Strategies for Sustainable Development of Less-Favored Areas
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RETURNS TO PUBLIC INVESTMENTS IN THE LESS-FAVORED AREAS OF INDIA AND CHINA

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Conventional wisdom suggests that the productivity returns to investment are highest in irrigated and high-potential rainfed lands and that growth in these areas has substantial trickle-down benefits for the poor, including those residing in less-favored areas. Even though investing in less-favored lands might have a greater direct impact on the poor living in those areas, it is argued that investments in high-potential areas give higher social returns for a nation than investments in low-potential areas. The logic behind this position is as follows. Investment in high-potential areas generates more agricultural output and higher economic growth at lower cost than in less-favored areas. Faster economic growth leads to more employment and higher wages nationally, and greater agricultural output leads to lower food prices, both of which are beneficial to the poor. Less-favored areas will benefit from cheaper food, from increased market opportunities for growth, and from new opportunities for workers to migrate to more productive jobs in the high-potential areas and in towns. Fewer people will try to live in less-favored lands, and this will help reduce environmental degradation and increase per capita earnings. Migrants may also send remittances back to less-favored areas, further increasing per capita incomes there, especially for the poor.

Many of the expected benefits arising from rapid agricultural growth in high-potential areas have been confirmed through empirical research. Nevertheless, the rationale for neglecting less-favored areas is being increasingly challenged by: (1) the failure of past patterns of agricultural growth and interregional migration to resolve growing poverty, food insecurity, and environmental problems in many less-favored areas; (2) increasing evidence of stagnating levels of productivity growth and worsening environmental problems in many high-potential areas; and (3) emerging evidence that the right kind of investments can increase agricultural productivity to much higher levels than previously thought in many less-favored lands. It now seems plausible that increased public investment in many less-favored areas may have the potential to generate competitive if not greater agricultural growth on the margin than comparable investments in many high-potential areas and that these investments could have a greater impact on the poverty and environmental problems of the less-favored areas in which they are targeted. If so, then additional investments in less-favored areas may actually give higher aggregate social returns to a nation than additional investments in high-potential areas. In fact, they might offer win-win-win possibilities (i.e., more growth, greater poverty reduction effect, and better environmental outcomes).

To test this hypothesis, IFPRI recently analyzed the agricultural production and poverty alleviation impacts of different types of investments in high- and low-potential areas in India and China. Unfortunately, the available data did not permit a comparable analysis of the environmental impacts of public investments in these two countries. India and China are good examples to study because, like many other Asian countries, past public

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investments have been biased toward high-potential areas, and the remarkable productivity gains achieved in those areas (which led from acute national food shortages to current surpluses) can now be juxtaposed against the lagging productivity and poverty, food insecurity, and environmental degradation that exist in many less-favored areas. The results provide strong support for our hypothesis that greater levels of investment in less-favored lands are now warranted, at least on growth and poverty alleviation grounds.

Measuring the Effects of Public Investment on Rural Poverty[1]

Public investment affects poverty through many channels. These include the direct benefits that the poor receive from spending on rural development programs, such as employment programs that are targeted directly to them. It also includes the indirect effects that arise when government investments in rural infrastructure, agricultural research, and the health and education of rural people stimulate both agricultural and nonagricultural growth, leading to greater employment and income-earning opportunities for the poor and to less costly food. Therefore, the methodology to be used must have the ability to capture all these direct and indirect effects.

But targeting government expenditures simply to reduce poverty is not enough. To provide a permanent solution to the poverty problem and to increase the overall welfare of all rural people, government spending must stimulate economic growth as well. Thus, the methodology to be used must also have the ability to measure the agricultural growth stimulated by different items of government expenditure.

In the two case studies, a multiequation system was constructed and estimated. In the system, rural poverty is modeled as a function of growth in agricultural production, changes in rural wages, growth in rural nonfarm employment, and changes in agricultural prices. Increases in agricultural production or wages should reduce poverty.

Improvements in relative prices for agriculture (a domestic terms of trade variable) are expected to hurt the poor in the short run because they increase food prices. But in the long run, higher agricultural prices may stimulate government and farmers to invest more in technology and infrastructure, thereby increasing agricultural production and reducing rural poverty.

Agricultural production is modeled as a function of conventional inputs such as labor, land, fertilizer, machinery, and public investment variables such as the use of high-yielding varieties, public and private irrigation, roads, markets, electrification, and education.

Rural wages and nonfarm employment are modeled as functions of growth in agricultural production as well as in public investment variables. Numerous studies have shown the important linkage between agricultural and nonagricultural growth. Ignoring the effect of public investment on rural poverty through this linkage could lead to underestimation of the poverty reduction effects of government investment in agriculture. A similar downward estimation bias could arise from overlooking the impact of improved infrastructure and education on wages and employment.

In addition to its ability to track the relevant linkages between public investments and rural poverty, a systems approach enables other endogenous variables to be properly specified. Once the model is estimated, the marginal effects of public investment variables on growth and poverty reduction can also be calculated by totally differentiating the equations system with respect to each public investment variable.

Returns to Public Investments in India[2]

In India, the analysis was based on district-level data, and districts were classified into three categories: irrigated, high-potential rainfed, and low-potential rainfed. Districts were defined as irrigated if more than 25% of the cropped area was irrigated. Rainfed districts were subdivided into high- and low-potential areas according to their agroecological characteristics. Table 1 shows the incidence of rural poverty for the three land types in 1972, 1987, and 1993. Poverty has been measured as the percentage of the rural population falling below the official poverty

[1] For more details about the methodology, refer to Fan, Hazell, and Thorat; and Fan, Zhang, and Zhang.

[2] The section is a summary from Fan and Hazell, and Fan, Hazell, and Haque.

Table 1. Poverty Changes by Type of Region, Rural India

		Irrigated Areas	Rainfed Areas		
			Total	High-Potential	Low-Potential
Percentage of poor in total population (%)	1972	39	52	59	47
	1987	32	46	48	44
	1993	28	39	44	36
Number of poor (millions)	1972	37	155	80	75
	1987	35	167	79	88
	1993	30	154	78	76
Number of poor per thousand hectares of geographic area (millions)	1972	862	880	1,680	583
	1987	813	951	1,660	688
	1993	705	878	1,629	599

Sources: Fan and Hazell.

line (Rs 15 per capita per month at 1960–61 prices) for each region.

In 1993, there were 184 million rural poor in the areas covered by the dataset (which covers about two-thirds of the total rural poor), and this total had hardly changed since 1972 when there were 192 million rural poor (table 1). Of the 184 million rural poor in 1993, 154 million (or 84%) lived in rainfed areas. These were distributed almost equally between high- and low-potential rainfed areas, a feature that has also not changed since 1972. The density of poor people is highest in the high-potential rainfed areas; 1,629 poor people per thousand hectares of geographic area in 1993, compared to 705 in irrigated areas and 599 in low-potential rainfed areas. The percentage of the rural population living in poverty is also highest in the high-potential rainfed areas (44% in 1993), and lowest in the irrigated areas (28%). The poverty shares declined by 25–30% between 1972 and 1993 in all three types of areas, but more because of population growth than because of any decline in the number of rural poor. The large number of rural poor remaining in rainfed areas represents a continuing challenge for India's policymakers, and highlights the importance of investing more in these areas.

The model was estimated using district-level data for 1970–95 and then used to calculate the impact on growth and poverty of another unit of each type of investment by land type. The results are shown in table 2.

For every investment, the highest marginal impact on agricultural production and poverty alleviation occurs in one of the two rainfed lands, whereas the irrigated areas rank second or last. Moreover, many types of investments in low-potential rainfed lands give some of the highest production returns, and all except education have some of the most favorable impacts on poverty. For example, the marginal impact of HYVs on production is much larger in high- and low- potential rainfed areas (Rs 243 and 688 per hectare of HYVs adopted, respectively) than in irrigated areas (Rs 63 per hectare). HYVs also contribute more to poverty alleviation in rainfed areas; another hectare of HYVs raises 0.02 and 0.05 persons above the poverty line in high- and low-potential rainfed areas, respectively. Although these varieties are often harder to develop for rainfed areas, the potential economic and social gains when successes occur are clearly quite high. Roads have sizeable productivity impacts in all three types of areas, but a much larger impact on poverty alleviation in rainfed areas, particularly the low-potential rainfed lands. Rural electrification and education have their biggest productivity impacts in rainfed areas, and they also impact favorably on the poor in these areas. Their impacts in irrigated areas are very small. Canal irrigation has its biggest productivity and poverty impacts in high-potential rainfed areas, whereas private irrigation has its biggest impacts in low-potential rainfed areas.

These results provide strong support to the hypothesis that investments in less-favored areas are becoming win-win opportunities and that more investment should now be channeled to less-favored areas in India.

Table 2. Marginal Returns to Public Investments in Rural India

Investment	Irrigated Areas	High-Potential Rainfed Areas	Low-Potential Rainfed Areas
	Production Return in Rupees per Unit of Investment		
HYV	63	243	688
Roads	100,598	6,451	136,173
Canal irrigation	938	3,310	1,434
Private irrigation	1,000	(2,213)	4,559
Electrification	(546)	96	1,274
Education	(360)	571	102
	Number of Poor Lifted Out of Poverty per Unit of Investment		
HYV	0.00	0.02	0.05
Roads	1.57	3.50	9.51
Canal irrigation	0.01	0.23	0.09
Private irrigation	0.01	(0.15)	0.30
Electrification	0.01	0.07	0.10
Education	0.01	0.23	0.01

Sources: Fan and Hazell.

Note: Production returns for high-yielding varieties, canal irrigation, private irrigation, and electrification are given in rupees per hectare affected by investment. Production returns for roads are given in rupees per kilometer of road built, and for education, in rupees per worker made literate. Poverty reduction returns for high-yielding varieties, canal irrigation, private irrigation, and electrification are given in number of persons lifted out of poverty per hectare affected by investment. Poverty reduction returns for roads are given in number of persons lifted out of poverty per kilometer of road built, and for education, in number of persons lifted out of poverty per worker made literate. The numbers in parentheses are negative. In most cases, these negative coefficients were not statistically significant.

Returns to Public Investments in China[3]

In a similar study of China, three regions were defined: the coastal, central, and western regions. The coastal region is the most fertile, with good rainfall, and can be classified as a high-potential region.[4] The western region is the least developed and has poor natural resources and social infrastructure; it is a low-potential area. The central region falls between the other two, and from an agricultural perspective can be considered a mid-potential area. More than 60% of the rural poor lived in the western region in 1996, and most of the rest lived in the central region. Given the low population density in the western region, the poverty incidence is much higher than the national average (table 3).

Using a similar model as for India and province-level data for 1970–97, the agricultural production and poverty impacts of additional investments were estimated for each region (table 4). All investments have their biggest impact on poverty in the low-potential western region and their second-biggest impact in the mid-potential central region. The high-potential coastal region ranks second or third for all investments. Most investments also have their highest production returns in either the central or western region, showing that investments in these regions are now win-win strategies. However, the production returns are mostly larger in the central rather than the western region, suggesting that some trade-off exists between growth and equity goals in allocating investments between mid-potential and low-potential areas.

Irrigation investments yield their highest production return in the coastal region, but their poverty impact is minimal. In contrast, agricultural R&D has both the biggest production and poverty impacts in the western region.

Conclusions

To promote economic growth and to redress poverty, policy makers in developing countries will need to promote agricultural intensification for both high- and low-

[3] This section is a summary of Fan, Zhang, and Zhang.

[4] The coastal region includes the following provinces: Hebei, Liaoning, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong, and Guangxi. The central region contains Shanxi, Inner Mongolia, Anhui, Jiangxi, Henan, Hubei, and Hunan. The remaining provinces are classified as western region. Tibet is excluded due to the lack of data. Hainan is included in Guangdong Province. Beijing, Shanghai, and Tianjin are excluded because of their small share of rural areas and population.

Table 3. Social Development, Productivity, and Poverty by Region in Rural China

	High-Potential Coastal Region	Mid-Potential Central Region	Low-Potential Western Region	National
		1985		
Illiteracy rate (%)	22.5	28.0	35.8	28.0
Years of schooling	4.8	5.1	4.5	5.1
Road density (km/1000km^2)	221.9	122.9	69.1	111.1
Irrigation (%)	58	36	40	44
Labor productivity (Yuan/person)	707.3	718.8	465.3	645.6
Annual rainfall (mm)	1097.6	716.7	506.9	
Number of poor (million)	10.8	30.4	59.5	100.8
Incidence of poverty (%)	4.5	12.5	35.8	15.5
		1996		
Illiteracy rate (%)	8.6	11.4	19.8	12.1
Years of schooling	6.9	6.6	6.1	7.0
Road density (km/1000km^2)	306.2	136.6	81.5	138.3
Irrigation (%)	62	45	46	51
Labor productivity (yuan/person)	1116.0	990.7	611.9	928.2
Annual rainfall (mm)	1127.3	686.6	506.9	
Number of poor (million)	5.9	12.7	31.6	50.2
Incidence of poverty (%)	1.9	3.5	14.3	5.6

Sources: Fan, Zhang, and Zhang.

potential regions. This dual strategy will be particularly challenging if government budgets for investment in agriculture and rural areas continue to remain tight, and striking the right investment balance between irrigated and rainfed regions, and between high- and low-potential rainfed areas will be particularly important. Investments in irrigated and high-potential rainfed areas cannot be neglected because these areas still provide much of the food needed to keep prices low, and to feed growing livestock and urban populations.

On the other hand, the poverty, food security, and environmental problems of many low-potential areas are likely to remain seri-

Table 4. Marginal Returns to Public Investments in Rural China

Investment	High-Potential Coastal Region	Mid-Potential Central Region	Low-Potential Western Region
Returns to Agricultural GDP	Production Returns in Yuan per Yuan Invested		
R&D	8.60	10.02	12.69
Irrigation	2.39	1.75	1.56
Roads	1.67	3.84	1.92
Education	3.53	3.66	3.28
Electricity	0.55	0.63	0.40
Rural telephone	1.58	2.64	1.99
Returns to Poverty Reduction	Number of People Lifted Out of Poverty per 10,000 Yuan Invested		
R&D	1.99	4.40	33.12
Irrigation	0.55	0.77	4.06
Roads	0.83	3.61	10.73
Education	2.73	5.38	28.66
Electricity	0.76	1.65	6.17
Rural telephone	0.60	1.90	8.51

Sources: Fan, Zhang, and Zhang.

ous in the decades ahead as populations continue to grow. Whereas out-migration and economic diversification should become increasingly important in the development of most low-potential areas, agricultural intensification will often offer the only viable way of raising incomes and creating employment on the scale required in the near future.

The size of the potential trade-offs between investing in high- and low-potential areas have yet to be widely quantified, and it is possible that they may be changing. Productivity levels in many high-potential areas have reached a plateau, whereas at the same time recent agricultural research in some low-potential rainfed areas is suggesting new avenues for increasing their productivity. The IFPRI studies reported here for India and China suggest that investments in rural infrastructure, agricultural technology, and human capital are now at least as productive in many rainfed areas as in irrigated areas, and they have a much larger impact on poverty. These results raise the tantalizing possibility that greater public investment in some low-potential areas could actually offer a win–win strategy for addressing productivity and poverty problems.

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