

Public Action for Public Goods

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Abstract

This paper focuses on the relationship between public action and access to public goods. It begins by developing a simple model to capture the various mechanisms that are discussed in the theoretical literature on collective action. We use the model to illustrate the special assumptions embedded in many popular theories of collective action and show how their apparently conflicting predictions can be reconciled in a more general framework. This is followed by a review of empirical research on collective action and public goods. These studies, while broadly consistent with the theoretical literature, account for a small part of the observed variation in provision. Access to public goods is often better explained by “top-down” interventions rather than the “bottom-up” processes highlighted in the collective action literature. We conclude with a discussion of some historically important interventions of this type.

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1 Introduction

Public goods in poor rural communities are remarkably scarce. Basic health and education have long been regarded as fundamental rights, yet constitutional and political commitments towards them remain largely unmet. Over a quarter of adults in developing countries are illiterate, at least a quarter of all children are not immunized, twenty percent of the population is without access to clean water and more than half live without adequate sanitation.¹

Within this picture of overall inadequacy there is considerable variation, both across countries and inside national boundaries. Table 1 documents access to public goods and associated outcomes for a small set of countries for which secondary data are readily available at the sub-national level.² Even keeping in mind the difficulties of cross-country comparisons of this type arising from the way regions and public goods are defined, these numbers are striking. In Nepal, access to schools is ten times better in the best districts compared to the worst. For Kenyan provinces, this ratio is 8:1; it is more than 2:1 for both Indian states and Russian regions and slightly over 1.5:1 for Chinese provinces. In contrast, regional differences are small in Mexico and Thailand and negligible in Vietnam.

While it is true that the largest gaps in access are typically found in the poorest countries, it is not clear how we are to explain the considerable variation that remains after we take account of differences in income levels. For example, public goods do not seem to arrive in any particular order as countries get richer. Nor do different types of public goods generally move together. Health and education services are especially scarce and unequal in South Asia but this is less true of other types of physical infrastructure such as roads, electricity and transport facilities.³ Vietnam has sizable gaps in physical infrastructure, but equal access to health and education. Economic reforms and prosperity have been accompanied by considerable convergence in access to education in India but by growing inequalities in China.⁴

Physical access to facilities is, of course, just one aspect of provision. Recent surveys show that existing facilities are often dysfunctional: A study in which enumerators made surprise visits to primary schools and health clinics in Bangladesh, Ecuador, India, Indonesia, Peru, and Uganda concluded, "Averaging across the

¹UNDP, *Human Development Report 2005*, Tables 1, 6, and 7, pages 222-243.

²Data sources are described in the notes accompanying Table 1. We present data at the largest sub-national level for which they are customarily reported.

³UNDP (2006).

⁴Zhang and Kanbur (2003) show sharp increases in the Gini coefficient of illiteracy rates for Chinese provinces after 1985 even though corresponding changes in income inequality across provinces were relatively small. In contrast, school availability during the nineties increased fastest in the backward states of Central and East India (Office of the Registrar General of India, 2001).

countries, about 19 percent of teachers and 35 percent of health workers were absent.” Even when physically present, many of these providers were not working: In India, only half of primary school teachers present were actually teaching when the enumerators arrived (Chaudhury et al, 2004). In a survey of a hundred hamlets in the Indian state of Rajasthan, enumerators found that most hamlets had a government health sub-center, but repeated visits revealed that some of these are almost never open, while others are open most of the time (Banerjee, Deaton and Duflo, 2004). These measures of public good quality are often correlated with physical access.⁵ In such cases, regional disparities are likely to be even larger than those suggested by the distribution of facilities.

It is implausible these very large differences in access to education, better hygiene, health and longevity could be entirely explained by differences in what people want. The National Election Survey in India, carried out by the Centre for the Study of Developing Societies in 1996, asked 10,000 voters an open-ended question: “What are the three main problems people like you face today?” Poverty was the most popular response and was ranked first by about a quarter of all respondents, but public goods came in a close second. Nearly a fifth of those surveyed listed problems associated with different types of public amenities (education, drinking water, electricity, transport and communication) as their “main problem.”⁶ Voting behavior seems to reflect these preferences, with numerous instances of incumbent politicians being voted out of office when their tenure is associated with poorly functioning public services.⁷

Motivated by observations like these, a recent literature has focused on the role of collective action by communities in improving their access to public goods. In this approach, the distribution of public goods is determined by what we call *bottom-up processes* in which communities compete, in various ways, to lay claim to limited public resources. In section ??, we lay out a framework within which the theoretical research in this area can be understood and outline conditions under which these models provide clear predictions for the relationship between community characteristics and the strength of collective action. We also discuss the many cases where the theory is ambiguous.

Section 3 surveys the empirical research related to these models of collective action. The broad patterns do suggest that public action by communities brings them public goods. However, an exclusive focus on these bottom-up mechanisms leaves important questions unanswered and a great deal of the observed variation

⁵The Probe Team (1999), chapter 4, documents this for public schools in India.

⁶See Center for the Study of Developing Societies (1996) for survey questionnaires. Tabulated data for this question were provided to us by their Data Unit.

⁷The incumbent Congress Party in the Indian state of Madhya Pradesh was defeated in the Assembly elections in 2003; the landslide victory of the Bharatiya Janata Party is often attributed to their slogan of “bijli, sadak, pani” (electricity, roads and water). A majority of voters surveyed at that time felt that there had been a deterioration in the quality of public infrastructure in Madhya Pradesh during the term of the incumbent government (*The Hindu*, 2003).

in public goods unexplained. Important historical expansions in public goods often served communities that were economically and politically weak. For instance, elementary schools in Indonesia in the 1970s, and programs to augment classroom facilities in India in the 1980s, were both concentrated in regions with the worst outcomes. In Europe, North America and Japan in the early twentieth century, schools reached the most marginal members of these societies.⁸ During the colonial era in India, the autonomously ruled princely states of Cochin and Travancore invested heavily in education and health in the absence of any political imperatives, and the unusually high social outcomes in the present-day Kerala state are, in part, “an example of princely autonomy having widespread, long-term effects.”⁹

We conclude that the distribution of public goods is the outcome of interactions between the forces of collective action and various *top-down processes*. These processes may be fueled by changes in the technology of providing public goods, the compulsions of the state, or the private objectives of its agents. What they have in common is that they are largely unrelated to what is happening on the ground *in the specific area* where the public goods get supplied. We end the chapter with a few historically significant examples of these types of interventions.

2 Theories of Collective Action

The premise of this approach is that an individual’s benefit from a public good depends on the group he is a part of, but his costs of participating in group activities are privately incurred. The early literature on public goods and collective action is concerned with questions relating to the provision of locally financed schools and the sustainability of common property resources managed by local communities. More recently, the focus has shifted to incorporate a much broader set of public goods and a variety of different mechanisms that influence their provision.

The change in focus has resulted in part from efforts to explain access to public goods in poor countries with centralized fiscal systems. Local infrastructure in such cases is not locally financed and often depends on decisions taken by politicians and bureaucrats living outside the communities that receive it. Community action in such cases includes writing to state officials, entertaining them, making private contributions for the good and a range of other influence activities. It could also include voting and investing in learning more

⁸Lindert (2004), chapter 5, and Benavot and Riddle (1988) present cross-national figures for primary school enrollments in the late nineteenth and early twentieth centuries. Goldin (1998) documents the rapid expansion in secondary school enrollment rates in North America in the inter-war period. Sen (2001) briefly describes the spectacular growth in literacy in Japan during the first decade of the twentieth century.

⁹Jeffrey (1993), p. 56.

about potential candidates, in order to elect those who would best serve their interests. In such cases, the collective action game would need to incorporate the kinds of non-convexities typical in most voting models.

Most models of collective action and public goods share a common underlying structure. Individuals, acting non-cooperatively, choose effort levels based on the costs and returns from such investments. In the case of local provision, group benefits depend directly on the public goods technology. Under central financing, they are the result of some more complex political process. Either way, since returns depend on the collective behavior of different groups, the equilibrium allocation of public goods will be determined by the distribution of group characteristics. We start by summarizing this basic logic in a simple model and then proceed to various extensions. We will often use the language of political competition in describing the results in this section, although the framework is more general and could be used to study collective action in many different contexts.

Imagine m groups in society with n_1, \dots, n_m members. Think of these as m , perhaps spatially distinct, homogeneous communities. We will subsequently introduce subgroups to capture within-community heterogeneity. Groups compete to extract public goods from the state; we are interested in how the nature of this competition and the ultimate allocation of public goods varies with group characteristics: their political visibility, their tastes, their size, their potential benefits from public goods, and other social factors that influence their ability to act together.

Denote by a_{ij} the effort put into the collective enterprise by member i of group j . We will sometimes use A_j to denote total effort by members of group j and A for the aggregate effort of all groups. Benefits from the public good for member i of group j are denoted by $b_{ij}(n_j)$. The dependence on n_j allows for possible congestion effects which might reduce the per-member value of the public good as a group gets larger.

The probability that group j will succeed in extracting the public good from the state depends on the effort expended by the group, as well as the total effort expended by all other groups in society. This probability is given by

$$f_j\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right).$$

We assume that this probability is increasing in the second argument and decreasing in the first ($f_{1j} < 0, f_{2j} > 0$) and that $f_{1j} + f_{2j} > 0$. These conditions imply that the probability of receiving the good always increases when a group puts in more effort, keeping constant the effort of other groups. In addition, we assume that $f_{11j} > 0$ and $f_{22j} < 0$ for all j . We do not require that $\sum f_j = 1$. We therefore allow higher aggregate effort to generate higher aggregate provision and, in particular, for the possibility that none of the groups may get the good. These convexity assumptions rule out a conventional, first-past-the-post voting

model, but can accommodate proportional representation or probabilistic voting.

Suppose that the cost of the effort is given by a_{ij}^β , $\beta > 1$. The payoff to agent i in group j is

$$b_{ij}(n_j)f_j\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right) - a_{ij}^\beta. \quad (1)$$

We assume that agents choose a_{ij} to maximize their private benefits and focus on the Nash Equilibrium of the political competition game that results from these non-cooperative decisions. The first order condition for the equilibrium effort level is:

$$b_{ij}(n_j)[f_{1j}\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right) + f_{2j}\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right)] = \beta a_{ij}^{\beta-1}. \quad (2)$$

The second order condition, $f_{11j} + 2f_{12j} + f_{22j} < 0$ is assumed to hold everywhere and for all j .¹⁰

Notice that we do not allow effort decisions to be coordinated at the group level. If they were, each member's effort would be chosen so as to maximize

$$\sum_{i=1}^{n_j} [b_{ij}(n_j)f_j\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right) - a_{ij}^\beta]$$

and the corresponding first order condition would be

$$\sum_{i=1}^{n_j} b_{ij}(n_j)[f_{1j}\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right) + f_{2j}\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right)] = \beta a_{ij}^{\beta-1} \quad (3)$$

For any fixed choice of effort by the other groups, each member in group j would now choose a higher level of effort. Aggregate effort (assuming that the groups play a Nash Equilibrium in effort choice) would also be higher. This is the well-known free-rider problem in collective action; each member tends to undervalue the spillover benefits of his own effort on other members and puts in less effort than would be optimal for the group as a whole.

Even though the structure of this game implies that free-riding always hurts the group, there is no presumption that it makes everyone worse off. Groups that are especially active inflict costs on other groups and could reduce social welfare through wasteful competition. There is nothing surprising here; we may be grateful for the disunity within social groups that makes it harder for them to go to war with each other! We will come back to this point later in our discussion of the empirical evidence. What remains true is that groups which are more subject to free-riding are likely to be less successful. We are then left with questions about how such free-riding is influenced by community characteristics.

¹⁰This condition holds, for example, if $f_j = \left[\frac{A_j}{A}\right]^\alpha$, $\alpha \in (0, 1]$. We will frequently return to this particular specification.

By focusing on non-cooperative equilibria, we do not allow for actions explicitly aimed at improving group cooperation. In other words, there is no scope for leadership, sanctions or any other type of organization in our model. Some of these devices have been shown to be empirically important in mitigating free-rider problems in public goods settings and our main reason for staying clear of them here is that strong enough coordination mechanisms can make almost any group outcome implementable. We believe a micro-founded theory of such coordination is required make this approach interesting and sharpen its predictive power. In its absence, it is hard to incorporate these coordination mechanisms into the type of analysis presented here.

Returning to our particular model, it can be shown that if $f_{11j} + f_{12j} < 0$ for all j , the game where each agent chooses his or her a_{ij} non-cooperatively will have a unique equilibrium.¹¹ For future reference, define $a_{ij}^*(n_j; \mathbf{n}_{-j})$ to be the optimal choice of a_{ij} in the unique equilibrium of the political competition game when there are n_j people in group j and \mathbf{n}_{-j} people in the other groups,¹² and let the corresponding payoff be $U_{ij}^*(n_j; \mathbf{n}_{-j})$. The uniqueness of the equilibrium, which makes it easier to think about the comparative statics, is something of an artifact of the way we set up the game. The simple and plausible modification of the model considered below introduces the possibility of multiple equilibria even when $f_{11j} + f_{12j} < 0$.

Suppose it was possible to buy the “public” good on the market at a price p , yielding a net payoff of $b_{ij} - p$ to the buyer.¹³ There would now be a trade-off between paying what is presumably a higher price and getting the good for sure, and the gamble of trying to get it from the public system. If $b_{ij}(n_j) = b_j$ for all j , the solution to the first order condition (??) takes the form $a_{ij} = a_j$ and can be rewritten as

$$b_j [f_{1j}(\sum_{k=1}^m A_k, A_j) + f_{2j}(\sum_{k=1}^m A_k, A_j)] = \beta \left(\frac{A_j}{n_j}\right)^{\beta-1} \quad (4)$$

where $A_j = n_j a_j$.

Now suppose some members of group j defect to the market so that n_j goes down but \mathbf{n}_{-j} remains the same. The right hand of equation (??) is declining in n_j and the left hand side is declining in A_j (by the second order condition for individual maximization) so with no change in the behavior of other groups, the fall in n_j must be accompanied by a fall in A_j to restore equality in (??). This however corresponds to a change in the aggregate effort level A and causes other groups to increase their effort (since $f_{11k} + f_{12k} < 0$ for any group k). Both the fall in A_j and the rise in \mathbf{A}_{-j} will make group j worse off, the former because the group was putting in too little effort to start with (as a result of free riding) and the latter because it is less likely to succeed in receiving public goods when its share of total effort declines.

¹¹This condition may often be violated. For example, in the case where $f_j = \left[\frac{A_j}{A}\right]^\alpha$, ($\alpha \in (0, 1)$), it only holds when A_j is small relative to A for all j and α is not too close to zero. On the other hand, the condition is sufficient but hardly necessary.

¹² \mathbf{n}_{-j} represents the vector $(n_1, \dots, n_{j-1}, n_{j+1}, \dots, n_m)$.

¹³Such “exit” from the public market is plausible for certain services such as education, individual medical care and electricity. It is likely to be much more costly for services such as roads, public health or law and order.

If the corresponding decline in the utility of the \tilde{n}_j members remaining in group j is large enough, we may have $b_j - p > U_j^*(\tilde{n}_j; n_{-j})$. Now everyone else in group j would also want to defect, leading to a new equilibrium with group j entirely in the private market. A sufficient condition for there being two equilibria is

$$\begin{aligned} U_j^*(n_j; n_{-j}) &> b_j - p \\ U_j^*(0; n_{-j}) &< b_j - p \end{aligned}$$

for some $n_j > 0$.¹⁴

The multiplicity here is entirely natural and captures the idea that there is no point in trying to get things from the public system if all your compatriots have deserted you. For the rest of this section we will ignore the possibility of such multiplicity in order to better focus on questions of comparative statics. We discuss, in turn, the various characteristics of communities that determine their ability to collectively invest in activities that bring them public goods.

2.1 Power or Influence

For a variety of historical, sociological and economic reasons, some groups in society hold power disproportionate to their size and their control over economic or social hierarchies influences the functioning of democratic institutions in their favor. Obvious examples are whites in South Africa in the Apartheid years, high castes in India through most of its history, large landowners in Brazil, capitalists of the robber baron years in the United States and party apparatchiks in China in the recent past. Group membership is sometimes by birth and sometimes circumstance. The existence of such groups is often associated with autocratic regimes, although democracy per se does not rule out their salience.

In terms of our model, an increase in power is captured by a shift in the $f_j(.,.)$ function. As long as this shift is not accompanied by a sharp fall in the productivity of effort, we would expect a higher probability of success for more powerful groups. This is easy to see in the case where $f_j(.,.) = \theta_j f(.,.)$, and effort costs are independent of θ .

The institutional histories of nation-states are dotted with instances of dramatically changed power equations that allow a careful study of how such power influences public goods. For instance, the extension of the franchise in the West was clearly aimed at reallocating power towards the working classes and resulted in

¹⁴There is a third, “unstable” equilibrium in between these two, in which all the members of group j are indifferent between trying to get the good through collective action and purchasing it from the market.

dramatic changes in the composition of government spending. In India, the reservation of seats in local and national legislatures for women and selected minorities was also intended to shift the balance of power in those specific directions. Our discussion of the evidence on public goods allocations suggests that these institutional changes often had important effects.

2.2 Tastes

Tastes for public goods in our model are captured by the parameters b_{ij} . To rank groups by their preference for a public good would involve comparisons of the distributions of these benefits across groups. In the special case where all members of a group enjoy the same benefit, groups with higher values of b_j would put in more effort and face a higher probability of receiving the public good. In the more general case where there is within-group inequality in benefits, we could define group j as placing a higher value on the public good than another group k if benefits for all members of group j are higher than those for members of group k . This is perhaps overly restrictive and would in general provide only a partial ordering of group preferences, but would once again generate the positive association between higher benefits from public goods and their greater availability.

The notion that differences in preferences can be used to explain the distribution of public goods has a long and hallowed tradition in public economics, going back to the work of Tiebout (1956). At the core of this approach is the idea that geographical differentiation in tastes emerges as an equilibrium outcome of a sorting process in which households select residential areas based on the public goods they offer. With well-functioning housing and credit markets, those that care most about public goods get the best provision.

The important insight of the Tiebout approach was that for local public goods, as for private goods, there was a “mechanism to force the consumer-voter to state his true preferences.”¹⁵ It also showed that, under certain conditions, the equilibrium allocation of public goods is efficient. Models of this type have been widely used to explain the response of local government budgets to the demographic characteristics of city populations. Subsequent work in this tradition has however shown that the link between preferences and public good allocations can be fairly tenuous. Benabou (1993) shows that spillover effects in the benefits from public goods can result in variations in quality across neighborhoods even with no individual heterogeneity, and that such variations are often inefficient. Such spillovers are certainly important in many practical cases. They allow, for example, the possibility that a school will function better if the average child in it is highly motivated.

¹⁵Tiebout (1956), p. 417.

Much of the recent literature on public goods in developing countries has ignored household mobility and has focused instead on the processes of collective decision-making that translate the characteristics of heterogeneous communities into policy choices. This seems appropriate for most developing countries where land markets are often dysfunctional and residential mobility is very limited. While 40% of the U.S. population reside in a state which is different from the one in which they were born,¹⁶ it is unusual for entire families in developing countries to relocate from one community to another; this would involve leaving social networks that have been central to their lives for many generations and creating space for themselves in established hierarchies elsewhere. We find that stark differences in public good access in many poor countries have not resulted in much permanent migration across rural communities.

2.3 Group Size

The question of how the size of a group affects its political leverage is an old and controversial one. As Mancur Olson argued in a very influential essay, “the larger the group, the less it will be able to favor its common interests” (Olson, 1965). Problems of free-riding are more serious in larger groups. On the other hand, in our earlier discussion of the multiple equilibrium issue we showed that total group effort in our model (and hence its probability of getting the good) is *increasing* in group size, echoing a point made by Esteban and Ray (2001). The effect of group size on access to public goods is thus theoretically ambiguous.

In the special case when $b_{ij}(n_j) = b_j$ for all i in group j , and

$$f_j\left(\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}, \sum_{i=1}^{n_j} a_{ij}\right) = \theta \left[\frac{\sum_{i=1}^{n_j} a_{ij}}{\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}} \right]^\alpha \quad (5)$$

where θ is some positive constant, it is easy to check that group effort increases in group size, even though total equilibrium effort as a fraction of first-best effort for the group goes to zero as the group size becomes very large. Free-riding, in this case, does not outweigh the natural advantage of larger groups.

The free-rider problem becomes much more serious when the benefits per head go down as the group gets larger. The assumption of constant benefits is a reasonable description of the situation when the group is trying to get a school or a health center or a road. It is much less so when the group wants a well or an irrigation canal, where the total off-take is limited and crowding more likely. In such cases benefits might take the form

$$b_{ij}(n_j) = b_0 + \frac{b_1}{n_j}.$$

¹⁶U.S. Census (2000).

Assuming the form of the f function given in (??), a group member will now maximize

$$\theta\left(b_0 + \frac{b_1}{n_j}\right) \left[\frac{\sum_{i=1}^{n_j} a_{ij}}{\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}} \right]^\alpha - a_{ij}^\beta,$$

from which it follows that in equilibrium

$$\alpha\theta\left(b_0 + \frac{b_1}{n_j}\right)n_j^{\beta-1} = \beta(A)^\alpha (A_j)^{\beta-\alpha} \left[1 - \frac{A_j}{A}\right]^{-1}.$$

The right hand side of this equation is increasing in A_j . Therefore, comparing two groups in this equilibrium, the bigger group is more likely to get the good if and only if the left hand side is increasing in n_j . But increasing n_j increases congestion on the one hand (thereby reducing benefits to each member) and raises the ability of the group to put in more effort on the other. As long as $\beta < 2$, the net effect can go either way. In particular, if $\beta < 2$ and the purely public component $b_0 = 0$, smaller groups will do better, while if $b_1 = 0$ (no congestion effects), bigger groups will do better.

2.4 The Distribution of Group Benefits

Olson (1965) argued that groups could be more effective in articulating their demands if most of the benefits from public goods are captured by a small number of group members, because the strong stake of these members would encourage them to invest in group activities. In our model, this is just one possibility. In general, group inequality has ambiguous effects and can increase or decrease collective effort depending on the shape of the effort cost function.

To show this, assume that f is given by (??), $\beta < 2$ and the total benefit that the group can get from the public good is fixed at b_1 . As discussed above, this is the case where the Olson group-size effect dominates and smaller groups do better in the absence of within-group inequality.

What if members of the same community receive different shares of total benefits? Schools benefit those with young children, roads are most useful to those who commute out of the village, and benefits from irrigation water may be proportional to the amount of land owned. Denote by γ_{ij} the share of the benefits going to member i in group j , so that $\sum_{i=1}^{n_j} \gamma_{ij} = 1$. Each group member chooses an action that maximizes

$$\gamma_{ij} b_1 \theta \left[\frac{\sum_{i=1}^{n_j} a_{ij}}{\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}} \right]^\alpha - a_{ij}^\beta$$

and effort as a function of γ_{ij} is therefore given by

$$a_{ij} = (\gamma_{ij})^{\frac{1}{\beta-1}} \left[\frac{\alpha b_1 \theta}{A^\alpha \beta} (A_j)^{\alpha-1} \left(1 - \frac{A_j}{A}\right) \right]^{\frac{1}{\beta-1}}$$

It follows that in equilibrium

$$A_j = \sum_{i=1}^{n_j} a_{ij} = \left[\frac{\alpha b_1 \theta (A_j)^{\alpha-1}}{A^\alpha \beta} \left(1 - \frac{A_j}{A}\right) \right]^{\frac{1}{\beta-1}} \left[\sum_{i=1}^{n_j} \gamma_{ij}^{\frac{1}{\beta-1}} \right]$$

or

$$\frac{A_j}{\left[\frac{\alpha b_1 \theta (A_j)^{\alpha-1}}{A^\alpha \beta} \left(1 - \frac{A_j}{A}\right) \right]^{\frac{1}{\beta-1}}} = \left[\sum_{i=1}^{n_j} \gamma_{ij}^{\frac{1}{\beta-1}} \right].$$

The left hand side of this expression is increasing in A_j so group effort and the equilibrium probability of success is increasing in $\left[\sum_{i=1}^{n_j} \gamma_{ij}^{\frac{1}{\beta-1}} \right]$. As long as $\beta < 2$, this expression is convex in γ and success is most likely when group benefits are concentrated with $\gamma_{ij} = 0$ or 1. This is the Olson case.

When $\beta > 2$, $\sum_{i=1}^{n_j} \gamma_{ij}^{\frac{1}{\beta-1}}$ becomes concave in γ_{ij} and diluted benefits are an advantage because costs are rising steeply. Spreading total benefits across many group members elicits higher aggregate group effort in this case. This is the case emphasized in Baland, Dagnelie and Ray (2006).

Khwaja (2004) proposes an interesting combination of these two cases where the convexity of individual cost functions decreases after a certain threshold because large farmers use hired labor rather than their own at the margin. This can result in a U-shaped relationship between inequality and total effort: Effort falls when we first move away from equal benefits because the cost of effort function is convex, but eventually the person who gets the greater share of the benefits will start employing outside labor. Further increases in inequality beyond this point actually increase total effort. Bardhan, Ghatak and Karaivanov (2005) consider a cost function that permits corner optima. They focus on equilibria where some people put in zero effort but enjoy the public good nonetheless. The effects of increased inequality in the sharing of benefits now depends on whether inequality hurts those with positive contributions or just those putting in zero effort.

The effects of unequal benefits are further complicated if we introduce the possibility of exiting from the system into the private market, along the lines suggested at the beginning of this section. If the individuals with the highest benefits are the ones most likely to exit from the system, inequality reduces the probability that those who stay behind get the public good; a small increase in inequality can then cause the entire group to switch to the market.¹⁷

¹⁷We are assuming here that the exit by some does not increase the absolute amount of benefits that would go to those who remain, if they were to get the public good.

2.5 Cohesion

It seems intuitive that more cohesive groups will be able to organize themselves more effectively to secure the public goods they want. This may happen because individuals in a community want different types of goods, but only one of these goods can be provided in equilibrium (Alesina, Baqir and Easterly, 1999). Alternatively, people may be socially minded, but such altruism may only extend to those whom they consider similar to themselves (Vigdor, 2004). If this set of people is large, each person would invest in the collective effort whereas if perceived differences among individuals are large, they may all shirk even if they all have the same preferences for the public good.

Miguel and Gugerty (2005) suggest an alternative reason why the lack of cohesion may influence provision even if there is no disagreement about the ideal public good. They envision a scenario where free-riding is observable but not necessarily contractible. For instance, villagers can identify those who attend village meetings but it is just too costly to exclude non-attendees from using public goods. In such settings, social networks help sanction those who free-ride and it is easier to impose these sanctions when everyone is a part of the same network.

These models all share the prediction that a community consisting of n equal-sized sub-groups will be better at getting the public goods they want than one with $n+1$ groups. There are however other plausible contexts in which this may not hold. Consider a simple extension of our previous model in which group j consists of n_{jq} equal-sized sub-groups, s_1, \dots, s_k . Suppose that the public good has a purely public component b_0 as well as a sub-group-specific component b_1 which reaches only one of the sub-groups. The probability that sub-group s_k will get the sub-group specific component, conditional on the public good being built in the village is assumed to be given by

$$\frac{\sum_{i \in s_k} a_{ij}}{\sum_{i=1}^{n_j} a_{ij}}.$$

An example would be a road that connects the village to the highway. All the groups in the village want the road (this is the b_0) but only one of them will have it start in their neighborhood (the value of a road in the neighborhood is b_1). A member i of sub-group s_k will maximize

$$\theta \left(b_0 + b_1 \frac{\sum_{i \in s_k} a_{ij}}{\sum_{i=1}^{n_j} a_{ij}} \right) \left[\frac{\sum_{i=1}^{n_j} a_{ij}}{\sum_{k=1}^m \sum_{i=1}^{n_k} a_{ik}} \right]^\alpha - a_{ij}^\beta.$$

At the optimum

$$\alpha \theta \left(b_0 + b_1 \frac{\sum_{i \in s_k} a_{ij}}{A_j} \right) \left(\frac{A_j}{A} \right)^{\alpha-1} \left(\frac{A - A_j}{A^2} \right) + \theta b_1 \left(\frac{A_j - \sum_{i \in s_k} a_{ij}}{A_j^2} \right) \left(\frac{A_j}{A} \right)^\alpha = \beta a_{ij}^{\beta-1}$$

which can be rewritten as

$$\left[\alpha \left(b_0 + b_1 \frac{\sum_{i \in s_k} a_{ij}}{A_j} \right) \left(1 - \frac{A_j}{A} \right) + b_1 \left(1 - \frac{\sum_{i \in s_k} a_{ij}}{A_j} \right) \right] (A_j)^{\alpha-1} = \frac{\beta}{\theta} a_{ij}^{\beta-1} A^\alpha.$$

Using the fact that everyone in group j faces the same problem and will make the same choice, we get

$$\alpha \left(b_0 + b_1 \frac{1}{n_{jq}} \right) \left(1 - \frac{A_j}{A} \right) + b_1 \left(1 - \frac{1}{n_{jq}} \right) = \frac{\beta}{\theta} (A_j)^{\beta-\alpha} (n_j)^{\beta-1} A^\alpha$$

or

$$\alpha b_0 \left(1 - \frac{A_j}{A} \right) + b_1 \left(1 - \frac{1}{n_{jq}} \left[1 - \alpha \left(1 - \frac{A_j}{A} \right) \right] \right) = \frac{\beta}{\theta} (A_j)^{\beta-\alpha} (n_j)^{\beta-1} A^\alpha. \quad (6)$$

It is clear that increasing n_{jq} , keeping n_j fixed, makes the group more divided, and raises the left hand side of the above expression. On the other hand, increasing A_j increases the right hand side but lowers the left hand side. It follows that if we compare two groups with the same n_j , the group with the higher n_{jq} will put in greater effort. Heterogeneity helps! This apparently surprising result is a direct implication of Olson group size effect. Smaller groups are less subject to failures of collective action and a community with many such tiny groups does better than a conglomerate of few large groups. In the special case when $\alpha = 1$ and $\frac{A_j}{A} \approx 0$, the fact that others are working does not make you want to work less. There is therefore no Olson group-size effect and, as is evident from equation (??), sub-dividing the group neither helps nor hurts.

Esteban and Ray (1999) consider a variant of this set-up in which groups can impose a certain effort level on their members. Heterogeneity in this case can be shown to dampen collective action. Let ξ_j be the share of group j in the entire population. Let a_j be the action chosen by everyone in group j . Assuming that $\beta = 2$ and $b_0 = 0$ (the purely public component is absent), the choice of a_j will maximize

$$b_1 \left[\frac{\xi_j a_j}{\sum_{k=1}^m \xi_k a_k} \right] - a_j^2.$$

The first order condition for this maximization can be written in the form

$$b_1 \xi_j^2 \left[1 - \frac{\xi_j a_j}{C} \right] = 2C a_j \xi_j$$

where $C = \sum_{k=1}^m \xi_k a_k$. Adding across groups gives us

$$b_1 \sum_{k=1}^m \xi_k^2 \left[1 - \frac{\xi_k a_k}{C}\right] = 2C^2.$$

In an equilibrium with m equal and identical groups we must have $\frac{\xi_j a_j}{C} = \frac{1}{m}$. We can now rewrite the above expression as

$$b_1 \frac{1}{m} \left[1 - \frac{1}{m}\right] = 2C^2. \quad (7)$$

Effort C is decreasing in m for $m > 2$. Bigger groups in this case have a bigger stake in the success of their group and since there is no free-riding, get their groups to put in more effort.

These results on heterogeneity and collective action should be interpreted with caution. One can certainly think of settings where, intuitively, it seems more precarious to have two large and more or less equal-sized groups that are opposed to each other than a hundred tiny squabbling groups.¹⁸ As discussed earlier, group activities in a game of political competition could be quite wasteful. This is seen in Esteban and Ray (1999). They use a model very similar to the one above with the key difference that group effort directly reduces the quality of the public good. Effort is interpreted as more lobbying, and lobbying is assumed to reduce the net resources spent on the public good. For example, the group might allow the bureaucrat to steal some part of the public goods budget as long as he builds the public good that the group desires. Social divisions could therefore result in better public goods: no divisions is ideal but two equal-sized groups is the worst possible outcome.

Before we discuss the empirical evidence on public good allocations, it is useful to reflect briefly on some plausible empirical hypotheses that emerge from the theoretical analysis in this section. In the absence of coordinated behavior by individuals, we always get under-provision of effort from the perspective of the group but the extent, and even the presence, of social under-provision depends on the nature of collective action. If most group activities take the form of lobbying for relatively fixed aggregate allocations, group characteristics that reduce collective action could be welfare-improving and would have little effect on the overall availability of public goods. In contrast, in countries with rapidly expanding economies and government budgets, aggregate allocations may be quite responsive to the effort citizens put in to extracting public goods from the state, and free-riding is more likely to lead to overall under-provision. We've seen that allocations of public goods depend in a relatively straightforward manner on group preferences and group influence. Group size, within-group inequality in benefits and group fragmentation have more nuanced predictions and their net effects are hard to sign without additional information on the structure of individual costs of investing in group activity and the benefits from public goods. Careful empirical studies are therefore especially useful in understanding the nature of these effects.

¹⁸As Voltaire once said "If there were one religion . . . , its despotism would be terrible; if there were only two, they would destroy each other; but there are 30, and therefore they live in peace and happiness."

3 Evidence on Public Good Provision

Testing theories with nuanced predictions is always a challenge. In our setting, there are three main obstacles to empirical research. The most important problem is that public action is almost never directly observed except in experimental settings that are designed for this purpose. We review some of these studies in section ???. Observational studies must search for empirical patterns between the availability of public goods and the characteristics of communities that influence collective action. However, many community characteristics that influence collective action also determine the ease with which public goods can be supplied. Large villages, for example, are often located close to urban areas and such proximity makes it easier and cheaper to provide them with public goods (their roads, communication and power lines are closer to existing networks, bus services involve relatively short diversions from major routes and it is cheaper to transport school and medical supplies). To isolate the group-size effect on public goods that operates through collective action we would have to somehow control for these differences in the cost of supplying public goods.

Second, public good quality varies enormously, but these quality differences are notoriously difficult to measure. Most studies rely on public good expenditures or on the physical location of facilities. In the presence of widespread bureaucratic corruption and agency problems that plague the public sector, the link between these outcome measures and actual provision can be fairly weak. Third, community characteristics may respond to the availability of public goods, as in the Tiebout framework, making it hard to identify the causal effects of these characteristics.

These problems are now well-recognized in the empirical literature on public goods and empirical strategies have tried to address them with varying degrees of success. Unfortunately, except in a few specific instances, establishing causality remains an issue and the conclusions drawn in most studies continue to be based on suggestive correlations that are woven into a plausible story.

3.1 Empirical Methods

The typical empirical relationship that is estimated in this literature takes the form

$$y_{jkt} = f(\mathbf{p}_{jt}, \mathbf{x}_{jt}). \quad (8)$$

The dependent variable y_{jkt} is a measure of access or quality of public good k in community j at time t , \mathbf{p}_{jt} is a set of population characteristics of the community in year t and \mathbf{x}_{jt} is a vector representing various geographical and historical features of the area in which the community is located. The population characteristics \mathbf{p}_{jt} are of principal interest because they are directly related to the various mechanisms

explored in the theoretical literature on collective action. These typically include the shares of various population groups in the community (to capture differences in preferences or power), measures of social heterogeneity (as proxies for social cohesion), and measures of income or asset inequality that reflect the distribution of benefits from public goods. The variables \mathbf{x}_{jt} might include population density, village size, terrain, climate and other features of an area which might influence the demand for different public goods and the costs of providing them.

There is no universally accepted measure of the cohesion of a given group or population. It is most common to represent social heterogeneity by the index of ethnolinguistic fragmentation,

$$h_f = 1 - \sum_{i=1}^n \xi_i^2 \quad (9)$$

where ξ_i refers to the population share of the i th group. This is a measure that is maximized when there is a large number of very small groups. An alternative is to use the measure of polarization proposed by Esteban and Ray (1994) which formalizes the idea that two big groups may have a harder time working together than many small groups. Their measure takes the form

$$h_p = A \sum_{i=1}^n \sum_{j \neq i} \xi_i^{1+\alpha} \xi_j \delta_{ij}, \alpha \geq 0$$

where δ_{ij} denotes the *social distance* between group i and group j . Assuming that δ_{ij} is a constant (normalized to 1) for i not equal to j (and δ_{ii} is zero) this reduces to

$$h_p = A \sum_{i=1}^n \xi_i^{1+\alpha} (1 - \xi_i).$$

Notice that for the case where all the $\xi_i = \frac{1}{n}$ and $\alpha = 1$, this expression is exactly the one on the left hand side of equation (??) derived in the previous section. There is therefore at least one model for which an index of polarization corresponds exactly to a measure of (the lack of) social cohesion. In fact, as pointed out by Montalvo and Reynal-Querol (2005), there is a close relationship between this specific class of models of public action and the specific measure of polarization where $\alpha = 1$, that goes beyond the special case of equal group sizes.

Different measures work well in different settings: Using data for 138 countries between 1960-1999, Montalvo and Reynal-Querol (2005) find that polarization measures are important predictors of civil wars while fractionalization measures have no statistically significant effect. In contrast, Alesina et al (2003) find that fractionalization performs better than polarization in explaining long-run growth across countries and that the explanatory power of fractionalization measures improves significantly when coarse classifications of ethnic divisions are replaced by finer ones. However, it is not clear that either of these measures is particularly

effective in capturing the many aspects of social distance that are relevant to collective action: the fact that one works better than the other in certain cases might be largely fortuitous.

3.2 The Role of Group Characteristics

3.2.1 Group Tastes and Group Influence

Group preferences are not directly observable and evidence linking public goods to preferences is therefore fairly limited. Group influence on the other hand can be more easily linked to legislative and institutional changes, and the literature here is therefore more substantial. In fact, as we will see below, changes in group influence, and the resulting changes in the composition of public goods, can often reveal information about differences in preferences across groups.

One approach to testing whether the availability of public goods responds to group preferences is to identify variables that determine the economic returns to public goods and examine whether the availability of these goods responds to changes in these returns. Foster and Rosenzweig (2000) use data from a panel of 245 villages in India and find that between 1971 and 1982, secondary school enrollments and school construction both responded to the rapid growth in agricultural yields. Investments in schooling were found to be greatest in areas with a high fraction of landed relative to landless households. They argue that technological changes and the corresponding rise in yields made education more valuable and that the investments in public schools are therefore responses to the increased demand for schooling. They link the land distribution to public goods by emphasizing that it is the landed who make decisions on technology adoption and benefit most from schooling during a period of rapid technological change. The demand for schooling among the landless may actually fall as the withdrawal of children of landed households from the labor market increases agricultural wages and therefore the opportunity costs of sending children to school rather than to work. Their story is plausible, but the data are also consistent with other explanations. For instance, schools (and other public goods) expanded rapidly through the Indian countryside in the 1970s as part of the government's Minimum Needs Program, and it may be that the political leverage of the landed relative to the landless allowed them to appropriate a large share of these newly provided public goods. To be more convincing, one would have to show that it was precisely those public goods that farmers would want in times of substantial technological change that became more widely available to them and that the structural changes in the economy that accompanied technological change did not commensurately raise the returns to education for the landless.

Cultural norms and religious beliefs can sometimes provide us with information on group preferences. In the

caste-based social hierarchy of rural India, Brahmans are the elite priestly caste. Banerjee and Somanathan (2007) use data for Indian parliamentary constituencies and find that in the early 1970s, the population share of Brahmans in a constituency is positively correlated with access to primary, middle and secondary schools, to post offices and to piped water. These are precisely the goods we would expect them to value given their traditional role as the repositories of written knowledge and the norms of ritual purity which prevent them sharing wells and other common water sources. Brahman concentrations are not associated with more of other public goods such as electricity connections, health centers, roads or transport services. Preferences for this latter set of goods is more likely to be similar across the different castes.

Some studies have used exogenous changes in the political voice of particular groups to understand both the nature of a social group's preferences and their effects on public good provision. The idea is that these political shocks translate into demand shocks for public goods. An interesting example of this approach is Acemoglu, Johnson and Robinson (2001), who observe that the early mortality rates of European settlers had a strong influence on settlement patterns in the European Colonies of the 18th and 19th centuries. Places where the early settlers did relatively well attracted more Europeans settlers and as a result, these areas ended up with institutions and public goods which the Europeans demanded.

Another instance of a change in political power which influenced public goods was brought about by the 73rd Amendment to the Indian Constitution (passed in 1992), by which a certain fraction of the positions of the heads of village governments were reserved for women. The reserved villages are chosen randomly at each election. Chattopadhyay and Duflo (2004) find that political reservation for women in local government resulted in greater provision of goods which women value, such as drinking water and roads.

Changing political voice may not be a simple matter of passing appropriate legislation, as shown by the experiences of the Scheduled Tribes and the Scheduled Castes in India.¹⁹ Both groups have long been recognized as disadvantaged, and affirmative action policies were put in place to increase their representation in politics and within the bureaucracy. Pande(2003) finds that reserving electoral constituencies for Scheduled Caste candidates resulted in higher job quotas and greater welfare spending for that group while similar policies for the Scheduled Tribes did not lead to the same benefits. Similarly, Banerjee and Somanathan (2007) find that, between 1971 and 1991, areas with Scheduled Caste concentrations experienced a rapid expansion in public goods while the Scheduled Tribes continued to lag behind. This asymmetry across the two groups is also seen in their political behavior. The Scheduled Castes began to mobilize effectively in the 1970s and that a major political party representing their interests came to power in the North Indian state of Uttar Pradesh in the 1980s. Scheduled Tribes on the other hand remained isolated, both geographically and

¹⁹The Scheduled Castes have historically been at the bottom of the Hindu caste hierarchy and the Scheduled Tribes in India are groups outside the Hindu caste system.

politically.²⁰ While one cannot rule out the possibility that these relationships are partly driven by omitted variables (perhaps Scheduled Tribes live in remote areas that are harder to reach with public goods), patterns of provision do appear to mirror changing political equations.

3.2.2 Distribution of benefits

In general it is not easy to separate the effects of inequality in the distribution of benefits from that of inequality in the underlying asset distribution, for the simple reason that inequality of benefits is often a result of inequality in assets. Khwaja (2002) tries to deal with this by separately measuring assets and benefits. Even after controlling for inequality in the land distribution, inequality in benefits has a significant U-shaped effect. Increases in inequality at low levels of inequality hurt the maintenance of public projects, but further increases at higher levels of inequality actually lead to greater maintenance. As noted in the theory section, Khwaja also suggests a reason for why he finds a U-shaped relationship.

Gaspart, Jabbar, Melard and Platteau (1998) study the role of inequality in benefits on labor contributions in building draining canals in rural Ethiopia, while Gaspart and Platteau (2002) study voluntary restraints on fishing by Senegalese fisherman. Individual contributions in both these cases are shown to increase significantly in the benefits derived from the public good. These studies also show that part of the effect of inequality on public goods comes about because richer households enjoy the leadership and prestige that comes with coordinating collective activities.

Foster and Rosenzweig (1995) provide an interesting example of the Olson effect, though in a context that is slightly removed from our main concern here. They consider knowledge about new agricultural technologies as the public good. Since those who have the most land have the biggest stake in experimentation, big farmers will experiment the most and as a result a small farmer who lives next to a big farmer will experiment less than a small farmer who is next to another small farmer. Using data from the introduction of high-yielding varieties (HYV) of cereals in India, they find that those who have more assets do adopt HYV sooner, but those whose neighbors have more assets adopt late.²¹

²⁰Chandra (2004) documents the rise of the Scheduled Castes in Indian politics and speculates on reasons for the poor mobilization of the Scheduled Tribes.

²¹The chapter by Munshi in this Handbook surveys several other instances where the public good in question is information about new technologies.

3.2.3 Cohesion

Much of the empirical work on public good provision focuses on the relationship with social and economic heterogeneity. Alesina, Baqir and Easterly (1999) pioneered this literature by analyzing data on public expenditures from a cross-section of US cities in 1990. They regress the share of expenditures on specific public goods on per capita income, city size, average educational attainments, income inequality, age structure and a measure of ethnic fragmentation (based on a five-way classification of ethnicity). They find that more fragmented cities spend proportionally less on schooling, roads and trash pickup but more on health and police, even after controlling for the population shares of specific ethnic groups and whether the city is majority African-American.

This, and other related research, is subject to three major caveats. First, the welfare implications of these types of results are unclear. Can we be sure that heterogeneous communities are not simply substituting other, equally useful, public goods for the ones that they are under-supplying? It is not clear, for instance, that the increased spending on health and police is less useful than spending on schools or roads. Second, do the results indicate that there is less collective action when there are more groups (as Alesina et al believe), or is it the case that multiple groups actually generate more collective action, but that the collective action is wasteful, as Esteban and Ray (1999) suggest?

Finally, and perhaps most importantly, it is difficult to establish the exogeneity of the heterogeneity measure. A number of factors that can affect heterogeneity (such as urbanization, being in a border area, being near a major road or waterway, being next to a region where there was a war and therefore a large exodus) can also directly influence other economic outcomes, including the demand for and the supply of public goods. There may also be reverse causality, with the poor, for example, converging to areas that effectively implement anti-poverty programs, making these areas much more homogeneous than they would otherwise be. Because the measures of heterogeneity used in the literature are often contemporaneous with the measures of public good availability, this is likely to be a serious problem, especially in high mobility environments.

Alesina et al (1999) try to address the endogeneity issue by using community fixed effects, but once they include fixed effects and all their controls, the effect of heterogeneity becomes insignificant or even positive. Their results do however get some support from a companion paper on heterogeneity and school district consolidation in the United States: One natural implication of the view that heterogeneity makes it harder to provide public goods is that people will want to separate into smaller jurisdictions. The constraint is that there are increasing returns to scale in urban agglomerations, which makes it costly to have very tiny jurisdictions. Over the 20th century the number of jurisdictions (school districts) in the United States has

decreased by a factor of 12. Alesina, Baqir and Hoxby (2004) find that this process of consolidation was significantly slower in areas where racial heterogeneity increased: Areas where racial heterogeneity went up by 2 standard deviations between 1960 and 1990 lost 6 fewer jurisdictions over the same period.

Several subsequent papers have looked at the same question in a developing country context. Overall, the results indicate a negative relationship between heterogeneity measures and access to public goods, but, once again, it is not fully clear whether these results can be interpreted in a causal sense.

Banerjee and Somanathan (2007) limit the substitution problem mentioned above by using data on the location of public goods (where a particular community can do better along all dimensions) rather than expenditure shares, where some substitution is inevitable. They also consider a range of public goods; various types of schools, health centers, water, power, communication and transport facilities. Their measure of social heterogeneity uses data on population shares of non-Hindu religions as well as 185 distinct Hindu caste groups. In 1971, when most public goods were extremely scarce, they find that the standard measure of ethnolinguistic fragmentation applied to caste and religious divisions was negatively related to access to several public goods. Land inequality on the other hand had a positive association with provision, reflecting perhaps the political weight of large landowners in India at that time. They also estimate a differenced model based on changes in provision and a set of explanatory variables between 1971 and 1991 and find much weaker effects of both social heterogeneity and land inequality on public goods. These two decades experienced rapid expansions in rural access to public goods as well as realignments in the balance of political power. While it is certainly plausible the role of these measures of social and economic heterogeneity declined over this period, it is not possible to convincingly establish this because of differences in the extent to which these two specification deal with measurement error and omitted constituency-level variables.

Miguel and Gugerty (2005) look at the effect of ethnic heterogeneity on school spending in Western Kenya. In Kenya, a significant part of school expenses are financed by parents through their *Harambee* contributions. Least squares estimates of school spending on school level heterogeneity suggest an insignificant or slightly positive effect of heterogeneity. School heterogeneity is however likely to be endogenous with good schools being chosen by committed parents from all social groups. When they use the regional ethnic composition as an instrument for school level heterogeneity, they find a negative effect of heterogeneity on school spending, maintenance and the per pupil availability of desks and textbooks. Going from a perfectly homogenous school to one with the average level of diversity reduces school spending by 20%. It is of course possible that a region that is more open to outside influences is both more heterogenous and more serious about education and this would cast doubt on the use of regional social composition as a valid instrument.

There are a number of other interesting papers that look at the correlation between heterogeneity and

public good outcomes. Khwaja (2002) finds that village-level social heterogeneity (based on religious and political differences as well as clan divisions) in the Baltistan area of northern Pakistan adversely affected the maintenance of public infrastructure. Baland and Platteau (1998) and Dayton-Johnson (2000) also find a negative relationship between heterogeneity and maintenance of the commons. Somanathan, Prabhakar and Mehta (2006) find no relationship of heterogeneity on forest conservation in the Indian Himalayas. Baland, Bardhan, Das, Mookherjee and Sarkar (2003) look at firewood collection in Nepal and find that social heterogeneity increases firewood collection (implying worse maintenance of the commons). Both these papers find that economic inequality improves conservation for certain types of forests, perhaps because the benefits are more concentrated, as discussed above.

Banerjee, Mookherjee, Munshi and Ray (2001) model a very specific public good setting; the productivity of a sugar farmers' cooperative, which jointly runs a sugar crusher. They begin from the observation that the productivity of the cooperative depends on paying attractive prices to the sugar growers. On the other hand, a cooperative that pays lower-than-optimal prices makes profits, which can be skimmed by the farmers who control the cooperative. When small farmers are in an overwhelming majority, they make sure that high prices are maintained. When the large farmers dominate, low prices are much more likely unless large farmers are so numerous that the distortion caused low price hurts them more than they can gain by capturing the profits of the cooperative. The model leads to the prediction that cooperatives with a very low or a very high share of large farmers will have high prices. They test for this U-shaped relationship using data from sugar cooperatives in the state of Maharashtra in India and find that there is indeed such a relationship between the share of small farmers in the area around the cooperative and the price of sugar. To control for unobserved differences in the productivity of different areas, they used a fixed-effects specification. They also show that the participation of the larger farmers in the area moves in the opposite direction to the price of sugar-cane while the participation of the smaller farmers mirrors the price: if the movements in the price were driven by unobserved differences in productivity, one would have expected the participation of the small and the large farmers to move together.

An alternative way to circumvent the problem of endogenous heterogeneity measures, is to focus on the effect of specific shocks that radically alter social structure. Engerman and Sokoloff (2000, 2002) observe that among the European colonies in the Americas, those suitable for the cultivation of sugar (Brazil, Haiti) or for extractive industries (Mexico, Peru), have less egalitarian institutions than areas with no such possibilities (United States, Canada). Engerman and Sokoloff argue that the presence of these highly profitable but labor intensive industries made it very important for these economies to have a large and docile labor supply which came about by either importing slaves or enslaving the local population. This created a society with high inequality and consequently much less cohesion. Also, the elites controlling these states were not particularly

interested in investing in education for the masses, since this was likely to make labor more expensive. As a result, these colonies had much lower literacy than the United States and Canada.

In a similar vein, Banerjee and Iyer (2005) study the long-term impact of being assigned a particular land revenue collection system by the British colonial rulers in India. They distinguish between areas with landlord-based systems, where the landlord was assigned the primary responsibility for collecting land revenue on behalf of the British, and a non-landlord system where the taxes were collected directly from the peasant. They argue that the landlord-based system introduced a class of powerful intermediaries between the rulers and the ruled, and this class was perceived (probably rightly) to be exploitative by the peasant population. While the landlord-based system was abolished (along with all land revenue collection systems) in the early 1950s, this history of class conflict made rural society in the ex-landlord areas less cohesive and therefore less effective in getting public goods. Using district-level data from the 1981 Indian census, they find that formerly landlord-controlled areas indeed lag behind other areas in the provision of schools and health centers, and consequently have lower literacy rates and higher infant mortality rates. Some indication of the different social climate is provided by the fact that rates of violent crimes (such as murders) are much higher in ex-landlord areas. The potential endogeneity of the land revenue system is dealt with by exploiting changes in British land revenue policy over the 19th century to construct instrumental variables estimates.²²

The impact of historical landlord control persists in the 1991 census data: Banerjee, Iyer and Somanathan (2005) extend the analysis to 25 different public goods, and they also control for caste and religious fractionalization and a dummy for being directly ruled by the British in the past. As in Banerjee and Somanathan (2007), they include a wide range of geographic and population characteristics as controls. The OLS estimates of the non-landlord effect are positive and significant for 13 of the 25 goods and negative and significant for three. In related work, Pandey (2005) compares one landlord area (Oudh) with the area surrounding it (which was non-landlord) and finds that while both areas have the same level of access to primary schools in 2002, teacher attendance is 17% higher in the non-landlord area schools and teacher activity is 32% higher.

Overall, these results suggest that where heterogeneity is highly salient because of historical circumstances, it can be a major constraint on public action. In other cases, the estimates of commonly used measures of heterogeneity on public goods are more mixed.

²²Specifically, Banerjee and Iyer (2005) use the fact of being conquered by the British in the period 1820-1856 as an instrument for being non-landlord. The paper contains detailed discussions of the validity of this instrument.

3.3 Public Goods Experiments

A serious concern with the observational studies discussed above is that collective action choices are inferred from public good outcomes. It is possible that, at least some of the time, we are spuriously attributing empirical patterns to the mechanisms contained in our models. Experiments allow us to observe the actual choices made by individuals under varying conditions and therefore address some of these doubts.

There have been a large number of laboratory experiments on *Voluntary Contribution Mechanisms*. In the simplest experiment of this type, subjects are divided into groups and given a fixed endowment of tokens. They are asked to choose the fraction of their endowment that they would like to contribute to a group project or public good. The group members decide, simultaneously and independently, on their contributions. The experimenter totals group contributions, doubles them (or multiplies them by some other constant) and divides this amount between the subjects in each group. Each member's payoff consists of an equal share of the group return plus the amount the member decided not to invest in the project. These experiments are typically set up such that the first-best outcome involves some level of positive contributions by all members and Nash equilibria are characterized by under-provision of the public good.

A survey of the results from such experiments is found in Ledyard (1995). A common finding in this literature is that subjects generally contribute more to the public good than predicted by Nash-equilibrium strategies. In one-shot trials, contributions are usually positive and total to about 40%-60% of the socially optimal level. With repeated trials, most studies find that contributions tend to decline towards Nash-equilibrium levels.

These results are similar in flavor to those obtained from experiments on ultimatum bargaining games. There has been some debate about whether the positive contributions reflect altruism and cooperative behavior or whether they are just mistakes made by agents who would like to maximize their own payoff but do not fully understand the structure of the game. To distinguish between these possibilities, experiments have been set up to ensure that both the Nash equilibrium outcome and the social optimum are interior so that mistakes can be made in both directions (by contributing both too little and too much), while altruism would always result in contributing too much. The results obtained suggest that a sizable fraction of subjects do seem to behave selfishly but a sizeable fraction does not, which raises questions about the modeling of collective action in the theoretical literature summarized above.

The effects of group size on public goods has also been studied in an experimental setting. Issac and Walker (1988) perform experiments with groups of two different sizes and find that larger groups exhibit more free-riding, but mainly because marginal returns fall as the group size increases. To isolate the "pure numbers-in-the-group" effect from the effect of declining marginal returns, they increase the return from

investing in the public good for larger groups in a manner that keeps the marginal return roughly constant. They find that most of the group-size effect can be attributed to differences in marginal returns from the group activity. Once this is controlled for, individuals in larger groups do not contribute less.

A variety of approaches have been used to test the role of inequality or heterogeneity within the group on public goods. Cardenas, Stranlund and Willis (2002) conduct experiments in rural Colombia in which subjects allocate a fixed time endowment between collecting firewood and a market activity. To examine the role of heterogeneity, they contrast the results of two treatments: One in which the return from the private activity is the same across agents and another where the return is unequal. They find that public goods levels are higher (firewood extraction lower) when returns are unequal. This happens because increases in private returns lead to lower extraction levels, while decreases do not increase extraction very much (theoretically, this could go either way as shown in Section ??). Anderson, Mellor and Milyo (2004) introduce heterogeneity into the voluntary contributions game by varying the distribution of payments for participation rather than changing payoffs within the game. In experiments with college students, they find that heterogeneous show-up costs lower public good contributions if the distribution of these costs is publicly observed. Cardenas (2003) also finds that awareness of payoff asymmetries lower contributions in heterogeneous groups. It appears that some of the effects of heterogeneity on public goods may stem from psychological effects of heterogeneity on perceived status.

Of special interest are experiments that estimate the importance of group monitoring and communication on the size of contributions. Monitoring in these games means that group members are informed about the value of total group contributions between successive trials of the experiment. Communication refers to allowing subjects a few minutes to converse before they decide on contributions. There are usually no restrictions on the nature of this conversation and subjects can use this to coordinate their actions or just to get to know each other. This communication is strictly *cheap talk* in the sense that it is not allowed to directly influence payoffs. Cason and Khan (1999) contrast outcomes from alternative versions of this type of experiment to understand how interactions between communication and monitoring determined contributions. In the perfect monitoring case, subjects are informed about total contributions after each round, while in the imperfect monitoring case, this information is available after every six rounds. Their results on communication are particularly striking: They find that in the absence of communication, contributions with both types of monitoring are fairly similar and decline over time. In the presence of communication, overall contributions are much higher (about 80% of the tokens were invested in the group activity as opposed to a high of 40% in the no-communication case) and did not decline in later rounds. Monitoring thus improved contributions only when it was combined with communication. This favorable effect of communication on contributions in public goods experiments is observed more generally under many different experimental designs (Ostrom,

2000).

The communication effects described above can be used to justify measures of heterogeneity such as the ethnolinguistic fractionalization index. If it is true that most communication takes place within groups, and that communication favorably influences contributions to group activity, then we would expect an index that is correlated with the frequency of within-group interactions to explain the provision of public goods. In a recent experimental study in Uganda, Habyarimana et al (2006) find that successful public goods provision in homogenous ethnic communities can be attributed to the fact that co-ethnics are more closely linked through social networks, and hence may be able to sustain cooperation through the threat of social sanction.

3.4 The Welfare Costs of Public Good Misallocation

The empirical research that we have discussed in Section ?? attempts to isolate the causes of variation in the availability of public goods. It demonstrates that the uneven political leverage of social groups and their various other characteristics can skew the allocation of public goods in favor of some groups and against others. In this section we briefly discuss some recent approaches to measuring the aggregate welfare costs associated with the misallocation of public facilities.

There has been a very rapidly expanding computer science literature on *facility location* that deals with spatial optimization problems. A common problem in this class is one in which there is a given (arbitrary) distribution of the population across a finite set of locations and a fixed number of facilities are to be allocated to a subset of these locations. In a typical developing country, we can think of the locations as villages and facilities as centrally financed public goods (schools, health centers, post offices). Suppose that social welfare is decreasing in the aggregate distance travelled by the population. For small numbers of citizens and facilities, the total number of possible spatial configurations of facilities remains small and one can simply compute the allocation of facilities that minimizes distance travelled. A measure of the cost of misallocation is then the difference between the distance travelled under the actual and the optimal allocations. As the number of villages increases, the number of computations involved increases exponentially and this optimization problem becomes intractable. A variety of optimization algorithms have been recently developed which provide approximate solutions. The difference between the actual distance travelled and the distance corresponding to the algorithmic solution is then a lower bound on the welfare cost of public good misallocation.

Athreya and Somanathan (2007) adapt an algorithm in the facility location literature and apply it to the allocation of post offices in a region of South India. Between 1981 and 1991, there was a 23% increase in the

number of villages with post offices in the area studied. They find that aggregate travel costs corresponding to the observed allocation of post offices in 1991 are 21% higher than the costs associated with the (near)-optimal allocation of the additional post-offices. Rahman and Smith (1999) study the location of Health and Family Welfare Centres in an administrative region of Bangladesh, and find that relocating a set of seven centres can reduce the mean distance travelled by 43%. These papers, in themselves, do not offer any clues to the reasons for misallocation. Given however, that they both deal with fairly small geographical areas (an administrative block in South India and a Bangladeshi *thana*, each with less than a quarter of a million people), the social composition of villages does not vary very much. Bureaucratic mistakes could thus be a large part of the explanation, given the difficulty in computing optimal allocations.

The types of problems that have been studied so far in this literature are still fairly specific and little is known about the optimality of available algorithms when applied to non-linear travel costs and multi-period settings. The field is however expanding rapidly. As spatial data becomes widely available, this approach might well become very valuable in improving the delivery of public goods.

4 Some Top-down Interventions

Much of the evidence summarized in the previous section points to the importance of local population characteristics in determining access to public goods. There are two major reasons to look for explanations beyond those provided by these results. The first is that population variables, even when they exhibit systematic effects on the availability of public goods and on associated outcomes, leave much of the observed variation in these variables unexplained. The *World Development Report* (World Bank, 2006), for instance, reports significant differences in educational attainment between urban and rural populations and between males and females; yet, the share of inequality attributable to location and gender on average is only 6% and 2% respectively. Among the papers cited in the previous section, the explanatory variables in Miguel and Gugerty (2005) account for less than 25% of the variation in school funding across schools and those in Banerjee and Iyer (2005) account for about 30% of the variation in public good outcomes. This brings us to our second point: If public good access were determined primarily by local population characteristics, we would rarely see rapid changes in such access, since many of these characteristics (religion, caste, ethnicity) change very slowly over time. It would also be difficult to explain the convergence of under-provided areas with those that have been historically advantaged. In this section, we discuss the role of *top-down* interventions in bringing about these changes.

It is worth emphasizing that we are not claiming that top-down interventions are more effective than bottom-

up interventions, nor that they explain more of the observed variation in the data. We mainly want to highlight that there are several cases where they have been central to the process of public good expansion and it is worth trying to understand them better.

Much of the historical expansion in public schooling took place under colonial or autocratic regimes. In the late 19th century and early 20th century, large parts of the presently developing world were ruled by colonial powers. One might expect the compulsions of these powers to be roughly similar with regard to the provision of public goods, yet the differences in provision across the colonies were very large. In 1930, the mean primary enrollment rates for British colonies was 35%, the corresponding figure for French colonies was about half of this (Benavot and Riddle, 1988). Dutch colonies were somewhere in between, and Belgian and Portuguese colonies had the worst outcomes. More recently, in Indonesia, in the five years between 1973-74 and 1978-79, more than 61,000 primary schools were built under the Sekolah Dakar INPRES program; this more than doubled the number of schools in the country (Duflo, 2001). While the autocratic Suharto regime probably had a specific political purpose behind this intervention, the fact that it was based on a rule that explicitly targeted under-served areas and that this rule was largely followed, suggests that there was very little local influence on the decision to build the schools.

The history of public good provision in India is dotted with a series of top-down interventions. The erstwhile princely states of India provide us with interesting cases of autocratic rulers providing public goods even with limited political incentives to do so. These princely states were parts of India that had accepted the overall suzerainty of the British and, in return, were allowed to retain a large measure of internal autonomy. The presence of the British army guaranteed that the power of these rulers was unchallenged within their domains, and they could afford to ignore the wishes of their people.²³

Despite the limited pressure to deliver, some rulers did invest heavily in public goods and the high social outcomes observed in some areas today are arguably, a legacy of these investments. The Travancore state in present-day Kerala is particularly well-known for its long tradition of enlightened rulers. In 1817, the Regent Gauri Parvathi Bai declared, “The state should defray the entire cost of the education of its people in order that there might be no backwardness in the spread of enlightenment among them, that by diffusion of education they might become better subjects and public servants and that the reputation of the state might be enhanced thereby.” This remarkable announcement was said to be heavily influenced by the diwan (prime minister) James Munro, and it set an important precedent for state action in education. In particular, the reign of Swati Tirunal (1829-1847) was regarded as a “golden age” for the state. An English school

²³British administrative intervention in these kingdoms was limited to posting a British Political Agent or a British Resident in these states. The Resident’s reports of misrule could result in a ruler being deposed by the British and another being set up in his place. This was relatively rare.

was opened in Trivandrum in 1834, and schools were established in each district as well. His successors were all committed rulers who continued the process of reforms in various branches of the government; Mulam Tirunal Rama Varma (1885-1924) introduced an Education Code, opened the schools to children of untouchable communities and even set up a Popular Assembly consisting of elected representatives of the people. The contribution of the Travancore rulers to education in the state went well beyond expanding enrollments. The *Travancore Administrative Report* (State of Travancore, 1991) records 809 students in the Maharaja's High School of whom 800 had received vaccinations. The students came from both the priestly Brahman caste and the lower castes and from a wide range of occupational groups. This was quite remarkable given the numerous accounts of bitter caste conflicts in the State at that time.

We see a similar pattern in nearby Cochin, where Munro again acted as diwan. In both Travancore and Cochin, he reorganized the administration of the states along the lines of the system in British India and played a large role in eradicating corruption. He was also instrumental in setting up vernacular schools in every village of Cochin state. Future diwans of Cochin continued on the path of progressive reforms, introducing western medicine and English schools, and expanding access to education for all sections of society. We should note that while some public investments might be motivated by the desire to expand the tax base, it is unclear that setting up an English school was such a case at that time. After all, the British colonial state, never shy to make investments that expanded the tax base, set up the first English school in British Malabar (northern region of modern Kerala state) only in 1848.

Another dynamic ruler was Sayajirao III of Baroda in present-day Gujarat state, who declared that education was "absolutely necessary for the realization of my ambitions and wishes for the future of my people." The state ordered that schools be provided in all villages which could produce 16 children willing to attend; Sayajirao was also the first to introduce compulsory education in certain areas in 1892. It took the British more than twenty years to introduce a similar law in the neighboring Central Provinces.

In more recent times, the Indian state has made important commitments to public good provision. These first appeared in the late 1960s. In 1968, the ruling Congress Party brought out the National Policy on Education, which made a commitment to universal primary education. The Minimum Needs Program of 1974-75 set down explicit norms about access to public goods in rural areas: a primary school and safe water within a mile of every village, paved roads to villages with populations over 1000, electricity to at least 40 percent of villages in every state, and a multi-tiered health system. Indira Gandhi made the removal of poverty (*Garibi Hatao*) the cornerstone of her successful election campaign in 1971. This rhetoric was accompanied by concrete results. Between 1971 and 1991, the fraction of villages with primary schools went up by about a third, those with high schools doubled and access to piped water increased nine-fold. Many

of these changes were specifically targeted at bringing about equality of access. Banerjee and Somanathan (2007) find that for 12 out of 15 public goods, higher access in 1971 was associated with significantly slower growth in the subsequent period. This is by no means a mechanical *mean reversion* effect; many of these facilities were available in less than 5 percent of Indian villages in 1971 and in less than 10 percent of villages in 1991.

There have been a variety of other nationally mandated programs which have been shown to improve health and educational outcomes in India over the last two decades. In education, *Operation Blackboard* significantly increased the availability of teachers and infrastructure in areas with poor educational outcomes.²⁴ The program of Integrated Child Development Services (ICDS), introduced in 1975, is a good example of how top-down interventions interact with local characteristics. The program, funded by the government and various donor agencies, expanded very rapidly in the 1990s and now covers over 7 million mothers and 34 million children below the age of 6.²⁵ Although the program is envisioned to have universal coverage, current coverage still varies widely across states and survey evidence shows that the functioning of ICDS units and workers is strongly influenced by the degree to which mothers are involved in the program.²⁶

Top-down interventions do not need to be initiated by governments or political actors. For instance, an NGO is one of the biggest suppliers of primary schooling in Bangladesh: BRAC's Non-Formal Primary Education Program (which covers the same competencies as the government schools) had grown from 22 one-room schools in 1985 to 49,000 schools in 2004, accounting for about 11% of the primary school children in Bangladesh.²⁷ BRAC also has large health-care and microfinance programs, and has recently expanded its activities into Afghanistan and Sri Lanka. Singh (2006) describes how a group of committed bureaucrats created the innovative *Lok Jumbish* program in Rajasthan, with the goal of promoting primary schooling.

A recent innovation in top-down interventions is the trend towards explicit experimentation, as a way to find ways to improve the effectiveness of public good delivery. A number of them focus on corruption and governance issues. In one such experiment, conducted on behalf of the Indonesian government, Olken (2005) finds that corruption in road construction in Indonesia was substantially reduced (and road quality improved) when an auditing program was introduced. Duflo and Hanna (2005) describe another experiment, conducted on behalf of an NGO in India, which shows that using cameras to monitor teacher attendance reduces absenteeism and improves test scores in rural primary schools. Other experiments look at the benefits of providing additional resources: for example, Glewwe, Kremer and Moulin (1997) and Glewwe et al (2004)

²⁴Chin (2005) contains an evaluation study of *Operation Blackboard*, which began in 1987.

²⁵http://www.unicef.org/india/nutrition_1556.htm

²⁶State coverage figures are available at <http://wcd.nic.in>. Dreze (2006) contains data from the FOCUS survey of ICDS units and participating households across seven Indian states.

²⁷<http://www.brac.net/history.htm>

find that providing more textbooks or flip charts to schools in Kenya at best improves the test scores of the top quintile of students, without much improvement in the overall level of learning.

Miguel (2004) illustrates how top-down actors can influence the allocation of public goods is by manipulating the conditions under which the bottom-up processes operate. He describes the contrast between Kenya and Tanzania, which shared many common characteristics during the colonial period. After independence, the Kenyan leadership played up tribal loyalties for political reasons and little effort was put into building a Kenyan identity; in contrast, the Tanzanian leadership put a lot of emphasis on creating a single Tanzanian identity. This seems to have implications for public good provision: in the Busia region of Kenya, ethnic heterogeneity at the local level is negatively correlated with the quality of public goods (mainly schools), while in the nearby Meatu region of Tanzania, they are slightly positively correlated.

Taken together, these examples make a number of useful points. First, it seems clear that an agency with sufficient political will, be it a dictatorial state or a local NGO, can improve access to public goods, irrespective of local conditions. Second, there might be important interactions between top-down and bottom-up process that are not captured in the current literature. In the case of Kerala, after the initial set of initiatives led by the local kings, the next stage in the expansion of access to public schools was actually much more bottom up—the result of lower caste social movements in the late nineteenth and early twentieth centuries (Singh, 2006 and Ramachandran, 1997). The fact that Gujarat, which started out as the other early leader in education in India (see the discussion of Baroda state above), is now much like the average Indian state, while Kerala is almost 100% literate, may be a result of differences between them at this later, bottom-up, stage.

We are still far from understanding the systematic patterns behind the success or failure of top down interventions, compared to bottom-up processes. Bardhan and Mookherjee (2000, 2006a, 2006b) and Bardhan (2002) ask whether local government elections are more subject to capture than elections to the national (more top-down) government. They suggest that national elections may indeed be less subject to capture, partly because the national elite tends to be more divided and also because national elections tend to be more competitive (perhaps because more is at stake). Weighing against this however, is the fact that it might be cheaper to “buy” the national election because the lobby group can focus on a smaller set of pivotal constituencies. Their model also shows that local capture is more likely in high inequality districts. It is not clear whether these results would extend easily to other types of collective action that do not operate through the electoral process but these papers point to the need for more theoretical and empirical work in this direction.

5 Conclusion

We began this chapter by documenting the enormous spatial variation that is commonly observed in the availability of public goods. We proceeded to survey the now substantial literature that links this variation to the characteristics of groups and the ability of their members to act collectively to promote group interests. Theoretical approaches in this area explain the under-provision of public goods in terms of individual incentives to free-ride in collective endeavors. Group characteristics influence these incentives and they can therefore be linked to variations in public good access. Empirical research on group characteristics and public good provision finds that while these characteristics do matter, the social composition of communities is able to explain only a fraction of the total variation in provision. The experimental evidence is also not entirely conclusive: Experiments on voluntary contribution mechanisms find that group contributions are generally below socially optimum levels but often above those corresponding to Nash equilibrium strategies. Moreover, these experiments find that communication between members can be important in achieving group cooperation, even if it is not directly linked to payoffs. This suggests that group identities can be created by communication, something our models currently do not allow.

More generally, the research on group characteristics and collective action surveyed here suggests that there are many missing pieces to the public goods puzzle. Access to many basic public goods is likely to converge in the coming years. Some areas that have had historically poor access are currently in the midst of major economic expansions accompanied by rapid increases in public good coverage. As this happens, we will need to shift our attention to quality differences, where both the theoretical and empirical literature is in its infancy. There are several challenges to delivering quality rather than access. First, quality is much harder to evaluate than access—anyone can see that there is no school building in the neighborhood, but judging whether the children are learning as much they should, can be quite a challenge. This makes it harder both to demand quality and to deliver it. Second, the incentives of the government bureaucrats may be very different in delivering access versus quality. For instance, they may favor school construction and even hiring new teachers for venal personal reasons (such as being able to give contracts to favored parties), but they clearly have no financial stake in getting the teachers to work.

Another major deficiency in this literature is the absence of a body of knowledge on the technology of delivering public services. Even in the absence of political competition and rent-seeking by different communities, the efficient allocation of public goods requires the ability to compute optimal allocations and provide bureaucrats with the incentives to implement them. This is not a trivial exercise. The field of spatial optimization techniques has been expanding rapidly and shows that optimal allocations can, at best, be computed quite approximately. We still know relatively little about the extent to which misallocation

results from these types of information gaps. This is likely to be a fruitful area of future research.

The problem of providing the right incentives to government agents is related to the question of the appropriate level of political and administrative decentralization.²⁸ The World Development Report on Making Services work for the Poor (World Bank, 2004), comes out in favor of giving local communities greater control over the delivery of public goods as a way of improving quality. While those who consume public goods are presumably the ones with the greatest stake in making sure that they work well, factors determining the effectiveness of local control need to be better understood. Such control may depend on collective community effort, as we saw in the first part of this paper, on the nature of political capture (as discussed in the previous section) and also on whether decentralized monitors have the information necessary to evaluate public services. Can a patient really judge whether he is getting the right medicines? Will remote village level governments know whether building contractors are using the stated materials, or whether teachers are properly covering the grade-appropriate course syllabus? The field experiment by Olken (2005) suggests that the task of monitoring may indeed be quite difficult for the village community: While centralized auditing reduces corruption in his data, greater monitoring by villagers has no detectable impact on the level of corruption. Perhaps decentralized delivery works well only with simple project designs, as Khwaja (2002) seems to suggest.

Even if one opts for decentralization, there are many more decisions that have to be taken. Is it enough to give the local community the right to hire and fire the teacher? Or do they also need information about how well the teacher is doing (from standardized tests, for example)? If allowing them to hire and fire is politically infeasible, is it still worth giving them information about the teacher's performance? If, instead, we opt for centralization, so that hiring and firing teachers is in the hands of some higher level government, how can we make sure that the government finds out when the teacher is absent, or when the money for books is stolen before it reaches the school? The recent empirical work mentioned at the end of the previous section has made a start in answering these important policy questions, but there is clearly much more work to be done.

²⁸Oates(1999) provides a review of the literature on the vertical structure of the public sector.

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Table 1: Access to public goods across subnational regions

Country	Year	% population with access to														
		Clean water			Health facilities			Sanitation			Electricity			Access to schools		
		Overall	Highest region	Lowest region	Overall	Highest region	Lowest region	Overall	Highest region	Lowest region	Overall	Highest region	Lowest region	Overall	Highest region	Lowest region
Brazil	2003	94.30	98.30	76.30				94.10	98.10	89.70	99.50	99.90	97.80	97.20	98.90	93.70
Bulgaria	2001													100.00	82.80	
China	1999	96.30	100.00	74.72		99.50	61.11							100.60	57.79	
Egypt	2002	91.30	99.80	72.10	3.80 ^a	16.10	1.80	93.60	99.90	73.00	98.70	99.90	75.40	72.10	79.70	56.50
India*	2001	33.70	99.00	2.00	3.20	61.00	0.00				76.00	100.00	36.00	78.00	98.00	39.00
Indonesia	2002	55.20	72.20	21.50	76.90	97.10	49.90	75.00	100.00	43.70				96.10	99.00	83.50
Kenya	2000	54.90	93.90	37.20	49.00	55.00	11.00							50.70	76.70	9.50
Mexico	2002	87.45	97.77	67.06	50.84	79.77	22.70	72.31	96.80	38.47				63.14	75.46	58.82
Nepal	2001	44.80	82.00	12.00	0.30 ^b	2.24	0.00	43.72	93.25	11.18	32.15	97.38	5.89	1.35	4.85	0.44
Pakistan	1998													71.00	75.00	64.00
Russia	2001													69.80	100.80	43.80
South Africa	2001	72.80	90.50	50.50	66.10	79.00	49.70	90.80	98.70	70.90	71.70	88.10	46.80	83.90	90.30	72.60
Thailand	2001	98.90	99.80	97.10				98.90	100.00	96.60	98.30	99.90	97.20	73.80	63.40	88.60
Vietnam	2001				99.00	100.00	97.20				79.30	98.90	50.50	99.90	100.00	99.30

a: Number of health units per 100,000 population; b: Number of health centers per 1000 population.

*All numbers for India refer to the % of villages with access to specified public goods.

Access to schools is measured by primary school enrollment rates for Brazil, Indonesia and Pakistan; combined primary, secondary and high school enrollment for Bulgaria, China, Egypt, Kenya and Russia; % of villages having any educational institution in India; number of schools per 1000 population in Nepal; lower secondary enrollment in Thailand; % of population living within 2km of a primary school for South Africa; and % of communes with access to a primary school in Vietnam.

Sources: Sintese de Indicadores Sociais 2004, Bulgaria Human Development Report 2001, China Human Development Report 2002, Egypt Human Development Report 2004, Authors' calculations from Indian census 2001 data, Indonesia Human Development Report 2004, Kenya Human Development Report 2004, Mexico Human Development Report 2002 and 2004, Nepal District Profile 2002, Pakistan Human Development Report 2003, Russia Human Development Report 2004, South Africa Human Development Report 2003, Thailand Human Development Report 2003, and Statistics of Agriculture and Rural Development 1996-2000 for Vietnam.

The relevant sub-national units are regions for Brazil, Bulgaria, Russia, South Africa and Thailand; provinces for China, Indonesia, Kenya, Pakistan and Vietnam; governorates for Egypt; states for India and Mexico; and districts for Nepal.