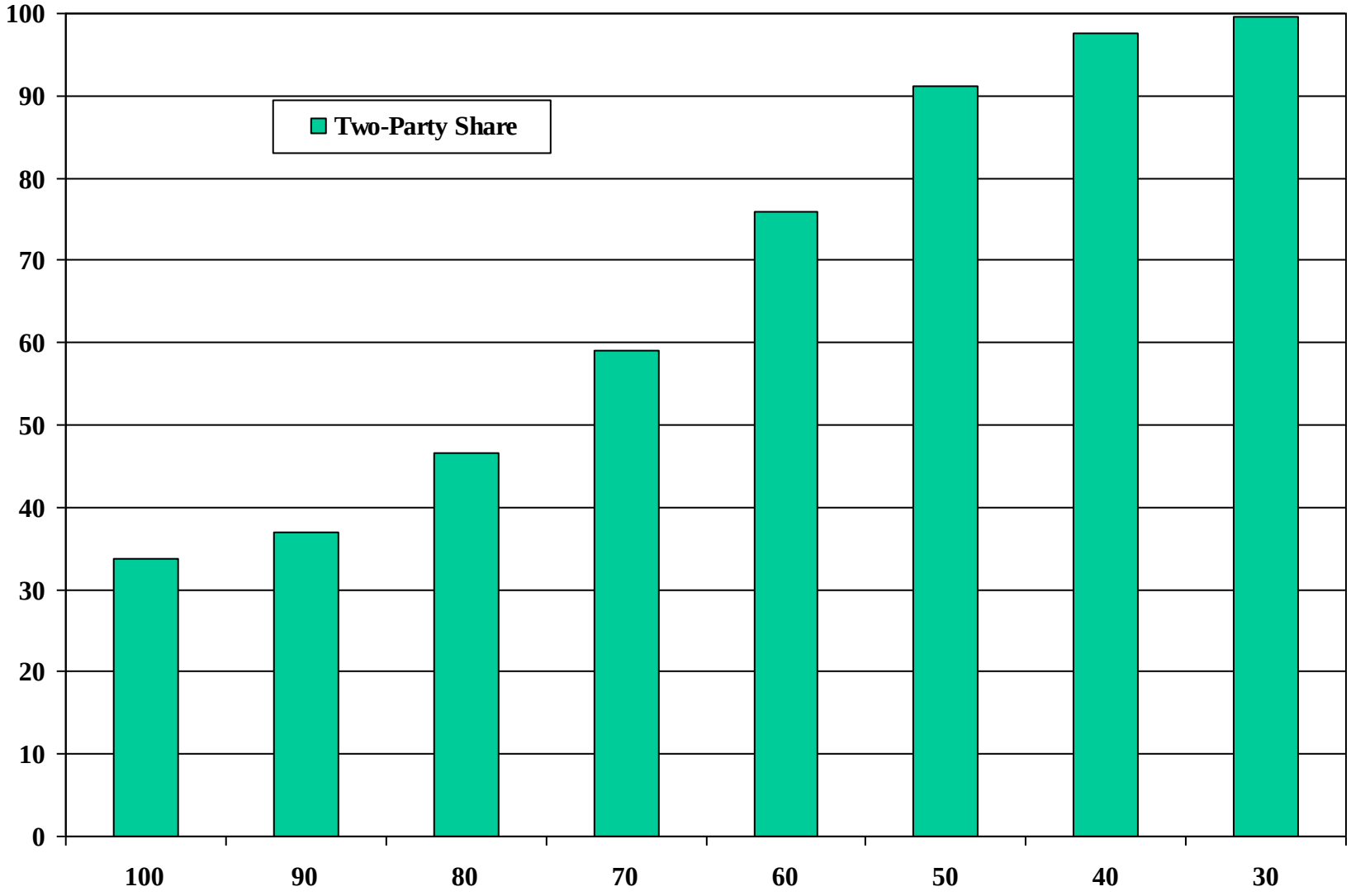

Figure 1. Fraction of REDS Villages Under State Stage 2 and 3 Amendments and with an Elected Panchayat

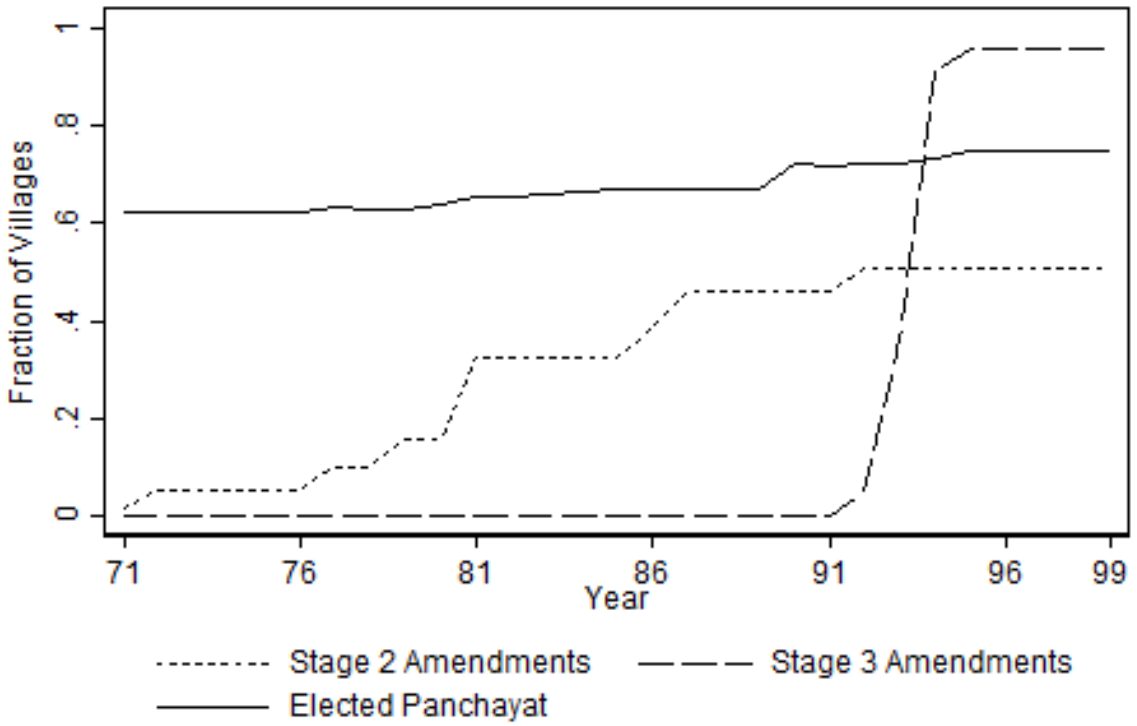

Figure 3. Fraction of REDS Villages with Infrastructure Programs by Type and Year

Figure 4. Fraction of REDS Villages with Local Schools
by Type and Year

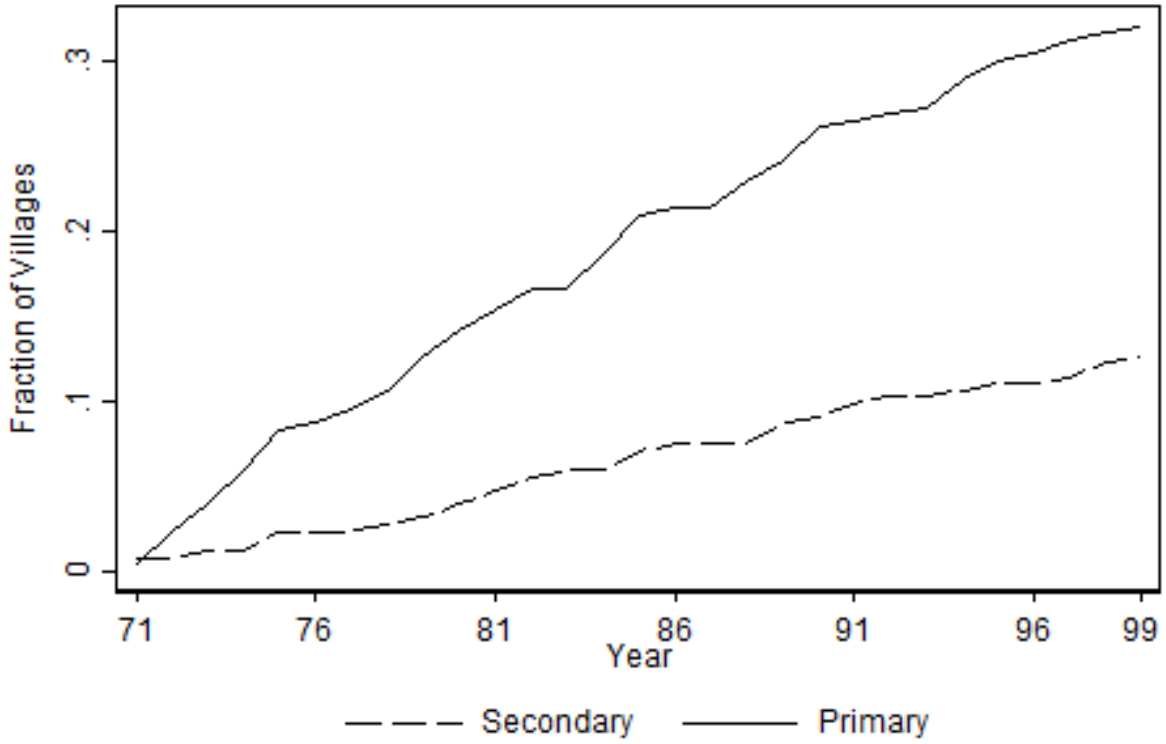

Figure 5. Fraction of REDS Villages with Public Employment Programs by Type and Year

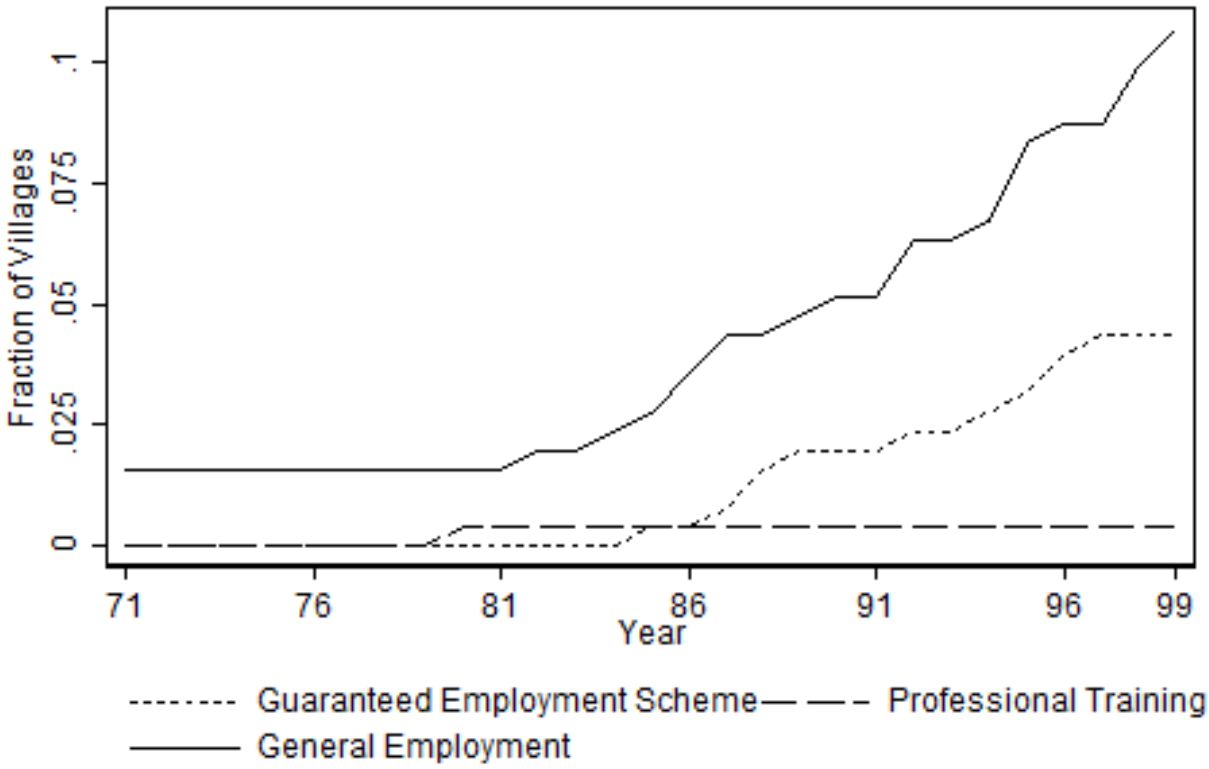

Figure 6. Changes in the Share of Land Irrigated, School Enrollment Rates (Ages 10-14), and the Ratio of Landless to Landed Household Food Expenditure. 1971-1999

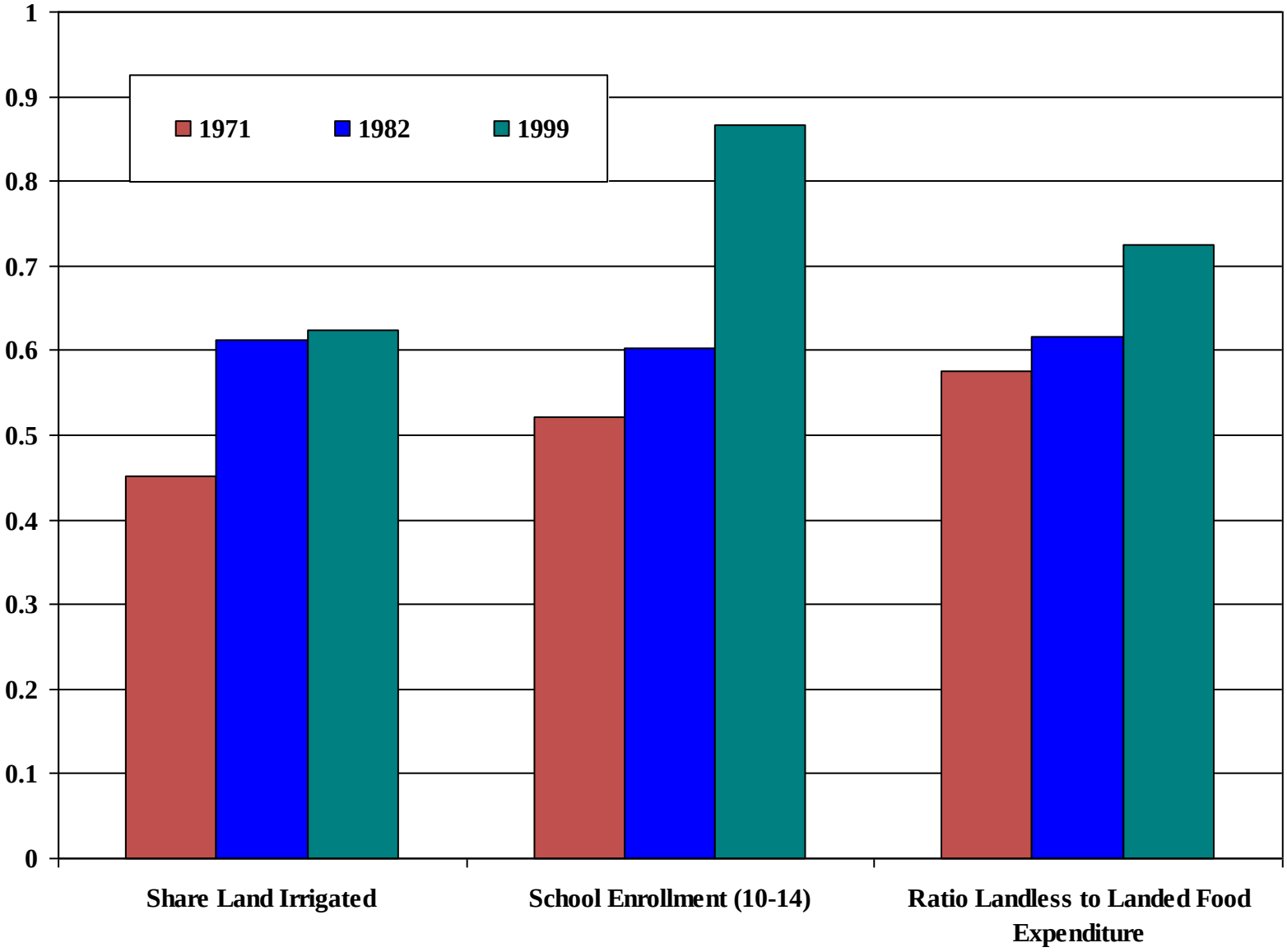

Figure 7. Use of Electricity in Electrified REDS Villages in 1982

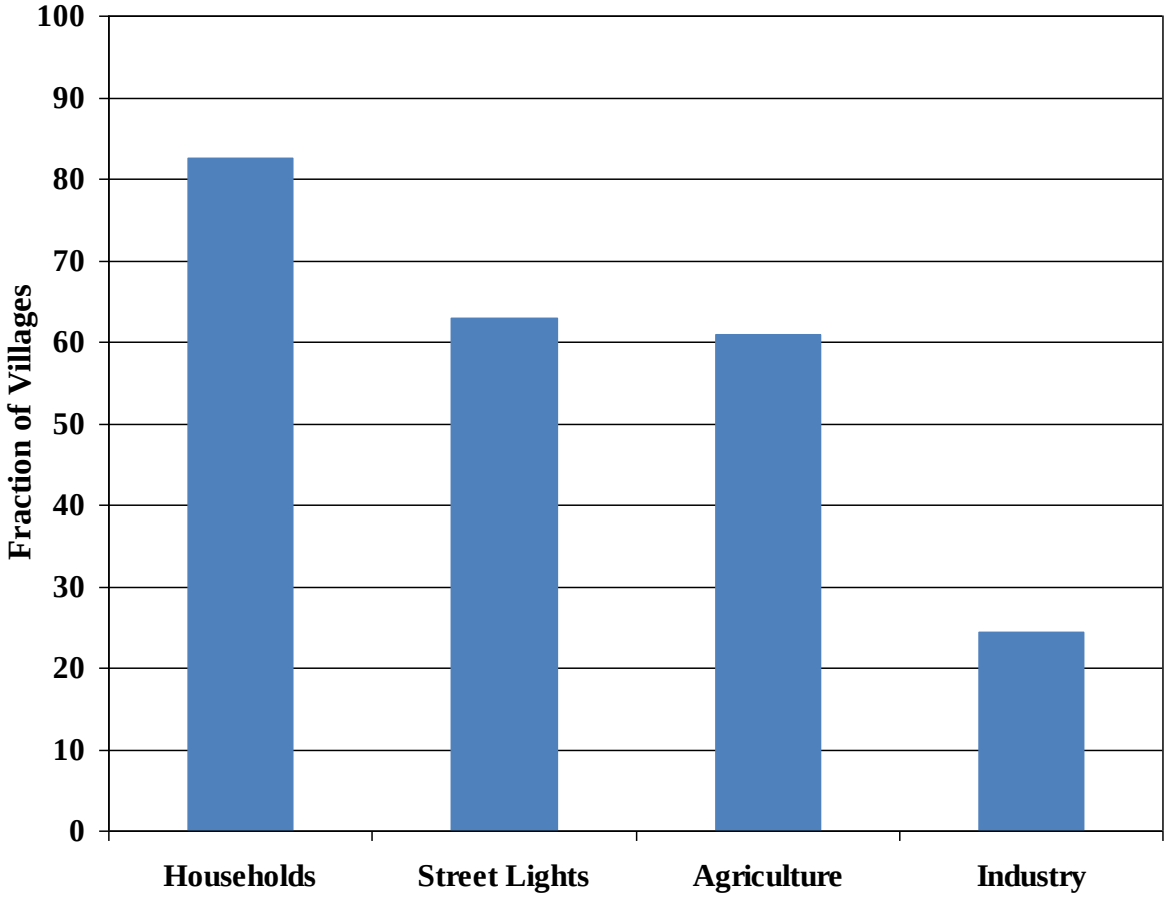

Figure 8. Event History for Stage-2 State Amendments

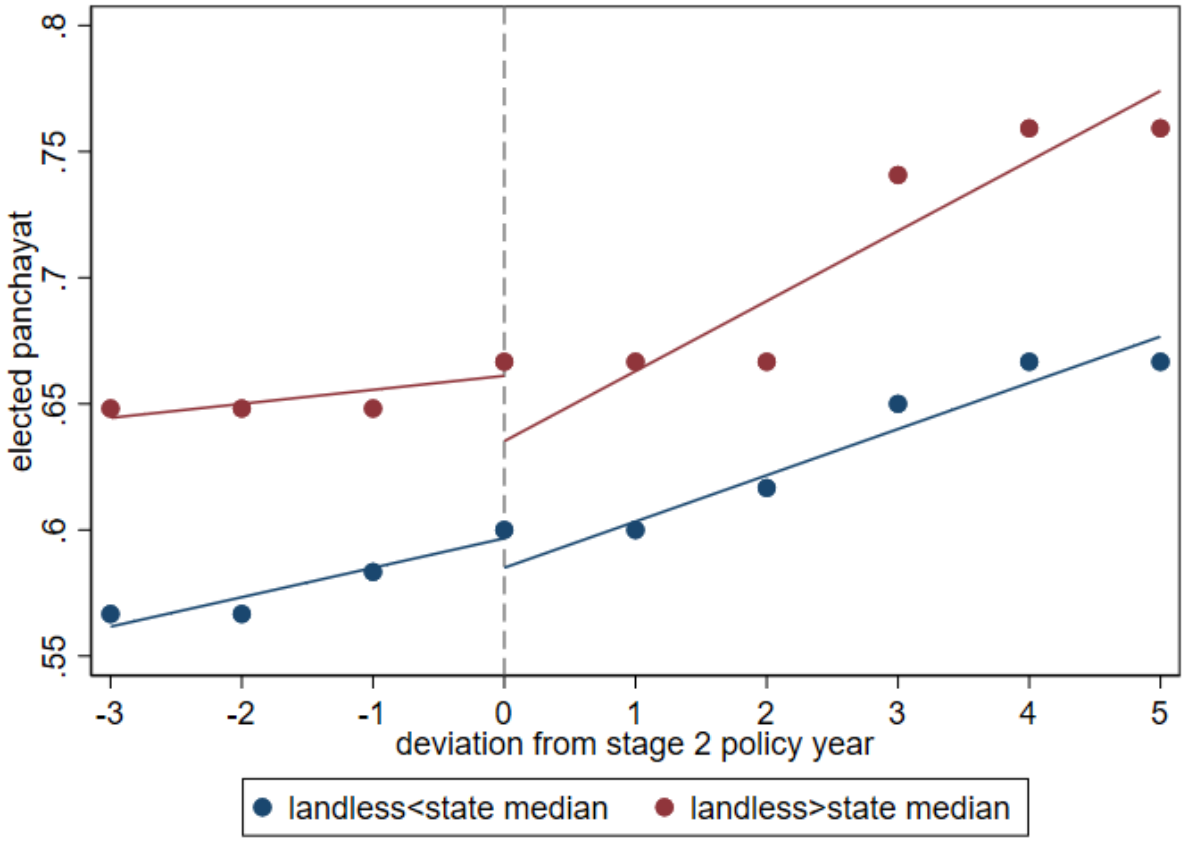

Figure 9. Event Histories for stage-3 State Amendments

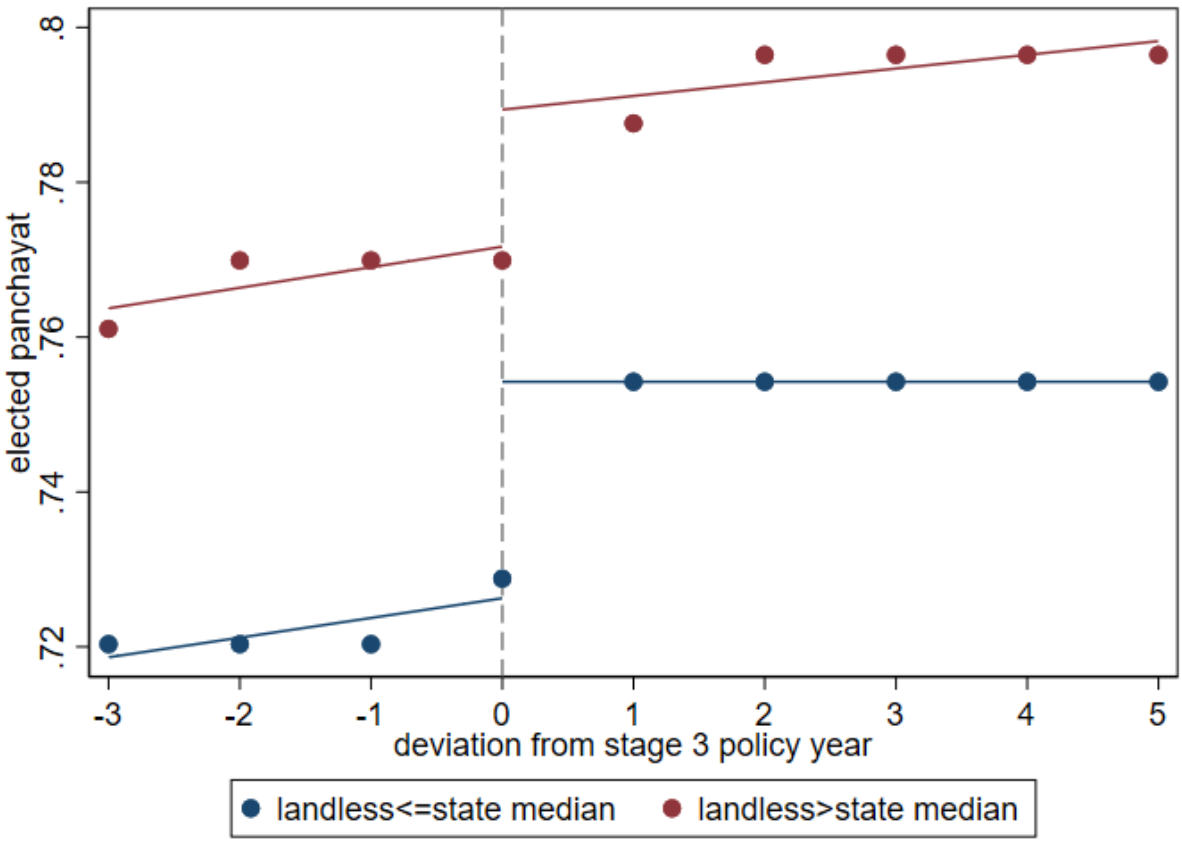

Table 1
Percentage of Villages With a Local Public Project in Previous Decade,
by Public Good and Program Source: 1982 and 1999 Survey Years

	1982		1999	
Program/project	Village Self-help Program	Village Food-for-Work Program	Village Self-help Program	Village Food-for-Work Program
Irrigation construction or installation	2.8	2.4	4.3	2.8
School building	24.0	0.4	15.0	5.5

Table 2
Irrigation and Log Real Land Rent and Log Real Wage Bill: ICRISAT Farm Plots 2009-14

Variable	Log of Land Rent			Log of Wage Bill		
	(1)	(2)	(3)	(1)	(2)	(3)
Share of plot irrigated	0.549 (0.0148)	0.478 (0.0147)	0.503 (0.0237)	0.158 (0.0228)	0.139 (0.0236)	0.0133 (0.0392)
Log of plot size (acres)	0.111 (0.00792)	0.103 (0.00752)	0.0364 (0.0136)	0.535 (0.0159)	0.535 (0.159)	0.437 (0.0335)
Village-year fixed effects	Y	Y	Y	Y	Y	Y
Plot characteristics[a]	N	Y	Y	N	Y	Y
Farmer fixed-effects	N	N	Y	N	N	Y
N	7,909	7,909	7,909	7,155	7,155	7,155

Standard errors in parentheses clustered at the farm level. [a]Plot characteristics include 11 soil types, 4 levels of soil fertility, 4 slope levels, 6 levels of soil degradation, soil depth, and distance of the plot to the homestead.

Table 3
ICRISAT VLS 2009-2014: Estimates of the Effect of Schooling on Real Agricultural Output and Profits and Own Hourly Wages Among Men with the Maximum Schooling Level in Farm Households

Dependent variable	Log Real Output per Acre		Real Profits per Acre		In Wage Market	Log Real Hourly Wage	
Estimation method	OLS		OLS		ML Probit	OLS	ML Selection
Primary	0.100	0.067	383	312	-0.518	-0.0248	-0.0369
	(0.066)	(0.065)	(345)	(327)	(0.110)	(0.0229)	(0.0267)
Secondary	0.371	0.352	844	778	-1.29	-0.00569	-0.0386
	(0.060)	(0.057)	(323)	(323)	(0.120)	(0.0251)	(0.0387)
Age	-0.017	-0.014	27.8	42.7	0.0959	0.0074	0.0099
	(0.011)	(0.011)	(76.5)	(78.1)	(0.0147)	(0.0044)	(0.0044)
Age squared	0.00015	0.00013	-0.38	-0.505	-0.00120	-0.000098	-0.00013
	(0.0001)	(0.00010)	(0.752)	(0.770)	(0.00018)	(0.000050)	(0.000052)
Total land owned	-0.0384	-0.038	-31.8	-31.9	-0.128	-	-
	(0.008)	(0.0074)	(34.7)	(34.8)	(0.0263)		
Share irrigated land	0.394	0.353	2861	2905	-0.233	-	-
	(0.101)	(0.097)	(882)	(910)	(0.113)		
Mills-ratio	-	-	-	-	-	-	0.0372
							(0.0386)
Land quality variables	N	Y	N	Y	Y	Y	Y
FE village-year	Y	Y	Y	Y	Y	Y	Y
Selection correction	-	-	-	-	-	N	Y
N	2989	2989	2989	2989	4143	989	4143

Standard errors clustered at the household level. Land quality variables include10 soil types, six levels of soil depth and average distance of the plots from the farm household.

Table 4
Schooling Attainment and the Probability of Permanent Migration
for All Sons of Household Heads Aged 20-59, by Household Land Status: REDS 1999

Household type	Landed Households		Landless Households	
Variable	(1)	(2)	(1)	(2)
Primary schooling	-0.0554 (0.0142)	-0.0574 (0.0273)	-.0230 (0.0290)	-0.0254 (0.0525)
Secondary schooling	-0.0161 (0.0142)	-0.0254 (0.0291)	0.0266 (0.0361)	0.0773 (0.0568)
Age	0.0216 (0.00392)	0.0253 (0.00856)	0.0113 (0.0109)	0.0161 (0.0182)
Age squared	-0.000203 (0.0000588)	-0.000260 (0.000129)	-0.000003 (0.000168)	-0.000137 (0.000275)
Owned landholdings (acres) $x10^{-3}$	-0.135 (0.723)	-	-	-
Share land irrigated	-0.0303 (0.0184)	-	-	-
Village fixed effects	Y	Y	Y	Y
Household fixed-effects	N	Y	N	Y
N	6,682	1,453	6,682	1,453

Standard errors in parentheses clustered at the household level.

Table 5
IV-FE Estimates of the Effects of Village Democratization on Electrification, Schools, and Public Programs for Irrigation and Employment
REDS Villages 1971-1999

Variable/Program	Irrigation work program	Electrification	Secondary School	Primary School	Employment Program 'for general welfare'	Employment Guarantee Scheme	Professional Training Program
Elected Panchayat	0.393	0.253	0.349	-1.155	-0.367	-0.367	-0.0121
	(0.103)	(0.155)	(0.0840)	(0.170)	(0.120)	(0.0800)	(0.0142)
Elected Panchayat x proportion village landless	-0.955	-1.20	-0.542	2.089	1.30	0.964	0.0576
	(0.217)	(0.325)	(0.176)	(0.355)	(0.252)	(0.168)	(0.0296)
Land per household 1971*elected panchayat	-0.00344	-0.000021	-0.00318	0.00962	0.00125	0.00201	0.0000052
	(0.00846)	(0.00126)	(0.000681)	(0.00137)	(0.000975)	(0.000650)	(0.000115)
Village fixed effects	Y	Y	Y	Y	Y	Y	Y
State-specific time trends	Y	Y	Y	Y	Y	Y	Y
N	7,279	7,279	7,279	7,279	7,279	7,279	7,279

Standard errors in parentheses. Observations weighted by village population size in 1971. The first-stage excluded instruments include: amendment stages 1-3, the three stages interacted with each other, the three stages interacted with the village landless share, and interacted with each other, the three stages interacted with village land per household and interacted with each other. The F-statistics (F17, 6996) for the excluded instruments for the elected panchayat, and the interactions of the elected *panchayat* with the landless share and land per household are 330.88, 68.35, and 363.28, respectively

Table 6
FE-IV Estimated Effects of Democracy by the Proportion of the Population Landless on Infrastructure Investment and Employment Programs
REDS Villages 1971-99

Program/ρ value	Landed in Control (ρ=0)	Landless Majority (ρ=0.6)	Landless Minority (ρ=0.29, mean)
Irrigation work program	0.214 (0.0627)	-0.359 (0.0732)	-0.0633 (0.0200)
Electrification	.254 (0.0948)	-0.467 (0.110)	-0.0944 (0.0306)
Secondary school	0.184 (0.0512	-0.141 (0.0592)	0.0270 (0.0166)
Primary school	-0.655 (0.104)	0.598 (0.120)	-0.0493 (0.0335)
Employment program 'for general welfare'	-0.303 (0.0734)	0.479 (0.0849)	0.0753 (0.0237)
Employment guarantee scheme	-0.242 (0.0489)	0.337 (0.0566)	0.0378 (0.0158)
Professional training program	-0.0118 (0.00863)	0.0227 (0.00999)	0.00488 (0.00279)

Table 7
IV-FE Estimates of the Effects of Village Democratization on Public Irrigation Infrastructure, Irrigated Land Share, School Enrollment, and Landless/Landed Relative Food Expenditures
REDS Villages 1971, 1982, and 1999

Variable/Outcome	Any Public Wells	Any Public Pumps	Share of Irrigated Land	School Enrollment, Boys 10-14	School Enrollment, Girls 10-14	Ratio Landless/Landed Log Household Food Expenditure
Elected Panchayat	1.16	1.21	1.11	0.672	0.353	-1.395
	(0.649)	(0.371)	(0.449)	(0.372)	(0.453)	(0.549)
Elected Panchayat x proportion village landless	-4.16	-2.51	-2.21	-1.63	-1.49	2.44
	(1.10)	(0.629)	(0.668)	(0.550)	(0.669)	(0.793)
Land per household 1971*elected panchayat	-0.00253	-0.00629	-0.00606	-0.00351	-0.00132	0.00740
	(0.00514)	(0.00294)	(0.00321)	(0.00267)	(0.00326)	(0.0760)
Village fixed effects	Y	Y	Y	Y	Y	Y
State-specific time trends	Y	Y	Y	Y	Y	Y
N	441	441	686	697	697	584

Standard errors in parentheses. Observations weighted by village population size in 1971. The first-stage excluded instruments include: amendment stages 1-3, the three stages interacted with each other, the three stages interacted with the village landless share, and interacted with each other, the three stages interacted with village land per household and interacted with each other. The F-statistics (F17, 6996) for the excluded instruments for the elected panchayat, and the interactions of the elected panchayat with the landless share and land per household are 6.46, 8.27, and 11.43, respectively.

Table 8
FE-IV Estimated Effects of Democracy by the Proportion of the Population Landless on Public Irrigation, Secondary School Enrollment, and Relative Food Expenditures
REDS Villages, 1971, 1982, 1999

Outcome/ρ value	Landed in Control (ρ=0)	Landless Majority (ρ=0.6)	Landless Minority (ρ=0.29, mean)
Any public irrigation wells	1.03 (0.422)	-1.47 (0.368)	-0.182 (0.219)
Any public irrigation pumps	.887 (0.241)	-0.620 (0.210)	0.159 (0.125)
Share of land irrigated	0.795 (0.301)	-0.533 (0.197)	0.153 (0.159)
School enrollment, boys 10-14	0.490 (0.249)	-0.490 (0.163)	0.0161 (0.133)
School enrollment, girls 10-14	0.284 (0.304)	-0.611 (0.197)	-0.149 (0.162)
Ratio landless/landed log household food expenditure	-1.01 (0.384)	0.451 (0.196)	-0.304 (0.195)

Appendix Table A1
Schooling Attainment and Log Agricultural Wages
for Male Agricultural Wage Workers Aged 20-59: REDS 1999

Variable	(1)	(2)
Primary schooling	-0.00377	-0.0328
	(0.0257)	(0.0978)
Secondary schooling	0.0264	-0.0132
	(0.0330)	(0.0758)
Age	0.0230	0.0209
	(0.00796)	(0.0191)
Age squared	-0.000286	-0.000265
	(0.000103)	(0.000262)
Village fixed effects	Y	Y
Household fixed-effects	N	Y
N	1,915	1,915

Standard errors in parentheses clustered at the household level.

Appendix Table A2
IV-FE Estimates of the Effects of Village Democratization on Electrification, Schools, and Public Programs for Irrigation and Employment, within 5-Year Effects, REDS Villages 1971-1999

Variable/Program	Irrigation work program	Electrification	Secondary School	Primary School	Employment Program 'for general welfare'	Employment Guarantee Scheme	Professional Training Program
Elected Panchayat	0.567	0.102	0.306	-1.173	-0.366	-0.225	-0.0126
	(0.107)	(0.157)	(0.0861)	(0.174)	(0.124)	(0.0807)	(0.0145)
Elected Panchayat x proportion village landless	-1.358	-0.792	-0.571	2.154	1.35	0.709	0.0576
	(0.224)	(0.3305)	(0.181)	(0.366)	(0.262)	(0.170)	(0.0305)
Land per household 1971*elected panchayat	-0.00461	0.000898	-0.00241	0.00963	0.00119	0.00116	0.0000140
	(0.00868)	(0.00126)	(0.000690)	(0.00140)	(0.000997)	(0.000646)	(0.000116)
Elected Panchayat>5	-0.00706	0.0435	0.0729	-0.0378	-0.169	-0.181	0.00278
	(0.0232)	(0.0351)	(0.0192)	(0.0389)	(0.0278)	(0.0806)	(0.0324)
Elected Panchayat x proportion village landless>5	0.132	-0.0943	-0.0776	0.0463	-0.0323	0.200	-0.00242
	(0.0350)	(0.0532)	(0.0292)	(0.0590)	(0.0422)	(0.0273)	(0.00491)
Land per household 1971*elected panchayat>5	-0.000298	0.000115	-0.00129	0.000654	0.00115	0.00138	-0.0000289
	(0.00233)	(0.00352)	(0.000193)	(0.000391)	(0.000279)	(0.000181)	(0.0000325)
Village fixed effects	Y	Y	Y	Y	Y	Y	Y
State-specific time trends	Y	Y	Y	Y	Y	Y	Y
N	7,279	7,279	7,279	7,279	7,279	7,279	,279

Standard errors in parentheses. Observations weighted by village population size in 1971. The first-stage excluded instruments include: amendment stages 1-3, the three stages interacted with each other, the three stages interacted with the village landless share, and interacted with each other, the three stages interacted with village land per household and interacted with each other. The F-statistics (F17, 6987) for the excluded instruments for the elected *panchayat*, and the interactions of the elected *panchayat* with the landless share and land per household are 199.10, 46.56.35, and 181.28, respectively. Those for the three endogenous variables after five years are, respectively, 116.64, 185.30, and 67.39.

Appendix Table A3
FE-IV Estimated Effects of Democracy by the Proportion of the Population Landless
on Infrastructure Investment and Employment Programs: Within 5-Year Effects

Program/ρ value	Landed in Control (ρ=0)	Landless Majority (ρ=0.6)	Landless Minority (ρ=0.29, mean)
Irrigation work program	0.327 (0.0652)	-0.487 (0.0751)	-0.0665 (0.0203)
Electrification	.148 (0.0964)	-0.327 (0.110)	-0.0813 (0.0300)
Secondary school	0.181 (0.0529	-0.161 (0.0606)	0.0158 (0.0165)
Primary school	-0.672 (0.107)	0.620 (0.123)	-0.0475 (0.0334)
Employment program 'for general welfare'	-0.304 (0.0764)	0.504 (0.0876)	0.0865 (0.0238)
Employment guarantee scheme	-0.165 (0.0495)	0.260 (0.0568)	0.0405 (0.0154)
Professional training program	-0.0119 (0.00889)	0.0226 (0.0102)	0.00478 (0.00277)

Standard errors in parentheses.

Appendix Table A4
IV-FE Estimates of the Effects of Village Democratization on Electrification, Schools, and Public Programs for Irrigation and Employment
REDS Village Sample with Single Control Villages 1971-1992

Variable	Irrigation work program	Electrification	Secondary School	Primary School	Employment Program 'for general welfare'	Employment Guarantee Scheme
Elected Panchayat	1.248	2.423	-0.174	-3.745	-2.854	0.597
	(0.253)	(0.737)	(0.0413)	(0.745)	(0.514)	(0.0972)
Elected Panchayat x proportion village landless	-1.755	-3.779	0.0640	4.533	5.036	-0.836
	(0.361)	(1.050)	(0.588)	(1.061)	(0.733)	(0.138)
Land per household 1971*elected panchayat	-0.0154	-0.0309	0.00317	0.0452	0.0316	-0.007161
	(0.00310)	(0.00902)	(0.00505)	(0.00912)	(0.00629)	(0.00119)
Village fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
N	1,617	1,617	1,617	1,617	1,617	1,617

Standard errors in parentheses. Observations weighted by village population size in 1971. The F-statistics (F18, 1512) for the excluded instruments for the elected *panchayat*, and the interactions of the elected *panchayat* with the landless share and land per household are 130.51, 15.91, and 360.63, respectively

Appendix Table A5
FE-IV Estimated Effects of Democracy by the Proportion of the Population Landless
on Infrastructure Investment and Employment Programs
REDS Village Sample with Single Control Villages 1971-1992

Program/ρ value	Landed in Control (ρ=0)	Landless Majority (ρ=0.6)	Landless Minority (ρ=0.29, mean)
Irrigation work program	0.447	-0.606	-0.0619
	(0.0960)	(0.126)	(0.0259)
Electrification	0.819	-1.448	-0.277
	(0.0279)	(0.365)	(0.0753)
Secondary school	-0.00890	0.0295	0.00967
	(0.156)	(0.205)	(0.0422)
Primary school	-1.404	1.316	-0.0896
	(0.282)	(0.369)	(0.0761)
Employment program 'for general welfare'	-1.212	1.809	0.248
	(0.0734)	(0.255)	(0.0525)
Employment guarantee scheme	0.224	-0.278	-0.0186
	(0.0368)	(0.0482)	(0.00993)

Standard errors in parentheses.