Democratization and the Distribution of Local Public Goods in a Poor Rural Economy

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A major and longstanding issue in the study of economic development concerns how democracy influences the level, growth and distribution of economic resources. Central to this debate is the question of whether and to what extent democratization helps to alleviate poverty by serving the interests of the poor. It has been argued on the one hand that increased democracy promotes the welfare of the poor by improving flows of information between citizens and policy makers and by increasing the accountability of policy makers to poor and low-status individuals. Conversely, it has been suggested that democratization may adversely affect the welfare of the poor by increasing rent-seeking behavior and distributing decision-making to relatively uninformed individuals, thereby shifting public resources from those with fewer private resources.

Existing empirical evidence on the welfare effects of democracy and democratization have been primarily at the cross-national level and have focused on GNP growth as the outcome of interest (e.g., Barro 1996; Minier 1998). The results have been somewhat mixed and are, in any case, subject to a variety of possible problems of interpretation.[1] National-level data, however, provide little opportunity for understanding the mechanisms by which democratization affects the policy choices that influence economic performance or for studying the effects of

[1]Cross-sectional comparisons of growth and democracy may be influenced by the fact that areas with certain types of cultural institutions or endowments may exhibit both rapid growth and tend to be democratically governed. Panel studies at the national level address this issue but have problems of their own. Relatively few countries have clear transitions in democratic structure and, even if these transitions are taken to be exogenous with respect to economic change, measurement of how changes in economic structure affect economic change may be difficult given likely lags between the timing of a transition to democracy and changes in traditional measures of aggregate economic performance. Finally, given substantial heterogeneity across countries in the macroeconomic structure and interests of the poor it is difficult using national-level data to assess key predictions of political theory such as that democracy increases the adoption of policies that benefit the poor.

democratization on the poor.

Given recent trends toward fiscal and political decentralization in many developing countries, within-country variation may provide a useful complement to macro-level studies of the effects of democratization. Indeed, a recent, primarily theoretical, literature has developed that focuses on the question of how and whether this process of decentralization is welfare-enhancing (e.g., Bardhan and Mookherjee 2000, forthconing-a,b; Besley and Coate 2002). Paralleling the cross-national literature on the effects of democracy this literature concludes that democracy may have both favorable and unfavorable effects on the level and distribution of resources depending on the nature of local and national institutions and endowments. Public resource capture by local elites plays a central role in much of this literature but there is little consensus as to whether the degree of capture is likely to be increasing or decreasing in local democracy. There is a clear need, therefore for empirical work evaluating the effects of democratization on the allocation of local public goods.

A key aspect of models of democracy is that public goods distributions will reflect the population shares of different interest groups. There are thus two challenges in empirically assessing the implications of such models. First, it is necessary to define the interests groups and identify the specific public goods that differentially affect their welfare. Second, because distinct interests groups will also play unique roles in the economy, changes in population proportions will have general-equilibrium effects on the economy in addition to those effects that depend on governance type. Thus, governance models must be embedded in a general-equilibrium framework if they are to be useful in most empirical applications.

India provides an especially interesting case in which to examine how local

democratization affects the interests of the poor and economic performance. India is a country with a strong-democratic tradition at the national level as well as longstanding concern with the establishment of democratic governance at the local level. More significantly, although there has been substantial national legislation advocating local democracy since the early 1950s, implementation has been largely left to individual states, yielding variation in both the extent and timing of the transition to democracy in local villages (World Bank, 2000).

India also provides an especially useful environment for examining the consequences of democratization for the poor because of the prominence, in rural areas, of clearly defined groups with different levels of resources and distinct policy interests - the landed and the landless. The distinction between those who own land and those who do not in rural India is both important for studying distributional issues and useful for understanding the role of democratization in aiding the poor. First, the large majority of the rural poor are landless. Second, landownership mobility is quite limited,[2] so that classification by land ownership is related to lifetime welfare. Third, and most importantly, the two classes have distinctly different interests. In particular, because landless households are net sellers of labor while landed households are typically net buyers of labor, the two types of households will have substantially different views about the merits of public goods which serve primarily to raise the local wage. There is thus good reason to believe that these strata will differentially assess the benefits of allocations of village public resources to the extent these differentially affect the returns to labor and land.

Five recent papers have examined the implications of democratic governance for the

[2]Foster and Rosenzweig (2003b) show that, in the sample villages used in this study, less than 10% of landless households cultivate and only 5% of landed households in 1982 were landless in 1971.

provision of public goods to particular population groups in the Indian context, two of which exploit the reforms that have accompanied the local democratization initiative. Besley and Burgess (2002) assess to what extent the accountability of government actions affects the responsiveness of state governments to short-term adverse shocks using a probabilistic voting model of democracy in which the media provide information to voters. They define an interest group as the population that is "vulnerable" to adverse weather outcomes and an implication of the model is that the proportion of the vulnerable population affects the probability that an incumbent is re-elected when adverse shocks occur. The model does not, however, allow the variation in the proportions of vulnerable and non-vulnerable groups to have direct effects on the economy. This is not a major issue given the empirical strategy employed because only the effects of short-term shocks are examined, and Besley and Burgess do find that accountability and information matter for these important goods allocations in the democratic process. However, there is no variation in democracy at the state level in India over the relevant period and the population that is vulnerable is not defined in the empirical work. It is thus not established empirically whether the size of the vulnerable group matters for democratic outcomes, whether such groups benefitted from the governmental actions, or whether democracy affects the responsiveness of the government to the vulnerable.

Betancourt and Gleason (2000) use cross-sectional data at the district level to examine the effects of variation in voter turnout, the gender composition of voters, and the landless population share on levels of provision of doctors, nurses, and teachers. Abstracting from possible problems arising from unobserved fixed district attributes that may be correlated with voting patterns as well as the outcomes, interpretation of the results as an effect of democracy is

difficult as measures of population composition may affect the relative returns to providing the social services. For example, if there were higher returns to providing nurses in areas with high landless shares then the landless share would affect the allocation of nurses even in the absence of democratic effects. Again the absence of variation in political institutions within the data make it difficult to assess the role of democracy.

Ghatak and Ghatak (2002) and Chattopadhyay and Duflo (forthcoming) focus on groups defined by caste and gender, which are readily measured and have been historically under-represented in village governance, in the Indian state of West Bengal after the local democratic reforms. Ghatak and Ghatak (2002) studies village constituency meetings, which were introduced along with electoral reforms to increase the accountability of elected *panchayats* to women and low-caste individuals at the village level. They find that these meetings were largely ineffective due to low levels of participation. Because this study does not include information on policy outcomes before and after the introduction of these reforms, however, it cannot provide direct insight into how democracy itself may have influenced these outcomes.

Chattopadhyay and Duflo (forthcoming) take advantage of the random assignment of *panchayat* set-asides that was also introduced as part of democratic reforms to examine the policy implications of having women seated on the local council. The results indicate that the gender-composition of the council matters for such outcomes as road and school quality, but without direct evidence on the nature of women's preferences relative to men's it is difficult to know whether any observed effects on the distribution of public goods reflect the increased ability for women to implement their preferred outcomes as their representation on the council increases. Moreover, because women's set-asides were not linked to the distribution of women

in the village, this study does not address how democracy affects the ability of under-represented groups at the level of the village to implement their desired outcomes.

A fifth paper, by Bardhan and Mookherjee (2003), has important similarities with ours in terms of its emphasis on clearly defined interest groups with identifiable interests: land owners whose holding are sufficiently high that they are subject to having their land expropriated and landless individuals who can be recipients of this land as part of a land reform program. They find as might be expected that the number of local seats held by the leftist party in West Bengal is decreasing in the share of large land owners and, perhaps more surprisingly, that composition of the local governance by party has a non-monotonic relationship with land reform. This is explained in terms of a model that integrates both political competition and party ideology. However, this work is carried in one state of India and does not reflect a period in which there were major changes in political institutions. It is thus not possible to assess the effects of democratization per se. To test the implications of a model of democracy one needs data on outcomes under different political institutions, variation within political institutions in the relative size of the relevant constituencies, and a framework that clearly predicts how different groups value these outcomes.

In this paper we take advantage of a unique panel data set describing village governance, public goods allocations, and economic circumstances in India over the past twenty years to examine the consequences of democratization within a model that highlights landownership-based interest groups. We first construct a simple model of two-party representative democracy with probabilistic voting in which local governments must choose to allocate public resources among three different goods representing the principal local public goods in Indian villages:

roads, which primarily benefit the poor by raising wages; irrigation facilities, which differentially benefit landowners; and schools which have neutral effects. A key implication of this model is that an increase in the landless share should result in outcomes that are, *ceteris paribus*, more favorable to the landless, that is greater road construction. We embed the voting model in a general-equilibrium model of the rural economy in order to capture the general-equilibrium effects of changes in the landless share on the economic returns to the public goods. The model yields clear predictions about how the landless share affects allocations of the specific public goods under democracy relative to an alternative regime in which the local elite have a disproportionate effect on outcomes relative to that dictated by democracy.

The model is applied to a twenty-year panel data set from 250 villages in rural India that includes detailed information on economic conditions, public good stocks, local political structure, and revenue-raising authority. We first show that local road construction and maintenance, public irrigation installation and school building projects constitute a major proportion of village public activities and are not just or primarily a reflection of higher-level governmental priorities. Based on specifications consistent with the model, we then find evidence consistent with the two-party model of democracy in which increasing the population weight of the poor induces public resource allocations that increase the welfare of the poor. In particular, gross of general-equilibrium effects, an increase in the landless share in villages with democratic governance increases public resources to roads and decreases allocations to irrigation assets compared with villages with a non-democratic governance system. Thus, local democratization appears to serve the interests of the poor. Finally, we assess the growth implications of local democratization. We consider the possibility that public irrigation

investments crowd out private investment so that a shift in local public resources from landed-preferred irrigation investments to landless-preferred road projects may have positive effects on total output. Our evidence is consistent with almost-perfect substitution of public and private irrigation investment. Our findings thus suggest that the shift in the portfolio of local public goods associated with local democratization in part represents a transformation of a local welfare program from one that serves the rich to one that increases the welfare of the poor with possibly a net gain in total output.

1. Governing the Village Economy

To assess the distributional and welfare consequences of alternative forms of local governance to local communities we develop a simple general-equilibrium model of the village economy incorporating two classes of households - landless poor households and landed rich households - and three public goods. Two of the public goods are class-specific in that they benefit the two classes differentially. The village governing authority optimally allocates the public goods from village revenues, which derive from externally provided resources.[3] Two types of village governance are considered - a two-party democracy and an aristocracy, which places greater weight on the interests of wealthier, landed households. The latter may also be considered a modified democracy in which benefits are captured by the elite over and above that which would result from competition between two parties for the votes of a fully-informed electorate. We assess which government type benefits the poor landless households by

[3]Villages have limited taxing authority, although decentralization of such authority has begun. In Foster and Rosenzweig (2002), we incorporate local taxation in the model and show how it is possible empirically to infer the progressivity of such local taxes with information on the distribution of land and the public goods allocation.

comparing the amounts of class-specific public goods that are allocated with public funds and the extent to which strength in numbers, the population share of a class, affects the allocation.

Each village in the economy has H households. There are aH total units of agricultural land in each village but a fraction ρ of the households is landless. Agricultural land is divided evenly among the (1-ρ)H landowning households so that there are a/(1-ρ) units of land per landowning household. We assume that the three public goods to be allocated given public revenues are irrigation facilities (pumps, tanks, tubewells) t, roads r, and schools s. We will first assume, and then show in a model with plausible assumptions about technology, preferences, and market structure, that the first two of these public goods differentially affect the welfare of the landed and landless households. In particular, public revenues allocated to road-construction programs primarily benefit landless households by increasing local labor demand and the public purchase of irrigation facilities increases agricultural production and thus raises land rents.[4] Thus t is a landed-preferred public good and r is landless-preferred public good and the relative amounts of resources devoted to these public goods then signal to what extent village governance favors landless versus landed households.

a. Democratic public goods allocations

We consider first governance by a local representative democracy in which two parties, denoted X and Y, compete for votes from landless and landed households. The parties are able to credibly commit before the election to a proposed expenditure on the three goods given the

[4]The differential interest of the landed in having public resources devoted to productive assets such as irrigation is discussed by Swamy (2000), who argues that the differential political strength of landed households in India has resulted in a bias toward the purchase of such assets at the expense of social service such as schools and health services.

public budget constraint

(1) $\pi(t,r,s)=B-(w+p_r)r-p_t t-p_s s$

where B is public revenue, w is the wage, p_r denotes the non-labor cost per worker of road construction, and p_t and p_s are the unit costs of public irrigation facilities and schooling, respectively.

Individual voters vote based on the relative value they assign to the two parties, where the value assigned to a particular party reflects the welfare that individual will achieve given the proposed allocation 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

(2) $v_K^*(t_X,r_X,s_X)-v_K^*((t_Y,r_Y,s_Y)+\delta\epsilon_{Ki}-\delta\epsilon_{Ki}\geq 0$

where $v_K^*(t,r,s)$ denotes utility for household given t, r, and s. 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 .5 would determine public goods allocations. In that case variation in ρ would have no effect on public goods allocations as long as ρ does not cross the .5 threshold. If, however, δ>0 then there are other attributes of parties or candidates unrelated to class interests that attract votes.

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

(3) $1/(1+\exp\left(-\frac{(v_K^*(t_X,r_X,s_X)-v_K^*(t_Y,r_Y,s_Y)}{\delta}\right))$.

The expected proportion of votes received by party X given the respective policy choices of the parties, is

(4) $(1-\rho)/(1+\exp\left(-\frac{(v_A^*(t_X,r_X,s_X)-v_A^*(t_Y,r_Y,s_Y)}{\delta}\right))+\rho/(1+\exp\left(-\frac{(v_N^*(t_X,r_X,s_X)-v_N^*(t_Y,r_Y,s_Y)}{\delta}\right))$.

Each party chooses its own proposed public goods allocation to maximize its chance of winning given the policy choice of the other party.[5] For a sufficiently large population of voters this corresponds to constrained maximization of (4). Thus, for example, the first-order condition with respect to the landed public good r_x for party X is

$$(5)\qquad \frac{\frac{1-\rho}{\delta}\frac{\partial v_A^*}{\partial r_X}}{\left(1+\exp\left(\frac{(v_A^*(t_X,r_X,s_X)-v_A^*(t_Y,r_Y,s_Y)}{\delta}\right)\right)\left(1+\exp\left(\frac{(v_A^*(t_X,r_X,s_X)-v_A^*(t_Y,r_Y,s_Y)}{\delta}\right)\right)} + \frac{\frac{\rho}{\delta}\frac{\partial v_N^*}{\partial r_X}}{\left(1+\exp\left(\frac{(v_N^*(t_X,r_X,s_X)-v_N^*(t_Y,r_Y,s_Y)}{\delta}\right)\right)\left(1+\exp\left(\frac{(v_N^*(t_X,r_X,s_X)-v_N^*(t_Y,r_Y,s_Y)}{\delta}\right)\right)} + \mu\frac{\partial \pi}{\partial r_x}=0$$

where μ is the Lagrange multiplier associated with the budget constraint. Assuming $(1-\rho)v_A^*(t,s,r)+\rho v_N^*(t,s,r)$ is concave with bounded second and third derivatives over the relevant range, there exists a sufficiently large δ such that (5) 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.[6] The term inside the exponent of (5) is therefore zero and (5) reduces to

$$(6)\qquad (1-\rho)\frac{\partial v_A^*}{r_X}+\rho\frac{\partial v_N^*}{r_X}+\mu\frac{\partial \pi}{\partial r_X}=0,$$

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

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

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

to the utility of the two classes is equalized, where the weights are the population proportions of the two land classes. This is equivalent to maximization of a utilitarian welfare function.

b. Aristocratic public good allocations

To emphasize the contrast between traditional and democratic governance in terms of the possible influence of the poor we assume that the alternative to democratic governance is aristocratic governance in which only the interests of the landed households are considered in policy making. In particular, consider an objective function

(7) $$(1-d\rho)v_A^*(t,r,s)+d\rho v_N^*(t,r,s)$$

which nests the two extremes of democratic and aristocratic governance. For d=0 this objective function reflects maximization of the welfare of the landed households, corresponding to the full capture of the local authority by the local elite. For d=1 this objective function corresponds to a utilitarian optimum: it maximizes the weighted (by population share) sum of utilities of the poor and rich and thus will yield the same outcome as democracy as modeled above.

The first-order condition for r, for example, is then

(8) $$d\rho\frac{\partial v_N^*}{\partial r}(t,r,s)+(1-d\rho)\frac{\partial v_A^*}{\partial r}(t,r,s)+\mu\frac{\partial \pi}{\partial r}=0$$

It is evident from (6) and (8) that under democracy the allocation of public expenditures will depend directly on the share of landless households. Specifically, (6) and (8) imply that an increase in the proportion of the landless will, for given economic conditions, decrease the allocation to the landed public good and increase it for the public good that particularly benefits the landless. Democratization thus appears to make public good allocations more sensitive to the size of the poor population. However, economic conditions are not likely to be invariant to the share of landless households in the population. An increase in the landless share may change the

relative incomes of the rich and poor so as to cause a reallocation of public goods even holding fixed the weights given to the marginal utilities in (8). Moreover, if the landless share affects economic conditions directly, then it is possible that an aristocratic government that is not directly responsive to the concerns of the landless (d=0) may appear to be so as in the democracy case. To assess whether democracy benefits the landless, we need to be explicit about both the alternative governmental structure and technology, preferences, and market structure.

c. Technology and preferences in the village economy

Here we briefly set down the structure of the village economy and establish the relationships between the three public goods and the welfare of the two classes. Each household (both landed and landless) is endowed with *l* units of labor which is supplied inelastically and can be divided between agricultural work and work on public construction financed by public funds. There is a market for labor, and own-farm and hired labor are perfect substitutes. Thus if *r* denotes the per-household number of workers employed in the construction of public roads then *l-r* workers per household are involved in on-farm agricultural production or agricultural wage work. Agricultural production is assumed to be increasing and concave in both public irrigation and roads (improved access to markets), increasing in technology ϕ, and to be characterized by a Cobb-Douglas function in land and labor with labor share α. Thus

(9) $f_0(\phi,t,r,a,l)=\phi g(t,r)f(a,l)=\phi g(t,r)a^{1-\alpha}l^{\alpha}$

with $g(t,r)=g_t(t)+g_r(r)$, $g_t'(t)>0$, $g_t''(t)\leq 0$, $g_r'(r)\geq 0$, and $g_r''(t)\leq 0$.

Households are endowed with utility functions that are logarithmic in consumption and increasing and concave in publicly-provided schooling:

(10) $u(c,s)=\ln(c)+h(s)$,

with $h'(s)>0$ and $h''(s)<0$. Earnings in landed households, given the hiring of l_h agricultural workers, is

(11) $c_A=\phi g(t,r)f(a/(1-\rho),l+l_h)-wl_h$.

For landless households income consists only of labor income so landless earnings are

(12) $c_N=wl$.

If labor markets are competitive, landed farmers will employ labor in farm production so that $\alpha\phi g(t,r)f(a/(1-\rho),l+l_h)/(l+l_h)=w$. Equilibrium in the labor market requires

(13) $l_h=(l-r)/(1-\rho)-l=(\rho l-r)/(1-\rho)$

and thus the equilibrium wage is

(14) $w=\alpha\phi g(t,r)f(a/(1-\rho),(l-r)/(1-\rho))/((l-r)/(1-\rho))=\alpha\phi g(t,r)f(a,l-r)/(l-r)$ and agricultural output per landed household is

(15) $y=\phi g(t,r)f(a,l-r)/(1-\rho)$.

We make the plausible assumptions that r is sufficiently small that landed households are net users of hired labor ($l_h>0$) .That is, landed households are rich and landless households are poor.

The model delivers the result that public expenditures on roads are preferred by the poor and irrigation facilities by the rich. First, adding to irrigation facilities, although increasing consumption in both landed and landless households by the same proportion, adds more to the consumption of the wealthy landed households.[7] Letting $c_A^*(t,r)$ and $c_N^*(t,r)$ denote the functions determining landed and landless earnings, respectively, as a function of t and r then:

[7]We have assumed that there is no private irrigation investment. We consider the alternative of substitution between public and private irrigation investment below.

(16) $$\frac{\partial c_A^*}{\partial t} - \frac{c_N^*}{\partial t} = \frac{g_t'(t)}{g(t,r)} wl(c_A/c_N - 1) > 0.$$

An increase in road-building also increases the earnings of the landless and landed in absolute terms because we have allowed road-building to directly augment agricultural production as well as wages. The differential effect of road-building on landed and landed consumption therefore depends on the magnitude of the direct effects of roads on agricultural productivity:

(17) $$\frac{\partial c_A^*}{\partial r} - \frac{\partial c_N^*}{\partial r} = \frac{(1-\alpha)w}{1-\rho}\left(\frac{(l-r)g_r(r)}{\alpha g(t,r)} - 1 \right)$$

If in (17) $g_r=0$ so that roads have little direct effect on the productivity of land, for example, then a wage-augmenting road-building program unambiguously decreases the gap between the poor and rich because it increases the income of the landless poor while simultaneously decreasing the profits of the landed. In fact, however, the poor will prefer road-improvement programs to irrigation expenditures even if better roads enhance agricultural production more than do increased irrigation facilities because the former absorbs (more) labor. The necessary condition for the poor to prefer a reallocation of a rupee of resources from irrigation pumps to roads, comparing (16) and (17), is that the difference between the marginal contributions of improved roads and enhanced irrigation facilities to agricultural production must not exceed a positive scalar, which is increasing in both the share of labor in agricultural production and the labor intensity of road production r, as given by:

(18) $$g_r'(r) - g_t'(t) < \frac{\alpha g(t,r)}{l-r}.$$

Thus, to that extent that road programs are mainly employment programs, they are a preferred public good by the landless; irrigation improvement is preferred by the landed.

An important feature of the model is that agricultural production y per landholding

household is increasing in the landless share for given t and r. This is because as the proportion of landless households increases, for given population and total land size, landholdings per landed household rise. Changes in the share landless in the absence of any reallocations of the public goods, however, do not change the wage or total output. This is because as long as landed and landless households have the same number of workers a change in the share of landed households, given total land area, does not change the number of agricultural workers per unit area. Thus, changes in the relative size of the landless class directly affect the welfare of the landed class and the relative welfare of the two classes even in the absence of a government that responds to weighted class interests. This means, as shown below, that even in a governance structure completely dominated by the interests of the landed, the population proportions of the two classes will affect the allocation of public goods.

d. Democratization

We consider now the effects of democratization on the allocation of the three public goods in the context of the general-equilibrium model and contrast the two extreme governance regimes - competitive democracy and aristocracy or elite full capture - in terms of both the relative levels of the public goods and the response of the public good allocation to changes in the share of the landless. The model delivers the result that democratization, which gives weight to the interests of the landless, increases road construction, as is not surprising given that road-building differentially benefits landless households. Solving first-order conditions of the form of (8) and implicitly differentiating public good demand functions $r^*(d,\rho,\tau)$, $t^*(d,\rho,\tau)$ and $s^*(d,\rho,\tau)$ with respect to d yields

$$(19) \qquad \frac{\partial r^*}{\partial d} = \frac{1}{z0}(z_{11}p_s^2 + z_{14}^2 h''(s))\frac{(1-\alpha)\rho}{(l-r+\alpha(l\rho-r))}$$

where

(20) $$z_{11}=\frac{g_t''(t)}{g_t'(t)wr+p_t g(t,r)}-\frac{g'(t)^2}{g(t,r)^2}<0$$

and

(21) $$z_{14}=-\frac{g'(t)wr+p_t g(t,r)}{g(t,r)})<0$$

and z_0 is the determinant, which must be negative for an interior maximum. As roads are increasing in d over the relevant range, it follows that more roads will be built under democracy (d=1) than under aristocratic governance (d=0).

The model also suggests, however, that under aristocratic rule public resource allocations actually lower the per-household incomes of the poor the larger the share of poor in the economy, the opposite of the result under democracy. The effect of an increase in the share of the village population that is landless on road-building is given by:

(22) $$\frac{\partial r^*}{\partial \rho}=-\frac{1}{z0}(z_{11}p_s^2+z_{14}^2 h''(s))\frac{(1-\alpha)(\alpha l-d(l-(1-\alpha)r))}{(l-r+\alpha(l\rho-r))^2}$$

For aristocratic governance, d=0, road construction and thus the wage rate that is the sole source of income among the landless decrease as the landless share increases. This reflects the fact that when there is higher proportion of landless households labor hiring is increased among landed household. This causes the landed elite to favor reduced road construction in order to lower wages. However, as can also be seen in (22), for full democracy (d=1), road construction is increasing in the landless share, reflecting the weight given to the landless in a democratic voting game.

The expressions for the effects of democracy and the landless share-effect on irrigation facilities are opposite in sign from those in roads. In particular, irrigation facilities

(23) $$\frac{\partial t^*}{\partial d}=-\frac{1}{z0}(z_{12}p_s^2+z_{14}z_{24}h''(s))\frac{(1-\alpha)\rho}{(l-r+\alpha(l\rho-r))}<0$$

are decreasing in d where

$$(24) \qquad z_{12} = -\frac{g_t'(t)g_r'(r)}{g(t,r)^2} - \frac{(l-\alpha r)wg_t'(t)^2}{(l-r)g(t,r)(g_t'(t)wr+p_t g(t,r)} < 0$$

and

$$(25) \qquad z_{24} = -\frac{(l-\alpha r)w}{l-r} - wr\frac{g_r'(r)}{g(t,r)} < 0,$$

Thus irrigation expenditures will be higher under aristocratic governance than under democratic governance. Moreover, the relationship between the share of the landless and irrigation facilities is opposite across the two governance regimes. The irrigation relationship is the mirror image of the road construction relationships in (22):

$$(26) \qquad \frac{\partial t^*}{\partial \rho} = \frac{1}{z0}(z_{12}p_s^2 + z_{14}z_{24}h''(s))\frac{(1-\alpha)(\alpha l - d(l-(1-\alpha)r))}{(l-r+\alpha(l\rho - r))^2}$$

Expression (26) is positive for aristocratic governance (d=0) - landed elite rulers shift public resources to increase land productivity as the share of the population that is landless increases- and negative for democracy (d=1) - as the size of the landless voter population increase relatively, less public resources are devoted to land augmentation, reflecting the greater weight given to the welfare of the landless.[8]

Finally, given that schools in the model do not directly redistribute resources between households the effects of democratization on school building are unclear. In particular,

$$(27) \qquad \frac{\partial s^*}{\partial d} = -\frac{p_s}{z0}(z_{11}z_{24} - z_{14}z_{12})\frac{(1-\alpha)\rho}{(l-r+\alpha(l\rho - r))},$$

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[8]We have assumed that the total government grant B does not depend on the landless population share ρ. If B depends on ρ but that relationship is invariant to the form of government, then the difference between the effect of the landless share on roads and irrigation in (22) and (26) would be unaffected. Moreover, if the effect of ρ on B does differ by regime, then that would tend to make the effect of ρ on the two public goods across regimes the same sign, rather than the opposite sign that the model delivers. Only if block grants are very responsive to ρ and to the regime change would it not be possible to identify local democratization effects on the public goods portfolio.

where the sign of the first term in parenthesis is indeterminant and is zero, for example, with $g(t,r)=t$. Similarly, it is not possible to predict how democratization changes the relationship between the relative sizes of the two classes and the allocation of public resources to schools:

$$(28) \qquad \frac{\partial s^*}{\partial \rho} = -\frac{p_s}{z0}(z_{11}z_{24} - z_{14}z_{12})\frac{(1-\alpha)(\alpha l - d(l-(1-\alpha)r))}{(l-r+\alpha(l\rho - r))^2}.$$

However, although it is not possible to sign the effect of democratization on schools, the difference between the effects of a change in the landless share on school building across the democratic and aristocratic regimes governance should be opposite in sign from the democratization effect on schools, or zero if the latter is zero.

2. Data

As noted, India has initiated over the past two decades at the national and state levels reforms aimed at transforming village governing authorities into democratic organizations having some ability to raise revenues at the local level. In recognition of the importance of these activities, we incorporated a set of questions on village governance in the latest re-survey of rural households carried out by the National Council of Economic Research (NCAER) that was carried out in 1999-2000. 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. The REDS data provide sampling weights for all households, as described in more detail in Vashishtha (1989), thus permitting construction of village population characteristics from the household survey data. Based on the population weights and the household data, we thus constructed for each village the proportion

of households that do not own land. These proportions have basically remained the same within villages over the 1982-99 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.

Information in the 1999 round was elicited on 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 provided - 'traditional *panchayat*', 'elected *panchayat*', 'village headman', 'wealthy individual', 'regional government official', and 'none'- plus a miscellaneous category. Data were also collected on the characteristics of the membership of the governing body in 1999. These data support a key assumption of our model of democracy, that there are two parties. Figure 1 plots the cumulative distribution of the share of seats on the local 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. 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 (.25) between the proportion of landless households in the village and the proportion of landless members of the council, but this correlation did not differ across the democratic and non-democratic regimes.

Two important issues in using local public activities to infer the importance of local governance regimes using the model are (i) the extent to which projects are determined by local authorities and (ii) the importance of the specific local public goods highlighted in the model. The 1982 and 1999 REDS village surveys provide comprehensive information on the set of

public activities in the village in the past decade 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 road building/improvement, 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 these areas in the previous decade 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 from either source reflects at least in part the decisions of local decision-makers. This conclusion also conforms with the results of Chattopadhyay and Duflo (forthcoming) in which the gender composition of local government affect, for example, the quality of roads.

Because there is no information on the timing and duration of the public projects we look at the outcomes of local public resource allocations in terms of existing public infrastructure. It is important to note that roads, irrigation facilities and school buildings deteriorate without maintenance. Thus, for example, the existence of a paved road at a point in time reflects recent construction and maintenance activities. The 1982 and 1999 village surveys obtained information on the current state of the facilities created by the FWP projects (this information was not obtained for the village-initiated projects). In 1982, on average an FWP project was initiated 2.8 years prior to the survey; in 1999 the average FWP project was started 6.3 years

prior to the survey. Table 2 reports the proportion of FWP-sponsored road and irrigation facilities that were reported as "damaged" or not in place at the time of the survey. As can be seen, FWP projects exhibited high deterioration associated with the absence of a recent project. For example, the proportion of FWP road projects in disrepair in 1999 is over 44%, more than twice that for 1982. The existence of a paved or improved (pucca) road thus signals recent public road work that, given Table 1, employs local labor. And, the current stock of public irrigation facilities reflects both recent installation or public maintenance.

The 1982 and 1999 REDS provide a consistent set of information on village infrastructure for 253 villages at the time of the survey.[9] We also obtained information on the survey villages from the 1991 Indian Census. In particular, the Indian Census provides data for every village in India on road types and population size for 1991.Using as matching information village, *tehsil* and block names we were able to match 234 of the 253 villages represented in the 1999 survey.[10] We then used the histories of village governance obtained from the 1999 survey to construct a village-level panel data set based on the 1982 REDS, matched data from the 1991 Census, and the 1999 REDS. In particular, we created variables indicating whether at the three relevant survey/census points the village governing body was democratically elected. The 1999

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

[10]The sources for village population sizes for the 1981-82 REDS surveys was the 1981 Census of India. Surprisingly, a non-trivial number of the villages in the Census data do not report population or household size. The fraction of non-reporting villages for the years 1982 and 1991 are .279, and .051, respectively. Population estimates for the 1999 village survey are missing for 13.1% of the villages. In the econometric analyses reported below, we include observations with missing values for population by setting the missing values to zero and adding to the specification dummy variables indicating that these variables were not available.

REDS also provides the dates of establishment for all schools located within10 kilometers of the villages classified by whether they were public, private, aided, or parochial and by schooling level - primary, middle, secondary, and upper secondary. We used this history to construct a variable indicating whether in 1982, 1991 and 1999 there was a secondary school in the village.[11] For the analyses here, we look at the changes in the presence of secondary, inclusive of upper secondary, schools. We do this because even in the 1960's primary schools were nearly universal - by 1971 primary schools were located within 90% of the sample villages. The relevant margin is at the secondary school level. In 1971, only 41% of villages were proximate - within 5 kilometers - to a secondary school. However there was considerable school building - by 1981 secondary school village coverage had reached 57% and coverage increased to 73% by 1991.

Both the 1982 and 1999 REDS provide an inventory of irrigation assets classified by type and by whether they are public or private. We aggregated the irrigation assets across types in each village for each year and created a village-year-specific indicator variable for whether there were any public irrigation assets in the village. The REDS and the village census data sets also provide information on whether the village had a paved (*pucca*) road in the relevant year. Indicative of the importance of continued road maintenance, in 17% of the villages that had a *pucca* road in 1991, there was no such road in 1999.

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[11]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 histories, suggest that the school building histories accurately reflect the true changes in school availability over the survey period. 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.

Local governance reform in rural villages in India has been accompanied by important technological progress in agricultural productivity, which may have an independent impact on the disposition of public goods that affect agricultural productivity and wages. It is particularly important to measure these advances, as they have been geographically uneven to a large extent (Foster and Rosenzweig, 1996). To construct a measure of agricultural technology at the village level over the 1982-99 period, information from the 1999 and 1982 surveys on crop outputs and acreage planted by crop, type of land and seed variety (high-yielding (HYV) or not) was used to construct a Laspeyres index of HYV crop yields on irrigated lands combining four HYV crops (corn, rice, sorghum and wheat) using constant 1971 prices for each of the villages for the two survey years. We computed the HYV technology index on irrigated lands to remove the effect that the spread of irrigation has on yields. This index, however, clearly measures technology with error and may be affected by the public goods variables. We use instruments to predict yields, as described below, to correct for these problems.

Finally to assess to what extent efforts at the state and national levels to promote local democratization and decentralization have actually influenced the changes in local governance we examined state legislation related to local governance issues. These can be roughly classified in three stage, 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).[12] All states, except Bihar, enacted legislation to make their own Panchayat Acts conform to the national provisions. In the 1990's as well, individual states set up tax commissions making recommendations about the provision of local tax authority

Table 3 provides by survey/census year the means and standard deviations of the constructed variables, including the state political variables indicating whether a village was located in a state that had passed stage-two or stage-three governance legislation. As can be seen, while there has been a growing and significant amount of legislation at the state and national levels in recent years designed to institutionalize local democratization, democratization at the village level has not been advancing as rapidly - 76% of the survey villages had elected *panchayats* in 1999, up from 65% in 1982, a rise of 16%. Economic development has evidently occurred at a much more rapid pace than political development over the same period - while population size rose by 47%, the HYV crop-yield index rose by 78%, the proportion of villages with a good road more than doubled, and village coverage of public secondary schools increased by almost 60%.

3. Estimation

The equations we wish to estimate, linearizations of the model-based reduced forms relating village governance structure, and the landless population proportion to each of the

[12]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.

public goods for given land and population sizes and technology, are:

(29) $P_{njt} = \gamma_0 + \gamma_1\rho_j + \gamma_2 d_{jt} + \gamma_3\rho_j d_{jt} + \gamma_4 A_j + \gamma_5 H_{jt} + \gamma_6\phi_{jt} + \mu_j + \epsilon_{jt}$,

where the γ's are parameters to be estimated and the P_{njt}, n=r,t,s , are indicators of whether village j at time t has one of the three public goods. There are three problems in obtaining consistent estimates, or identifying, the γ's that arise due to omitted variables that are impounded in the time-varying error term ϵ_{jt} and in the village fixed effect μ_j. First, areas of India are likely to vary considerably in their preferences for public goods, for democracy and for equity. For example, West Bengal is known to be a state with a long history of egalitarian movements - it carried out land reforms prior to the survey period, resulting in a small proportion of landless households ρ_j compared with other states during the survey period and, West Bengal, as noted above, was also one of the first states to enact legislation encouraging the decentralization of decision-making. Thus, the unobserved fixed effect, reflecting persistent differences across areas in egalitarian preferences, is likely to be correlated with the regressors. To remedy this, we include in (29), village-level fixed effects. We also include year-effects to capture the effects of national changes in policies that may jointly affect trends in the variables.

Note that including village fixed effects makes it impossible to identify γ_1, the direct effect of variation in the landless proportion ρ_j on the distribution of the public goods or γ_6, the effect of variation in total village land size A_j, because neither variable varies over the survey period. We can, however, identify the coefficient γ_2 on the public goods distribution of democratization, based on the changes in governance structure within villages over time d_{jt}, and the difference between the effects of changing the proportion landless across democratic and non-democratic regimes γ_3, based on the combination of cross-sectional variation in ρ_j and the

intertemporal variation in d_{jt} within villages.

The second estimation problem is that net of village and year fixed-effects the time-varying errors ϵ_{it} in (29) representing, for example, period- and village-specific productivity shocks may jointly affect the public goods like irrigation and roads and crop productivity ϕ_{jt}. In addition, our estimate of village crop productivity likely measures with considerable error true agricultural productivity. We thus use instruments to predict the village-specific changes in HYV crop productivity. We exploit three characteristics of the green revolution in India to assemble our instrument set. First, climate conditions across India make some areas of India substantially more suitable for growing rice, while other areas are suitable for growing wheat but not rice (ICAR, 1978; ICAR 1985). In 1971, 46% of the sample villages did not grow wheat and 32% did not grow any rice. In those areas not growing wheat, over 45% of land was devoted to growing rice while in the villages not growing rice, on average 18% of crop land was planted with wheat.

A second characteristic of the green revolution is that advances in productivity varied by crop. In particular, technological advances in yields for wheat preceded those for rice but slowed more than did those for rice in the later period, so that the areas differing by crop suitability experienced differential advances in crop productivity (Evenson and David, 1993). To capture these crop-specific yield growth differentials we will use as instrumental variables predicting the growth in the HYV-crop index over the 1982-99 period the proportion of land in the village devoted to rice and wheat in 1971, respectively, multiplied by year dummies. Finally, we use a variable representing whether or not the village was located in an Intensive Agricultural District Program (IADP) district. The IADP was initiated in the late 1960's in one district in each Indian state to promote the adoption of the new seed varieties of the green revolution through

information dissemination and credit subsidy. This variable is thus unlikely to be correlated with the initial crop productivity shock in1982 but should be a good predictor of agricultural productivity growth at least in the first decade of the sample.[13]

A third potential problem is that the village-governance structure may itself be changed by the distribution of public goods - the addition of schools, which raise educational levels, for example, may alter preferences for democracy as might changes in the distribution of incomes brought about by public goods distributions. To test whether the set of governance variables is correlated with the time varying residual, we estimated equations predicting whether the village was governed by an elected *panchayat* and then carried out Wu-Hausman tests. The regressors included village and year dummy variables, the (predicted) log of the HYV yield, the log of village population size, and the state-level variables indicating the passage of legislation relevant to local governance interacted with the village proportions of landless households that appear in the top panel of Table 3.

Table 4 reports the two-stage fixed-effects estimates of the equations describing the relationships between the state legislation variables, the village variables and village-level democratization. The first column of Table 4 provides the estimates from a linear specification of the equation determining whether or not the village had an elected *panchayat*. The estimates suggest that both state legislation in the period preceding the national constitutional amendments

[13]The fixed-effects estimates of the predicting equation for the crop productivity index are reported in Foster and Rosenzweig, 2003b. F-statistics indicate that the complete set of variables and the set of instruments explain a statistically significant proportion of the variability in HYV yields across the villages over the sample periods. The estimates also appear to capture the main attributes of the green revolution, mainly the early productivity growth for wheat yields and the more rapid advancement for rice yields later in the period.

(stage-two legislation) in the late 1990's as well as post-amendment state-level legislation affected the probability that villages adopted a democratic governance structure - the point estimate suggests that a village in state with such legislation prior to the constitutional amendments was 23% more likely to have an elected *panchayat*. The estimates also suggest that villages experiencing lower agricultural productivity were more likely to become democratic, but population size does not seem to matter for village government form. The addition of the interaction terms between the proportion of households landless in the village and the stage legislation variables do not add significantly to explanatory power.

5. Estimates

The principal use for the estimates reported in Table 4 is to test whether the democratization variables in equation (29) are correlated with the time-varying error term. Application of the Wu-Hausman test indicated non-rejection of the hypothesis of a statistically significant relationship between the set of governance variables and their interactions with the landless share and the error term at conventional levels of significance for each of the public goods. Thus we only report in Table 5 instrumental-variables fixed effects (FE-IV) estimates of (29) treating the yield variable as endogenous. There are three specifications for each of the three public good variables - a linear specification omitting the interactions between the village ρ and the village governance variables, a specification including the interaction terms, and the interactive specification including an interaction between the proportion of landless households at the state level (from the relevant censuses) and the village governance variable.

The estimates from the linear specifications indicate that villages under a democratic *panchayat* have more of each of the public goods. In particular, the point estimates suggest that

democratic villages are 15% more likely to have a paved road, 80% more likely to have public irrigation facilities and 22% more likely to have a secondary school. Moreover, the interaction terms involving the village landless population share variable, which are jointly statistically significant for both of the class-specific public goods irrigation and roads, conform to the democracy scenario of the model, suggesting that nominal democratization at least mimics true democratization. The estimates in particular indicate that villages with elected *panchayats* are clearly more attentive to the welfare of the landless - under an elected *panchayat* an increase in the share of the village population that is landless increases the probability that the village has a paved road, which favors labor, and decreases the probability that it has public irrigation facilities, which augment land rents. Indeed, in villages where the proportion landless exceeds 43%, democratization reduces the probability of public investment in irrigation.[14] Also consistent with the model, and thus with the assumption that schools benefit both land classes, under democracy the landless population share does not affect the likelihood of a village secondary school. Finally, the results from the third specification indicate that the share of the landless in the state does not have any effect on the village distribution of public goods. The local landless share is not just a proxy for that in the state population. Local democratization thus appears to have reduced the capture of local government resources by the elite landed.

5. Democratization, Crowding-Out and Growth

It is easy to establish that under the aristocratic regime, there is less investment in roads than would maximize total output. Democratization, by altering the composition of public goods in favor of road construction/improvement preferred by the poor landless, thus not only reduces

[14]The landless proportion exceeds 43% in approximately 30% of the villages.

inequality but may increase total output and as well. This is accomplished at the expense of irrigation asset investment, however, so it is possible that at some larger values of the landless share ρ there is overinvestment in roads under democracy. However, we have up to this point assumed that public infrastructure is productive in the sense that public investment in infrastructure increases total output for given land and labor allocations. This ignores the potential for public investment to crowd out the private provision of these assets.

Although the assumption that road investments augment output may be reasonable it is subject to question in the context of the contribution of public irrigation assets if private investments are considered.[15] Indeed, if public and private irrigation assets are perfect substitutes, then the shift of resources to the poor might then not only decrease income inequality but increase output even if the share of the landless population is large when improved roads contribute to growth. Or, put starkly, democratization in that case transforms a welfare program for the rich into a welfare program for the poor that also has positive output effects. Because crowding-out behavior may thus importantly influence the effects of local democratization on economic growth and has implications for the relative welfare of the two land classes it is important to establish whether such substitution is in fact taking place. To do this we extend the model to include private investment in irrigation by landowners and establish and carry out tests for whether or not there is crowding out.

Let t_v denote the number of private irrigation assets per household so that expenditure by each landed households is $p_t\, t_v/(1-\rho)$. To simplify the analysis we assume that public and private

[15]There also may be effects of substitution of private for public schooling. Given the absence of testable predictions of the pure public-school model presented above, it is not possible to test for private school substitution using the available data.

irrigation assets are perfect substitutes so that the effective quantity of irrigation assets per household is $t+t_v$. Then, landed consumption given hired labor l_h is

(30) $$c_A = g(t+t_v, r) f(a/(1-\rho), l+l_h) - \frac{p_t t_v}{1-\rho} - w l_h .$$

We assume that each farmer takes as given public irrigation assets t and roads r in determining his level of investment in private pumps and that this level of investment does not affect his utilization of the public pumps and thus the availability of public irrigation assets to other landed households. We also assume an interior solution for t_v so that public irrigation assets are infra-marginal. Thus t_v and l_h are determined by maximizing profits, yielding first-order conditions

(31) $$\phi g_t'(t+t_v) f(a, l+l_h) = p_t$$

(32) $$\alpha \phi g(t+t_v, r) f(a, l+l_h)/(l+l_h) = w .$$

Imposing equilibrium in the labor market as before, the optimal level of private irrigation assets is

(33) $$t_v^*(r,t) = g_t'^{-1}(p_t/(\phi f(a, l-r))) - t$$

and the equilibrium wage is

(34) $$w^*(r) = g(g_t'^{-1}(p_t/(\phi f(a, l-r))), r) \alpha \phi f(a, l-r)/(l-r) .$$

Expressions (33) and (34) indicate that as a consequence of the assumption of perfect substitution between public and private irrigation assets, there is a one-for-one crowding out of private pumps and, consequently, the equilibrium wage does not depend on the public allocation of irrigation assets. Public irrigation asset allocations in this case are therefore a pure transfer towards landed households and have no effect on output - just as road programs serve mainly to augment the incomes of the poor, public irrigation investments are welfare payments to the wealthy.

In the Appendix we show that the key empirical implications for the effects of governance structure and changes in the local landless population share on the allocation of public goods are not affected by the introduction into the model of private irrigation assets. Roads continue to transfer resources towards the landless by raising the wage and public irrigation assets play an even strong role in transferring resources in the opposite direction. However, despite the fact that there are no effects of an increase in public irrigation investment on production when private and public irrigation assets are perfect substitutes, private investment in irrigation does not fully compensate for the loss of public irrigation resources. The reason is that the return to irrigation investment is lowered due to the increased cost of labor induced by the road program. Thus, even in the perfect-substitution case, in equilibrium there may be a loss in output when landless-preferred public investments are favored.

The effects of an increase in democracy on private irrigation assets is the sum of a positive effect that arises because fewer public irrigation assets are built and a negative term attributable to lower net returns to private investment as a consequence of greater road construction

$$\frac{\partial t_v^*}{\partial d} = -\frac{\partial t^*}{\partial d} + \frac{g_t'(t+tv)\alpha}{(1-r)g_t''(t+tv)}\frac{\partial r^*}{\partial d}. \tag{35}$$

Similarly, the effect of an increase in landless share, under democracy, is also the sum of negative and positive terms

$$\frac{\partial t_v^*}{\partial \rho} = -\frac{\partial t^*}{\partial \rho} + \frac{g_t'(t+tv)\alpha}{(1-r)g_t''(t+tv)}\frac{\partial r^*}{\partial \rho}. \tag{36}$$

Thus, the effects of democratization and changes in the landless share on private investment are not the exact mirror image of those on public provision due to general-equilibrium effects. However, evidence that private irrigation investment moves in opposite

directions to public investments due to shifts in the governance would imply that there is at least some substitution between private and public investments.[16] Expression (34) for the wage rate provides a direct test for perfect substitution, as it implies that, for given road investments, variation in public irrigation assets does not affect the equilibrium wage.

We use information from our survey data on whether there are private irrigation assets in the village and the number of irrigation pumps to assess how democratization affects private investments. That is, we estimate equation (29) replacing the dependent variable by the two measures of private irrigation goods. We also estimate a wage equation, corresponding to (34), of the form:

$$(37) \quad \log(w_{jt}) = \eta_0 + \eta_1 r_{jt} + \eta_2 t_{jt} + \eta_3 R_{jt} + \eta_4 A_j + \eta_5 H_{jt} + \eta_6 \phi_{jt} + \mu_{wj} + \epsilon_{wjt},$$

where R_{jt} is a measure of local rainfall in the village in the survey year.[17] Again, we add time dummy variables and village fixed effects to (37), which precludes the identification of the land area effects. The model clearly indicates that wage shocks ϵ_{wjt} will be correlated with public investments. We employ as instruments to predict road and public irrigation assets the set of governance variables used in (29) that we have seen affect public investments, the assumption being that governance structure affects wages only through the choice of public goods. The model implies that $\eta_1 > 0$ - road projects push up wages - and, if there is perfect crowding out

[16]The greater is the concavity of the function $g_t(t+tv)$ the more likely that the expected result of mirror-image effects on private and public irrigation assets will obtain.

[17]We have geo-coded the survey villages and have matched information on annual rainfall to each of the villages in each of the relevant years based on data from the set of 30 weather stations in India reporting data to the National Climate Data Center (NCDC) over the 17-year period.

with respect to irrigation, $\eta_2=0$.

Table 6 reports the estimates of the private investment equations, again estimated using fixed-effects with instruments for the yield variable. Although the coefficients are not estimated with a great deal of precision, the set of estimates together with those of Table 5 suggests that there is substitution of public and private irrigation investments - the sign patterns with respect to the governance and share variable coefficients for private and public irrigation are indeed mirror images. In particular, under democracy an increase in the share of the landless in the population decreases the probability of there being public irrigation facilities in the village but evidently also increases the likelihood of their being private irrigation assets and the total number of private pumps - the output loss is thus less than implied by the decline in public irrigation investments.

Finally, Table 7 reports fixed-effects and fixed-effects instrumental-variables estimates of the wage equation (37). These estimates clearly indicate that improved roads raise village wage rates, an important assumption of the model.[18] They are somewhat more ambiguous on whether or not public irrigation investments are on net productive - on the one hand we cannot reject the hypothesis with either estimation procedure that public irrigation assets have no effect on equilibrium wages; on the other hand, the point estimate for irrigation in the statistically-(and theoretically-) preferred specification using instrumental-variables suggests that the existence of public irrigation assets in a village pushes up wages by an economically significant 14%.

6. Conclusion

[18]Note again that the existence of a paved road implies recent work activity, given evident high depreciation rates.

The purpose of this paper has been to provide empirical evidence pertinent to theories of democratization in low-income countries, with particular focus on the distributional consequences of these processes. Our analysis is based on a simple voting model embedded in a general-equilibrium framework describing a rural economy that highlights class interests defined by landownership and the principal public goods that are allocated by local governments. Our evidence suggests that two major local public goods, irrigation assets and roads, differentially affect the welfare of the land-specific classes and that the shifts in the relative amount of local public resources devoted to these goods reflect the differing weights accorded the two classes by governance regime.

There are three major findings from our analysis of data describing the changes in local governance over the past 18 years in India across approximately 250 villages. First, traditional local governance in village India is biased toward landed households so that a shift toward democracy results in the implementation of an outcome that maximizes the weighted average of landed and landless households and thus serves to reduce poverty and inequality. In particular, we find that relative to the effects under traditional governance, an increase in the landless share under democracy has a positive effect on road construction and a negative effect on irrigation facilities. This reflects the facts that road-building is a labor-intensive activity that raises wages and that on average wealthier, landed households are net buyers of labor. The effects of democratization on school building, which is posited to similarly benefit both types of households, are limited. These results are inconsistent with the premise that landless households are either uninformed about local public resources or unable to use the franchise to advance their interests when public resources are allocated by a democratically-elected governing body. Thus,

elite capture of local public resources, if present, is diminished by the presence of local democracy.

Second, the consequences of local political change for economic growth appear to be limited. There is evidence of strong substitution between public and private irrigation assets so that any increase in local public pump investments represents a direct transfer to the landed rather than an augmentation of the total supply of irrigation facilities. As long as public irrigation assets are inframarginal the landless will wish to lower and the landed to raise public provision of these assets but these desires will reflect distributional concerns rather than an attempt to achieve an efficient allocation of public resources. Conversely, landed households have an incentive to under-provide and landless households to over-provide roads.

Although democracy balances the interests of the two land classes in supporting an equilibrium that maximizes total utility, there is no guarantee that this allocation will be fully efficient in the sense that the marginal revenue products of the different assets is equated to the their respective costs of production. Indeed, the fact that the data indicate that the provision of public goods responds significantly to the landless share is *prima facie* evidence that democracy does not in general yield an efficient allocation of resources: for given technologies, preferences, and total land and labor endowments a change in the landless share should not change the efficient levels of productivity-enhancing assets. The source of this efficiency loss is of course the limited scope given in the model for the local government to freely reallocate resources across economic strata through lump-sum taxes and subsidies. The fact that productive resources are evidently being used to redistribute resources between the landed and landless suggests that such constraints do in fact play a significant role in terms of the developmental and

distributional consequences of political change.

Appendix

In order to examine the predictions of the public goods model incorporating private investment behavior for the public provision of irrigation assets and roads it is helpful to substitute (37) and (38) into (34) to obtain an expression for equilibrium consumption by landed households of

$$(1) \qquad c_A^*(t,r)=\frac{g(t+t_v^*(t,r),r)f(a,l-r)}{1-\rho}-\frac{p_t t_v^*(t,r)}{1-\rho}-w^*(r)\left(\frac{l-r}{1-\rho}-l\right)$$

and by landless households of

$$(2) \qquad c_N^*(t,r)=w^*(r)l.$$

We assume that the productivity return to roads is sufficiently small relative to the labor share so that $\partial c_A/\partial r<0$.

It may be established that road investments are increasing with democratization

$$(3) \qquad \frac{\partial r^*}{\partial d}=\frac{\rho}{z_0^* c_A}\left(\frac{p_t}{(1-\rho)}z_6-\left(\frac{\partial c_N^*}{\partial r}\frac{c_A}{c_N}-\frac{\partial c_A^*}{\partial r}\right)z_7\right)>0$$

and irrigation assets are decreasing

$$(4) \qquad \frac{\partial t^*}{\partial d}=\frac{\rho}{z_0^* c_A}\left(\frac{p_t}{(1-\rho)}z_5-\left(\frac{\partial c_N^*}{\partial r}\frac{c_A}{c_N}-\frac{\partial c_A^*}{\partial r}\right)z_6\right)<0,$$

where $z_0^*<0$ is the determinant of the bordered hessian of the corresponding public good allocation problem,

$z_5=-z_{22}^* p_s^2-h''(s)(w(r)+w'(r)r)^2>0$, with $z_{22}^*<0$ for the second order conditions to be satisfied,

$z_6=\frac{(1-\rho d)p_t p_s^2}{(1-\rho)c_A^2}\frac{\partial c_A^*}{\partial r}+p_t p_s h''(s)<0$, and $z_7=-\frac{(1-\rho d)p_t^2 p_s^2}{(1-\rho)^2 c_A^2}-h''(s)p_t^2>0$.

Moreover, the sign patterns for the effects of changes in the landless share on the composition of public assets under the two regimes is the same as in the model in which there is no private offset to public irrigation investment:

$$(5) \qquad \frac{\partial r^*}{\partial \rho}=-\frac{c_N-d((1-\rho)c_A+\rho c_N)}{z_0^*(1-\rho)c_A^2}\left(\frac{p_t}{(1-\rho)}z_6-\left(\frac{\partial c_N^*}{\partial r}\frac{c_A}{c_N}-\frac{\partial c_A^*}{\partial r}\right)z_7\right),$$

which is positive for d=0 and negative for d=1 and

$$(6) \qquad \frac{\partial t^*}{\partial \rho}=-\frac{c_N-d((1-\rho)c_A+\rho c_N)}{z_0^*(1-\rho)c_A^2}\left(\frac{p_t}{(1-\rho)}z_5-\left(\frac{\partial c_N^*}{\partial r}\frac{c_A}{c_N}-\frac{\partial c_A^*}{\partial r}\right)z_6\right),$$

which is negative for d=0 and positive for d=1. Thus, as before, roads are favored more than irrigation assets under a democratic regime and the effects of the landless share with and without democracy on each of the public goods are also of the same sign as they were in the no-private irrigation assets model.

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Figure 1. Cumulative Distribution of the Top-Two Party Shares of Village Council Members, Democratic Councils in 1999

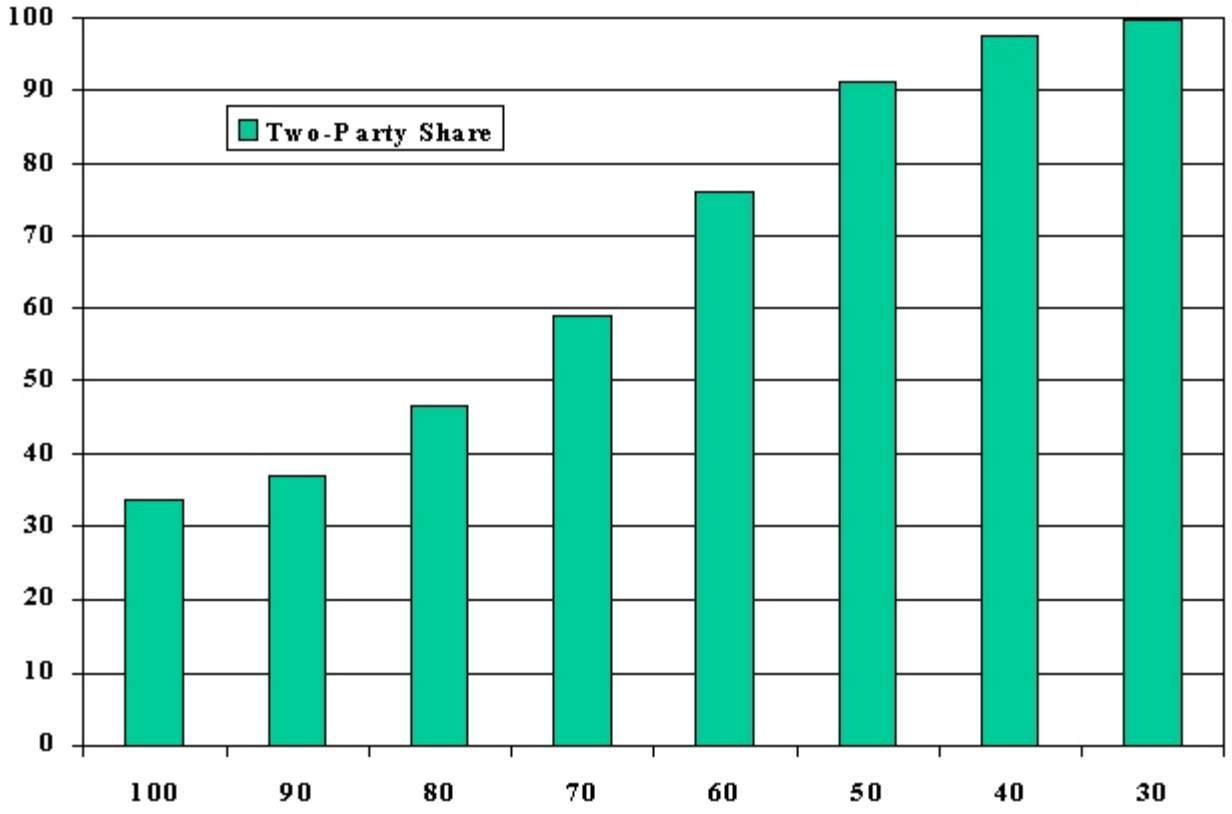

Table 1
Percentage of Villages With a Local Public Project in Previous Decade,
by Public Good and Program Source: 1982 and 1999 Survey Years

	1982		1999	
Program/project	Village Self-help Program	Village Food-for-Work Program	Village Self-help Program	Village Food-for-Work Program
Road construction or improvement	26.8	8.8	25.3	16.2
Irrigation construction or installation	2.8	2.4	4.3	2.8
School building	24.0	0.4	15.0	5.5

Table 2
Percentage of Food-for-Work Project Public Goods Damaged at the Survey Date, by Public Good and Survey Year

	1982	1999
Road	20.0	44.4
Irrigation facility	33.3	40.0

Table 3
Means and Standard Deviations of Variables: 1982-1999

Variable/Year	1982	1991	1999
State Actions Related to Governance			
Stage-two legislation passed	.154 (.362)[a]	.379 (.486)	.379 (.486)
Stage three legislation passed	0	0	.957 (.204)
Village Governance			
Elected *panchayat*	.652 (.477)	.723 (.448)	.755 (.431)
Proportion *panchayat* members landless	-	-	.170 (.271)
Village Public Goods			
Pucca road	.310 (.463)	.705 (.457)	.748 (.435)
Government pumps, tanks, wells	.293 (.456)	-	.346 (.476)
Public secondary school	.403 (.614)	.553 (.674)	.644 (.724)
Village Characteristics			
Total land area (acres)	1791 (2153)	1791 (2153)	1791 (2153)
Proportion households landless	.267 (.256)	.267 (.256)	.267 (.256)
Population size	2642 (3466)	3311 (4948)	3877 (5510)
HYV productivity index	561.9 (352.7)	-	1001.9 (500.4)

[a]Standard deviation in parentheses.

Table 4
FE-IV Estimates: State Legislation, Village Characteristics and Village Governance

Variable	Elected *Panchayat*	
Stage-two state legislation	.1726 (1.95)[a]	.308 (2.35)
Stage-two state legislation x local landless proportion	-	-.408 (1.62)
Stage-three state legislation	.0587 (2.47)	.0651 (2.27)
Stage-three state legislation x local landless proportion	-	-.0218 (0.40)
Log of village HYV yield	-.00594 (1.71)	-.00571 (1.66)
Log of village population size	-.00410 (0.29)	-.00546 (0.39)
N	740	740

[a]Absolute value of t-ratio in parentheses.

Table 5
Fixed-Effects IV Estimates: Village Public Goods and Village Governance

Variable	*Pucca* Road			Irrigation facilities			Public School		
Elected *panchayat*	.111	-.149	-.395	.290	.777	.111	.141	.120	.0298
	(1.28)[a]	(1.01)	(0.80)	(1.84)	(5.05)	(0.29)	(1.82)	(1.12)	(0.06)
Elected *panchayat* x local landless proportion	-	.892	.904	-	-1.72	-1.72	-	.0724	.0605
		(2.53)	(2.48)		(7.51)	(6.21)		(0.22)	(0.19)
Elected *panchayat* x state landless proportion	-	-	.728	-	-	.200	-	-	.281
			(0.57)			(1.58)			(0.21)
Log of HYV yield	.290	.339	.351	.144	.0393	.0335	.417	.421	.407
	(0.83)	(0.88)	(0.90)	(0.34)	(0.09)	(0.08)	(1.45)	(1.38)	(1.35)
Log of population size	.0731	.0767	.0774	.0687	.0490	.0444	.0568	.0572	.0550
	(1.07)	(1.11)	(1.12)	(1.00)	(0.72)	(0.67)	(0.67)	(0.67)	(0.65)
N	700	700	700	480	480	480	740	740	740

[a] Absolute value of t-ratio in parentheses

Table 6
Fixed-Effects IV Estimates: Private Irrigation Facilities and Village Governance

Variable	Any Private Pumps	Number of Private Pumps
Elected *panchayat*	-.272	-85.8
	(1.25)[a]	(1.55)
Elected *panchayat* x local landless proportion	.764	227.3
	(1.05)	(1.35)
Log of HYV yield	.0934	126.3
	(0.17)	(0.81)
Log of population size	.0561	60.9
	(0.70)	(3.25)
N	480	480
Mean of dependent variable	.827	37.6
	(.379)	(71.8)

[a]Absolute value of t-ratios in parentheses based on standard errors corrected for heteroskedasticity and arbitrary correlations of errors within state/time-period groupings.

Table 7
Log of Agricultural Wage, *Pucca* Roads and Public Irrigation Facilities

Variable/Estimation procedure	FE	FE-IV
Pucca road	.122	.761
	(1.49)[a]	(2.58)
Public irrigation facilities	.00071	.141
	(0.01)	(0.37)
Rainfall (mm x 10^{-3})	.0597	.158
	(1.34)	(2.10)
Log of village population	-.0175	-.0187
	(1.44)	(1.62)
Log of HYV yield	.0590	.0568
	(1.18)	(0.26)
Year=1982	-.520	-.239
	(6.76)	(1.00)
N	481	481

[a]Absolute value of t-ratios in parentheses based on standard errors corrected for heteroskedasticity and arbitrary correlations of errors within state/time-period groupings.