

Large Dams in India

At independence, in 1947, there were fewer than 300 large dams in India. By the year 2000 the number had grown to over 4000, more than half of them built between 1971 and 1989. India ranks third in the world in dam building, after US and China. While some of these dams were built primarily for flood control, water supply, and hydroelectric power generation, the primary purpose of most Indian dams (96 percent) remains irrigation. In fact, large dam construction has been the main form of investment in irrigation undertaken by the Indian government. But, starting in the 1980s, public investment in large dams in India has been the subject of a sustained controversy—epitomized by the Sardar Sarovar Project—centering on the balance between the social, environmental, and economic costs of dams and their benefits. This essay analyzes the economic impact of large irrigation dams in India, focusing on both their aggregate productivity effects and their distributional effects.

Given that the economic gains and losses from dams, like those from many other public investments, often accrue unevenly to different groups in society, one way to begin is to identify the putative winners and losers. Most irrigation dams in India are embankment dams. That is, they consist of a wall built across a river valley to impound water so as to form a reservoir upstream and a system of spillways and gates to bypass the wall so as to maintain normal river flow and convey water to a network of canals feeding irrigated regions downstream. The upstream areas that feed the dam and those submerged by its reservoir make up its “catchment” area, and the downstream areas fed by its irrigation canals make up its “command” area. Before any mitigating effects of resettlement and compensation, whether a household stands to gain or lose depends on its location relative to the placement of the dam. People living in the catchment area, who lose property and livelihood but gain little, if anything, from irrigation, tend to lose out, while people living in the command area, who bear little of the social cost but gain the most from irrigation, typically gain.

Proponents of large dams focus on the aggregate productivity benefits, emphasizing the role of dams in enabling irrigation. And, even though this is controversial, on their role in recharging the water table, which had been lowered by overuse of underground water sources for irrigation.

Between 1951 and 2000, India’s production of food grains increased fourfold, from 51 million tonnes to about 200 million tonnes. This not only obviated the importation of food grains, with attendant saving in foreign exchange, but left India with a marginal food grain surplus. Proponents point to the fact that about two thirds of this increase was in irrigated areas, and that by the year 2000, areas irrigated by dams constituted 35 percent of irrigated land in India. The most optimistic estimates attribute 25 percent of the increase in food grain production to dam irrigated areas. But it is incorrect to attribute the entire production gains in dam irrigated areas to dams. First,

the increase in irrigation coincided with increased uptake of other inputs and technologies, such as high yield varieties beginning in the 1960s, fertilizer, machinery, and multi-cropping. Even though the contribution of these cannot be readily disentangled, we can surmise that it lowers the proportion of the productivity increase due to irrigation alone. Second, there are other methods of harvesting water for irrigation, and so some of the dam-irrigated areas would still have been irrigated even if the dams had not been built.

Indeed, other methods of harvesting water for irrigation, such as ground water and small dykes, remain pervasive in India. Even so, proponents of large dams have argued that these cannot be relied upon to meet the needs of India's large and growing population. Moreover, it has been argued, these forms of water harvesting are not cost-effective and do not have the added advantages of hydropower generation and flood management.

Opponents of large dams, on the other hand, emphasize the social costs of dams. They point out that the economic gains accrue disproportionately to people living in the command areas.

The losses, on the contrary, are suffered disproportionately by people living in the catchment areas. Dam construction and submersion leads to significant loss of arable farmland and forest. Water logging and increased salinity reduce agricultural productivity in the vicinity of the reservoir. Policies to ensure adequate flow into the reservoir sometimes prohibit water harvesting in the catchment area, reducing agricultural productivity even more. Large-scale impounding of water increases exposure to vector-borne diseases, such as malaria, schistosomiasis, filariasis, and river blindness. Furthermore, the Indian government's compensation policy towards the displaced remains insufficient in many cases. In particular, since the compensation is based on the amount of land owned, landless households were typically not compensated whatsoever. Nor were people compensated for loss of income or subsistence derived from communal holdings, such as common grasslands and forests. Although dams may also increase economic activity in the catchment area—through construction and economic activity around the reservoir, such as tourism and fishing—these increases are either temporary or depend on the ability to learn new trades, and often can not compensate for the loss of familiar livelihood.

Ultimately, both the aggregate economic impact of dams and their distributional impact remain complicated empirical questions. As has been said already, whether a household accrue net losses or gains depends in part on the placement of the dam. That, in turn, depends on several factors determine, including the political and financial power of the local governments; the relative strengths of proponent and opponent civic organizations; and the potential of improved agricultural productivity in the would-be command region. All these factors may have direct impact on both agricultural production and poverty quite independently of the construction of the dam. As such, a simple comparison of the areas in the command or the catchment areas of dams and other areas

does not directly inform us about the impact of dams, since these areas are likely to differ along these other salient dimensions, and it is difficult to disentangle their effect and the effect of the dams.

One specific determinant of dam placement, however, is geographic suitability. Dam location is strongly influenced by river gradient. A river flowing at a moderately positive gradient favors irrigation dams; higher water levels upstream facilitate water storage and diversion into irrigation canals. Consequently, within states, new dams tend to be built in those regions that have river flowing at a moderate incline. After one accounts for the impact of the overall hilliness of the district and the availability of rivers, the gradient of the rivers is unlikely to have a direct impact on changes in agricultural productivity or other district-level outcomes before and after a state builds new dams. It is possible, therefore, to use the variation in dam construction induced by differences in river gradient across districts within Indian states to determine the impact of large dams.

In Duflo and Pande (2005), we use this strategy to estimate the impact of dam construction on district agriculture and poverty outcomes. We find that agricultural productivity in the catchment areas is unaffected, but poverty and vulnerability to rain shocks increase. Poverty increases in terms of both the headcount ratio (the fraction of rural population with consumption levels below the poverty line) and in terms of the poverty gap (how much income would be needed to bring the poor to a consumption level equal to the poverty line). In the command areas, irrigation and agricultural productivity increase, and poverty and vulnerability to rainfall shocks decline.

A cost-benefit analysis suggests that the dams are, on average, only marginally cost-effective, although there is large variation from dam to dam. We also estimate that large dams increased all-India agricultural productivity by about 9 percent, a number close to the World Commission on Dams's estimate of 10 percent, which has been criticized as too low by proponents of dams.

The increase in poverty in the catchment areas suggests that, even though losers are clearly identified, as those who live in the vicinity and upstream of the dam, they are rarely adequately compensated. This finding suggests that losers do not have the institutional capacity to negotiate higher compensation. To explore this further, we took a cue from Banerjee and Iyer (2005), who show that Indian districts where the British colonial authorities had delegated the setting and collection of land taxes a class of landlords tend to have less collective action and public good provision than districts where the individual cultivator paid the taxes directly to the colonial authorities. We found that, while the impact of dams on production is similar in both types of districts, the increase in poverty due to large dams is twice as large in districts where taxation had been delegated to landlords. Our findings are consistent with the view that where the relationship between the elite and the losers is adversarial and where the civic organizations advocating for the losers are relatively weak or non-existent, losers are less likely to be compensated. The fact that historically disadvantaged groups are disproportionately represented among the displaced (scheduled

tribes represent 8% of the population, but 47% of the displaced) also suggests inadequate capacity to negotiate higher compensation. Planning authorities facing groups that have poor capacity to negotiate may not adequately account for the costs of resettlement and compensation, overestimating the economic viability of a dam, which may also increase poverty. .

Large dam construction has been an important and expensive undertaking for the Indian government. While dams have enhanced agricultural productivity in India, there is no evidence that they have been very cost effective, and they have significantly adverse distributional implications. The case of large dams suggests strongly that distributional implications of public policies should be central to any evaluation. Clearly, the case of large dams suggests the need to understand the institutions, and power structures, that led to the implementation of these projects.

References:

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