

Analysis on the Effects of Road Infrastructure on Poverty Reduction in China

Presented by

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China! China!

- **Second-largest** economy in the world
- Average **10 percent** GDP growth since 2002
- Still has **128 million impoverished** people, **10%** of its total population
- Gini coefficient: more than **0.473** in 2013



Poverty Reduction Project in Rural China

- “Linking All Villages” (村村通) project in China
 - The largest infrastructure reconstruction project in rural area in the world, including **road**, electricity, water, telephone network, cable television network, internet, etc.
 - Time span: 1998- 2020
 - Budget: 1 trillion RMB (16 billion USD)



village roads before reconstruction



village roads after reconstruction



Criticism

- Transportation infrastructure as a channel linking rural people to the outside world
 - Provide convenience for farmers to sell their products to the market
 - Criticized as lacking enough empirical evidence on poverty reduction
 - Public intellectuals doubt the effect of investing money on road construction
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Literature Review

- Ravi Kanbura and Ganesh Rauniyar(2010)
 - should improve road connections within rural areas
 - should improve road connections between rural and urban areas
- Wang (2010)
 - believes that investing on infrastructure will alleviate poverty and enhance economic growth

Literature Review

- Department for International Development (DFID, 2002)
 - infrastructure investment had little relevance to poverty reduction
 - actual benefits from infrastructure were significantly less than anticipated
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Theoretical Framework

- Asian Development Bank (1999); Ali and Pernia (2003)
 - The poor need greater access to **education, health services, water, sanitation, employment, credit, and markets**

Theoretical Framework

- Asian Development Bank (1999); Ali and Pernia (2003)
 - The poor need greater access to **education, health services, water, sanitation, employment, credit, and markets**
- My interest:
 - Based on the ADB poverty reduction model, review the rationality of the investment policy based on testing significance of effects of transportation improvement on increasing income of rural households

Research Question

- The effect of road infrastructure construction on poverty alleviation in China's poor villages.

Data Source and Extraction

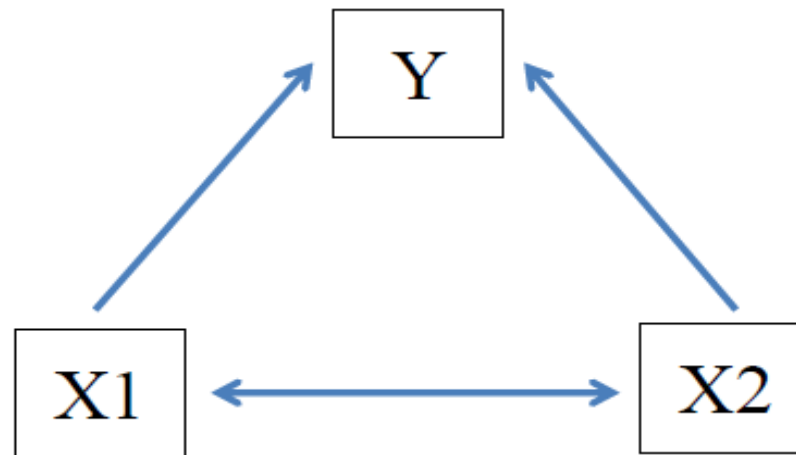
- Dataset: World Bank CCAP Village Survey (2003),
- Observation unit: village
 - In total 2459 village
 - choose only **1540** villages with net income per capita under **RMB 2000 (US\$320)** per year

Independent Variables

- Variable of interest
 - **roadpass**: =1 if there is a tarred/paved/cement road passing through the village; =0 otherwise

Criteria for control variables

Omitted Variable Bias



- If $X2$ is omitted in the model ($Y_i = \beta_0 + \beta_1 X1_i + u_i$), coefficient of $X1$ will capture the effect of $X2$ on Y
- This problem could cause upward or downward bias in the estimate of the effect of $X1$ on Y

Control variables

■ Control variables

- ❑ percentage of illiterates: **propilliter**
- ❑ owning a clinic: **ownclinic**
- ❑ distance to water-source: **distwat**
- ❑ percentage of non-farm income: **nonaginc**
- ❑ owning enterprise: **ownentpriz**

Variables and Description

Variable	Description	Unit
ln(netinc)	Log form of per capita net income of the village in year 2002	
roadpass	if there is a tarred/paved/cement road passing through the village	Yes=1; No=0
propilliter	percentage of illiterates among labors	%
diswat	distance to water-source	km
ownclinic	If the village owns a clinic	Yes=1; No=0
nonaginc	percentage of non-farm income	%
ownentpriz	If the village own enterprise	Yes=1 No=0

Regression Model

- $\ln(\text{netinc}) = C + \alpha_1 * \text{roadpass} + \beta_1 * \text{ownclinic} + \beta_2 * \text{propiliter} + \beta_3 * \text{diswat} + \beta_4 * \text{nonfarminc} + \beta_5 * \text{ownentpriz}$

Correlation among variables

variables	netincome	roadpass	propillit	ownclinic	distwat	nonaginc	ownentpriz
netincome	1.0000						
roadpass	0.1366	1.0000					
propillit	-0.2509	-0.0731	1.0000				
ownclinic	0.0990	0.1279	-0.1678	1.0000			
distwat	-0.1603	-0.0855	0.0723	-0.0342	1.0000		
nonaginc	0.1756	0.1369	-0.0230	0.1123	-0.0185	1.0000	
ownentpriz	0.1595	0.2492	-0.0895	0.1273	-0.0664	0.1939	1.0000

Preliminary Regression Result

Table: Regression Models of Per capita Net Income (netinc)				
Dependent variable (Y): Per capita net income of surveyed villages in 2002.				
Regressor	Y	Ln(Y)	Ln(Y)	Ln(Y)
	(1)	(2)	(3)	(4)
Roadpass (1=road passing, 0=otherwise)	138.4018** (25.6017)	0.1474** (0.0273)	0.1069** (0.0264)	0.0686* (0.0269)
Percentage of illiterates			-0.0076** (0.001)	-0.0075** (0.0008)
Ownclinic (1=owning clinic, 0=otherwise)			0.0990* (0.0388)	0.0705 (0.0381)
Distance to water source (in 100m)			-0.0072** (0.0015)	-0.0070** (0.0014)
Percentage of non-farm income				0.0034** (0.0006)
Owntpriz (1=owning enterprise, 0=otherwise)				0.0899** (0.0302)
Constant	1049.189** (15.5744)	6.8265** (0.0176)	6.8737** (0.0398)	6.7776** (0.0423)
Summary Statistics				
Adjusted R ²	0.0186	0.0171	0.0982	0.1260
SER	485.09	0.5301	0.5078	0.4999
No of observations	1540	1540	1540	1540

Note: Standard errors are given in parentheses under coefficients. Individual coefficients are statistically significant at the *5% level or **1% level.

Discussion-Research Design

- Data: **Cross-sectional Data** of CCAP Village Survey (2003)
 - Field research in rural areas in 6 provinces
 - 1541 villages(with net per capita<2000 annual income RMB)
- Sampling: **multi-stage stratified** sampling

Discussion-Validity

■ Internal Validity

□ Omitted variable bias

- labor force ratio
- credit

□ Reverse causality

□ Errors-in-variables bias

- ambiguous questions: proportion of non-farm income?
- intentional misreporting: net per capita income per year?

Discussion-Validity(cont.)

- External Validity

- ❑ 6 separately located provinces- increase representativeness and avoid convergence
- ❑ Applicable to poor rural areas, but not applicable to coastal villages
- ❑ May be not applicable to the current situation

Policy Implication

- **Maintain “Linking All Villages” project**
 - Build rural roads to facilitate better access between townships and villages and local markets
- **Enhance basic public services**
 - compulsory education
 - basic healthcare
 - water supply systems
- **Promote marketization**
 - Provide preferential policy to stimulate nonfarm economy
 - Offer training and privileges to local income-generating enterprises

Regressor	Coefficient
Roadpass (1=road passing, 0=otherwise)	0.0686*
Percentage of illiterates	-**
Ownclinic (1=owning clinic, 0=otherwise)	+
Distance to water source (in 100m)	-**
Percentage of non-farm income	+**
Owntpriz (1=owning enterprise, 0=otherwise)	+**

Case study: rural road development in Yuechi County

Yuechi County profile

- Location: east part of Sichuan Province
- Population: 1.14 million
- Area: 1457 square kilometers
- Agricultural county
 - 46 townships
 - 861 villages



Rural Road Construction

- The increasing investment on rural road construction
 - By 2012, the length of motorable road in the rural area has reached 1200 kilometers.
 - The growing quality of rural transport operation
 - 270 busses for the regular transport services, benefiting more than 40 townships
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Economic Development with rural road construction

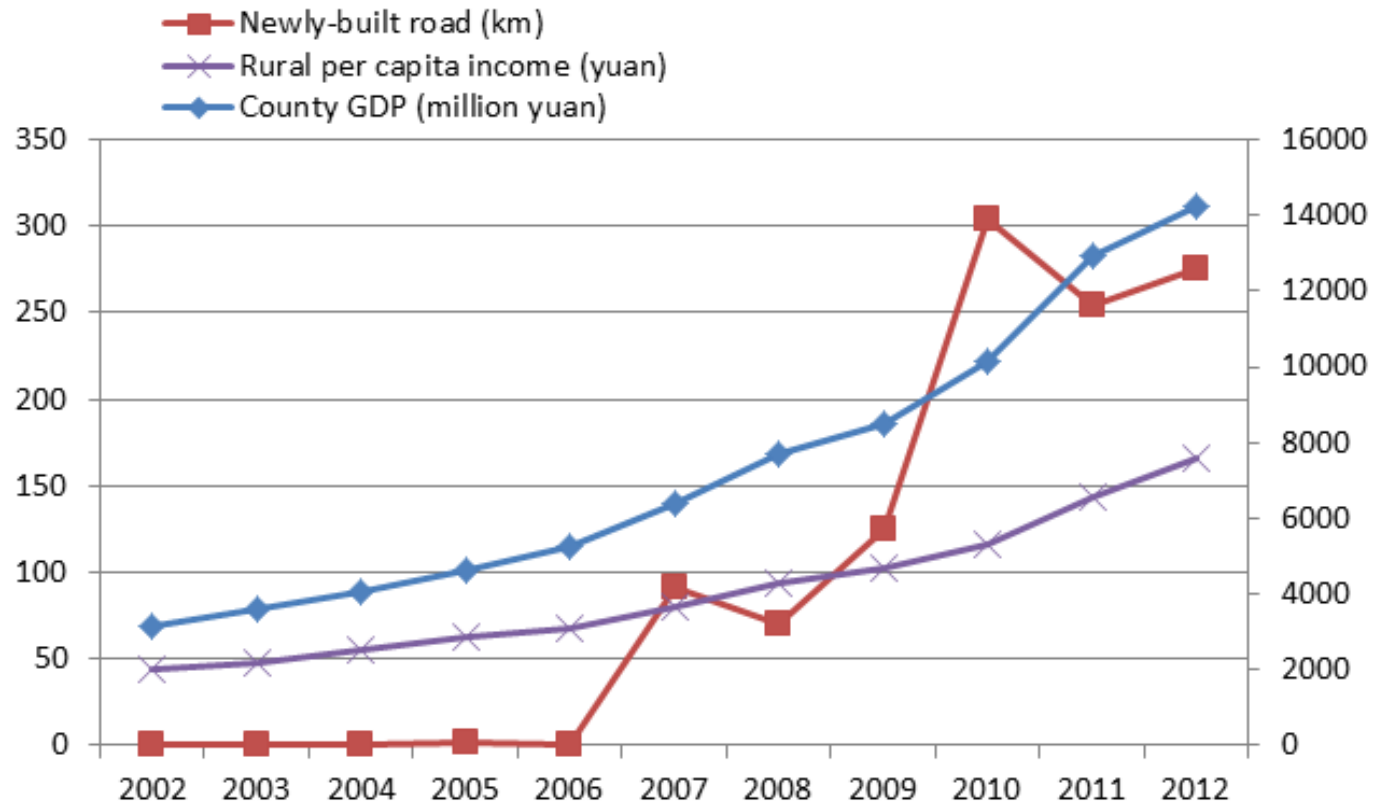
- In 2012, Yuechi's agricultural GDP reached 5.57 billion yuan, accounting for almost 40% of regional total GDP. a 5.7 percent growth over last year.
 - From 2007 onward, there have been a growing number of roads newly built each year averaging at **186.75 kilometers** per year.
 - the farmers' net per capita income has been increased and **more than doubled** from 3611 yuan in 2007 to 7601 yuan by the end of 2012.
-

Economic Development with rural road construction

Year	Newly-built road (km)	County GDP (million yuan)	GDP growth rate	Rural per capita income (yuan)	Amount of increase (yuan)
2002	0	3148	12.8%	2040	128
2003	0	3620	15.0%	2185	145
2004	0	4082	12.8%	2532	347
2005	1.84	4651	13.9%	2865	333
2006	0	5280	13.5%	3100	235
2007	91.2	6393	21.1%	3661	561
2008	70.1	7720	20.8%	4314	653
2009	125.2	8500	10.1%	4688	374
2010	304.3	10120	19.1%	5311	623
2011	254.7	12930	27.8%	6565	1254
2012	275	14226	10.0%	7601	1036

Source: Yuechi government website <http://www.scyc.gov.cn/>

Economic Development with rural road construction



Discussion

- The circulation of agricultural goods, rural human resources and lands has been escalated.
 - Production efficiency and transaction efficiency has been improved by rural roads connections.
 - The rural road construction has changed local agricultural economy from homegrown to commercialization.
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When it comes to practice, should the policymaker prioritize road infrastructure to other public project?

Data Source and Extraction

- Dataset: World Bank CCAP Village Survey (2003) sub dataset: Public Projects
- Observation unit: village
 - In total 2459 village
 - After cleaning missing and redundant records, **2453** villages remained in the pool

Regressors and Description

Variable	Description
ln(netinc)	Log form of per capita net income of the village in year 2002
HasRoad	if there was a road/bridge built in the village since 1998
HasIrri	if there was a irrigation project built in the village since 1998
HasWater	if there was a domestic water project built in the village since 1998
HasElc	if there was a electricity project built in the village since 1998
HasTlcm	if there was a telecome project built in the village since 1998
HasSchool	if there was a school built in the village since 1998
HasClinic	if there was a clinic built in the village since 1998

Regression Model

- Specification 1:

- $\lognetinc = c + \alpha_1 * HasRoad$

- Specification 2:

- $\lognetinc = c + \alpha_1 * HasRoad + \beta_1 * propilliter + \beta_2 * distwat + \beta_3 * nonfarminc + \beta_4 * ownentpriz$

- Specification 3:

- $\lognetinc = c + \alpha_1 * HasRoad + \alpha_2 * HasIrri + \alpha_3 * HasWater + \alpha_4 * HasElc + \alpha_5 * HasTlcm + \alpha_6 * HasSchool + \alpha_7 * HasClinic + \beta_1 * propilliter + \beta_2 * distwat + \beta_3 * nonfarminc + \beta_4 * ownentpriz$



Dependent variable (Y): Per capita net income of surveyed villages in 2002.			
Regressor	Ln(Y)	Ln(Y)	Ln(Y)
	Specification 1	Specification 2	Specification 3
<u>HasRoad</u> (1: has road project, 0: otherwise)	0.1880** (0.0287)	0.0455* (0.0253)	0.03422 (0.0254)
<u>HasIrri</u> (1: has irrigation project, 0: otherwise)			0.0601* (0.0270)
<u>HasWater</u> (1: has domestic water project, 0: otherwise)			-0.0367 (0.0262)
<u>HasElec</u> (1: has electricity project, 0: otherwise)			0.1071** (0.0312)
<u>HasTlcm</u> (1: has telecommunication project, 0: otherwise)			0.0113 (0.0243)
<u>HasSchool</u> (1: has school project, 0: otherwise)			-0.1364** 0.0243
<u>HasClinic</u> (1: has clinic project, 0: otherwise)			0.2554** 0.0404
<u>propilliter</u> (Percentage of illiterates)		-0.0139** (0.009)	-0.0135** (0.0008)
<u>distwat</u> (Distance to water source in 100m)		-0.0052** (0.0001)	-0.0045** (0.0016)
<u>nonfarminc</u> (Percentage of non-farm income)		0.0063** (0.0005)	0.0060** 0.0005
<u>Owntpriz</u> (1: owning enterprise, 0: otherwise)		0.3764** (0.0273)	0.3570** (0.0274)
Constant	7.176** (0.0222)	7.0198** (0.0294)	6.9738** (0.0416)
Summary Statistics			
Adjusted R ²	0.0167	0.2809	0.3038
SER	0.6981	0.5974	0.5886
No of observations	2453	2453	2453

Note: Standard errors are given in parentheses under coefficients. Individual coefficients are statistically significant at the *5% level or **1% level.

Project effectiveness comparison

Project	Coefficient	Significance	Explanation
Road	0.03422	insignificant	-
Irrigation	0.0601	5% level	6.01% increase in net per capita income if the project was implemented
Domestic water	-0.0367	insignificant	
Electricity	0.1071	1% level	10.88% increase in net per capita income if the project was implemented
Telecommunication	0.0113	insignificant	-
School	-0.1364	1% level	13.64% decrease in net per capita income if the project was implemented
Clinic	0.2554	1% level	25.03% increase in net per capita income if the project was implemented

Findings: Regardless of construction cost, other infrastructure construction such as clinic, electricity and irrigation is more effective than building roads on poverty reduction in short term

Policy Implication

- China should **continue** the “**Linking All Villages**” project. Taking into account the comparative costs and the villagers’ participation, building infrastructure merits priority because it is easier to implement and more acceptable by the villagers.
- Second, besides road construction, other infrastructure projects such as **electricity networks and irrigation system** should be also be considered

Policy Implication

- Government should promote **marketization** in impoverished rural areas.
 - the local government can formulate preferential policies to stimulate non-farm economy, and provide specialized training and privileges to local income-generating enterprises.
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Policy Implication

- The government should enhance **basic public services**
 - Provide **free education** to poor households to reduce illiteracy and conduct teacher training programs to enhance education quality;
 - Establish **clinics** to safeguard villagers' health and enable them to engage more in livelihood projects to augment income; and
 - Create water supply systems along accessible roads to reduce villagers' time and effort in obtaining water, a critical resource for both production and living.
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Scope of Future Research

- Include **credit** into the regression model
- Study the effect of transportation infrastructure on income for **rich** villages
- **Follow-up study** on the latest CCAP survey



Thank You