

The Way to increase efficiency of infrastructure investment to promote Quality Infrastructure

Naoyuki YOSHINO

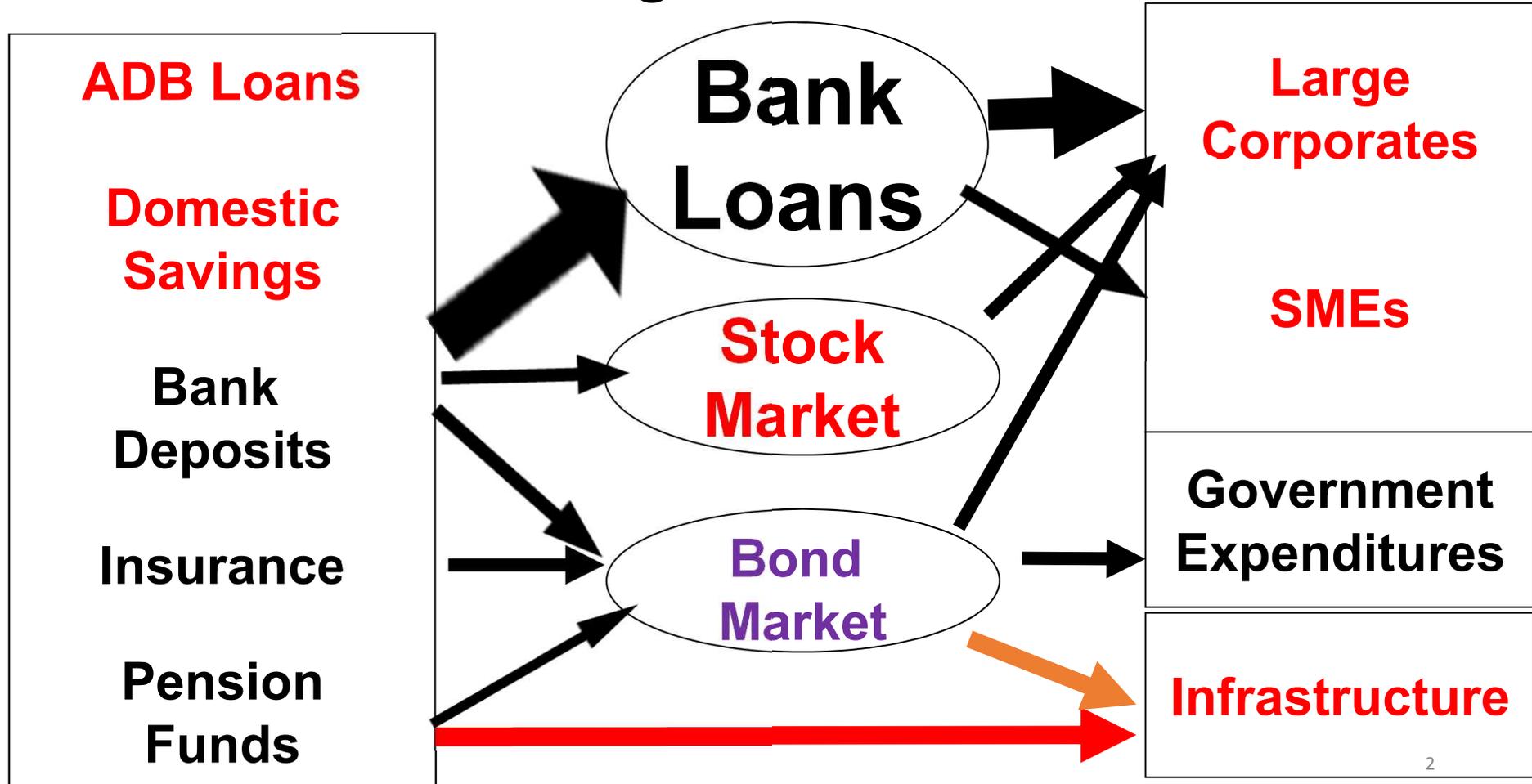
Dean & CEO

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Professor Emeritus of Keio University

MOFA, September 12, 2018

Circulation of Savings into Domestic Investment



Growing Savings Ratio in Asian Countries

(1) Savings → Bank Loans → SME → Economic Growth → Deposits

(2) Increase of domestic Savings are Important in Asian Growth

(3) 1997 Financial Crisis of Asia

→ Lack of Asian domestic Savings

	Nominal measure								Average
	1966–70	1971–75	1976–80	1981–85	1986–90	1991–95	1996–2000	2001–07	
PRC	28.9	29.1	33.0	34.8	37.0	41.9	40.7	46.2	37.8
Hong Kong, China	28.2	29.4	33.5	31.6	36.0	32.6	30.4	31.5	31.6
Indonesia	14.3	23.9	30.8	30.1	31.9	32.4	28.1	29.9	27.8
India	15.5	16.7	18.7	19.4	21.9	23.0	22.4	29.0	22.2
Korea, Rep. of	15.2	19.0	27.0	27.8	36.5	36.4	35.6	31.8	28.8
Malaysia	24.3	24.2	31.1	28.1	33.3	37.8	45.8	42.6	33.4
Pakistan	8.9	8.0	7.9	7.2	10.3	16.4	14.9	16.1	11.2
Philippines	21.9	23.6	26.2	21.0	19.0	16.3	17.1	13.8	19.1
Singapore	18.4	26.3	34.9	43.8	41.0	47.3	49.9	46.3	39.8
Thailand	21.2	22.8	22.1	24.3	30.8	35.8	34.3	32.2	27.9
Taipei, China	25.3	30.4	33.0	31.6	33.4	27.2	26.0	26.0	28.7
Viet Nam					3.9	14.6	22.2	29.0	17.4
Average a/	19.8	22.0	25.7	26.6	30.0	33.2	32.9	37.5	

Stock Budget and Flow Budget

(1) Flow Budget: Ordinary Budget

TAX Revenues → Government Expenditures

(2) Stock Budget: long-term

Pension Funds → Infrastructure, SME

Post Office Savings → Housing Loans

Infrastructure Investment Needs in Asia-Pacific (2016-2030)

(\$ billion in 2015 prices, annual average)

	Baseline Total	% of GDP	Climate Adjusted	% of GDP
Central Asia	33	6.8	38	7.8
East Asia	919	4.5	1071	5.2
South Asia	365	7.6	423	8.8
Southeast Asia	184	5.0	210	5.7
The Pacific	2.8	8.2	3.1	9.1
Asia & Pacific	1503	5.1	1744	5.9

Source: Meeting Asia's Infrastructure Needs, ADB (2017)

Infrastructure Investment Needs by Sector, 2016-2030

(\$ billion in 2015 prices)

Sector	Baseline estimates		
	Investment Needs	Annual average	% share to total
Power	11689	779	51.8
Transport	7796	520	34.6
Telecommunications	2279	152	10.1
Water and Sanitation	787	52	3.5
Total	22551	1503	100

Source: Meeting Asia's Infrastructure Needs, ADB (2017)

Various Risks in Infrastructure

1. Risks: Infrastructure Investment

- i. Political risk (government),
- ii. Construction risk,
- iii. Operation and maintenance risk,
- iv. Exchange rate risk.
- v. Environmental risk

2. User charges cannot be set too high

User charges \ll Total costs

3. How to maintain stable income stream ?

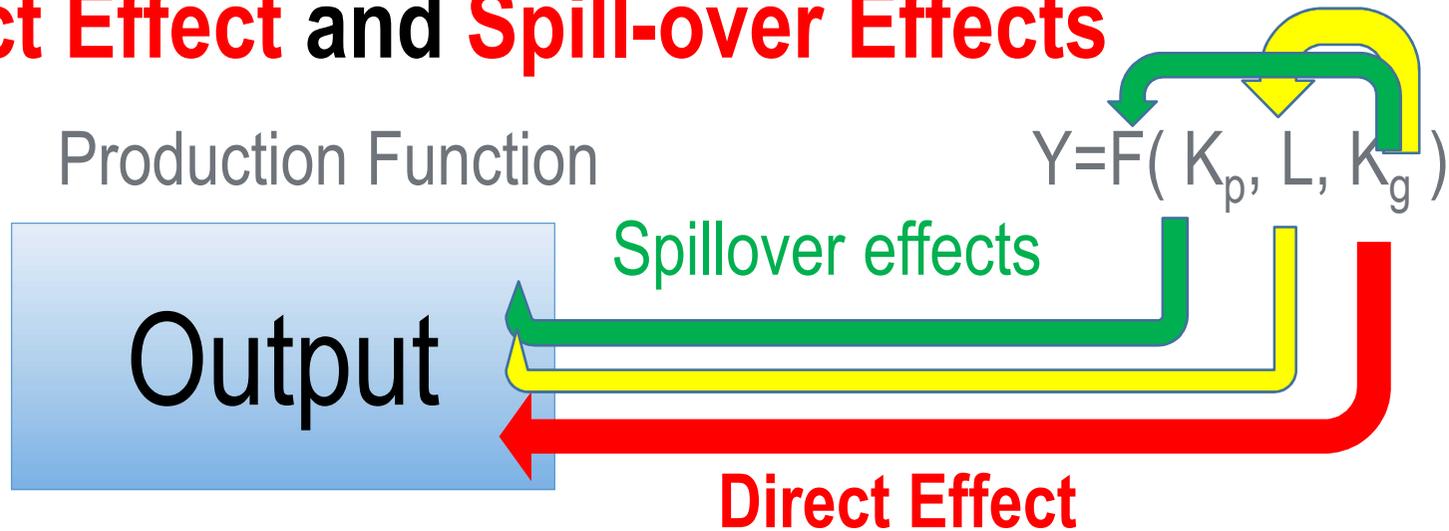
Utilize Spillover Tax Revenues

USA: Uses property tax revenues

Different Classes of Infrastructure Assets



Direct Effect and Spill-over Effects



Y = Output,

K_p = private capital,

L = labor

K_g = public capital (infrastructure)

**Quality of Infrastructure is
measured by
the spillover effects**

Spillover Effects of Infrastructure Investment



Macroeconomic Effect of Infrastructure Investment

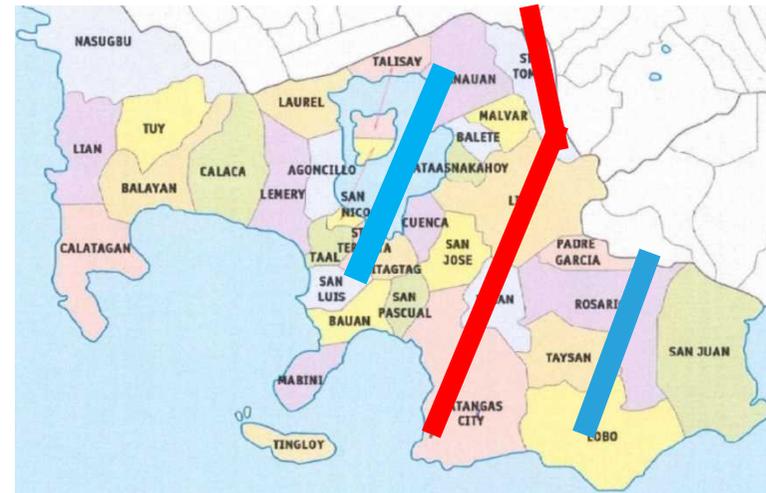
Spillover Effects Estimated from a Macroeconomic Translog Production Function				
	1956-60	1961-65	2001-05	2006-10
Direct effect (K_g)	0.696	0.737	0.114	0.108
Indirect effect (K_p)	0.452	0.557	0.091	0.085
Indirect effect (L)	1.071	0.973	0.132	0.125
20% returned	0.305	0.306	0.045	0.042
Increment	43.8%	41.5%	39.0%	39.1%

Source: Yoshino and Nakahigashi (2016)

Southern Tagalog Arterial Road (STAR)

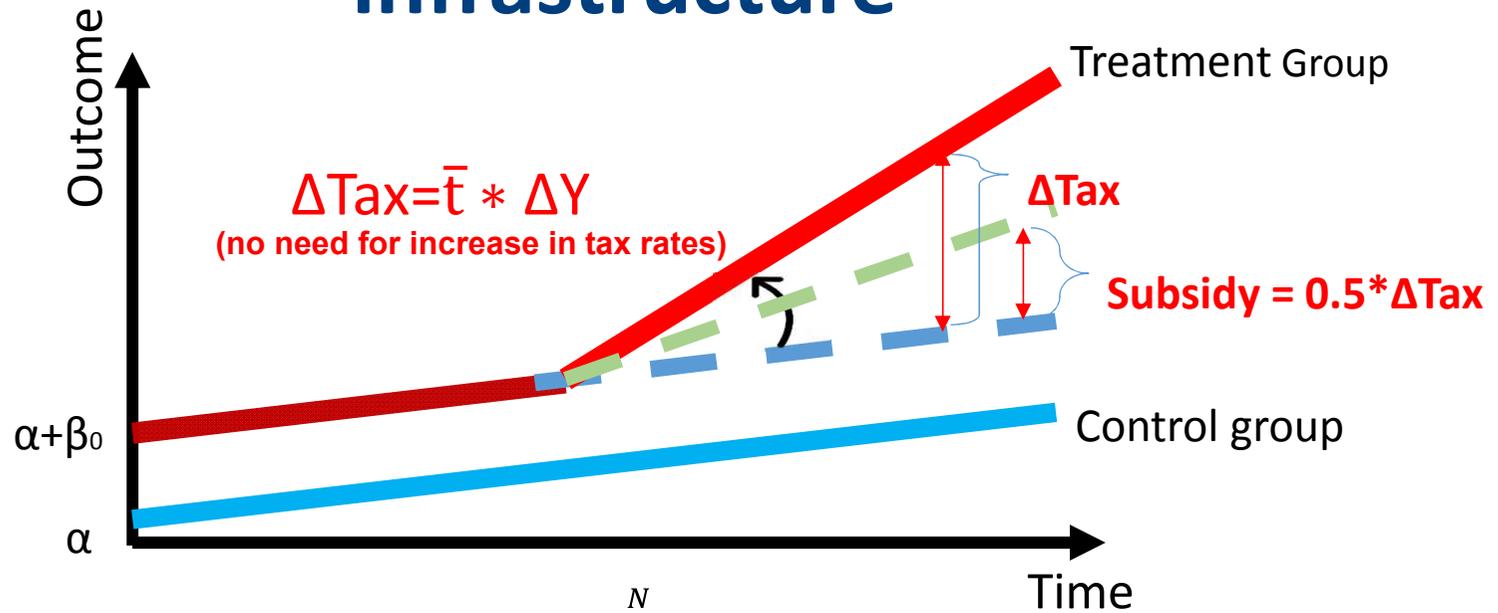
Philippines (Yoshino and Pontines, Chapter 3)

- STAR tollway built to improve road linkage between Metro Manila and Batangas International Port.
- Tax revenue increased during construction and after completion in communes along the tollway.



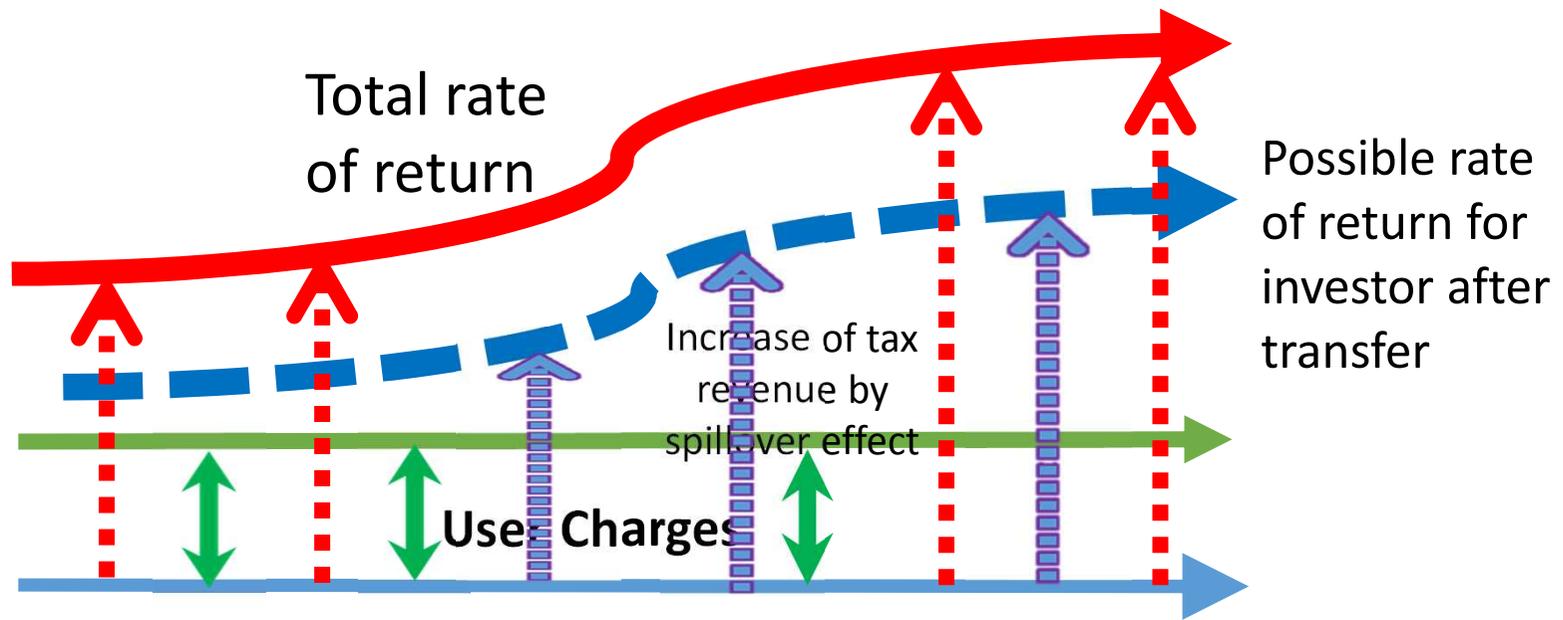
	t_{-2}	t_{-1}	t_0	t_{+1}	t_{+2}	t_{+3}	t_{+4} , forward
Lipa City	134.36	173.50	249.70	184.47	191.81	257.35	371.93
Ibaan City	5.84	7.04	7.97	6.80	5.46	10.05	12.94
Batangas City	490.90	622.65	652.83	637.89	599.49	742.28	1,208.61

Concept of subsidy based on additional flow of tax revenue due to infrastructure

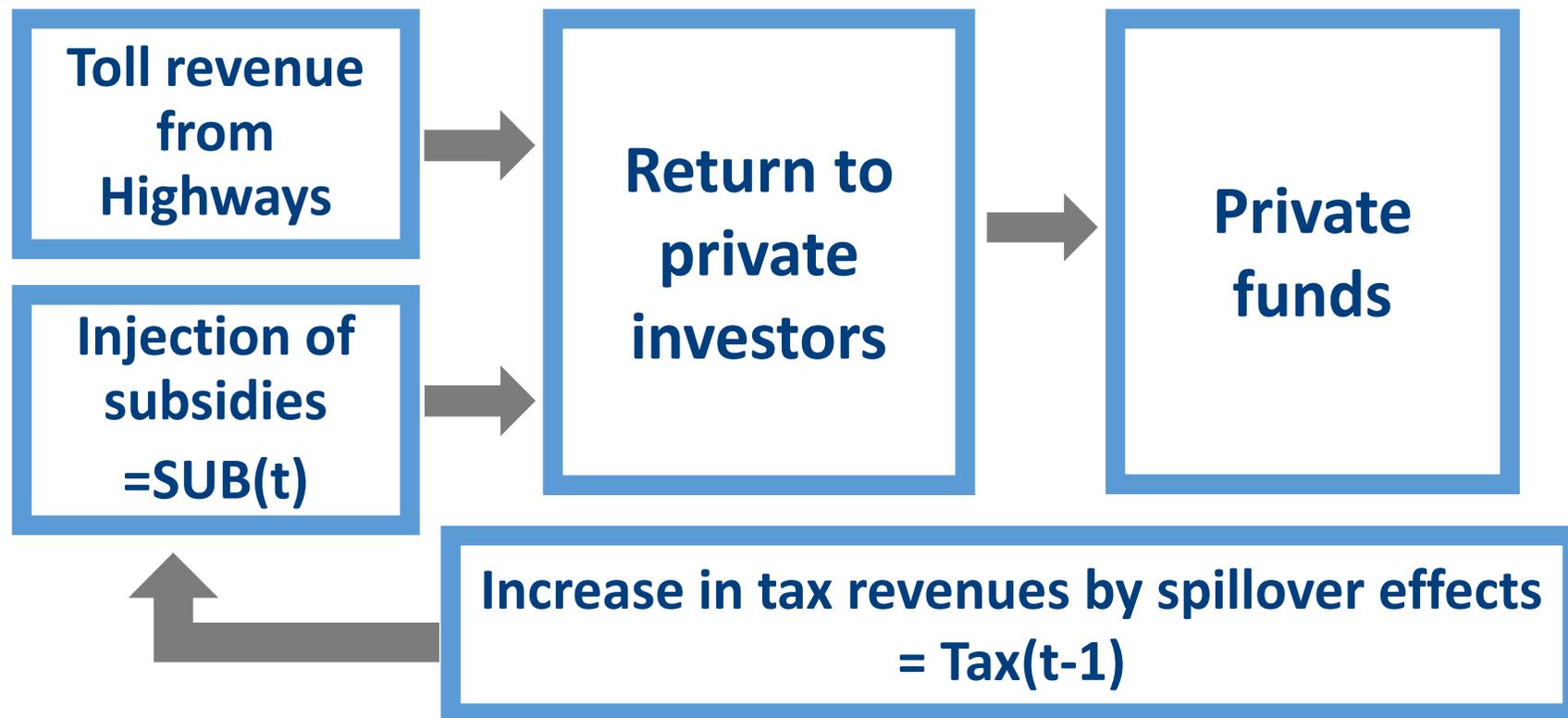


$$Outcome = \alpha + \beta_0 D_i + \sum_{t=1}^N \beta_0 * D_i * T_t + \varepsilon_{i,t}$$

Injection of Increased Tax Revenues to Increase the Rate of Return

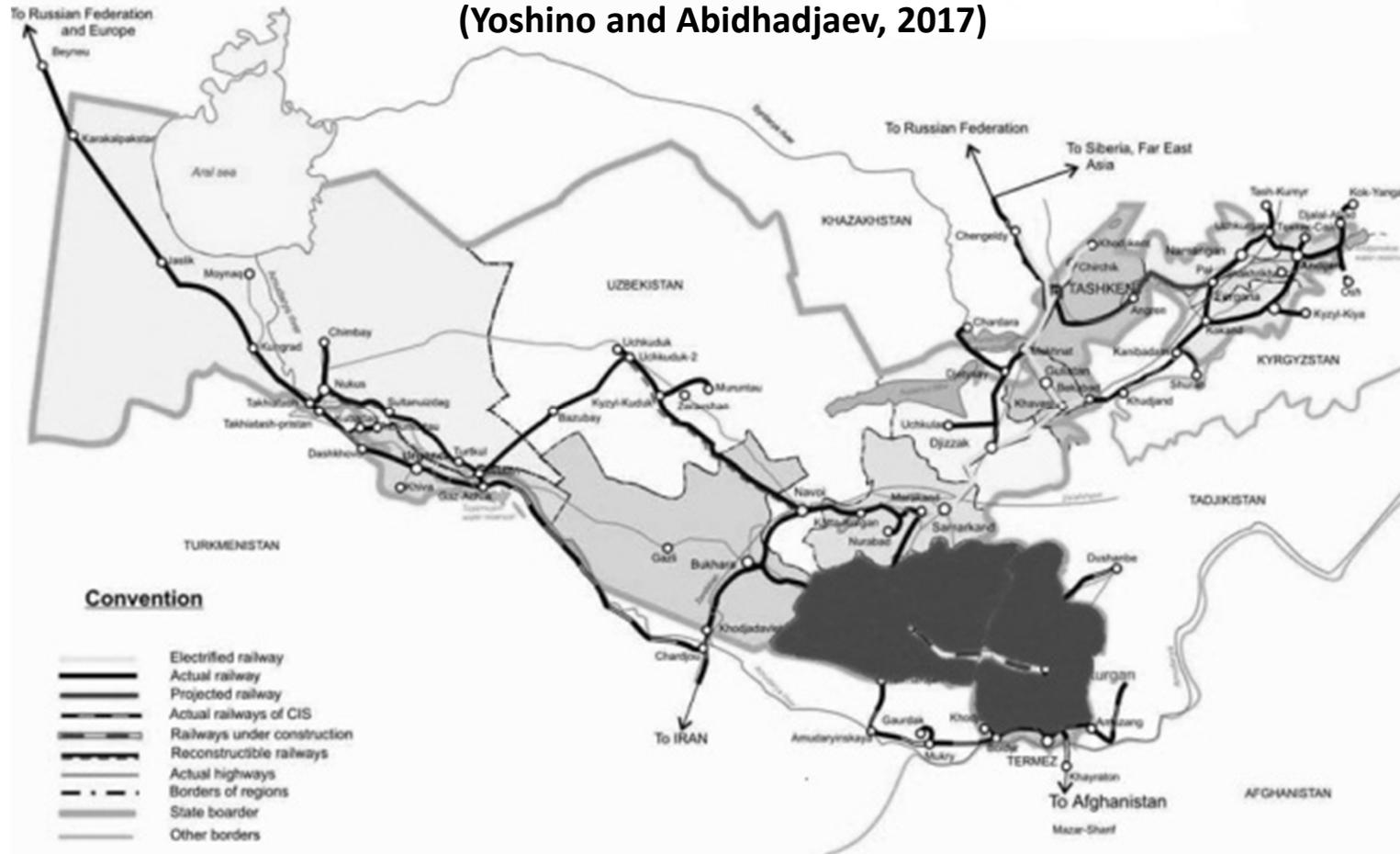


Injection of Fraction of Tax Revenues as Subsidy



Uzbekistan Railway

(Yoshino and Abidhadjaev, 2017)



GDP



		D_t	D_i	Connectivity effect $D_g = \text{connectivity}$	Regional effect $D_g = \text{regional}$	Spillover effect $D_g = \text{spillover}$
Launch effects						
	Short-term		$D_{t=2010:2009}$	2.83***[4.48]	0.70[0.45]	1.33[1.14]
	Mid-term		$D_{t=2011:2009}$	2.5***[6.88]	0.36[0.29]	1.27[1.46]
	Long-term		$D_{t=2012:2009}$	2.06***[3.04]	-0.42[-0.29]	2.29**[2.94]
Anticipation effects						
1 year	Short-term		$D_{t=2010:2008}$	0.19[0.33]	0.85[1.75]	-0.18[-0.20]
	Mid-term		$D_{t=2011:2008}$	0.31[0.51]	0.64[1.30]	-0.02[-0.03]
	Long-term		$D_{t=2012:2008}$	0.07[0.13]	-0.006[-0.01]	0.50[0.67]
	Postponed effects		$D_{t=2012:2010}$	1.76*[1.95]	-1.49[-0.72]	2.58*[2.03]
Anticipation effects						
2 years	Short-term		$D_{t=2010:2007}$	-1.54[-1.66]	1.42[0.78]	-1.32[-0.92]
	Mid-term		$D_{t=2011:2007}$	0.32[0.44]	0.84[1.42]	0.13[0.13]
	Long-term		$D_{t=2012:2007}$	0.11[0.15]	0.10[0.16]	0.87[1.19]
	Postponed		$D_{t=2012:2011}$	-0.14[-0.20]	-1.71[-1.35]	1.05[1.44]



Full length article

An impact evaluation of investment in infrastructure: The case of a railway connection in Uzbekistan[☆]

Naoyuki Yoshino^a, Umid Abidhadjaev^{b,*}

In the spectrum of economic sectors, the positive effect reflected in regional GDP seems to be driven by approximate increases of 5% in industrial output and of 7% in aggregate services. The effect on agricultural output is moderate relative to other sectors, constituting around 1% for connectivity effects, which is consistent with previous literature on the impacts of public capital.

Context: Japan

(Yoshino and Abidhadjaev, Chapter 2)

Travel time to Kagoshima		
	Before	After
Tokyo	9h 00m	7h 20m
Shin-Osaka	6h 20m	4h 40m
Hakata	3h 50m	2h 10m
Kumamoto	2h 30m	1h 00m
Shin-Yatsushiro	2h 10m	35m

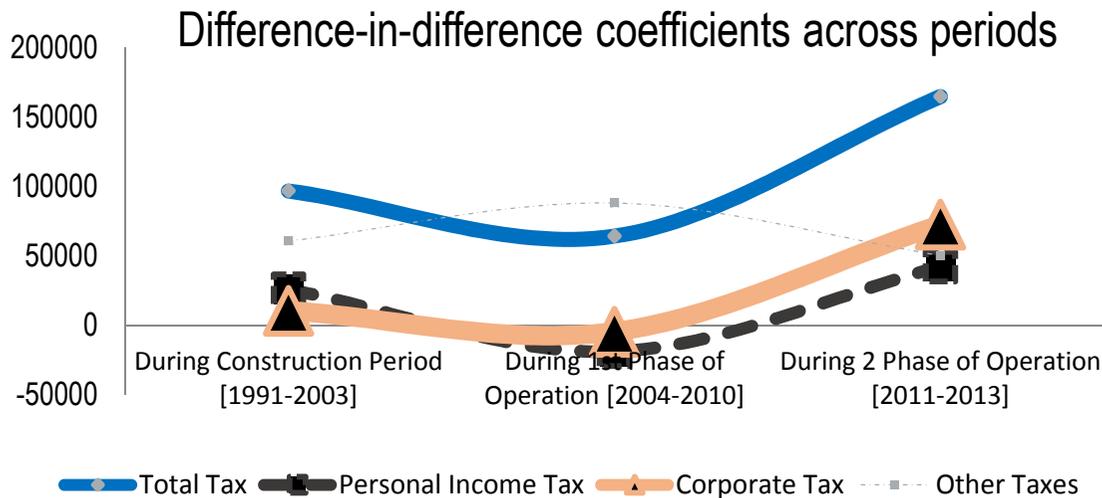
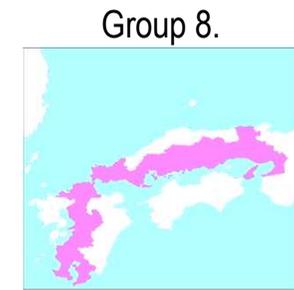
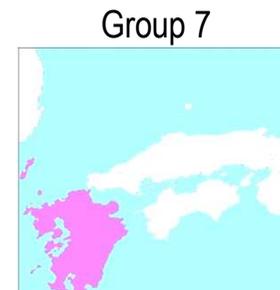
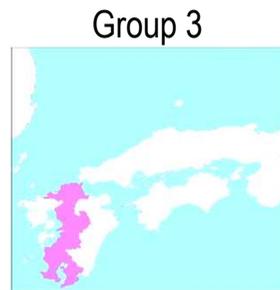
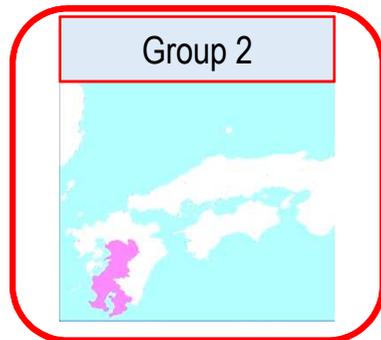


Kyushu Shinkansen

Japan

Source: <https://www.acprail.com/rail-passes/japan-rail/bullet-train/kyushu-shinkansen>

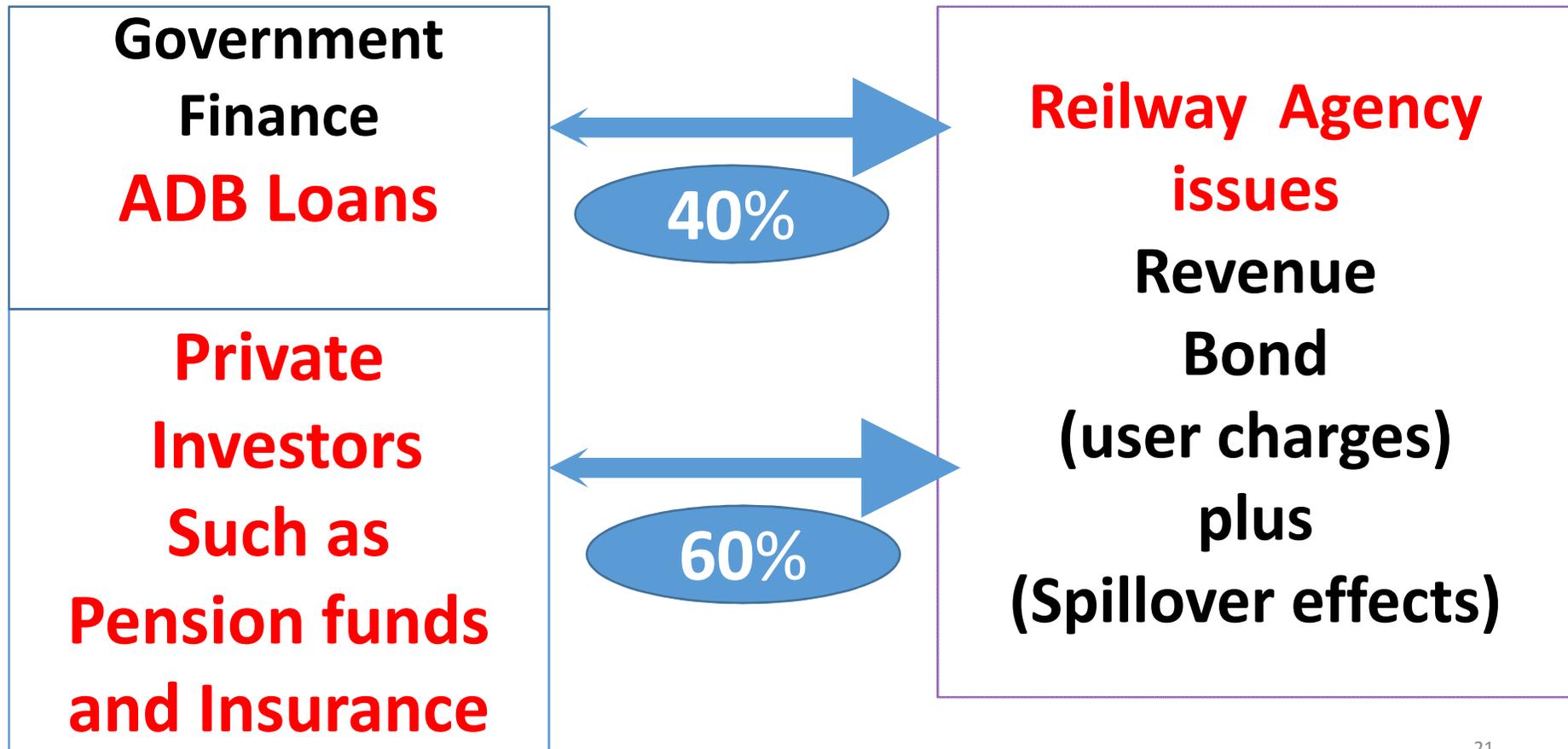
Estimation Results by Group of Prefectures



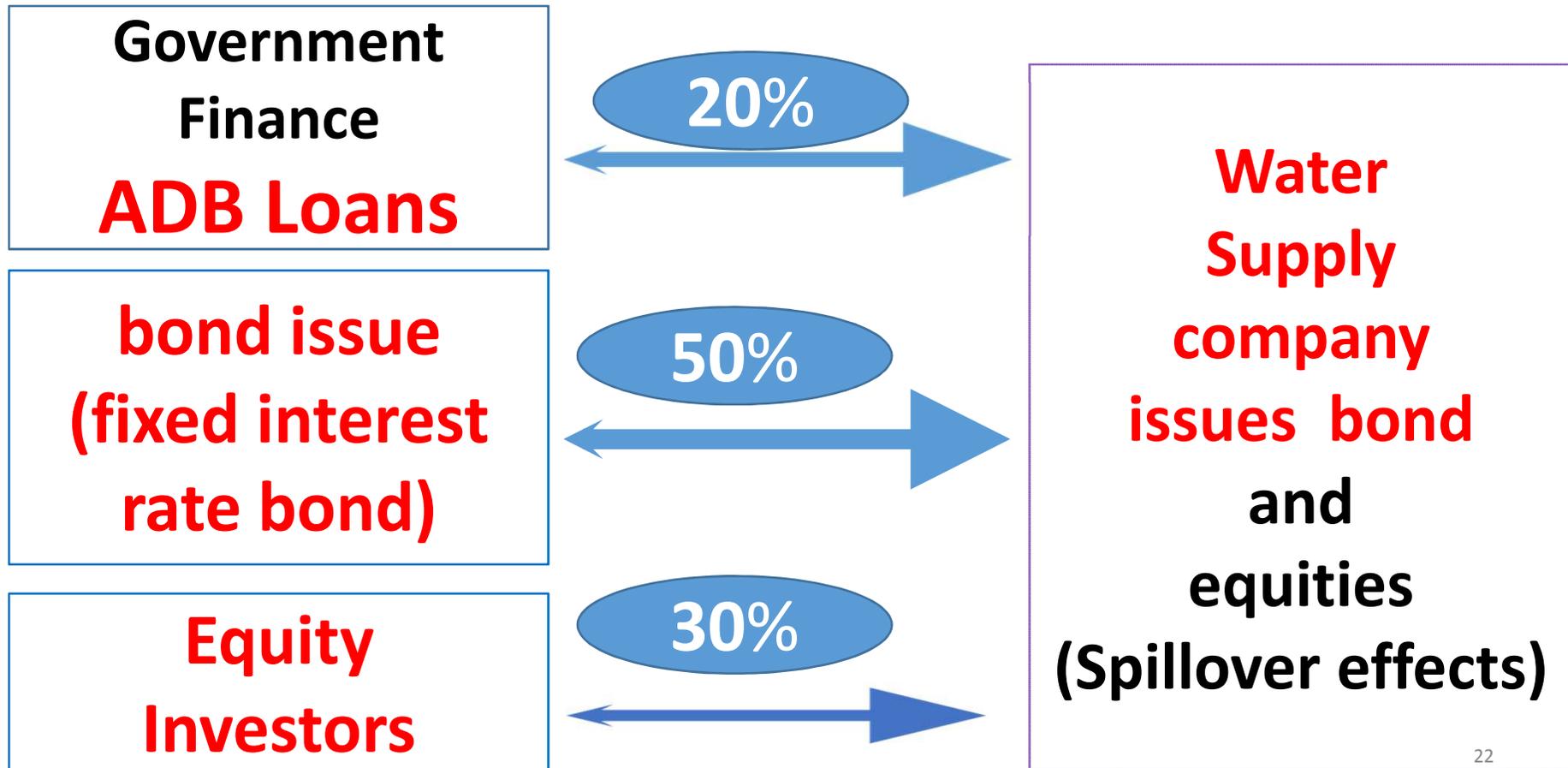
Impact took place during construction, decreased during operation of segmented(autonomous) rail line and bounced back after connection to greater rail system

Note: Numbers for tax revenue amount adjusted for CPI with base year 1982. Pre-shinkansen construction period covers years from 1982 to 1990. Non-affected groups include rest of the prefectures. Treated groups:
 Group 2: Kagoshima, Kumamoto
 Group 3: Kagoshima, Kumamoto, Fukuoka
 Group 5: Kagoshima, Kumamoto, Fukuoka, Oita, Miyazaki
 Group 7: Kagoshima, Kumamoto, Fukuoka, Oita, Miyazaki, Saga, Nagasaki
 Group Con.: Kagoshima, Kumamoto, Fukuoka, Yamaguchi, Hiroshima, Okayama, Hyogo, Osaka

Revenue Bond for Infrastructure Investment



Equity and Bond Investment in infrastructure



Financing for Start-ups along Roads and Railways (Hometown crowd funding)



**Creation of Jobs
and
Poverty
reduction**

**Increase
Spillover
Effects**



Naoyuki Yoshino · Sahoko Kaji *Editors*

Hometown Investment Trust Funds

A Stable Way to Supply Risk Capital

 Springer

Hometown Investment Trust Funds : Springer

A Stable Way to Supply Risk Capital

Yoshino, Naoyuki; Kaji Sahoko (Eds.) 2013,

**Japan, Cambodia
Vietnam, Peru, Mongolia**

Access to Digital Technology, Internet

 Springer



TRUST is important

- 1, Regular meetings with producers (every quarter)**
- 2, Look for good products and advertise by internet**
- 3, Give advise to innovators**
- 4, Order the products through internet**
- 5, Reputation**
- 6, Trusted by community, Trust by customers**

Infrastructure and Education

Yoshino, Naoyuki and Umid Abidhadjaev (2016), "Explicit and Implicit Analysis of Infrastructure Investment;
American Journal of Economics, 2016, 6(4): 1
Education

In a study of 44 companies, Professor Yoshino found that education played a significant role in impacting the quantum of the spillover effect. Secondary schools provided basic skills for blue collar workers. Universities provided education for highly skilled workers. Workers' education level impacted businesses' productivity.

Dependent variable: log difference GDP per capita in 1991-2010			
Regression number	REG.1	REG.2	REG.3
Variables	Coef.	Coef.	Coef.
InY_1991	-0.06 (-0.54)	-0.14 (-1.35)	-0.14 (-1.38)
In(n+g+d)	-3.09 (-0.59)	-5.75 (-1.23)	-4.36 (-0.77)
In(Kg)	0.23 (1.17)	0.31 (2.00)	0.53 (3.30)
In(Sec)			0.00 (0.46)
In(Kg)xIn(Sec)	0.20 (1.59)		
In(Uni)			0.21 (2.07)
In(Kg)xIn(Uni)		0.24 (2.76)	
Constant	-0.28 (-0.33)	0.56 (0.69)	0.48 (0.57)
Number of observations	44.00	44.00	44.00
R-squared	0.21	0.30	0.30
F-statistic	2.62	4.14	3.29

Give incentives to operating companies

SOE Reform → Increase efficiency and rate of return

Payoff table for infrastructure operating entity and investors

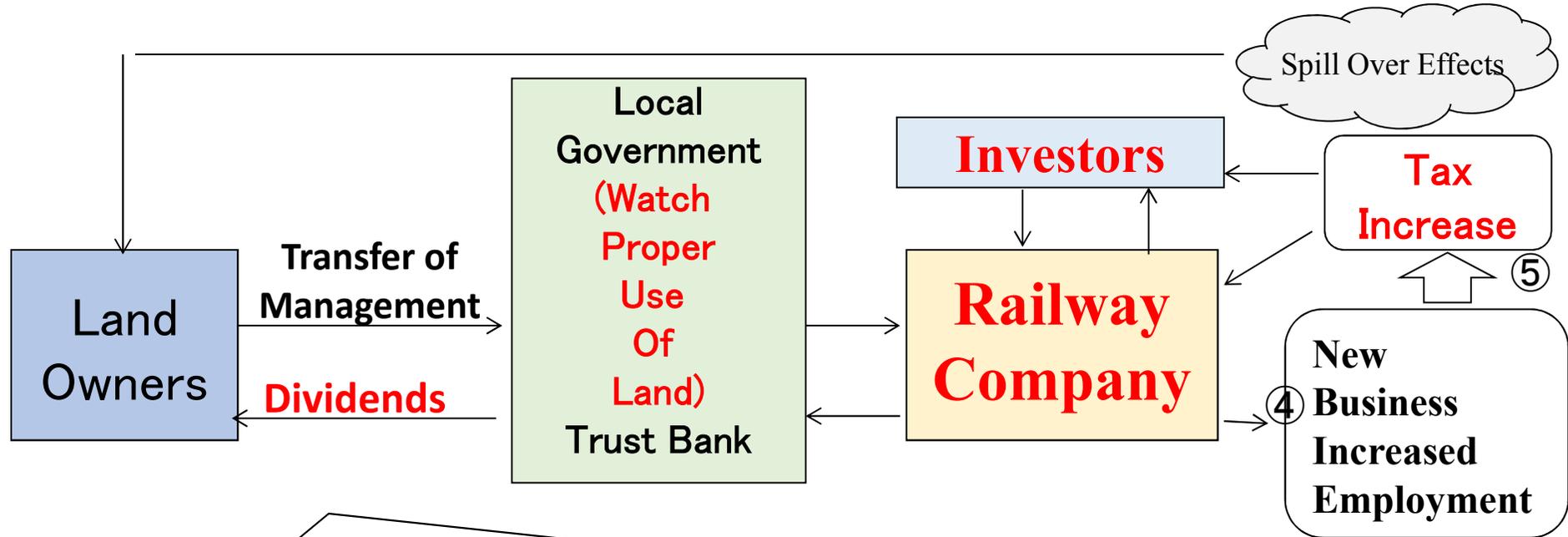
INCENTIVE MECHANISM

In order to enhance efficiency and increase the rate of return on infrastructure development, it is necessary to vary the dividend payment for private investors based on the project's revenues, including both user fees and spillover tax revenues. It is also necessary for infrastructure operating entities to exert efforts to increase income. Table 5 shows the payoff matrix, depending on the presence or absence of effort by investors and the infrastructure-operating entity.

Normal Case		Effort Case	
(50 , r) Operating Entity	Investors	(50 , αr) Operating Entity	Investors
(100 , r) Operating Entity	Investors	(100 , αr) Operating Entity	Investors

If the construction takes as is scheduled, bonus should be paid to construction company from Spillover effects

Land Trust for Infrastructure Investment

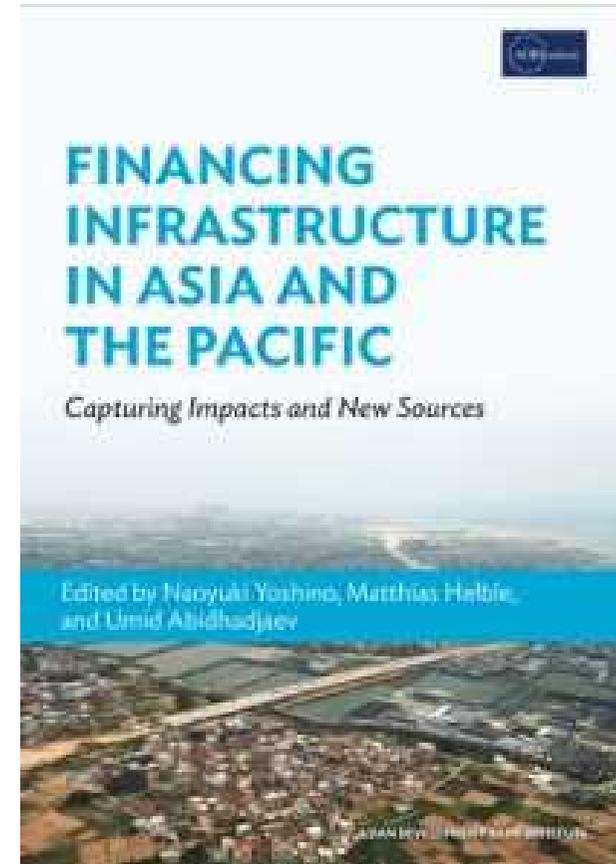


- 1, Reduction of Costs of Land Purchase at one time
- 2, Leasing contract
- 3, future tax revenues can be used for repayment
- 4, Land owners keep their ownership

New Book on Infrastructure

“FINANCING INFRASTRUCTURE IN ASIA AND THE PACIFIC: Capturing Impacts and New Sources”

- Edited by Naoyuki Yoshino, Matthias Helble, and Umid Abidhadjaev
 - the latest evidence on the impact of infrastructure investment on economic and social indicators
 - country studies on how infrastructure investment can increase output, taxes, trade and firm productivity
 - innovative modes of infrastructure financing
 - **DOWNLOAD FOR FREE:**
<https://www.adb.org/publications/financing-infrastructure-asia-capturing-impacts-and-new-sources>
 - [ADBI Web Site](#)



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