

Investing in China's Rural Infrastructure and Environment

Executive Summary

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The purpose of this executive summary is to provide a concise statement about what we have learned about investment into China's rural environment. The overall purpose is to help the Bank understand what is happening in rural China, what farmer's are thinking about the current trends and what they are hoping will happen in the future (if they had a say). One of the most important questions is answer what should the role of the state be.

To meet the objectives, we will take a direct approach. We will seek to answer the following questions:

What we know?

How farmers feel about it?

What farmers would like to do?

What is encouraging this and/or keeping farmer preferences from being implemented?

In writing this executive summary, although brief, we seek to tie the findings into our previous findings. These findings are not only raised in the earlier report, but also are included in two papers that focus on explaining investments in China, in general (Annex 1), and in poor areas, in particular (Annex 2). We are including both of those papers with this report. Our current executive summary differs from the previous works in that it

focuses on areas that are environmentally fragile and draws—in addition to the sources of data used in earlier works—on more recent data.

Data. At the heart of our analysis is our data set. We use two unique sets of data on the institutions and development investments in rural China collected by the authors in 2003 and 2005. The authors and several collaborators from inside and outside of China designed the sampling procedure and final survey instrument with the village as the unit of analysis. The field work team, made up of the three authors and 30 graduate students and research fellows from Chinese and North American educational institutions (all with PRC citizenship and an average education level higher than a masters degree), chose the sample and implemented the survey in 6 provinces and 36 counties in a nearly nationally representative sample. The sample provinces were each randomly selected from each of China's major agro-ecological zones.¹ This is called the *2003 China National Investment extensive data set*.

The sample villages were selected by a process that the survey teams implemented uniformly in each of the sample provinces. Six counties were selected from each province, two from each tercile of a list of counties arranged in descending order of per capita gross value of industrial output (GVIO). GVIO was used on the basis of the conclusions of Rozelle, 1994 and Rozelle, 1996 that GVIO is one of the best predictors of standard of living and development potential and is often more reliable than net rural per capita income. Within each county, we also chose six townships, following the same procedure as the county selection. When our enumerator teams visited each of the 216 townships (6 provinces × 6 counties × 6 townships) officials asked each village to send two representatives (typically the village head and accountant) to a meeting in the

township. On average, enumerators surveyed around 11 villages in each township. The number of villages per township ranged from 2 to 29.² In total there were 2400 villages in the extensive data set. Because there were different numbers of villages in each sample township, there were differences among the provinces in the number of sample villages. For example, Jiangsu (19 percent) and Hebei (23 percent) provinces had relatively more sample villages than the other sample provinces (between 13 and 15 percent).

After answering questions about the economic, political and demographic conditions of their villages in 1997 and 2003, the respondents answered a set of questions about all of the investment activities in or around their villages between the years 1998 and 2003. The questionnaire was designed to elicit information about the size of each investment, its primary objective, sources of funding and the level of participation in terms of investment and labor contribution of the village. The survey instrument collected information on both the *number of investment projects* in the village between 1998 and 2003 and the total *level of investment*. The information was collected for 17 different types of *public goods projects* and 10 different types of *development projects* (where development projects were defined as projects with the major objective of promoting an economic enterprise that is normally run by the household as a private income generating activity, such as the development of orchards, cash crop enterprises or livestock raising activities). Because of the predominance of public goods investments (more than 85 percent of investments were targeted at public goods), in this paper we focus mostly on public goods projects.

The other data set, the *2005 China National Investment intensive data set*, is closely related to the extensive data set. In this data set, we used the original set of villages from the extensive data set as our population. From the comprehensive list, we chose a random sample of 100 villages from 5 provinces (5 counties per province; 2 townships per county; 2 villages per township). The sample selection was stratified (by income per capita) in order to assure us that we chose one county per province from each of five groupings (the top 20 percent of the counties in terms of wealth; the second most wealthy group of counties and so on).

From each of the subset of 100 villages, the main source of new data comes from two focus groups. Each focus group was composed of six randomly selected farmers. None of the farmers was either a current or former cadre or a relative of a current or former cadre. A trained focus group facilitator engaged the six respondents in a conversation about a number of issues, including a discussion on the opinion of the group towards the village's infrastructure. During the discussion a second member of the enumerator team recorded (and subsequently coded) answers of the group to three questions: Are you satisfied with the level of service of your village's public goods? What type of project would you favor to invest in if your village had a grant for RMB 50,000? Would you be willing to contribute (labor or capital) to supporting infrastructure investment? In addition to the quantitative information, we also recorded more qualitative responses that villages made during the discussion of their village's environment and infrastructure.

What we know?

What we know about China, in general? In our previous work (in a paper—Annex 1), we have used our data set (collected in part with funding from the World Bank) to create a profile of China's investments at the village level. In doing so, we have discovered that in recent years upper level officials have begun to invest increasingly more into rural China. Moreover, unlike in earlier years (when government investment funds were used to promote private economics activities, such as orchards), they are investing mostly in public goods. By far the largest concentration of investment is in roads, bridges, irrigation, drinking water and schools. In some cases (in some areas), there have investments in projects that should have positive environmental effects (explored more in this executive summary). When looking at investments over time, we can also state that there has been a rise in the number of investment projects, especially in roads and bridges, irrigation, drinking water and schools.

When assessing this effort, we also have discovered that at least in the case of funding directed from above, there is an effort to meet some of rural China's more pressing problems. While we do not know how investments were targeted in the past, according to our results we know that between 1998 and 2003, upper level officials are focusing their efforts on poverty alleviation and are doing so in minority areas. In fact, over all, China's investment into villages in poor, inland regions is now occurring at a higher rate and is growing faster than in richer areas. Our results show, however, that communities in better off areas are making public goods investment themselves.

If this is true, then China's leaders should be praised for their efforts and encouraged to continue along the same path and expand future investment plans, though

some problems such as showcasing is still exist and should be taken into account by officials in their works later. During the 1980s and 1990s, it was shown that China actually was still taxing agriculture and the rural sector, although there were signs in the macro data that a turnaround was occurring. Our study suggests that indeed either the turnaround has actually occurred or that at least there is a shift from net taxation to net investment in rural China underway. Undoubtedly, given China's size in population and land and the depth of poverty and backwardness in some areas, more is needed. In fact, on a per capita basis, despite the recent record, compared to other countries in East Asia (during their periods of rapid development), China's spending is still relatively low. So while, at the very least, for perhaps the first time, it appears as if the transformation to a more modern nation is happening, more is needed.

What we know about investment in environmentally sensitive areas? In order to examine investments in the environment, we need to make two sets of assumptions, one about projects and one about the types of villages. Of the 17 types of publicly supported, non-development projects that we enumerated, we classify four of them as having a primary objective of environmental protection and/or environmental restoration. The four include a.) Grain for Green (a cultivated area conservation set aside program targeted at prevention of soil erosion); b.) eco-system restoration (a multi-dimensional project targeting soil erosion prevention; flood control; forest development); c.) forest-ecology restoration and d.) new forest development.³ We use investment in this subset of projects as a metric of commitment to environmental projects.

We also classify villages into two types, *environmentally fragile villages* and *non-environmentally fragile villages*. To do so, we use two different definitions based on two

criteria, one based on the average slope of the village's main land area (henceforth, *hilly* versus *non-hilly villages*) and the other based on the percent of the village's land area that is in either forested area and/or grasslands (henceforth, *forested* versus *non-forested villages*). Table 1 shows that distribution of the villages that meet our two criteria. As can be seen, the overlap is substantial. Of the 1124 hilly villages and 1227 forested villages, 830 villages fall into both categories. Because of the overlap, we focus only on hilly versus non-hilly villages in the executive summary.⁴

Using assumptions about the nature of environmental projects, we can see that although there is investment into environmental projects, there is not a lot of activity overall relative to other types of projects (Table 2, columns 1 and 2). In total, of the 9099 projects, only about **XX percent** are targeted directly at environmental problems. Moreover, if Grain for Green were removed, the percentage would fall to **XX percent**. Clearly compared to a set of *basic infrastructure projects* (henceforth, referring to roads, bridges, irrigation, drainage and drinking water projects), which account for XX percent of total number of investments, there is substantially less activity in environmental projects.

Although generally quite low, when we divide villages into environmentally fragile villages (hilly versus non-hilly), our data show that there are differences in the pattern of investments (Table 2). In fact, there is substantially more investment into environmental projects in hilly villages. Specifically, in hilly villages more than 25 percent of projects were environmental projects (columns 3 and 4). In contrast, in non-hilly villages only 11 percent of projects were environmental projects.

When asked about the primary objective of a project (regardless of whether the project was an environmental project or not), our data support the findings from Table 2. In our extensive survey we asked the respondents about the main motivation for each project. Asked this way, it was possible to pick up the fact that some environmental projects, in fact, were primarily being implemented to raise incomes (choice 1), improve the standard of living in the village (choice 2), raise village fiscal revenues (choice 3), increase employment (choice 4) instead of assuming all environmental projects were primarily motivated to improve/protect the environment (choice 5). For example, in the case of 23 percent of pasture development projects, environmental protection was listed as the primary goal. Likewise, it allowed us to capture the fact that some basic public goods investment projects were also primarily targeted at the environment, instead of some other primary motive. For example, while 65 percent of respondents in villages with Grain for Green projects believed the primary motivation was environmental protection, in 27 percent of villages, respondents stated they believed income generation was the most important goal. When aggregated across all projects (Figure 1), while in non-hilly villages only 10 percent of village projects were explicitly targeted at improving the environment (Panel A), in hilly villages 22 percent of projects targeted specific environmental problems (Panel B).

When comparing other aspects of investment behavior in hilly versus non-hilly villages, it is clear that in some topics, the two types of villages are similar, while in other types of villages, there are fundamental differences. For example, in Table 3 we see that regardless of the nature of the fragility of the environment (from 0% hills to more than 75% hills), almost all investment activity is focused on public goods projects, not

development projects. In all categories, there are more than 5 times as many public goods projects than development ones (rows 1 and 2).

When asking respondents about the source of their funds, hilly and non-hilly villages differ fundamentally (Table 3, rows 3 and 4). In the survey, projects were funded one of three ways: completely from above (100% of the funds from the government; none from the village/villagers); completely from below (100% of the funds from the village/villagers; none from outside the village); and funded with matching funds (part from above and part from below). Examined this way it can be seen that on average each non-hilly village (0 percent hilly category—column 1) funded 1.4 projects over the study period on their own (from below) and only 0.7 from above. In almost a complete opposite finding, projects in those villages in the most hilly regions (with more than 75% of hilly land) were mostly funded from above (on average 1.5 projects during the study period) and only 0.8 projects from below.

When examining the sources of funding for environmental and basic infrastructure projects, it can be seen that one of the major drivers of the results in Table 3 is that funding for environmental projects (which are more common in hilly villages) are by far mostly from above (Table 4—this is a new table, I think). Nearly XX percent of environmental projects were fully funded from above. In contrast, only XX percent of projects were fully funded from above in the case of basic infrastructure projects.

While it is impossible to know for sure, there are several reasons for this result. First, hilly villages tend to be poor (the correlation coefficient between the propensity to be hilly and poor is 0.XX) and through a variety of channels it has been shown that poor villages receive a lot more support from above (Annex 2). In addition, and perhaps more

relevant, there also is a greater necessity that environmental projects be funded from above. For example, in the case of Grain for Green projects, Uchida et al. (2005) show how almost all of the benefits of many Grain for Green projects accrue completely to downstream users and in fact impose a cost on farmers. It is easy to see in such a case why it would be infeasible to ask villagers to bear the cost for such projects. If the project is wanted, then it must be funded from above (or at least mostly funded from above).

In summary, then, investment in China's rural areas is dominated by public goods investment. In most places there is little investment in the environment. There is relatively more environmental investment in fragile areas. However, at most only about 20% of investments are environmentally targeted. If Grain for Green is not counted, the level of investment in environmental projects is less than 10%. Almost all environmental projects are funded from above.

How farmers feel about it and what farmers would like to do

In this section we draw on the intensive data set seeking to try to understand what farmers are thinking about the investments that are going into their villages. To do so, we first asked farmers about the level of satisfaction for the infrastructure and environment in their village. We then asked farmers about how they would invest 50,000 yuan if their village had access to no-strings-attached funding from above. Farmers then were asked to comment on the way they perceive their village's infrastructure and environment.

Satisfied or Dissatisfied? The level of satisfaction with the village's infrastructure and environment (Table 5) appears to be negatively correlated with recent

investment activity in infrastructure (Table 2). Although investment over the sample period in drinking water was only made in **XX%** of villages, on average, farmers in 58% of villages expressed satisfaction with their drinking water. When examining the responses of focus groups composed of men or women, about the same answer was found. The second and third highest degrees of satisfaction were found for clinic (47%) and schools (35%).

In contrast, focus groups found that villagers were least satisfied with their irrigation systems and roads. On average, 59% of respondents stated they were unhappy with their irrigation systems. Interestingly at the national, more money is expended on irrigation than any other type of rural infrastructure project (Annex 1). Likewise, although road projects account for the highest number of projects (Table 2), 57% of villagers are dissatisfied with their roads.

There was a large difference in the answers regarding satisfaction when examining hilly versus non-hilly villages (Table 5). For example, there was a lower percentage of hilly villages that were satisfied with drinking water (53%) than non-hilly villages (62%). More poor (74%) and non-hilly villages (55%) were also dissatisfied with their roads.

One of the largest areas of dissatisfaction was in the nature of the village's cleanliness. In total, **XX percent** of villages stated they were unhappy with the garbage disposal situation in their villages. Only **XX villages** (out of 2400) had garbage pick up. Many stated they thought that garbage collection should be improved. An even lower percentage of villages in hilly areas had garbage collection.

Investment Prioritization. Despite their satisfaction with roads, by far most villagers are most interested in investing in roads (Table 6). On average, during the focus sessions, in 55% of the villages respondents ranked roads as the top priority investment. Although we initially thought that men would favor roads in far more cases than women, in the all men's focus group 55% rank roads as number one; in the all women's focus groups, 49% percent (not significantly less) ranked roads as number one. Interestingly, despite their relative dissatisfaction, poor villages rank roads as the top priority (43%) much less than non-poor villages (58%).

Second and third to village roads, 24 percent and 18 percent of villages favor making investments in drinking water and irrigation as their top priorities. Interestingly, as found in similar work in India, women favor investments in drinking water more than men. Significantly more hilly villages rank drinking water a priority (31%) when compared to non-hilly villages (19%).

In contrast, only 10% favored spending the 50,000 yuan on school buildings. Interestingly, this is after less than half of the villages were satisfied with their schools. One reason, however, that appears to explain this is that after recent changes to the funding of school buildings, responsibility for school facilities has been passed to upper level governments. In an environment of scarce resources, villagers appear to be allocating their funds in a direction in which they may have to depend on their own effort. No villages ranked investment in clinics as their top priority.

When the question was asked what project ranked as top priority when villagers had to contribute financially, the answers were nearly the same.

Explaining the patterns. Such patterns of course raise several fundamental questions. Why is it that although there is more investment into roads and irrigation, villagers are the least satisfied? There are three possible explanations—one that suggests that investment priorities and implementation is proceeding fairly smoothly; a second that suggests that there is problem with investment planning; a third that suggest both could be true. First, the positive: it could be that the current level of roads and irrigation is so poor and that villages and upper level governments are investing into the areas in which villagers are least satisfied. If this were the case, whatever the mechanism, investment planning is working. Alternatively, it could be that despite investing large amounts of funds, the level of infrastructure is so poor since the investments have not been successful. A third alternative is that while targeting is accurate, project implementation is not always succeeding.

Listening to the response of farmers, one may be able to deduce that in part the system seems to be working. Farmers are clearly dissatisfied with their roads. This is despite the fact that they have been investing more in roads than in any other investment activity. In the past 5 years, in the 100 villages in the intensive survey, there were more than 150 road projects. If farmers were truly dissatisfied, they would not rank roads as the top priority. Yet by more than two to one margin, road investment (for men and women) ranks as the top priority. At the very least they are not so dissatisfied with the recent road projects that they are turned off by them. They are still willing to invest their own funds in roads.

However, there is a lot of room for improvement. Although many people believe that their roads are better than before, they also are quick to point out a lot of problems.

In many cases, farmers are dissatisfied with maintenance of new roads. In a few cases, they claim that fees were charged for maintenance, but the roads deteriorated. Perhaps it is a testament to the importance of roads that even despite these problems, they rank as the highest priority.

There also is evidence that villagers are unhappy with the priority given to developing irrigation systems and that this may be turning them off from wanting to support more investment. More than 60% of villagers are dissatisfied, yet only less than 20% rank irrigation as a top priority. One explanation can be found in the comments of many villagers. They often talk about the deterioration of the irrigation system. Whereas roads were getting better, irrigation systems were getting worse. In some cases, they stated that the old system was better than now because of poor maintenance and lack of leadership. In other cases, the deterioration of water resources (both quantity and quality were cited) were leading to poor irrigation. Hence, in such a case, despite a lot of investment activity, the system's quality is declining. This, of course, would explain why villagers are reluctant to accord irrigation higher priorities. It could also be that the importance of agriculture in many villages is declining and vis-à-vis roads, it is not as attractive.

The case of drinking water suggests that it is important to take into account regional heterogeneity. Although most villages said they were satisfied (by far more than any other infrastructure activity), villagers ranked drinking water as top priority just after roads. This inconsistency, however, can be explained by looking at differences between hilly and non-hilly villages. In nearly one-third of the villages (31%) in villages that are in fragile environments demand drinking water.

Schooling Crisis. When compared to all other investments, villagers express their greatest outrage at the schooling system. Many villagers are not happy with the recent changes in schooling that are due to the new policy of combining schools and focus onto central elementary schools. More than any other public goods activities, more people believe the state of schooling in their villages has become worse.

There are many reasons that people are not happy. They do not like the fact that the school in the own community was closed. The school that they now attend is in either the township seat or another village. Villagers say that the new school is too far away. Although the quality of the school is supposed to be better and although school fees in recent years have come down, the new policy is imposing a lot of new costs, such as, school buses (if available) and food and lodging. Probably the biggest cost is that when the school is too far away one of the adults (the wife in most cases) has to spend time taking the child to and from school. In all, villagers believe that schooling is now more expensive than before.

This is not to deny there are benefits—in some schools. In many schools the facilities and teachers have improved. In some schools, the overall quality of education is up. The villagers in villages that have a central elementary school are most happy. However, in many cases—especially in poor areas and in remote areas (areas that have fragile environment)—the policies have been adopted and costs have risen, but the quality has not risen very much (if at all). Clearly, there needs to be policies that consider all of the ramifications of policies in all different kinds of villages.

Clinics. There also is a crisis in clinics. Many villagers are unhappy with the shift to privatization and raising of fees. Many villagers believe the care has decreased in quality. In many villages paying for health care is becoming more and more difficult.

What are keeping environmental investments down?

So what are keeping environmental investments down? Overall, investment is relatively low (less than 20% of all investments) and even lower (less than 10%) when not including Grain for Green. Even more telling, when villagers were asked to rank investments, not one set of villagers (out of 200) said that they preferred to invest in an environmental project. With all of the environmental problems in China, why is it that preferences by villagers rank environmental investments so low?

One answer is that there are not any environmental problems in rural China. Of course, according to all of the literature that is not true. In addition, according to any observer that has been in rural China, that also is not true.

Another answer is that although villagers want to, they can not afford to. There could be a capital constraint. However, according to multivariate analysis, a village's wealth is not a constraint to investment.

And yet another answer is that villagers have no ability to. As discussed in our last report, this is a problem in some villages. The fiscal reforms have been implemented to try to reduce the tax and fee burden on villagers. However, analysis by Luo et al. (2005) has shown that in many cases fiscal reform has reduced the authority of local leaders and affected the ability of villages to design and implement projects.

So, the question that is relevant is that in the case of environmental investments it is the lack of ability to invest. But if this were the case, then more villages would have ranked environmental projects higher in the “willingness to invest” exercise.

In fact, according to basic resource economics, it is easy to understand why villagers are not interested in pushing forward on their own to support environmental projects. As seen in the case of Grain for Green, although villagers would not implement this on their own, it does not mean that they are not interested in doing so if they get enough support from above. In other words, in the case of most environmental projects if there is support from the top, villages will implement them. Villages want other projects, such as roads, irrigation and drinking, but they will be happy to implement environmental projects if the support is there.

That does not mean that all investments need to be implemented from the top down. As we see there are heterogeneous preferences. However, in practice most investments are designed and implemented from above—and the trend will be towards more if the fiscal reforms continue. In another part of our survey we found that only in a very small share of projects were villagers ever asked to participate in the design (XX%); implementation (XX%); or maintenance (XX%) of the project. We have shown villagers know what they want and this is easily documented. We also have shown that when projects get implemented it is not done. There are many complaints that what otherwise would be a good project ends up failing (or succeeding less) because it is not well maintained. Clearly new ways are needed to design, implement and maintain projects.

Endnotes

¹ The sample villages come from six representative provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong; Shanghai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces on the Loess Plateau (Shaanxi and Shanxi) and neighboring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia; Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei; Henan; Anhui; Hubei; Jiangxi; and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). While we recognize that we have deviated from the standard definition of China's agroecological zones, the realities of survey work justified our compromises. Pretests in Guangdong demonstrated that data collection was extraordinarily expensive and the attrition rate high. One of our funding agencies demanded that we choose at least two provinces in the northwest. Our budget did not allow us to add another central province (e.g., Hunan or Hubei) to the sample.

² On average, the attrition rate was only 6 percent. In no case, did we leave a township until at least 80 percent of the villages had been enumerated. In order to examine if the villages that were not enumerated (due to attrition) were systematically different from those that participated, we collected a set of variables about no-show villages from the township and ran a probit regression with the dependent variable represented as an indicator variable where the variable equaled one if the village did not come and zero otherwise. There were no variables that were significant. If a village had more than 25 villages, we randomly selected 25 of them. This only affected less than 5 townships.

³ In addition, in the "other public projects" category there also was some activity in other environmental projects, such as **XXX, XXXX and XXXX**, but in total these projects add up to less than 0.1 percent of the overall projects.

⁴ For all of the tables that break down the data by hilly and non-hilly, we also have created tables by forested and non-forested. In most cases, the answers are similar.