

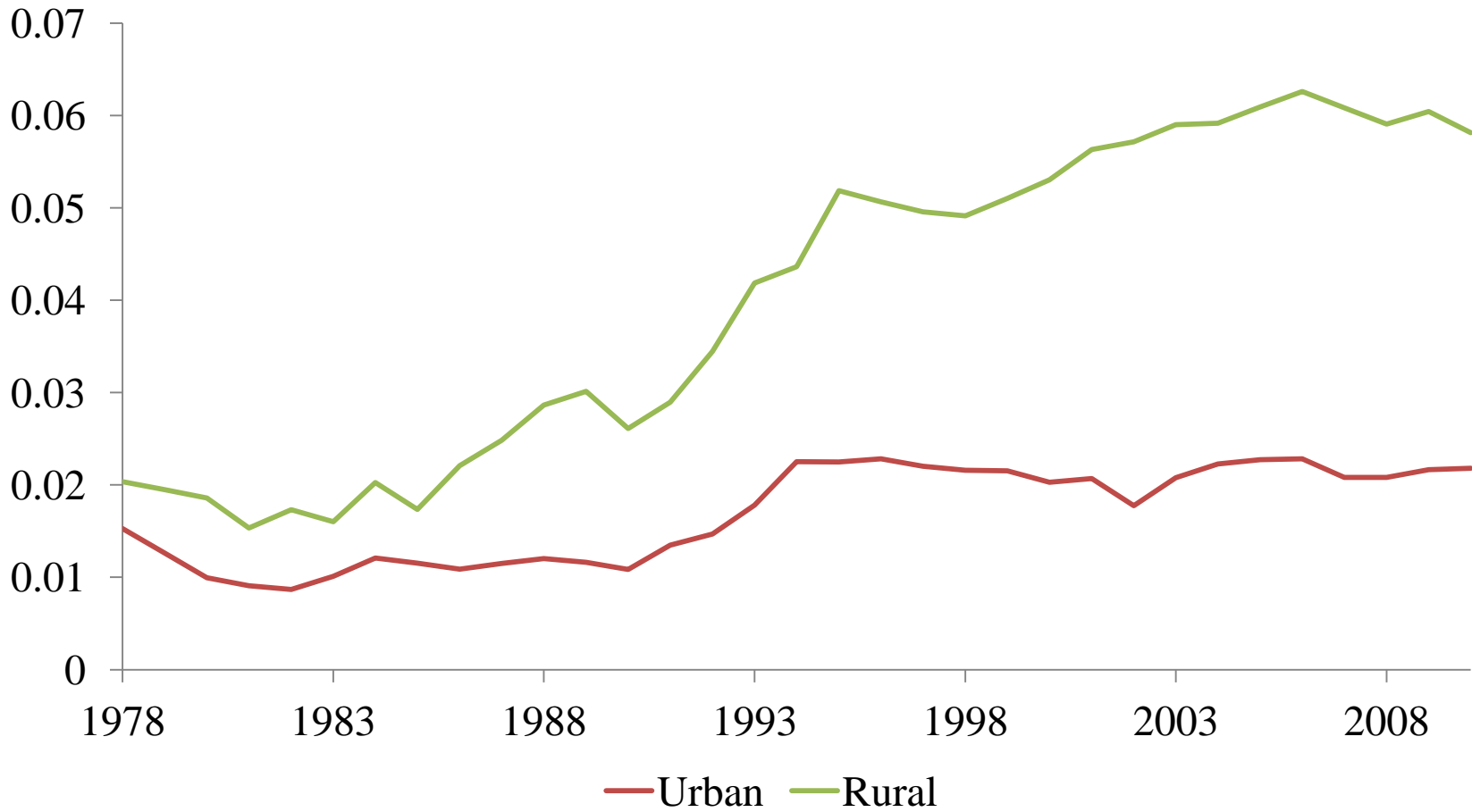
Disclaimer: The views expressed in this document are those of the author, and do not necessarily reflect the views and policies of the Asian Development Bank (ADB), its Board of Directors, or the governments they represent. ADB does not guarantee the accuracy of the data included in this document, and accept no responsibility for any consequence of their use. By making any designation or reference to a particular territory or geographical area, or by using the term "country" in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

Rural Infrastructure and Inclusive Growth

Guanghua Wan, ADBI

Xun Zhang, Beijing Normal University

Rising Inequality in China



Inclusive Growth

- **MDGs**
- **SDGs**
- **The Concept of Inclusive Growth: Growth and Equity**

Role of Infrastructure

- **Provide basic services or access to them**
- **Facilitate human/physical capital investment**
- **Promote trade via linkage to markets**
- **Lower production/transaction costs**
- **Improve the environment**
- **Does infrastructure contribute to inclusive growth?**

Literature: Efficiency Impacts

- **On growth (Barro, 1990; Easterly and Rebel, 1993; Gramlich, 1994; Morrison and Schwartz, 1996)**
- **Poor infrastructure as a major obstacle to growth in LDCs (Moccerro, 2008)**
- **Specific studies on growth channels:**
 - **Reduce trade cost (Bougheas et al., 1999)**
 - **Promote Urbanization (Atack et al., 2010)**
 - **Enhance competition (Du et al. 2013)**
 - **Increase rural income (Fan and Zhang, 2004)**

Literature: Distributive Impacts

- **Calderón and Chong (2004), Banerjee et al. (2012), and Calderón and Servén (2014)**
 - **Data: Country-level data**
 - **Result: Infrastructure reduces income Gini**
- **Aggregate Data Bias.**

Gaps and Objectives

- **Existing research that formally considers inclusive growth is lacking.**
- **This study:**
 - **For the first time proposes an analytical framework of inclusive growth.**
 - **Simultaneously considers growth and equity impacts of rural infrastructure in a unified framework.**
 - **Considers infrastructure of landline telephone, water, and electricity, which are more directly related to living**

Analytical Framework

- **Baseline model**

$$y_{it} = \alpha_0 + \alpha_1 P_{it} + \text{Controls} + \phi_i + \varphi_t + u_{it}$$

- **Factor P : 0-1 variable**
- **DID**
- **Specification to test inclusive growth**

$$y_{it} = \alpha_0 + \alpha_1 P_{it} + \alpha_2 y_{i,t-1} + \alpha_3 y_{i,t-1} \times P_{it} \\ + \text{Controls} + v_{it}$$

Identify Distributive Impacts

- Without factor P ,

$$E(y_{it} | P_{it} = 0) = \alpha_0 + \alpha_2 y_{i,t-1} + \text{Controls}$$

- With factor P ,

$$E(y_{it} | P_{it} = 1) = \alpha_0 + \alpha_1 + \alpha_2 y_{i,t-1} + \alpha_3 y_{i,t-1} + \text{Controls}$$

- P 's effect: $\alpha_1 + \alpha_3 y_{i,t-1}$
- If $\alpha_1 > 0$ and $\alpha_3 < 0$, inclusive growth

Empirical Specification

- **Baseline model**

$$y_{it} = \text{Ln}(\text{Inc}_{it}) = \alpha_0 + \alpha_1 \text{Inf}_{it} + \text{Controls} + v_{it}$$

- **Whether infrastructure contributes to inclusive growth**

$$y_{it} = \alpha_0 + \alpha_1 \text{Inf}_{it} + \alpha_2 y_{i,t-1} + \alpha_3 y_{i,t-1} \times \text{Inf}_{it} \\ + \text{Controls} + v_{it}$$

- **System-GMM**

Variables

- **Y: log (income) in 2009 prices**
- **Control variables:**
 - **School**
 - **Exp: Work experience = $\max(0, \text{age} - \text{school} - 7)$**
 - **Exp²**
 - **Dummies for marriage and gender**

Data

- **China Household Nutrition Survey (CHNS) Database.**
- **Whether he/she has:**
 - **fixed line telephone(s)**
 - **access to tap water**
 - **access to electric lights**
- **9 Years of data: 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011.**

Data Summary (1)

Variable	N	Mean	Std. Dev.	Min	Max
Ln(Inc)	48024	8.396	1.271	0.271	13.434
Ln(Inc _{t-1})	38846	8.237	1.224	0.271	13.434
Telephone	66554	0.490	0.500	0	1
Tap water	90169	0.623	0.485	0	1
Light	90062	0.979	0.142	0	1
Sch	60176	6.330	4.073	0	18
Exp	92657	20.434	21.006	0	94.67
Gender	62833	0.490	0.500	0	1
Marry	65461	0.757	0.429	0	1
East	92657	0.311	0.463	0	1
Mid	92657	0.412	0.492	0	1

Data Summary (2)

Variables	1989	1991	1993	1997	2000	2004	2006	2009	2011
Telephone=1	/	/	/	1575	3516	6094	7287	6083	7367
Telephone=0	/	/	/	6407	5588	3663	4930	6761	7283
Telephone Accessibility (%)	/	/	/	19.73	38.62	62.46	59.65	47.36	50.29
Tap Water=1	2827	3620	3867	4534	5556	6213	8371	9427	11792
Tap Water=0	4936	4571	3801	3486	3581	3564	3831	3342	2850
Tap Water Accessibility (%)	36.42	44.19	50.43	56.53	60.81	63.55	68.60	73.83	80.54
Light=1	6933	7719	7530	7952	9006	9744	12140	12706	14481
Light=0	820	476	132	67	87	25	46	37	161
Light Accessibility (%)	89.42	94.19	98.28	99.16	99.04	99.74	99.62	99.71	98.90

General Impacts on Income

	Telephone		Tap water		Light	
Inf	0.0365* (0.0215)	0.0377* (0.0215)	0.0425** (0.0197)	0.0427** (0.0198)	-0.00154 (0.0483)	-0.00387 (0.0483)
Sch	0.0684 (0.0457)	0.0652 (0.0434)	0.0751 (0.0502)	0.0726 (0.0484)	0.0780 (0.0524)	0.0756 (0.0506)
Exp	0.0817* (0.0452)	0.0788* (0.0429)	0.100** (0.0499)	0.0967** (0.0480)	0.103** (0.0521)	0.1000** (0.0503)
Exp²	-.00054*** (6.12e-05)	-.00055*** (6.34e-05)	-.00075*** (4.32e-05)	-.00073*** (4.50e-05)	-.00075*** (4.32e-05)	-.00074*** (4.50e-05)
Control	No	Yes	No	Yes	No	Yes
Ind & Time Effects				Yes		
N	30,090	29,885	45,757	45,500	45,718	45,460
R²	0.167	0.168	0.183	0.184	0.183	0.184

Impacts by Income Status

	Telephone		Tap water		Light	
Ln(Inc_{t-1})	0.642***	0.538**	0.695*	0.734*	6.765*	5.603*
	(0.226)	(0.227)	(0.401)	(0.408)	(3.975)	(2.892)
Ln(Inc_{t-1})*Inf	-0.644***	-0.559***	-0.679*	-0.725*	-6.798*	-5.649**
	(0.205)	(0.204)	(0.369)	(0.375)	(3.957)	(2.879)
Inf	5.670***	4.941***	5.695*	6.081**	53.67*	44.62**
	(1.721)	(1.721)	(2.990)	(3.040)	(31.10)	(22.62)
Sch	0.0497***	0.0446***	0.0492***	0.0411***	0.0666***	0.0576***
	(0.00690)	(0.00634)	(0.00844)	(0.00706)	(0.00375)	(0.00352)
Control	No	Yes	No	Yes	No	Yes
Time Effect				Yes		
N	20,259	20,121	29,346	29,174	29,325	29,152

Population Sub-groups

	Telephone		Tap water		Light	
Ln(Inc _{t-1})	0.695*** (0.224)	0.615*** (0.231)	0.721* (0.414)	0.775* (0.425)	7.445* (4.227)	6.720** (3.254)
Ln(Inc _{t-1})*Inf	-0.714*** (0.208)	-0.652*** (0.213)	-0.723* (0.390)	-0.786** (0.399)	-7.482* (4.212)	-6.768** (3.243)
Sch*Inf	0.0650*** (0.0166)	0.0523*** (0.0162)	0.0774** (0.0313)	0.0753** (0.0297)	0.576* (0.333)	0.548* (0.285)
Exp*Inf	0.00600*** (0.00213)	0.00448** (0.00211)	0.0104*** (0.00370)	0.00958*** (0.00346)	0.0510 (0.0486)	0.0499 (0.0441)
Gender*Inf		0.153*** (0.0382)		0.0838** (0.0400)		-0.463 (0.762)
Marry*Inf		0.0632 (0.0730)		0.171 (0.136)		2.039 (1.330)
Inf	5.620*** (1.608)	5.082*** (1.610)	5.250* (2.865)	5.610** (2.840)	54.49* (30.72)	47.59** (22.87)
Control	No	Yes	No	Yes	No	Yes
Time Effect				Yes		
N	20,259	20,121	29,346	29,174	29,325	29,152

Discussion

- **Efficiency Impacts:**
 - **Phone and water infrastructure have positive impacts on income in rural China.**
- **Distributive Impacts:**
 - **The relatively poor gain more from infrastructure.**
 - **The male, the more experienced and the better educated benefited more than their counterparts.**

Robustness Check

- **Subsample robust check for time periods and areas.**
 - **The distributive effects are most significant in central China and in later years.**
- **We deal with possible measurement errors:**
 - **Too large experience (truncate experience)**
 - **Mortality Selection Bias (drop observation of old people)**
 - **The decline of telephone accessibility (limit the samples before the replacement of landlines)**

Endogeneity

- **Household income may determine affordability of infrastructure.**
- **We average infrastructure accessibility to village and meanwhile clustering the standard error at the village level.**

Endogeneity

	Telephone		Tap Water		Light	
Ln(Inc _{t-1})	0.338** (0.156)	0.306* (0.157)	0.511* (0.272)	0.445⁺ (0.276)	0.583** (0.271)	0.502* (0.275)
Ln(Inc _{t-1})*Inf	-1.71e-05** (7.78e-06)	-1.61e-05** (7.63e-06)	-2.15e-05* (1.11e-05)	-1.93e-05* (1.09e-05)	-2.75e-05** (1.28e-05)	-2.41e-05* (1.26e-05)
Sch*Inf	0.0487*** (0.0113)	0.0418*** (0.0121)	0.0314*** (0.00787)	0.0267*** (0.00881)	0.0404 (0.0354)	-0.00172 (0.0370)
Exp*Inf	0.00549* (0.00307)	0.00425 (0.00324)	0.00537*** (0.00172)	0.00450** (0.00179)	-0.00610 (0.00984)	-0.0128 (0.0112)
Gender*Inf		0.181** (0.0743)		0.0603 (0.0489)		0.571*** (0.163)
Marry*Inf		-0.174* (0.101)		-0.0313 (0.0873)		0.0108 (0.259)
Inf	0.0791 (0.185)	0.206 (0.205)	-0.0616 (0.0876)	-0.00241 (0.113)	0.231 (0.452)	0.327 (0.425)
Control	No	Yes	No	Yes	No	Yes
Time Effect	Yes	Yes	Yes	Yes	Yes	Yes
N	20,379	20,239	29,455	29,280	29,455	29,280

Policy Implications

- We propose to further enhance the quantity and quality of rural infrastructure.**
- The focus of future investment in rural infrastructure in the three regions should be different.**
- Governments should increase educational expenditure in rural areas, especially in western rural areas.**

Thank you!