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Growth And Distributive Effects Of Public Infrastructure Investments In China: An Application Of Macro-micro Simulation Model

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16th GTAP conference June 12-14

Acknowledge and Online Version

- **Supports from the Partnership for Economic Policy (PEP) Network**

- **Grateful to John Cockburn, Jean-Yves Duclos, Yazid Dissou, Luca Tiberti, Selma Didic , Fan Zhai, Xinshen Diao, and Zhong Zhao for their technical support and guidance**

- **PEP working paper:**

  http://portal.pep-net.org/documents/download/id/18762

- **PEP policy brief:**

  http://portal.pep-net.org/documents/download/id/18763

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Background

China's Economic Growth

- Fast economic growth rate: 10%

- GDP ≈ 47 trillion Yuan (USD$7.3 trillion, 2011)

- Per capita GDP =35181 Yuan(USD$5447)

Poverty and Inequality

- China's success in poverty reduction but still has the second largest population of poor people in the world.(128 million in 2011, net income USD$356)

- Gini index passed the 0.4 "warning level" to reach 0.47 in 2009, one of the highest in the world

China Inclusive Growth Strategy

Rising concern for Chinese government: "whether the poor participate in and benefit from the growth process"

    APEC 2009: President Hu Jintao endorses inclusive growth

Inclusive growth becomes a strategic pillar to achieve "harmonious society"

    related measures include: increased spending on health, education, social protection and public infrastructure, etc.

In 2009, public infrastructure investments

Rising Investments in Public Infrastructure

Public Infrastructure Expenditure
(million Yuan, at 2005 constant price)
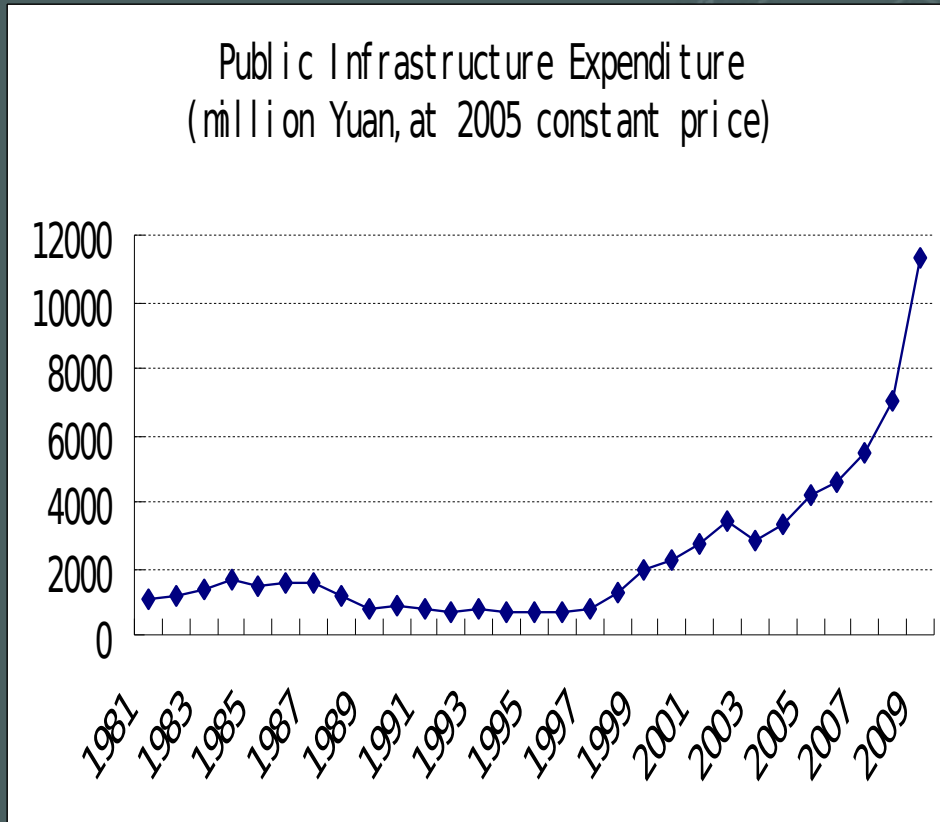
Public infrastructure investment:
1981: 111 billion yuan
2011: 1484 billion yuan (230billion USD$)

Annual real growth rate
1981-1997: 8.63%
1998-2010: 22.05%

Public Infrastructure in China

Overall competitiveness: ranked in 26th, Infrastructure: ranked in 44th (WEF 2011).

Length of transportation routes (1000 km)

Year	Railways	Highways	Navigable inland waterways	Total commercial air routes	Petroleum and gas pipelines
2000	69	1403	119	1503	25
2011	93	4106	124	3491	83

Source: China Statistical Yearbook (2012)

High-speed railways will be more than13,000 km in 2012
2006-2010,invest 2.2 trillion Yuan (≈ 341 billion USD$)
2011-2015,invest 3.5 trillion Yuan (≈542 billiion USD$)

China Macro-Micro Simulation Model

Intertemporal dynamic CGE model
(Macro Effects)

The changes of some important variables which affect households'
Income & Consumption

wage rate, non-wage income

consumer price saving rate

Micro simulation model
(Impacts on Poverty and Inequality)

Intertemporal dynamic CGE model

- The original model is developed by Yazid Dissou and Selma Didic

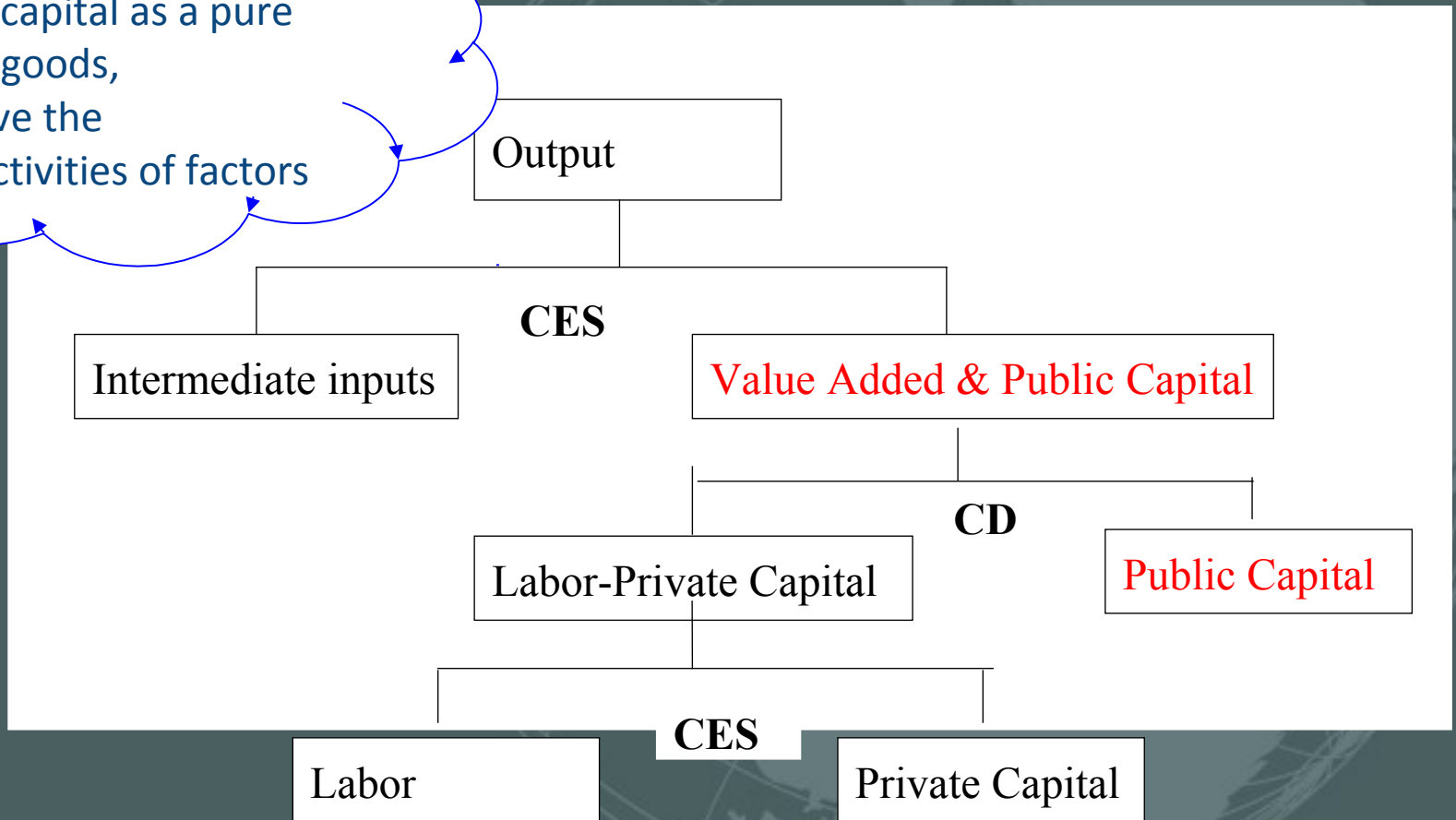- Applied in China, Philippine, Pakistan and Benin

Features

- Intertemporal: Modeling those crucial saving and investment behaviours

- Heterogeneous households and firms (Constrained and Non-constrained)

- Public capital as a stock in production function

- An infinite-horizon small open economy

- All variables are expressed in terms of efficiency units of labour

Intertemporal Dynamic CGE Model for China

- 2007 I-O table, 17 sectors
- Households are divided according to their behavior of whether borrowing in or lending out
- Government Revenue = taxes +transfers in
- Government spending = government consumption + transfers out + public infrastructure investment.
- Government saving = constant
- Public infrastructure investment as a ratio of current GDP is assumed to be exogenous as a policy variable.
- All the markets clear and all agents maximize their respective objectives subject to their budget constraints.
- 100 periods - a steady state has been attained

Production Structure

Public capital as a pure public goods,
Improve the productivities of factors

Output

CES

Intermediate inputs

Value Added & Public Capital

CD

Labor-Private Capital

Public Capital

CES

Labor

Private Capital

Micro Simulation Model

The layered macro-micro behavioral methodology in a "top-down" fashion is applied, following the work by Cockburn et al. (2011)

Transfer Channels:

The changes in wage and non-wage revenues, commodity

prices and savings

Revenue - Consumption expenditure – Poverty/Inequality

Method:

Poverty: The Foster-Greer-Thorbecke (FGT) index

Inequality: Gini coefficient

Data and Parameters

I-O table of 2007 is from NBS

The output elasticity of public capital stock

- 0.15 from Chunpu Son (2011)

- all sectors are assumed the same

Households survey data

- Produced by the Chinese Household Income Project (CHIP) of Inter University Consortium.

- Sample: 6,835 (urban), 9,200 (rural), and 2,000(rural-urban migrant)

- Update the data from 2002 to 2009 using national statistical data information

Poverty line (World Bank, international)

- $1.25 per day (PPP): about 2,085 yuan per year in 2009 for rural

- Living cost: urban = 1.5 times of rural

Simulating a 20% increase in ratio of public infrastructure investment to GDP

Using modeling and macro-micro simulation techniques

To assess the impact of such an increase on:

- the Chinese economy (macro impacts) as a whole GDP, price, wage rate, income, consumption and trade

- household welfare and disparities (distributive impacts):

  Who will gain? Is it an effective "inclusive growth strategy"?

Via 2 different scenarios of "financing mechanisms":

  Increasing 1- production tax or 2- foreign borrowing

Impact on China's Economy

Variable	Production TAX Scenario (%)		Foreign Borrowing Scenario (%)	
	First Period	*Long Run*	*First Period*	*Long Run*
Wage rate	-0.51	5.74	0.41	4.81
Constrained HHs Income	-0.47	4.54	0.31	3.72
Non-constrained HHs Income	-1.21	2.72	-1.15	3.51
Constrained HHs Consumption	0.46	3.78	0.61	3.25
Non-Constrained HHs consumption	0.31	3.72	-0.47	4.54
Private investments	-0.34	5.72	0.97	4.67
Export	-1.13	4.95	-1.91	4.59
Import	0.37	5.18	1.16	4.38
GDP	0.03	4.61	0.38	3.98

Sectoral Impacts

In the long run, all sectors are benefited from the increased investments in public infrastructure

- 2 sectors increase much more than the others:
  - **Construction & Manufacture of Nonmetallic Mineral Products**

- For some sectors:
  - **crowd out effects reduce private investments**

- For labor-intensive sectors - e.g. Textile:
  - **loss comparative advantage due to increased wage rate.**

Impact on Poverty

➤In the long run, both financing mechanisms have significant positive effects on poverty reduction.
➤Rural poor who benefit the most, as more of them exit poverty than urban and migrant households.
➤The increased wage income contributes most to poverty reduction.

Foreign Borrowing   **Production Tax**
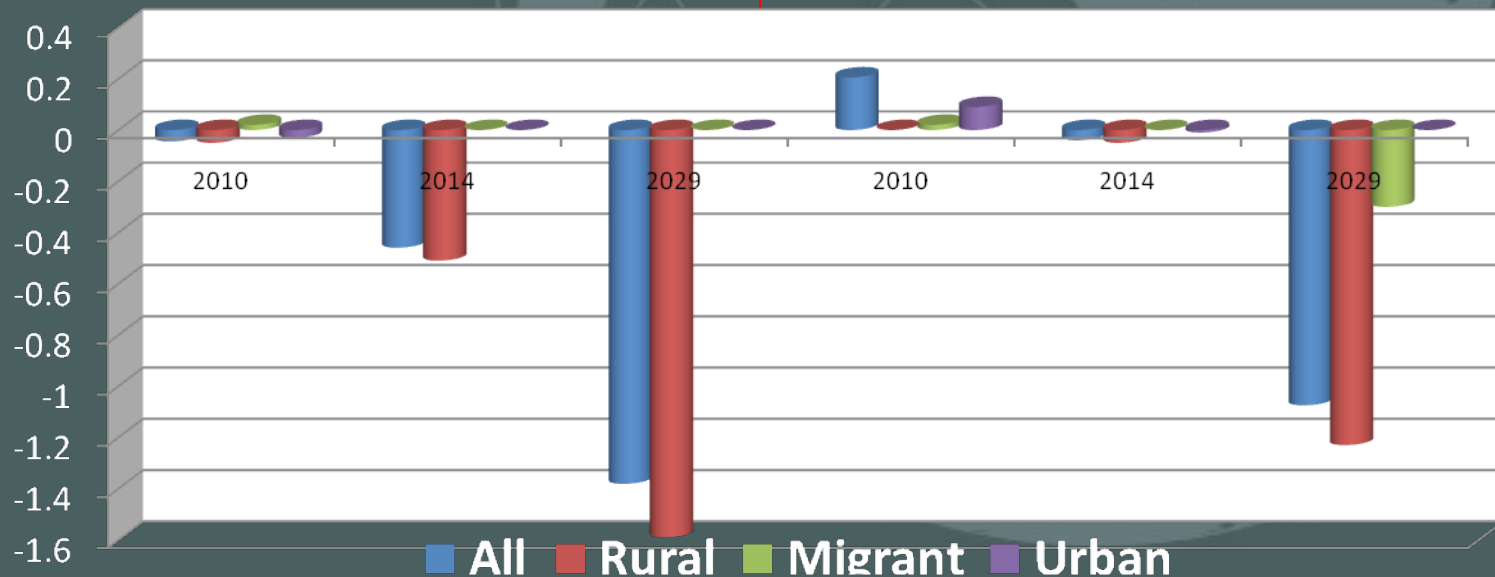
Impact on inequality

Equality is improved - within /between rural /urban HHs

⬚	Base	⬚ Foreign borrowing financing		Production Tax financing ⬚	
Period ⬚⬚		1st	100th	1st	100th
Group	**Gini Coefficient**	**Percent Deviations from Baseline (%)**			
National	0.3292	0.3288*	0.3271*	0.3293*	0.3267*
Rural	0.3021	0.3018 *	0.3004*	0.3023 *	0.3001*
Migrant	0.2862	0.2862	0.2877	0.2861	0.2884
Urban	0.3089	0.3086 *	0.3078*	0.3090	0.3076*
Within	0.1964	0.1959	0.1952	0.1961	0.1950
Between	0.0954	0.0948	0.0938	0.0950	0.0936
Overlap	0.0373	0.0370	0.0370	0.0371	0.0370

* The difference (relative to the base year) is statistically significant at the 10% level.

Key findings

- **An increase in PII drives economic growth. In the long run, real GDP would be accelerated, by approximately 4 percentage points, through improvements in productivity.**

- **Different sectors are impacted differently, due to distinct sectoral characteristics. For example, the construction and nonmetallic mineral products' sectors gain significantly from the increased PII, while textile industry loses in terms of competitiveness.**

Key findings

- **There are positive effects of the increased PII on poverty in both the short- and long-run.** The national poverty headcount ratio is decreased by more than 2 percentage points in the long-run.

- **Equality also improves following increases in PII,** not only within the groups (of rural and/or urban households), but also between them (rural vs urban households).

Policy Implications

- Public infrastructure investment is found to raise growth and lower income inequality in China. Increasing public infrastructure investment should be considered as a key strategy for inclusive growth.

- In particular, China could consider investing more in rural infrastructure to reduce inequality between rural and urban households by promoting equal access to basic public services.