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9-2

# **Linkages between Government Spending, Growth, and Poverty in India and China**

By:  
Shenggen Fan

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Edited by:

Per Pinstrup-Andersen ([globalfoodsystem@cornell.edu](mailto:globalfoodsystem@cornell.edu)) and Fuzhi Cheng  
Cornell University

In collaboration with:

Søren E. Frandsen, FOI, University of Copenhagen

Arie Kuyvenhoven, Wageningen University

Joachim von Braun, International Food Policy Research Institute

## Executive Summary

The objective of this case study is to present a synthesis of the links between government spending—in areas such as agricultural research and development (R&D), irrigation, rural education, and infrastructure (including roads, electricity, and telecommunications)—and economic growth and poverty reduction in China and India. The findings of this case study are intended to help explain how government spending on key investments can help meet the broader policy goals of improved growth and reduction in poverty through various channels. The study, using a common framework, seeks to broaden and deepen understanding of the mechanisms through which government investment results in pro-poor economic growth.

The overall picture for public investment can be summarized as follows:

- Using state-level data for India over time, the study found that many types of government spending have resulted in reductions in rural poverty, and most have also contributed to growth in agricultural productivity. Different kinds of spending, however, have different effects on poverty and productivity. Rural roads and agricultural research have the largest impact on agricultural growth and poverty reduction. Many investments in rainfed areas of eastern India offer the largest impact on rural poverty, but also contribute to higher growth in comparison with investments in the more-favored irrigated areas.
- Using provincial data over time, the study shows that for China, government investment in agricultural R&D and rural education have had the largest impact on both growth and poverty reduction. To eliminate the remaining poverty in China, the government should place the highest priority on public investment in western China, where the majority of the poor reside, because the marginal returns to public investments, in terms of poverty reduction, are higher there than in other regions.

Your assignment is to recommend a public sector investment strategy for rural infrastructure to be considered by the government of one of the two countries discussed in this case.

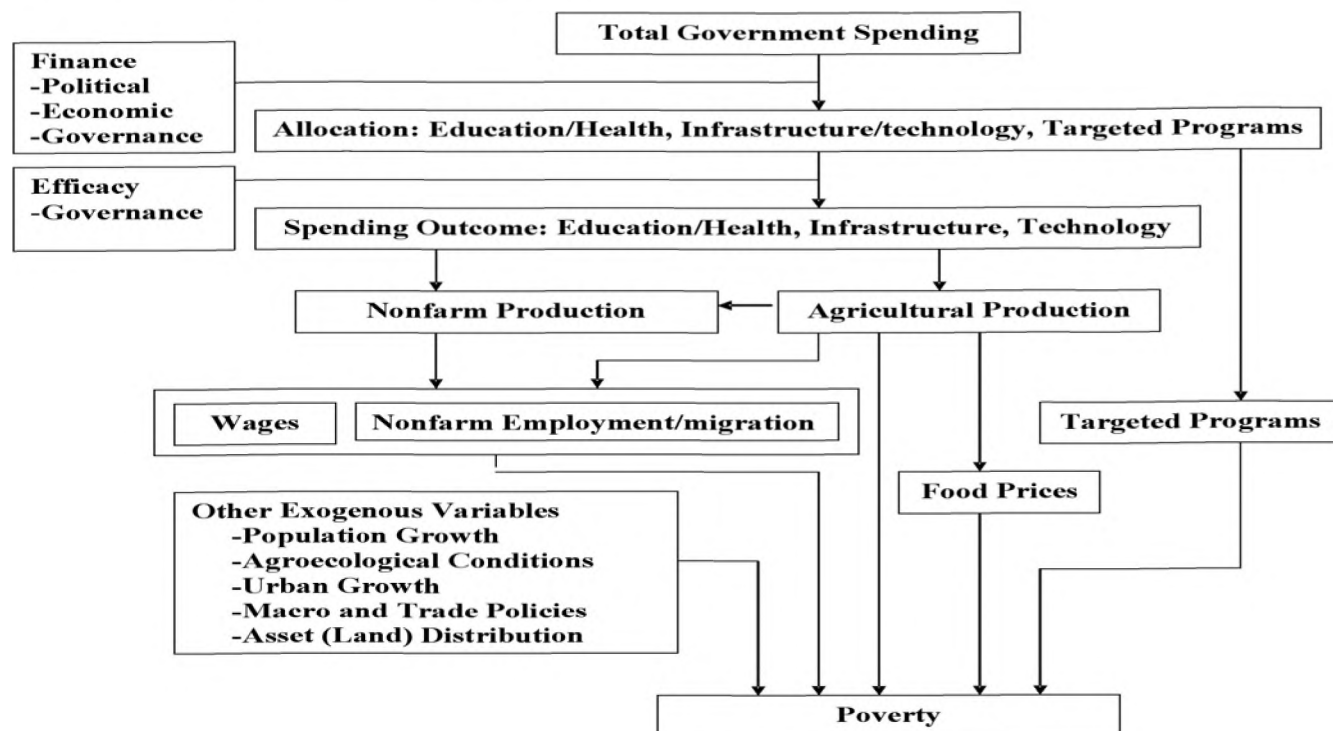
## Background

### Investment in Infrastructure, Technology, and Human Capital and Impact on Poverty: Conceptual Framework

The aim of this case study is to improve understanding of the relationship between government spending and poverty reduction through long-term growth by reviewing issues and synthesizing findings of major studies from the International Food Policy Research Institute (IFPRI). As shown in Figure 1, public spending affects poverty reduction through different channels. Understanding these channels will enable policymakers to design more effective policies. This case study analyzes the impact of differential spending and investment strategies not only on economic growth, but also on poverty reduction and regional inequality. Additionally, it distinguishes the effects by geographic region.

This case study considers public spending at different levels of government that leads to long-term growth through which the poor benefit. This type of spending is very different from targeted welfare or social safety net programs. This case study first reviews a framework for assessing public investment for poverty reduction. Particular attention is paid to how public investment affects rural poverty through various channels. This study then uses selected case studies to illustrate how different types of public investment can have differential impacts. Finally, this paper discusses the policy issues and offers policy options for a public investment strategy to achieve the twin goals of economic growth and poverty reduction.

Figure 1: Government Spending and Rural Poverty



### How Does Public Investment Affect Rural Poverty?

Public investment affects rural poverty through many channels, as depicted in Figure 1. For example, public investment in agricultural research, rural education, and infrastructure increases agricultural productivity, which directly increases farmers' incomes and reduces rural poverty. Indirect impacts come from higher agricultural wages and improved nonfarm employment opportunities induced by growth in agricultural productivity. Increased agricultural output from rural investment often leads to lower food prices, again helping the poor indirectly because they are often net buyers of food grains. Redistribution of land caused by higher agricultural growth also affects rural poverty. Public investments in rural education, health, and infrastructure not only have indirect effects on wages, nonfarm employment, and migration through increased productivity, but also directly promote rural wage increases, nonfarm employment, and migration, thereby reducing rural

poverty. For example, improved infrastructure access will help farmers set up small rural nonfarm businesses such as food-processing and marketing enterprises, electronics repair shops, transportation and trade, and restaurants.

Investments in rural sectors not only contribute to growth, employment, and wages in rural areas, but also help the development of the national economy by providing labor, human and physical capital, cheaper food, and markets for urban industrial and service development. Growth in the national economy reduces poverty in both rural and urban sectors. Understanding these different effects provides useful policy insights for improving the effectiveness of national poverty reduction strategies. In particular, an understanding of these effects shows how public investment can be used to strengthen weak links between poverty reduction channels and thus to target public resources more efficiently. More efficient targeting has become increasingly crucial as many developing countries have committed to achieving poverty reduction goals using

the Millennium Development Goal (MDG) framework with limited public resources.

### Channels through Which Public Investment Affects Rural Poverty

*Agricultural growth.* This section will focus on the evidence of poverty reduction impacts of agricultural growth for the following reasons: (1) the majority of the world's poor live in rural areas and a large share of their income is derived from agriculture; (2) growth in agriculture contributes to poverty reduction indirectly through increased rural wages and farm and nonfarm employment; and (3) agricultural growth may also contribute to poverty reduction in urban areas by lowering food prices for urban residents and contributing to national economic growth.

The most remarkable evidence on the poverty reduction effects of agricultural growth probably comes from the Green Revolution in South Asia from the late 1960s to the 1980s. In the late 1960s, the incidence of rural poverty in India fluctuated widely between 50 and 60 percent. The Green Revolution, based on the widespread use of high-yielding varieties (HYVs) developed jointly by national and international agricultural research centers, began in the mid-1960s. Over the next two decades farmers' wheat and rice yields doubled, tripled, or even quadrupled. The incidence of rural poverty declined from 64 percent in 1966 to 34 percent in 1989.

There is also strong evidence of the effect of growth on poverty in rural China, which has seen a tremendous reduction in poverty over the past three decades. The number of poor declined from 260 million in 1978 to 26 million in 2004 (Ministry of Agriculture of China 2005). The fastest reduction occurred during the initial phase of rural reforms from 1978 to 1984, which was highly correlated with agricultural growth stemming from institutional and policy changes in agricultural production. Between 1984 and 1989, however, rural poverty began to rise and is attributed to stagnation of agricultural growth during this period. The Chinese evidence convincingly shows that whenever agricultural growth is strong, poverty falls rapidly, and whenever agricultural growth is lacking, poverty reduction is slow.

In summary, agricultural growth is conducive to poverty reduction. The patterns of growth, however, and its distributional impacts also matter. Better distribution of production assets and more growth in the less-developed areas and in small farm sectors will foster more poverty reduction for the same rate of agricultural growth.

*Rural wages.* In the majority of developing countries, the bulk of poor people are either landless or live on small farms with inadequate land to meet their food needs. As such, they depend heavily upon the only available factor of production—labor. The poor gain from economic growth by increasing their productivity if they own land, by participating in the labor market, or both. For example, with the advent of the Green Revolution in India, the poor took advantage of extra labor demand and higher wages. Another factor of production—land—is also crucial in giving small-scale and landless farmers access to rural wages. Thiesenhusen and Melmed-Sanjack (1990) found that land distribution from large-scale farmers to small-scale farmers sharply increased family labor use per hectare and, to a lesser extent, labor hired per hectare.

Thus, improvement in wages has strong linkages to rural poverty. Public investment in infrastructure, health, and education promotes these wages by supporting agricultural productivity and nonfarm employment activities.

*Nonfarm employment.* Traditional rural households in developing countries are viewed mainly as agricultural producers and agricultural wage laborers. There is increasing empirical evidence, however, that rural households often diversify their activities, with nonagricultural sources of income often contributing significantly to household incomes. For the poor, different forms of nonfarm employment are a source of supplementary income and are ways to diversify and spread risk across a number of livelihood strategies. For the nonpoor, nonfarm activities are an avenue to generate more income and assets in addition to other factors of production such as land, capital, and technology.

Research evidence shows that nonfarm activities are generally associated with reduced levels of absolute poverty. Newman and Canagarajah (2000) concluded that between 1988 and 1992 poverty reduction in Ghana can be attributed mainly to



improvements in both average levels of income and the pattern of its distribution in the informal and nonfarm sectors in cities other than Accra and in rural areas outside Accra. Datt and Ravallion (1997) showed that growth in nonfarm output, in addition to growth in agricultural output, played an important role in reducing poverty across Indian states. The impact of the nonfarm economy on inequality is less clear-cut. A recent study of Ecuador explores these questions directly (Elbers and Lanjouw 2001). One key finding is that irrespective of income inequality, employment shares in both high-productivity and low-productivity nonfarm activities are associated with sharply lower absolute poverty rates. Thus, although inequality and poverty are clearly related, they are not equivalent. The authors suggest that the high-productivity subsector acts as an engine of growth by lifting the poor out of poverty either directly or by generating higher wage rates, while the low-productivity subsector acts as a safety net that helps prevent more households from falling below the poverty line.

*Migration.* Public investment can have a large impact on both rural-to-rural and rural-to-urban migration. For example, the Green Revolution in South Asia was initially concentrated in irrigated regions and only later spread to more favorable rainfed areas. Technological change, therefore, can contribute to widening disparities between regions. Worse, if technology leads to lower production costs per unit of output in the adopting regions, producer prices may fall, leaving non-adopting regions with lower prices and stagnant yields, so that their incomes actually decline. Interregional migration acts to buffer these gaps and provides an efficient way of spreading the benefits to poorer regions with limited agricultural growth potential.

In such instances, migrants leave their villages to settle permanently or temporarily in other parts of the country where there is a need for surplus labor or where there is a substantial increase in productivity. In India many people, both landless and land-owning, came to Haryana and Punjab from neighboring states such as Bihar because of the increased productivity of high-yielding crop varieties and the subsequent increase in labor demand. In the case of this so-called seasonal migration, these migrants would then return to their own villages. It is estimated that the Green Revolution led to seasonal migration of more than a million agricultural

workers each year from the eastern states to Haryana and Punjab (Westley 1986).

Similarly, in China, it is estimated that there were more than 150 million rural migrants working in various urban sectors in 2004, whereas this number was negligible 20 years ago (Ministry of Agriculture of China 2005). Such a large-scale relocation of population has reduced the large number of poor in rural areas and contributed to much of the rapid economic growth of the past three decades. The migration from rural to urban areas and from agricultural to nonagricultural sectors in rural China accounted for 14 percent of total poverty reduction and an even larger share of income growth in rural China from 1978 to 1997.

*Land distribution.* Improvement in the asset base of the poor is viewed as one of the ways to lift them out of poverty, which in a poor agrarian economy means improving access to land. The relationship between agricultural growth and land distribution has been debated over the past several decades. The consensus is that better land distribution through land reform not only improves income distribution, and consequently poverty reduction, but also helps agricultural growth, which in turn alleviates poverty. The effect of agricultural growth on land distribution, however, has been less clear-cut. In fact, one of the earliest controversies about the Green Revolution concerned whether higher agricultural growth worsened land distribution.

Critics argue that large farm owners who had better access to irrigation water, fertilizers, seeds, and credit were the main adopters of new technologies and that smallholders were either unaffected or made worse off because the Green Revolution resulted in lower product prices, higher input prices, and attempts by owners to increase rents or force tenants off the land. A recent study by Fan, Hazell, and Thorat (1999) using state-level data from India for several decades found that both relationships—between changes in poverty and land distribution, and between agricultural growth and changes in land distribution—have been very weak. The fact that agricultural growth did not contribute to worsening land distribution, however, does not mean that rural poverty is not correlated with land ownership. The rural poor are still either landless laborers or smallholders today. Therefore, future growth must be ensured to benefit these landless or marginal landholding peasants.

*Food prices.* Public investment in rural areas can lead to an increase in aggregate agricultural output, and this increased output will in turn reduce food prices. This process has proved to be one of the most important ways through which rural and urban poor people are affected by public investment (Scobie and Posada 1978; Fan, Fang, and Zhang 2003; Fan 2003). The impact of reduced food prices is particularly important for the urban poor, who often spend more than half of their income on food. These price reductions may not be very large in an open economy with low transport costs. Indeed, owing to recent liberalization policies, many more countries now fall into this category than previously. Nonetheless, many poor countries still face high transport costs because of poor infrastructure, remoteness from world markets, or inefficient marketing institutions, and these countries may face considerably higher endogenous domestic prices even after market liberalization. For example, in many Asian countries, such as China and India, and in landlocked African countries, domestic prices still fall sharply when domestic food production increases suddenly. Furthermore, the prices of many traditional food crops also continue to be endogenously determined within countries because they are not traded on world markets.

The impact of reduced food prices on rural poverty, however, largely depends on whether the rural poor are net sellers or buyers of food. In the case of China, the majority of the rural poor are net sellers of food. Fan, Zhang, and Zhang (2004) found a strong relationship between lower food prices and higher rural poverty in China. In this case, the lower food prices resulting from public investment may offset certain benefits of poverty reduction, although the net impact of public investment on rural poverty reduction is enormous. Ignoring the price effects would lead to overestimation of the poverty reduction effects.<sup>1</sup> On the other hand, many of India's rural poor are net buyers of food because of land constraints. As a result, they benefit from lower food prices induced by public investment.

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<sup>1</sup> How much net sellers will gain from increased productivity depends on the relative magnitude of demand and supply elasticities.

## The Case of India

*Background on government expenditure, agricultural growth, and rural poverty.* India is a federal country, with the national constitution defining the spheres of responsibility in making laws and exercising executive power between the central government and the Parliament, on the one hand, and the state governments and legislatures, on the other. In agriculture and related activities, the predominant responsibility for legislation and exercise of executive power lies with the state governments, whereas the central government has exclusive responsibility only for interstate rivers and for fisheries outside territorial waters. Even expenditures on agricultural research, on which the central government spends more than all the states put together, are disbursed through the states.

State governments are responsible for irrigation, power, agriculture, animal husbandry, dairy, soil conservation, education, health, family planning, rural development, forests, and more. Thus, it is important to look at the trends in state government expenditures.

State government spending has grown substantially in recent decades, with a fivefold increase in real terms between the early 1970s and the early 1990s. The rate of increase slowed, however, from 8 percent a year during the 1970s and 1980s to 3.14 percent a year in the early 1990s. The expenditure items that grew most rapidly during the period 1970–1993 were social welfare and rural development. In terms of composition, 75 percent of total state government spending went to development expenditures, and the remaining 25 percent went to nondevelopment expenditures. Since the 1980s, the share of agriculture in total expenditure has declined from 30 percent to 20 percent, and irrigation's share has also declined.<sup>2</sup> In contrast, expenditure on rural development programs has expanded from 6.3 to 16.4 percent of total economic services, suggesting that resources may have been reallocated away from productivity-enhancing investments to those that have a much lower

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<sup>2</sup> In 2004 China was the largest spender on agriculture among all developing countries, followed by India. India accounted for 27 percent of total spending on agriculture in all developing countries included in the IFPRI government spending dataset (44 countries). Together, China and India accounted for 70 percent of total agricultural spending in developing countries (Fan 2007).

impact on agricultural productivity and production growth.

*Technology, infrastructure, and productivity trends.* One of the most significant changes in Indian agriculture during the past few decades has been the widespread adoption of high-yielding varieties (HYVs). During the Green Revolution the crop area planted to HYVs for five major crops (rice, wheat, maize, sorghum, and pearl millet) increased from less than 17 percent in 1970 to 40 percent in 1980. The percentage reached 55 percent by 1994.

Although HYVs have been one of the major engines of productivity growth in Indian agriculture, irrigation has also been an important factor. For all of India, the percentage of cropped area that is irrigated increased from 23 percent in 1970 to 33 in 1988. In recent years, however, the increase has been marginal.

One of the greatest achievements in the development of rural India has been the rapid increase of electrification. In 1970 only 34 percent of villages in rural India had access to electricity, and by 1995 the percentage had increased to almost 90 percent. This rapid increase in electrification contributed not only to agricultural productivity growth by encouraging more irrigation, but also to reductions in rural poverty through the generation of non-agricultural employment opportunities.

The literacy rate in rural India increased steadily from 23 percent in 1970 to 40 percent in 1995, but with great regional variation. Similarly, road density in rural India, as measured in kilometers per thousand square kilometers of geographic area, increased from 2,614 in 1970 to 5,704 in 1995, a growth rate of more than 3 percent a year.

As a result of India's rapid adoption of new technologies and improved rural infrastructure, agricultural production and factor productivity have grown quickly. Overall agricultural production for India grew at 2.64 percent per year between 1970 and 1995. During the 1970s production growth was relatively low, at an annual average of 1.95 percent per year. During the 1980s it grew at 3.79 percent per year—much faster than most other developing countries during the same period. Since 1990 production growth has slowed to only 3.17 percent per year. Similarly, total factor productivity (TFP),

defined as aggregate output minus aggregate inputs, grew at an annual average rate of 1.75 percent between 1970 and 1995. In the 1970s TFP showed no improvement, but it grew by 2.52 percent during the 1980s. Since 1990 TFP growth in Indian agriculture has continued to increase but at a much slower rate of 2.29 percent per year. The correlation between productivity growth and poverty reduction is very high, implying that productivity growth may be a more important determinant than production growth for explaining poverty reduction.

*Rural poverty trends.* The head-count ratio, defined as the percentage of rural population falling below the poverty line,<sup>3</sup> is used to measure poverty. Rural poverty fluctuated between 50 and 65 percent in the 1950s and early 1960s, before beginning to decline from the mid-1960s until the late 1980s. It fell from about two-thirds to one-third of the rural population. In the early 1990s it increased to about 40 percent during the implementation of policy reforms but declined again in 1993.

The long downward trend in rural poverty over the period 1967 to 1989 can be attributed to several important factors. As already mentioned, the rapid adoption of HYVs together with improved irrigation increased agricultural productivity growth during this period. This change in technology was a direct result of increased government investment in agricultural research and extension, infrastructure, irrigation, and education during the 1960s, 1970s and 1980s. The stagnation in agricultural productivity growth and the increase in rural poverty observed during the early 1990s were due to reduced government expenditures in rural areas during this period.

### Major Findings: Marginal Impact of Government Spending on Rural Poverty and Agricultural Productivity

Table 1 shows the total effect of government spending on rural poverty and agricultural productivity growth. Two measures are constructed. The first measure is the elasticity of each item of government spending, which shows the percentage change in poverty or productivity corresponding to a 1 percent change in government expenditure

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<sup>3</sup> This is defined as Rs 49 of income per month at 1973–1974 prices.

*Table 1: Effects of Additional Government Expenditures on Poverty and Productivity in India, 1993*

Expenditure variable	Elasticities				Marginal impact of spending Rs 100 billion at 1993 prices				Number of poor reduced /Rs million spent	
	Poverty		TFP		Poverty		TFP			
					(percent)					
R&D	-0.065*	(2)	0.296*	(1)	-0.48*	(2)	6.98*	(1)	91.4*	(2)
Irrigation	-0.007	(5)	0.034*	(4)	-0.04	(6)	0.56*	(3)	7.4	(5)
Roads	-0.066*	(1)	0.072*	(2)	-0.87*	(1)	3.03*	(2)	165.0*	(1)
Education	-0.054*	(3)	0.045*	(3)	-0.17*	(3)	0.43*	(4)	31.7*	(3)
Power	-0.002	(6)	0.0007	(5)	-0.015	(8)	0.02*	(5)	2.9	(7)
Soil and water	-0.0004	(7)	0	(6)	-0.035*	(7)	0	(6)	6.7*	(6)
Rural development	-0.019*	(4)	n.a.		-0.15	(5)	n.a.		27.8*	(4)
Health	-0.0007	(8)	n.a.		-0.02	(4)	n.a.		4.0	(8)

Source: Fan, Hazell and Thorat, 1999

Note: Numbers in parentheses are ranks. TFP is total factor productivity. n.a. is not available.

\* denotes significant at the 5 percent level.

on that item. The second measure is the marginal return for an additional Rs 100 billion of government expenditure. The second measure is more useful because it compares the relative benefits of equal incremental increases in expenditures and thus provides crucial information for policy makers as they set government spending priorities to further increase productivity and reduce rural poverty.

The results show that government expenditure on roads had the largest impact on rural poverty. If the government increased investment in roads by Rs 100 billion, the incidence of rural poverty would be reduced by 0.9 percent. Further, for each Rs 1 million increase in investment in roads, 165 poor people would be lifted above the poverty line. These impacts on poverty are nearly twice as large as those of the next-best poverty reducer—government investment in agricultural research and development (R&D).

Investment in roads not only reduces rural poverty through productivity growth, but also increases nonagricultural employment opportunities and leads to higher wages. The productivity effect accounts for 24 percent of the total impact on poverty, nonagricultural employment accounts for 55 percent, and increases in rural wages account for the remaining 21 percent.

Government investment in agricultural R&D had the second-largest impact on rural poverty but the largest impact on growth in TFP. Another Rs 100 billion of investment in R&D would increase TFP growth by almost 7 percent and reduce the incidence of rural poverty by 0.5 percent. Moreover, another Rs 1 million spent on R&D would raise 91 poor people above the poverty line. R&D has a smaller impact on poverty than roads because it affects poverty only through improved productivity, and it has not been particularly targeted to the poor by the government.

Government spending on education had the third-largest impact on rural poverty reduction. An additional Rs 1 million spent on education would raise 32 poor people above the poverty line. Most of this effect comes through greater nonfarm employment opportunities and increased wages.

Government expenditure on rural development had the fourth-largest impact on poverty reduction. An additional Rs 1 million of expenditure would raise 28 people above the poverty line. Unlike other investments, however, rural development expenditures had no distinct impact on TFP growth in agriculture and thus do not provide a long-term solution to the poverty problem. Government expenditures on soil and water conservation and health had small impacts on rural poverty and no



discernible impact on agricultural productivity growth.

### Summarizing the Main Findings

The results show that government spending on productivity-enhancing investments (especially agricultural research and extension), rural infrastructure (especially roads and education), and rural development targeted to the rural poor all contributed to reductions in rural poverty, and most of them also contribute to growth in agricultural productivity. But their effects on poverty and productivity differ greatly.

The study also estimated the marginal returns to agricultural productivity and poverty reduction from additional government investments on different technology, infrastructure, and social investments. Additional government expenditure on roads had the largest impact on poverty reduction as well as a significant impact on productivity growth. It is thus clearly a dominant strategy. Additional government spending on agricultural research and extension had the largest impact on agricultural productivity growth and also led to large benefits for the rural poor. Additional government spending on education had the third-largest impact on rural poverty, and additional irrigation investment had the third-largest impact on agricultural productivity growth. Moreover, additional government spending on rural development contributed to reductions in rural poverty, but its impact was smaller than expenditures on roads, agricultural R&D, and education. Finally, additional government expenditures on soil and water conservation and health had no impact on productivity growth, and their effects on poverty alleviation through employment generation and wage increases were negligible.

### The Case of China

*Background on government expenditure, growth, inequality, and rural poverty.* China is one of the few developing countries that has made remarkable strides in reducing the total number of poor people during the past two decades (World Bank 2000). Although economic reforms began in the late 1970s, it would have been impossible to achieve rapid economic growth and poverty reduction without several decades of government investment. The case study identifies the different channels

through which government investments affect growth, inequality, and poverty.

*Trends in growth, poverty, and income distribution.* Per capita income in rural China was extremely low before the reforms in 1978. In 1978 average income per rural resident was only about US\$150 (Fan, Zhang, and Zhang 2004). China was one of the poorest countries in the world, and 33 percent of the total rural population was below the poverty line, without access to sufficient food or income to maintain a healthy and productive life.

This situation changed dramatically after the introduction of rural reforms in 1978. Per capita income increased from 220 yuan in 1978 to 522 yuan in 1984, a growth rate of 15 percent a year. The income gains were shared widely enough to cut the number of poor, and by 1984 only 11 percent of the rural population remained below the poverty line. During the second stage of reforms (1985–1989), rural income continued to increase but at a much slower rate of 3 percent a year. This slowdown was mainly due to stagnation of agricultural production after the reforms. Over the same period rural income distribution became much less egalitarian, and the Gini index rose from 0.264 to 0.301. The ratio of per capita rural income in coastal regions to that in other regions also increased, from 1.21 to 1.51 (Zhang and Kanbur 2001). Because development of the nonfarm sector was concentrated mostly in the coastal areas, where per capita income was already high and poverty incidence much smaller than elsewhere, the number of poor increased from 89 million in 1984 to 103 million in 1989, a net gain of 14 million in five years.

Only in 1990 did rural poverty begin to decline again. The number of rural poor dropped 9 percent a year, from 103 million in 1989 to 50 million in 1997. Additionally, the rate of rural poverty reduction was faster than that of income growth (5 percent a year) during the period, showing that factors other than income growth were at play. In 1995 the government set a target of eliminating all rural poverty by 2000. To accomplish this objective, it introduced a series of policies and committed substantial financial resources.

Although rural residents earned less than half their urban cohorts in 1978, with the success of the reforms, that percentage increased to 59 percent in 1983. By 1997, however, it had declined to 40

percent, mainly owing to fast growth in urban areas and relatively sluggish rural earnings. Poverty in China is thus mainly a rural phenomenon, and the urban poor are relatively few (Park, Wang, and Wu 2002). In 1990 average per capita income among the poorest 5 percent of urban residents was 689 yuan—more than double the urban absolute poverty line of 321 yuan and greater than the per capita income of 65 percent of rural residents. Higher income levels accompanied by annual consumer food subsidies of at least 200 yuan per urban recipient left the urban population much better nourished than their rural counterparts.

*Why was the government antipoverty program so successful?* Before 1979 the major national objective of rural policy was to provide cheap food, capital, and labor for urban residents and industrial development. Urban and industrial-biased development strategies were implemented at farmers' expense. Hence, reducing rural poverty was not a priority of the government's policy agenda during the pre-reform period.

China's poverty alleviation strategy developed in three steps. Before 1984 social welfare programs were used mainly to subsidize poor families, and no formal strategy existed for reducing the number of poor in rural areas. From 1984 to 1995, the government pursued a strategy of regional targeting whose objective was to alleviate poverty by developing regional or local economies. Because the extremely poor were concentrated in remote areas with limited access to roads and other infrastructure, this regional development policy did not trickle down to them.

After 1996 the government adopted a food-for-work program intended to build the necessary infrastructure in poor rural areas. The scheme provided a fund through which roads, irrigation, and other projects were carried out by extremely poor farmers. Individuals employed on the projects sometimes received food or vouchers that could be exchanged for food and other necessities.

### Trends in Public Investment

*Patterns in R&D expenditure.* China invested about 10–13 percent of total R&D expenditures in agriculture during the past four decades. The

development of China's research personnel,<sup>4</sup> however, has not matched the pattern of funds allocated to research. By 1973 about 10,000 scientists worked in the Chinese system. From 1973 to 1990, the number of research personnel increased rapidly, to almost 60,000 researchers—an annual rate of growth of 10 percent. After 1995 the number of researchers declined marginally to about 53,000 in 1997.

The regional pattern of R&D expenditures reveals that the northwest region (Gansu, Shaanxi, Qinghai, Ningxia, and Xinjiang) spent much less than coastal areas, and expenditures of the former were stagnant or even declining in the 1990s.

Several studies have quantified the effects and returns of research investment on agricultural production (Fan and Pardey 1997; Fan 2000). Huang, Rozelle, and Rosegrant (1999) suggest that if China increased its investment in agricultural research and irrigation by 4.5 percent per year, it would become a net exporter of grains by 2020. With every 1 percent increase in agricultural research and irrigation investment, China could produce an additional 21 million metric tons of grain in 2010 and an additional 36 million metric tons in 2020.

*Irrigation.* Investment in irrigation increased negligibly from 1976 to 1990. During this period there was no increase in irrigated areas in Chinese agricultural production. In response to a grain shortfall and large imports in 1994–1995, the government increased its investment in irrigation in 1996 and 1997. Among all the regions, the northwest accounted for the largest increase in the 1990s, followed by the northern China Plain. Investment in the northeast and southwest remained stagnant during most of the 1990s.

*Education.* After 1978 China adopted the “nine-year compulsory schooling” education policy, which implied that all children had to attend school for at least nine years to finish both primary and junior high school. As a result of these efforts, the illiteracy rate of the general population 15 years and older declined from 48 percent in 1970 to less than 10 percent in 1997. Labor quality improved substantially and provided opportunities for farmers to use

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<sup>4</sup> Research personnel are defined as researchers who have at least a bachelor's degree and one to two years of research experience.

modern farming technology and to engage in non-farm activities in both rural towns and urban industrial centers.

Despite extraordinary success in basic education in China, many poor were not reached by government efforts. Illiteracy was highest in the western region to begin with, and its rate of decline was the lowest of all provinces. According to official statistics, in the poorer half of the townships of 35 counties supported by a World Bank project in Yunnan, Guizhou, and Guangxi, average enrollment was at least 10 percentage points lower than the national average for the same age group (Piazza and Liang 1998).

*Infrastructure.* Government investment in rural road construction increased very little over the period 1953 to 1976. Nonetheless, the length of roads increased gradually. After 1985 the government increased its investment in roads, particularly high-quality roads such as highways connecting major industrial centers in coastal areas.

The greatest achievement in rural China was the rapid increase in electrification. Investment in power increased 90-fold. The percentage of villages with access to electricity was 97 percent in 1996, and more than 95 percent of households had an electrical connection. This percentage was much higher than that of India in the same year.

Before 1980 government investment in rural telecommunications was very low. Investment increased from 3 million yuan in 1953 to 237 million yuan in 1980. Large-scale development occurred only during recent years, with the number of rural telephones increasing from 3.4 million in 1992 to 17.9 million in 1997. This increase was a result of both public and private investments in the sector. During the period 1980 to 1997, public investment in telecommunications alone increased more than 10-fold.

### Marginal Effects of Public Spending on Growth and Poverty Reduction

Table 2 shows the marginal effects of government spending on agricultural and nonagricultural production and rural poverty for the three regions and for China as a whole. The effects are measured as the returns in yuan or the number of poor people brought out of poverty per unit of spending in 1997. These measures are useful in comparing

the relative benefits of additional units of expenditure on different items in different regions for setting priorities for government expenditure to further increase production and reduce rural poverty.

For the country as a whole, government expenditure on education had the largest impact on reducing poverty. In addition, it had the second-largest return for agricultural gross domestic product (GDP), and the third-largest return for nonfarm GDP and overall rural GDP. Thus, investing more in education was the dominant “win-win” strategy. For every 10,000 yuan invested, some 30 percent more are brought out of poverty compared with R&D investments, which had the second-largest poverty reduction effect. Investment in agricultural R&D had the largest impact on agricultural GDP and overall rural GDP.

Government expenditure on rural infrastructure also made large contributions to poverty reduction. Among the infrastructure variables considered in the study, the impact of roads was particularly large. For every 10,000 yuan invested, 3.2 poor people were lifted above the poverty line. Roads thus ranked third in poverty reduction impact, after education and R&D. In terms of impact on growth, for every yuan invested in roads, 8.83 yuan in rural GDP was produced, only slightly less than the return on R&D investments. Roads also yielded the largest return to rural nonfarm GDP, at 6.71 yuan for every yuan invested, which was 35 percent higher than the return to education investment. With respect to agricultural GDP, the return to road investment ranked third, after R&D and education investments.

Although electricity investment showed low returns for both agricultural and nonagricultural GDP, it ranked fourth in poverty impact. For every 10,000 yuan invested, 2.3 people were brought out of poverty. For rural telephony, investments had favorable returns for both agricultural and non-agricultural GDP, and the impact on rural poverty was similar to that of electricity investments.

For the country as a whole, irrigation investment had a relatively negligible impact on rural poverty reduction, although its economic returns were still positive and higher than those for electricity investment. This low impact may occur because

*Table 2: Returns of Public Investments for Production and Poverty Reduction in China, 1997*

Public investment	Coastal region	Central region	Western region	Average
Returns to total rural GDP from investments in (yuan per yuan expenditure):				
R&D	8.60	10.02	12.96	9.59
Irrigation	2.39	1.75	1.56	1.88
Roads	8.38	13.73	4.29	8.83
Education	9.75	7.78	5.06	8.68
Electricity	1.52	1.35	0.61	1.26
Telephone	7.12	8.54	4.13	6.98
Returns to agricultural GDP from investments in (yuan per yuan expenditure):				
R&D	8.60	10.02	12.69	9.59
Irrigation	2.39	1.75	1.56	1.88
Roads	1.67	3.84	1.92	2.12
Education	3.53	3.66	3.28	3.71
Electricity	0.55	0.63	0.40	0.54
Telephone	1.58	2.64	1.99	1.91
Returns to nonfarm GDP from investments in (yuan per yuan expenditure):				
Roads	6.71	9.89	2.37	6.71
Education	6.22	4.13	1.78	4.97
Electricity	0.97	0.71	0.21	0.72
Telephone	5.54	5.91	2.14	5.07
Returns to poverty reduction from investments in (number of poor reduced per 10,000 yuan expenditure):				
R&D	1.99	4.40	33.12	6.79
Irrigation	0.55	0.77	4.06	1.33
Roads	0.83	3.61	10.73	3.22
Education	2.73	5.38	28.66	8.80
Electricity	0.76	1.65	6.17	2.27
Telephone	0.60	1.90	8.51	2.21
Poverty loan	0.88	0.75	1.49	1.13

Source: Fan, Zhang and Zhang 2004

Notes: The parameters from the productivity functions were used to compute the returns to GDP. The marginal returns were calculated by multiplying the production elasticities by partial productivity of each spending item.

irrigation affects poverty reduction solely through agricultural productivity.

With respect to rates of return for growth in agriculture, R&D investment had the highest returns in

the western region, whereas irrigation investment had the highest return in the coastal region. For education and rural infrastructure (roads, electricity, and telecommunications), the central region had the highest returns. In the coastal region, a



large amount of land had been converted for non-agricultural use owing to rapid industrialization. In contrast, land in the western region is more marginal, with limited water and soil quality. Therefore, major growth potential for agricultural production lies in the central region, where land is relatively scarce and agricultural production is still the main source of farmers' income. Not surprisingly, most government expenditures had their largest impact on rural nonfarm GDP in the coastal and central areas.

### Impact on Regional Inequality

The contributions of each of the factors of production to inequality in agricultural, nonagricultural, and total labor productivity are assessed. Regional inequality in agricultural labor productivity has not changed much. The contributions of three conventional inputs (capital, labor, and land) declined, whereas the contributions of most public investments, especially R&D, electrification, and telephones, increased. Public investment's contribution to regional inequality in agricultural labor productivity increased from 11 percent to 22.1 percent during the period.

In contrast to agricultural productivity, regional inequality in nonagricultural labor productivity almost doubled. Public investment's contribution to regional inequality in nonagricultural labor productivity increased by 118 percent from 14.4 percent to 30.5 percent during the period.

The contribution of all the inputs to overall inequality was also assessed. Capital's contribution to worsening regional inequality increased from 8.5 percent to 22 percent, although its shares in the inequality of agricultural and nonagricultural labor productivity changed negligibly. This change was probably due to a structural shift in capital from agricultural to nonagricultural production in the economy, because rural industry is more capital intensive than agriculture. Similarly, irrigation accounted for a decreasing share of overall inequality. The contributions of roads, agricultural R&D, electricity, and telecommunications increased significantly. These results thus suggest a regionally biased public investment strategy over the past two decades. The coastal region enjoyed the most favorable investment from the government.

### Summarizing the Main Findings

The results of the case study show that government spending on production-enhancing investments, such as agricultural R&D and irrigation, rural education, and infrastructure, all contributed to agricultural productivity growth and reduced regional inequality and rural poverty. Variations in their marginal effects on productivity growth, however, were large.

Government spending on education had the largest impact on poverty reduction and very high returns for growth in agriculture and the nonfarm sector, as well as for the rural economy as a whole. Among all the types of investments, additional spending on education in the less-developed areas also had the largest effect in reducing regional inequality.

Government spending on agricultural research and extension improved agricultural productivity significantly. This type of expenditure also had the largest returns to growth in agricultural production and overall production in the rural economy.

Government expenditure on rural telecommunications, electricity, and roads also had substantial marginal impact on rural poverty reduction. These poverty reduction effects came from improved nonfarm employment and increased rural wages. Road investment had the largest return to GDP growth in the nonfarm economy and the second-largest return to the overall rural economy, which was only slightly lower than R&D investment.

Irrigation investment had a modest impact on growth in agricultural production and even less impact on rural poverty reduction. Across regions, additional investments in the western region contributed most to reducing poverty and regional inequality, because most of the poor were concentrated here. The poverty reduction effect of spending on education, agricultural R&D, and roads was especially high in the region. Economic returns to most investments, however, were larger in the central region.

### Stakeholders

The previous sections have highlighted the importance of investments in rural infrastructure and other key public services that are necessary for

achieving growth and reducing poverty in rural areas. The challenge for many developing countries is to find more effective ways to pay for additional public investments and to develop suitable institutional arrangements for their delivery. What institutional reforms are necessary to make the delivery of infrastructure services more efficient, and what is the potential role of the private sector?

### The Public Sector

In most countries the public sector is the dominant supplier of infrastructure services. The results have generally been disappointing. The state-owned monopoly on provision has resulted in high levels of waste and inefficiency (Brook and Smith 2001). According to one estimate, technical inefficiencies in power, roads, railways, and water alone caused losses of US\$55 billion a year in the early 1990s in developing countries, which is equivalent to 1 percent of all developing countries' GDP, a quarter of annual infrastructure investment, and twice the annual development finance necessary for infrastructure (World Bank 1994).

At present policy makers interested in expanding access to infrastructure services in remote rural areas can draw on a rich body of experience that challenges existing ideas. Governments must address the question of how infrastructure services are paid for, which raises pricing issues. Second, when delivering services to the poor, governments should allow for a range of service options in developing private participation schemes. Third, encouraging competition can help reduce prices and expand access and should thus be used to the maximum extent feasible. Fourth, the quality of regulation matters; the key to developing regulatory frameworks is to make them credible to investors and to ensure they are viewed as serving consumers. Finally, the politics of all of these actions matters. Technocratic solutions may exist, but building consensus and ensuring trust and support for these policies will remain challenging.

The key questions in the allocation of public expenditures and the need for institutional reforms include:

- Are market failures being tackled? If so, which ones, and how?
- Are public expenditures for the sector adequate in addressing the sector issues?

- Are distributive concerns being addressed by narrowly based targeting mechanisms?
- Are services being provided efficiently, at least cost, and are they responsive to user demand?
- Is there any way to reform the recurrent cost funding mechanism?

### The Private Sector

A global trend toward liberalizing and privatizing infrastructure activities began in the early 1980s and gained strength in the 1990s. At the forefront of this movement have been the developing countries, motivated by the desire to increase the efficiency of service delivery, accelerate the expansion of improved services, and bring a greater and more consistent consumer focus to service delivery (Brook and Smith 2001).

Between 1990 and 2000 private infrastructure projects in developing countries attracted more than US\$680 billion of investment (World Bank 2007). Privatization can be an effective way to improve efficiency, since private firms are more responsive to end-user needs. Privatization also encourages and facilitates the imposition of cost-covering tariffs or user fees, thus addressing the problems of underpricing that vex many public sector enterprises. Greater efficiency and cost recovery allow firms to make investments and provide services that might not otherwise have been possible (Fan 2004). These characteristics also improve the government's fiscal condition by making available the same quality and quantity of services with smaller budgetary subsidies.

Although some results of private sector involvement in providing infrastructure services have been positive, empirical testing remains difficult because ownership reforms in infrastructure usually take place in a context of broader economic reforms. Additionally, many infrastructure privatization programs are relatively recent, limiting the availability of time-series data to test propositions about poverty impact. Based on broad experience, however, it is evident that ownership reforms to systematically expand access to infrastructure will depend critically on their detailed design (Estache, Gomez-Lobo, and Leipziger 2000).

The critical question that remains is, what strategies should government follow in focusing on reforms

and pursuing private provision? A possible course of action might be to delay introducing private participation. This approach could allow time for market ideology to improve and boost the performance of inefficient public sector enterprises, thus making them attractive to potential bidders.

The first possible drawback to this approach is that it has often proven difficult, if not impossible, to improve the performance of public sector enterprises. The private sector has demonstrated that even in very difficult environments (for example, the power sector in Georgia), it can substantially improve efficiency and the quality of service. Relying on public provision can increase the pressure to adopt a more rational pricing policy for infrastructure, which will not only increase efficiency, but also increase reliance on funding from taxpayers rather than users. This situation may reduce the resources available to invest in expanding services for the rural poor, which in turn has implications for poverty reduction and economic growth. A second possible drawback is that because the private sector can be reluctant to place its capital at risk in developing-country infrastructure projects, governments may pursue options such as leases and management contracts. Management contracts, however, are often short term and may not lock in efficiency and productivity improvements. Moreover, because the private sector typically does not finance investment, approaches such as management contracts provide fewer pressures on them to commit to cost-covering tariffs. Thus, there should be some realism about the likely impact and benefits of these types of private participation schemes.

Whatever policies countries choose, governments cannot avoid the most important reality that infrastructure services must be paid for, whether provision is public or private. The real issue regarding infrastructure provision in developing countries is not whether it is public or private, but whether more or less infrastructure will be provided.

### The Role of Communities in Infrastructure Provision

Poor people and communities in developing countries are often viewed as beneficiaries or passive targets of interventions. They can also play a major role, however, in improving physical access to services, and government agencies need to

understand that the role of poor people goes beyond participation in public consultations.

The financial reality in many developing countries is that communities have no choice but to get involved in improving roads, ports, and bridges. Thus, community ownership and management of these types of infrastructure is a viable way of providing sustainable access to all. Some strong evidence shows that when communities voluntarily own and manage local infrastructure, the cost of maintenance is significantly lower than when the same type of infrastructure is owned and managed by a public sector enterprise (Wellenius, Foster, and Malmberg-Calvo 2004).

## **Policy Options**

Given that significant increases in public rural investment seem unlikely, countries will have to give greater emphasis to using their public investment resources more efficiently. This approach requires better targeting of investment to achieve growth and poverty alleviation goals, and improved efficiency within the agencies that provide public goods and services. Despite vast differences in economic systems, natural sources endowments, socioeconomic conditions, and sizes, these case studies offer some important lessons.

### Investing in Agricultural Research, Rural Infrastructure, and Education

Among the categories of investments, those in agricultural research, education, and rural infrastructure were found to be the most effective in promoting agricultural growth and poverty reduction in both countries. Developing countries need to focus on these three high-priority sectors in allocating their limited public resources.

### Investing in Less-Developed Areas

Developing countries also need to increase their investments in less-developed regions. These regions lag behind not only because of unfavorable natural resources and geographical location, but also because of government neglect. The cases of China and India show that returns to investment are very high in terms of poverty reduction. Evidence has also shown that in many such regions, returns to many investments are also higher in terms of growth.

### Investing in Low-Quality, Low-Cost Infrastructure

The limited evidence from China and Uganda suggests that it is often the low-quality, low-cost types of infrastructure, like feeder roads, that may have highest payoff in terms of growth and poverty reduction per unit of investment. Governments may begin to invest in this type of infrastructure in particular when the total government budget is limited.

### Proper Targeting of Antipoverty Programs

Given that government spending on antipoverty programs generally had a negligible impact on poverty reduction, mainly owing to inefficiency in its targeting and misuse of funds, more efforts are needed to better target the funds to the poor. Otherwise, governments should use the investments to improve rural education and infrastructure, which promote long-term growth and thereby offer a long-term solution to poverty reduction.

### **Assignment**

Your assignment is to recommend a public sector investment strategy for rural infrastructure to be considered by the government of one of the two countries discussed in this case.

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