



Providing quality infrastructure in rural villages: The case of rural roads in China



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ABSTRACT

When seeking to build high quality and cost-effective infrastructure in rural villages, a fundamental question is: Who is better at doing so? Should the village leadership or a government agency above the village finance and/or manage the construction of the infrastructure project? To answer this question, we surveyed all rural road projects in 101 villages in rural China between 2003 and 2007 and measured the quality and per kilometer cost of each road. According to our analysis, road quality was higher when more of the project funds came from the government agency above. Moreover, projects had lower cost per kilometer when the village leaders managed the road construction. Overall, our findings suggest that to build high quality and cost-effective rural roads village leaders and government agencies should collaborate and each specialize in a specific project role.

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1. Introduction

High quality infrastructure in rural villages is important to economic development in developing countries (World Bank, 1994). High quality roads have been shown to raise agricultural output, reduce agricultural price distortions, expand domestic trade, and grow local markets (Ahmed and Hossain, 1990; Buys et al., 2010; Minten and Kyle, 1999; Mu and van de Walle, 2007). High quality roads also benefit rural households by reducing poverty, raising consumption, providing access to off-farm jobs, and increasing school enrolment and completion rates (Dercon et al., 2009; Escobar and Ponce, 2001; Khandker et al., 2009; Warr, 2005; Yamauchi et al., 2009). Other types of infrastructure projects such as irrigation and drinking water also have been shown to have positive effects on villages (World Bank, 1994, 2003).

Given the wide range of benefits of high quality infrastructure, it is natural to ask how to build them in a cost-effective way. Many infrastructure projects in villages are financed and managed by government agencies above the village (World Bank, 1994). However, the villages themselves (as led by village leaders) also contribute (Adato et al.,

2005; Deininger and Mpuga, 2005; Faguet, 2004; Hoddinott, 2002; Olken, 2007). What is less clear, however, is how responsibility is delegated between the village leaders and the government agencies above the village (henceforth, *upper level government* or *government*). Specifically, how do their respective contributions affect the quality, cost and other characteristics of the projects? Does local village provision improve project quality and cost-effectiveness? Or is the top-down approach better?

Among the contributors to a village infrastructure project, it is perhaps the *financiers* and the *managers* who affect project quality and cost the most (Adato et al., 2005; Calvo, 1998; Hoddinott, 2002; Lebo and Schelling, 2001). In many projects, the financier has the most control over project design and quality standards. The manager, who oversees the construction, monitors the use of funds and mobilizes villagers for in-kind construction labor, has a strong influence on how the infrastructure is actually constructed and how much is ultimately spent. As such, for any village infrastructure project to be high quality and cost-effective, it is crucial to choose the right project financier and project manager—from the village leaders and upper level government.

Some argue that village leaders are better in taking charge of the provision of village infrastructure projects. Village leaders have better local information. When they lead the village to finance village infrastructure projects, they can better design the infrastructure to meet local needs (Faguet, 2004; Robinson and Stiedl, 2001). Also, village leaders are

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more accountable to local villagers and, as users of the infrastructure themselves, may have greater incentives to put out extra effort to ensure better project outcomes (Deininger and Mpuga, 2005; Faguet, 2004; Humplick and Moini-Araghi, 1996).

In contrast, there also are reasons for upper level governments to take the lead in village infrastructure projects. Through making project finance decisions, government can promote village development by incorporating higher quality standards in infrastructure design that would otherwise be neglected (Calvo, 1998). In developing countries, government (as opposed to village leaders) are better at construction management because they are more likely to possess the technical know-how, can promote proven experiences and can share quality inputs across projects (Calvo, 1998; Deller and Nelson, 1991; Deller et al., 1988).

The literature gives us no clear answer to the question of how the choice of project financier and manager of a village infrastructure project affects project quality or cost. Hoddinott (2002) provides a theoretical model on how contributions by local villages and outsiders in village public projects affect the outcomes of different project goals. The paper assumes that the three actors—financier, provider (or manager) and beneficiary—have different preferences for different project goals. The paper also assumes that, due to better local information, projects cost less when village leaders manage the project. Under these assumptions, the model predicts that it is best for the village to have village leaders setting the goals (through finance decisions) and managing the village projects—the village can promote the project goals that villagers value the most and can achieve them at a lower cost.

To our knowledge, there is only one published paper in the literature that seeks to test Hoddinott (2002)'s predictions. Adato et al. (2005) study a series of public works programs in South Africa following the country's democratic transition in 1994. The paper finds that when a village took charge of the goal-setting and the construction management of a village project, the project created more local jobs, spent more on wages, gave more training to local villagers and distributed more benefits to women and the poor. However, the paper is silent on how village contributions in village public projects affect project quality and cost, two key concerns of infrastructure investment on promoting economic development particularly in rural areas.

In this paper our goal is to study how to provide high quality and cost-effective infrastructure in villages. In particular, we seek to answer several important questions: who—the village leaders or the upper level government (or both)—should finance and manage village infrastructure projects in order to build *high quality* infrastructure in villages in developing countries? Likewise, who should finance and manage such projects for the projects to be *cost-effective*? Is it always the case that village infrastructure projects provided by the villages themselves are higher in quality and more cost-effective? Or is a top-down approach by the government above better? Or does it take some sort of collaboration between them to achieve optimal outcomes?

To meet this goal, we pursue three specific objectives. First, we develop a measure of infrastructure quality and describe the profile of project quality and cost among infrastructure projects in a nearly nationally representative sample of rural villages in China. Second, we analyze the differences in project quality and cost among these projects when the village leaderships and the upper level governments take different roles in the financing and management of the projects. Third, we seek to offer explanations for our findings.

We pursue our objectives by studying the quality and costs of road construction in China's rural villages. Why roads? Roads are an important type of infrastructure in rural areas and are mostly built by the villages and/or the government (World Bank, 1994). In developing countries, the rates of return for road investments are shown to be high and many scholars agree that there is a need for more high quality roads (Fan and Chan-Kang, 2005; Fan and Hazell, 2001; World Bank, 1994, 2003). However, road quality in many developing countries is poor. Paved roads—one indicator of road quality—constitute only 12% and 38% of all roads in lower and middle income countries (World Bank,

2000). Also, all-weather roads—another indicator of road quality—are available only to 35% and 74% of the rural population in these two types of countries (World Bank, 2006). Unfortunately, to our knowledge (outside of one paper by Olken, 2007), there is little empirical work that studies how village road projects can best be financed and managed.

There are two reasons why we focus on China. First, in recent years China has embarked on an ambitious road building agenda in rural areas. Specifically, between 2001 and 2009 China invested over 1 trillion yuan into the construction and upgrading of over 2 million kilometers of rural roads (People's Daily, 2006; Xinhua News, 2010). At the end of 2009, nearly 80% of all China's villages have direct access to paved roads (Xinhua News, 2010). Second (and in part because of the rapid pace of road building in recent years), we were able to collect a unique dataset on road investments in 101 villages in China between 2003 and 2007. Because there were multiple road projects in half of the sample villages during our study period, this dataset allows us to use a village fixed effect (FE) estimator to identify the impact of project finance and management on project quality and cost by exploiting within-village variations.

However, there are limitations to what this paper does. First, unlike Olken (2007), we have no capacity to run a randomized controlled trial. Instead, we conduct a detailed observational study of a nearly nationally representative sample of rural villages in China and analyze a panel dataset of these villages over time. Although we can control for unobserved, time-invariant village heterogeneity in our village FE estimations, the absence of valid instruments limits our ability to control for unobserved, time-varying village heterogeneity. We acknowledge that to the extent that there is such unobserved heterogeneity correlated with our explanatory variables of interest, our estimates may be biased.

The second limitation of this study is that we focus primarily on project quality and cost and neglect other immediate welfare implications such as job opportunities and training—implications that are studied in Adato et al. (2005). Fortunately, from our interviews and observations, such concerns may not be pertinent to rural China. For example, in the past decade, a large share of the labor force in China's villages gained access to off-farm jobs and do not rely on village projects for wage income (De Brauw et al., 2002; Wang et al., 2011).

The rest of this paper is organized as follows. In Section 2 we provide an overview of the provision of infrastructure and rural roads in China's villages. In Section 3 we describe our dataset and explain how we define road quality and cost. Section 4 presents the relationship between project quality and cost and the choice of project financier and manager. Section 5 describes the approach for analyzing the determinants of village road quality and presents the empirical results. Section 6 examines the determinants of unit project cost and also some other construction-related project characteristics. Section 7 discusses the findings and concludes.

2. Overview of provision of infrastructure and rural roads in China's villages

In China, both the village leadership and the upper level governments (county and township governments in particular) are important contributors to infrastructure projects in villages (Liu et al., 2009; Zhang et al., 2006). Villages in China are self-governed by *villagers' committees* which are fully staffed by local villagers. More specifically, this body of village leadership includes a committee of village administrative officers (who are elected by villagers, comprising the village head, deputy, accountant and other committee members) and also key members of the Communist Party in the village (who are appointed by party officials from inside and outside of the village). These village leaders together are responsible for managing village affairs on a day-to-day basis, undertaking village projects and sometimes acting as the agents of upper level governments for government-led activities in the village.

Although there is no doubt that village leaders would prefer high quality infrastructure projects over low quality ones, there are two

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