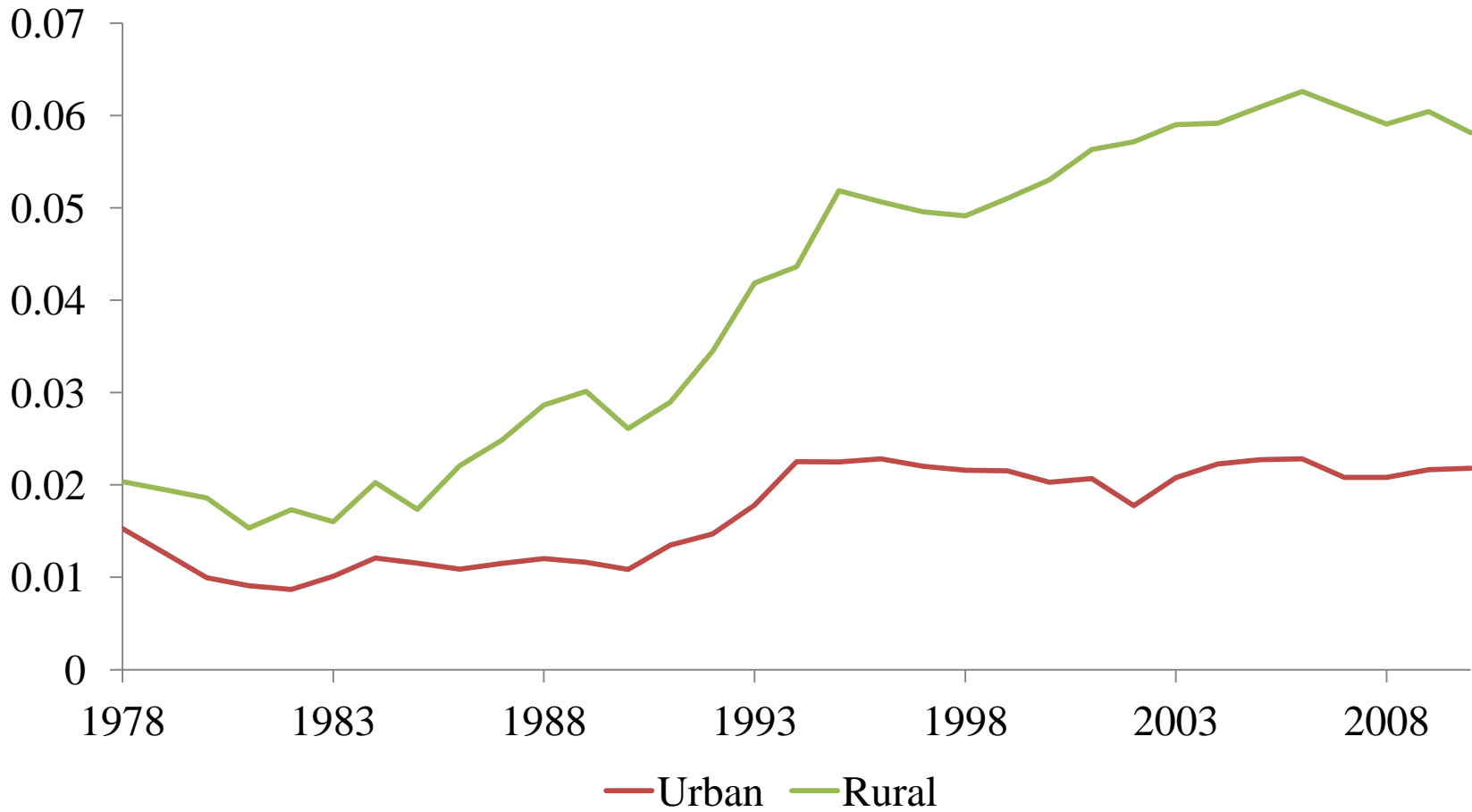


# **Rural Infrastructure and Inclusive Growth**

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# 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**

$$y_{it} = \text{Ln}(Inc_{it}) = \alpha_0 + \alpha_1 Inf_{it} + \text{Controls} + v_{it}$$

- **Whether infrastructure contributes to inclusive growth**

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

- **System-GMM**

# Variables

- **Y: log (income) in 2009 prices**
- **Control variables:**
  - **School**
  - **Exp: Work experience =  $\max(0, \text{age} - \text{school} - 7)$**
  - **Exp<sup>2</sup>**
  - **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)

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Variable	N	Mean	Std. Dev.	Min	Max
Ln(Inc)	48024	8.396	1.271	0.271	13.434
Ln(Inc <sub>t-1</sub> )	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
<b>Exp</b>	<b>92657</b>	<b>20.434</b>	<b>21.006</b>	<b>0</b>	<b>94.67</b>
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

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# 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	
<b>Inf</b>	<b>0.0365*</b> <b>(0.0215)</b>	<b>0.0377*</b> <b>(0.0215)</b>	<b>0.0425**</b> <b>(0.0197)</b>	<b>0.0427**</b> <b>(0.0198)</b>	<b>-0.00154</b> <b>(0.0483)</b>	<b>-0.00387</b> <b>(0.0483)</b>
<b>Sch</b>	<b>0.0684</b> <b>(0.0457)</b>	<b>0.0652</b> <b>(0.0434)</b>	<b>0.0751</b> <b>(0.0502)</b>	<b>0.0726</b> <b>(0.0484)</b>	<b>0.0780</b> <b>(0.0524)</b>	<b>0.0756</b> <b>(0.0506)</b>
<b>Exp</b>	<b>0.0817*</b> <b>(0.0452)</b>	<b>0.0788*</b> <b>(0.0429)</b>	<b>0.100**</b> <b>(0.0499)</b>	<b>0.0967**</b> <b>(0.0480)</b>	<b>0.103**</b> <b>(0.0521)</b>	<b>0.1000**</b> <b>(0.0503)</b>
<b>Exp<sup>2</sup></b>	<b>-.00054***</b> <b>(6.12e-05)</b>	<b>-.00055***</b> <b>(6.34e-05)</b>	<b>-.00075***</b> <b>(4.32e-05)</b>	<b>-.00073***</b> <b>(4.50e-05)</b>	<b>-.00075***</b> <b>(4.32e-05)</b>	<b>-.00074***</b> <b>(4.50e-05)</b>
<b>Control</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>
<b>Ind &amp; Time Effects</b>				<b>Yes</b>		
<b>N</b>	<b>30,090</b>	<b>29,885</b>	<b>45,757</b>	<b>45,500</b>	<b>45,718</b>	<b>45,460</b>
<b>R<sup>2</sup></b>	<b>0.167</b>	<b>0.168</b>	<b>0.183</b>	<b>0.184</b>	<b>0.183</b>	<b>0.184</b>

# Impacts by Income Status

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



# Population Sub-groups

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

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

# **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!**