SHS Web of Conferences **14**, 02006 (2015)
DOI: 10.1051/shsconf/20151402006


# A Study on Supply Model of Rural Highways in China

Dexiang Wang[1] and Fei Xie[1,2,a]

[1]Economics and Management School, Wuhan University, 430072 Wuhan Hubei, China
[2]First Auditing Division, Shanghai Municipal Bureau of Local Taxation, 200011 Shanghai, China

**Abstract.** Rural highway has a significant impact to build a moderately prosperous society in all aspects, and it is an important critical infrastructure to build harmonious society. Highway has its own economics attributes, and rural highway also has its own characteristics. This paper combines with rural highway characteristics to analyze the supply model and problems of rural highway. It summarizes several mixed supply models of rural highways.

**Keywords.** rural highways; public goods; supply mode

Rural highway is the foundation of the highway network. And in rural areas, it is the most important and even the only transport mode in some areas. It is related to the production and living of the peasant masses. Rural areas economic and social development has a relationship with rural highway. And it is an important critical infrastructure to build a moderately prosperous society in all aspects and harmonious society.

## 1 Economic analysis of highway

### 1.1 Common attributes of highway

*Highway has a first effect to economic development.* As an important part of the transportation industry, highway industry not only itself has a huge economic benefit, but also has a strong correlation effects for the other industries development. It could promote the economic development in tangible and intangible aspect, and let the associated industry be the first industrial of economic development.

*Highway industry profit has been restricted to a certain level.* For highway industry, if it is fully supplied as pure public goods by the government, it would be subjected by financial resources and the result would be insufficient supply. However, as it is provided by fees, if the price charged too high, it will definitely lead to improve the downstream industry costs, causing prices to rise. So in order to achieve the maximized welfare of society members, it must control highway industry profit level.

[a]Corresponding author: 94025774@qq.com

### 1.2 Private property of highway

Highway has Quasi-public product attributes, and it determines that it has private product characteristics in a certain extent, such as exclusivity, etc.. The characteristics is the foundation of the highway market supply. As a commodity, the realization form of highway's value is different from general merchandise. It has to be gradually achieved by retail selling the use value (i.e., collection of tolls). As a result, it will lead to the highway industry interests different from social welfare objectives. It has major performance that social welfare objective, highway investor, must first realize their economic interests. That economic benefit will increase the difficulty of pursuing social welfare.

## 2 The analysis of rural highway supply

### 2.1 Characteristics of rural highway investment projects

The particularity of investment projects of rural highway is shown as follows:

*A.* **It has a range of regional benefits.** Rural highways mainly serve rural economic development and resource exploitation. It has a directly relationship with majority of rural economic development, people production and life. The benefit is primarily aimed at the township (town) and village groups.

*B.* **The demand of highway grading standards is not high.** Rural highway construction must meet the requirements of economic development within limits, to avoid pursuing high-grade unilaterally. It is on the basis of local subsistent or potential traffic flow.

*C.* **The money demand is large.** Even if the cost per kilometre of rural highways is not high as the main highway, but the advantages of rural highway are multiple site, wide cover and long front. In order to achieve this goal, a large fund is needed.

*D.* **The rate of return on investment isn't high.** Rural highway is impossible to charge like the highway, which is determined by grading standards. And because of the property of rural high. Not all charges are allowed, so the rate of return on investment is low.

### 2.2 The analysis of the admixture accommodation of rural highways

Rural highways are quasi-public goods, and the mainly public characteristics are strong positive externalities. To make economic efficiency achieved, the government can provide quasi-public goods directly at lower prices to encourage people to increase consumption, so as to achieve efficient consumption. If it is absolutely free of charge and is supplied by the government, the result is over-consumption which may bring welfare loss. If this kind of quasi-public goods is supplied entirely by the private sector, it is prone to excessive fees and high charge standard.

Meanwhile rural highway is typical congestible public goods in the quasi-public goods. When the supply of highway is given, the marginal cost of highway congestion in the village will increase, and the marginal construction cost will decline with population increase. Therefore, when cost=gain, it is optimal population. In many rural areas of our country, especially western regions, because it is remoteness from the national, provincial distant, the requisite construction of rural highway is large quantity, and it requires more funds. Because the residence is remote, the residents are few. The "club" is failed to achieve the optimal size of the amount of members. It needs investment in the country to come forward to fill the gap, and help these areas construct rural highway.

Take rural highway construction as an example to make a game analysis. If only two parties are involved in the negotiations game, one is representative of the government which considers whether the state highway construction investment is profitable, the other one is the public representative which considers whether donate part of fund to get provision of public goods such as rural highway. Assume that the basic construction price of a rural highway is 10 million; both the State and the farmers themselves will get 75,000 Yuan as income. The game theory model of confidence of rural highway construction is showed in Table 1.

**Table 1.** The game theory model of confidence of rural highway construction.

| Government | Public (villagers) | |
|---|---|---|
| | Positive decision | Negative decision |
| Positive decision | (10, 10) | (-2.5, 7.5) |
| Negative decision | (7.5, -2.5) | (0, 0) |

When the two sides made a positive decision, the result is the most satisfactory. In the confidence gambling, both sides prefer to choose cooperative strategy. If the government can give some "advance commitment", the public is willing to pay part of the cost while the government will be willing to grant the construction-related subsidies. The game between government and private is easier to reach an agreement.

### 2.3 The analysis of supply problem of rural highways

The main problems are: First, the administrative villages' accessible asphalt roads are not enough. Total length of highways in rural areas is a lack, and a lot of villages are not accessible to highway, causing unsolved travel problems for villagers; Second, rural highway construction quality is varying degrees of disease. Rural highway construction projects, wide distribution, engineering and management personnel need quality and quantity suited to large-scale rural highway construction, quality control is weak, inadequate funding, project management difficult; Third, the implementation of local matching funds cannot be placed. Rural highway construction, mostly local matching funds committed to the policy of investment, has an impact on the progress and quality; Fourth, rural highway maintenance management tasks is difficult. The vast majority of rural highways just organized a number of temporary and seasonal assault conservation, and maintenance and management responsibilities are not clear, so there is no stable source of funding. There is a big security risk.

## 3 Main supply model and problem of rural highways in China

### 3.1 State investment model

State investment has mainly the following ways: (1) State budget investment, refers to the state budget and funding sources included in the national plan of investment in fixed assets. Since the conditions of use of such funds have the advantage of offers and safe, is actively fighting around transportation construction investment. (2) Bond funding investment. According to experience, every 1 billion in highway infrastructure bond funds attracted banks and other sources of local matching funds totaling 533 million Yuan. (3) Local government investments. Since establishment in 1984, our township finances, county revenues have been expanding, increasingly standardized expenditure management, in promoting rural economic development, ensure the implementation of government functions play an important role.

Relying on state investment, there are some problems. Rural highway construction and development is the principles of the "Three-Self" principles, namely "self-built, self-support, self-management". "Three-Self" policy is strongly dependent on the geographical characteristics, resulting in a "Matthew effect" on rural highway construction. That is adequate funding for economically developed areas of rural highway construction, highway

construction speed is high, and in turn, it promotes greater economic prosperity; remote backward areas have no money to build highways, the result is there is no money to build highways, so poor highway conditions lead to economy even further behind.

### 3.2 "One Project One Discussion" supply model

"One project one discussion" refers to use the form of democracy to raise labor and money, which is a funding model to beneficiaries to raise money for the supply of public goods, with the nature of raising fees. The core of "one project one discussion" is that in the provision of rural highways, to collect money from farmers must be consent agreement by farmers firstly. Its potential implication is that if farmers do not agree, it is difficult to reach a unified consensus, and it is difficult to provide a rural highway.

"One project one discussion" conditions for success are: first, a strong collective economy. Conference farmers is mainly how to spend money collectively, and do not need the farmers to pay themselves; second, the matters discussed is related to the vital interests of the villagers and the amount of investment is not a big; third, village cadres has a good personal ability and charisma.

"One project one discussion" conditions for failure are: first, the farmers cannot afford; second, funding upper limit and it is difficult to get enough funds needed; third, village cadres are afraid of difficulties; fourth, the villagers worry income inequality and funds were misappropriated; fifth, cadres and the masses have disagreement; sixth, in the majority opinion consistent case, a few people finally led boycott of procedure and the result is unsuccessful; seventh, few people refuse investment, and after the project Completed, the not funded enjoyment the achievement.

Not all villages have characteristics of the three factors that lead to success. Every village has the Factors leading to the failure more or less. As long as the existence of any one reason it could lead to "discussions" mode to failure. Therefore, the effectiveness of "one project one discussion" at the village level to provide public goods is questionable.

## 4 The analysis of supply modes and funding channels of rural highways

### 4.1 Public-private mixed supply model of rural highway

State investment represents the full sense of the government investment; "one project one discussion" can be understood as a typical "private supply". Through the above analysis, it could get the result that relying solely on the state invested or entirely by self-organized villagers was unable to achieve the effective provision of rural highways. Rural highways should be used in "government-led - Folk active participation" of the public - private mix supply model.

### 4.2 Brief analysis to other several funding sources

#### *4.2.1 Private enterprises and individuals to invest*

Allowing private capital into infrastructure, public utilities embody the principle "the people's livelihood and in addition to the field of national monopolies must allow private capital to enter the".

It is in favour of raising funds and improving social services, and it is conducive to that when state capital exiting certain industries, the competition mechanism can be smoothly introduced to achieve an effective alternative of private capital. That is beneficial to national economic development and maintenance of the national economic security.

#### *4.2.2 Donations from benefit units and individuals*

Expressway and first grade arterial highway need hundreds of thousands million yuan per kilometer inputs. But rural highway construction funds are basically within 1million Yuan and even some three or four grade highways need 200-300 thousand Yuan per kilometer relatively. Thus, each unit and individual donations may be a drop in the bucket for expressway and arterial highway. However it is a power cannot be reckoned for rural highways.

#### *4.2.3 Loan financing*

**1. Domestic Policy banks**
Government policy bank fund is from tax funds, treasury bonds and funds from other parties have different ways of borrowing money, and so on. As an example, the State Development Bank as one of China's three policy banks is primarily to finance large-scale national infrastructure, public utilities and policy projects.

**2. World Bank loan**
The World Bank is the largest international aid agencies in the world. It is an international bank consortium, and our country is also one of shareholders. It provides low-interest loans to developing countries to support economic development in these countries. China has the World Bank to build highways precedent.

#### *4.2.4 BOT and PPP mode*

**1. BOT mode**
BOT financing model is the use of domestic and international projects in the field of highway construction financing a better model. BOT model has the complexity and systemic, so prevalence of multi-project negotiations, but the success of the negotiations and begin implementation. And because the rural highway toll restriction, it is not many companies are willing to construct. It has not yet been used in BOT mode of financing in China.

**2. PPP mode**
Public Private Partnership mode (PPP), the core of the mode is the introduction of private capital in the supply

of public goods process, and forming partnerships between the public and private sectors. Government could get rid of inefficient supply deficiencies in production of public goods and services, and turn to be the one which need services, develop service standards and the limited role of managers. In deed restriction mechanism, the private sectors provide public services production, and the public sector (or government) pays their production costs to the private sector in return for compensation and benefits.

#### *4.2.5 Lottery of highway construction*

Highway in China, especially the rural highway, has a great political significance. And at the same time, because the low grade of rural highway is non-fee, fund-raising is very difficult. Highway construction has the nonprofit nature like sports and welfare. The issue of "highway construction lottery" is a good funding model for rural highway construction.

## 5 Conclusions

For a long time, rural highway as public goods has been charged with the task of construction investment by the state. The people also believe that the construction of highways is the obligation of the country. However, highway is essentially quasi-public goods with congestible character. Rural highway has personal characteristic in some extent, and it provides the possibility of private sector participation in the supply of rural highways.

China's current rural village with a population of generally small scale cannot reach the "club" membership optimal model point scale. It needs investment of the country to fill the gap to help rural highway construction in these areas. In the confidence game both of them will prefer to choose cooperation strategy. And if the government gives some "pre-commitment" before the game, then the government and private mixed supply model is easier to form more efficiently.

County financial is difficult, and it is limited that funds can be invested on a rural highway construction. And over-reliance on central financial support is also irrational. Farmers "one project one discussion" is farmers mainly fund raising. But the success of "one project one discussion" has many uncertain factors. And most of our villages are not fully equipped with factors such success. "One project one discussion" mode is very easy to go failure. In this paper, it is given rural highway public - private mix supply model in China, and briefly discussed some financing the supply channel of private sources.

## References


1. Sudhir Wanmali & Yassir Islam. Rural infrastructure and agricultural development in Southern Africa: A centre-periphery perspective [J]. *The Geographical Journal*, 1997, 163(3):259-269.
2. Edward M. Gramlich. Infrastructure investment: A review essay [J]. *Journal of Economic Literature*, 1994, 32(3):1176-1196.
3. Tarek M. Harchaoui, Faouzi Tarkhani & Paul Warren, Public infrastructure in Canada,1961-2002, [J]. *Canadian Public Policy-Analyse de Politiques*, 2004, 30(3):303-318.
4. Sytze A. Rienstra & Peter Nijkamp. Lessons from private financing of transport infrastructure Dutch infrastructure in the 19th century and European projects in the 20th century [J]. *Revue Economique*, 1997, 48(2):231-245.
5. Jonathan C. Levine. Equity in infrastructure finance: When are impact fees justified? [J] *Land Economics*, 1994, 70(2):210-222.
6. Ronald J. Daniels & Michael J. Trebilcock. Private provision of public infrastructure: An organizational analysis of the next privatization frontier [J]. *University of Toronto Law Journal*, 1996, 46(3): 375-426.
7. Clifford Winston. Efficient transportation infrastructure policy [J]. *The Journal of Economic Perspective*, 1991, 5(1):113-127.
8. Masakatsu Akino. Land infrastructure improvement in agricultural development: The Japanese case, 1900-1965 [J]. *Economic Development and Cultural Change*, 1979, 28(1):97-117.
9. Lata Chatterjee & Syed Abu Hasnath. Public construction expenditures in the united states: Are there structural breaks in the 1921-1987 period? [J]. *Economic Geography*, 1991, 67(1):42-53.
10. Alan Altshuler. Infrastructure investment [J]. *Journal of Policy Analysis and Management*, 1989, 8(3): 505-508.
11. Yang H. & Meng Q. Highway pricing and capacity choice in a road network under a build-operate-transfer scheme [J]. *Transportation Research*, 2000, 34A.
12. M.M. Kumarsawamy & X.Q. Zhang. Governmental role in BOT-led infrastructure development [J]. *International Journal of Project Management*, 2001.
13. Lin Qiao, Shaoqing Wang, Robert L.K. Tiong & Tsang-Sing Chan. Framework for critical success factors of BOT projects in China [J]. *The Journal of Project Finance*, 2001.