Infrastructure Investment, SME promotion and Education for Sustainable Growth

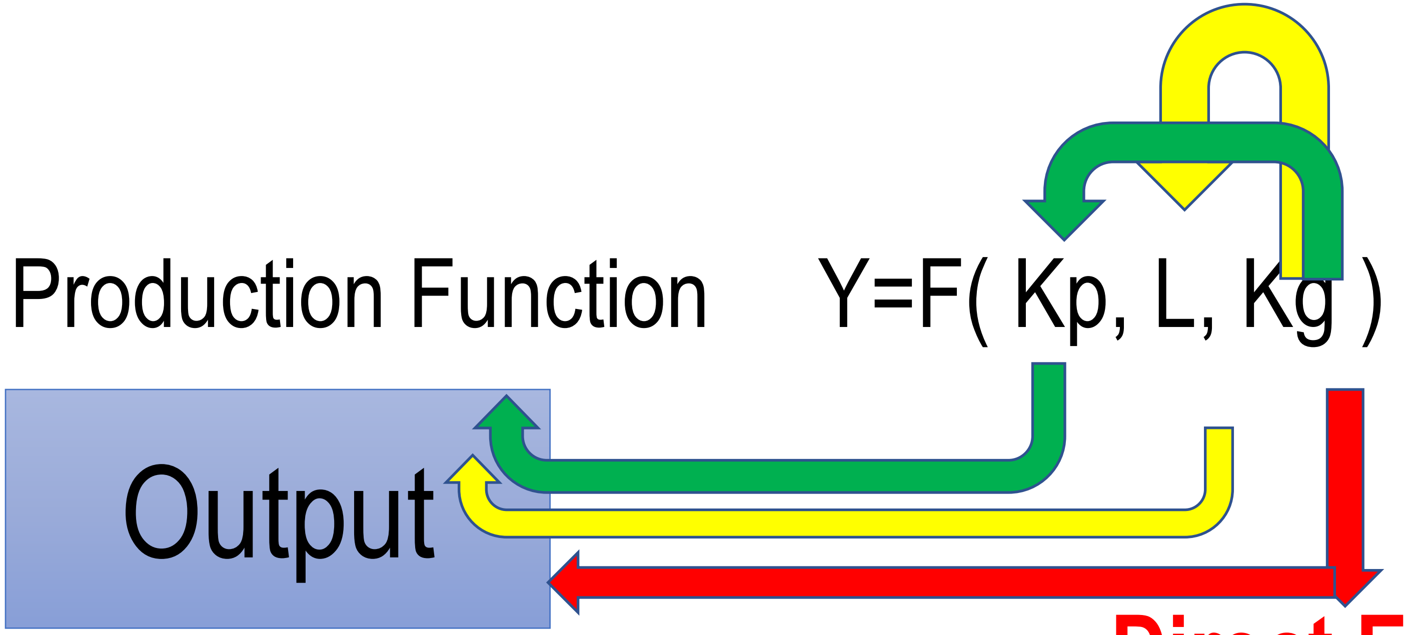
Naoyuki Yoshino

Dean, Asian Development Bank Institute (ADBI)

Professor Emeritus of Keio University

Direct Effect and Spill-over Effects

Production Function $Y=F(Kp, L, Kg)$



Direct Effect

Y= Output, Kp= private capital, L = labor

Kg = public capital (infrastructure)

NAOYUKI YOSHINO
Asian Development Bank Institute and Professor Emeritus, Keio University, Japan

MASAKI NAKAHIGASHI
Niigata University, Japan

VICTOR PONTINES
The SEACEN Research and Training Centre, Malaysia

Spring 2017 Vol.1/No.2

NOMURA JOURNAL OF ASIAN CAPITAL MARKETS

Attract Private F
Infrastructure Ir
Injecting Spillov

Need for Infrastructure Investment

In Southeast Asia, USD 8 billion in infrastructure investments are implemented every year. However, it is expected that USD 210 billion infrastructure investment is needed every year. Public money is insufficient to satisfy Asia's infrastructure needs. In many developing countries in Asia, we observe heavy traffic congestion in cities; highways, trains and various modes of public transport are lacking. Public-Private Partnerships (PPPs) have been promoted for infrastructure development in India, Thailand and other places in Asia. However, most PPP projects were disappointing since the rate of return on infrastructure depends mainly on user charges, such as train fares and highway tolls. When the region was hit by economic crisis after the Lehman shock, the private sector withdrew from infrastructure investment. Risks associated with infrastructure were so large that private investors were hesitant to put their money in infrastructure.

It is well known that good infrastructure creates huge spillover effects in the

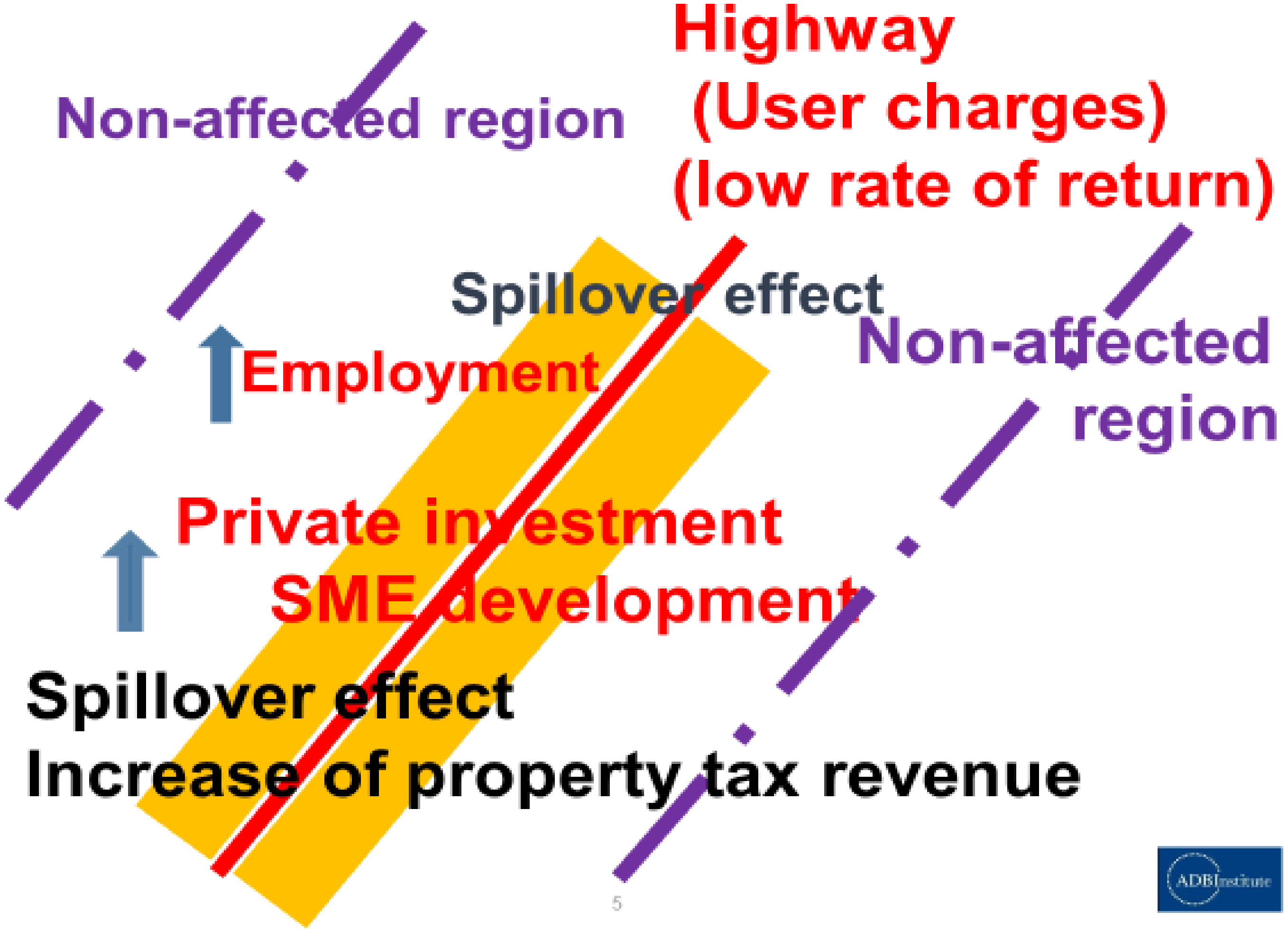


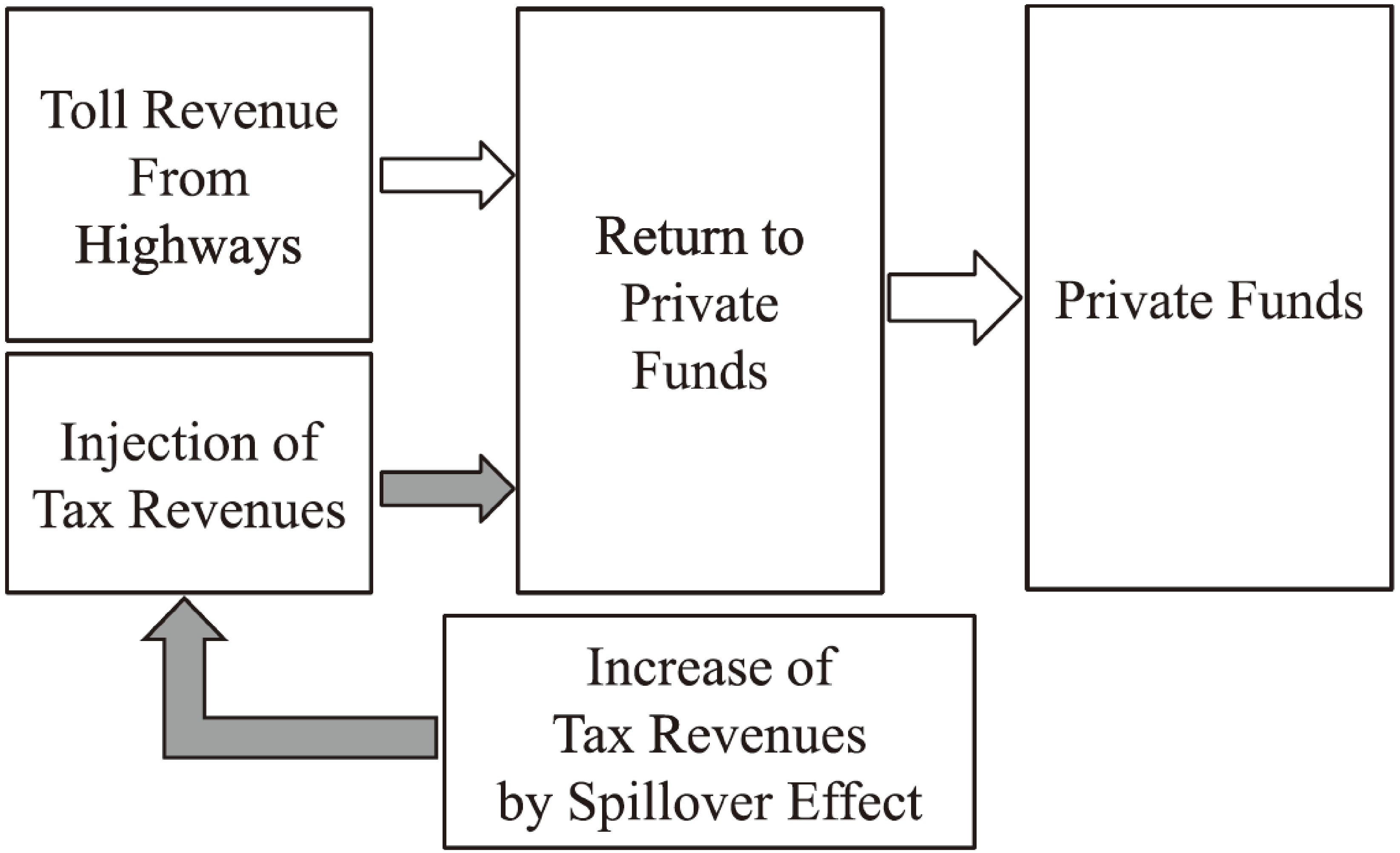
Table 1: Spillover Effects Estimated from a Macroeconomic Translog Production Function

	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
Direct effect	0.696	0.737	0.638	0.508	0.359	0.275
Indirect effect(Kp)	0.452	0.557	0.493	0.389	0.270	0.203
Indirect effect(L)	1.071	0.973	0.814	0.639	0.448	0.350
20% returned	0.305	0.306	0.261	0.206	0.144	0.111
increment	0.438	0.415	0.410	0.404	0.400	0.402

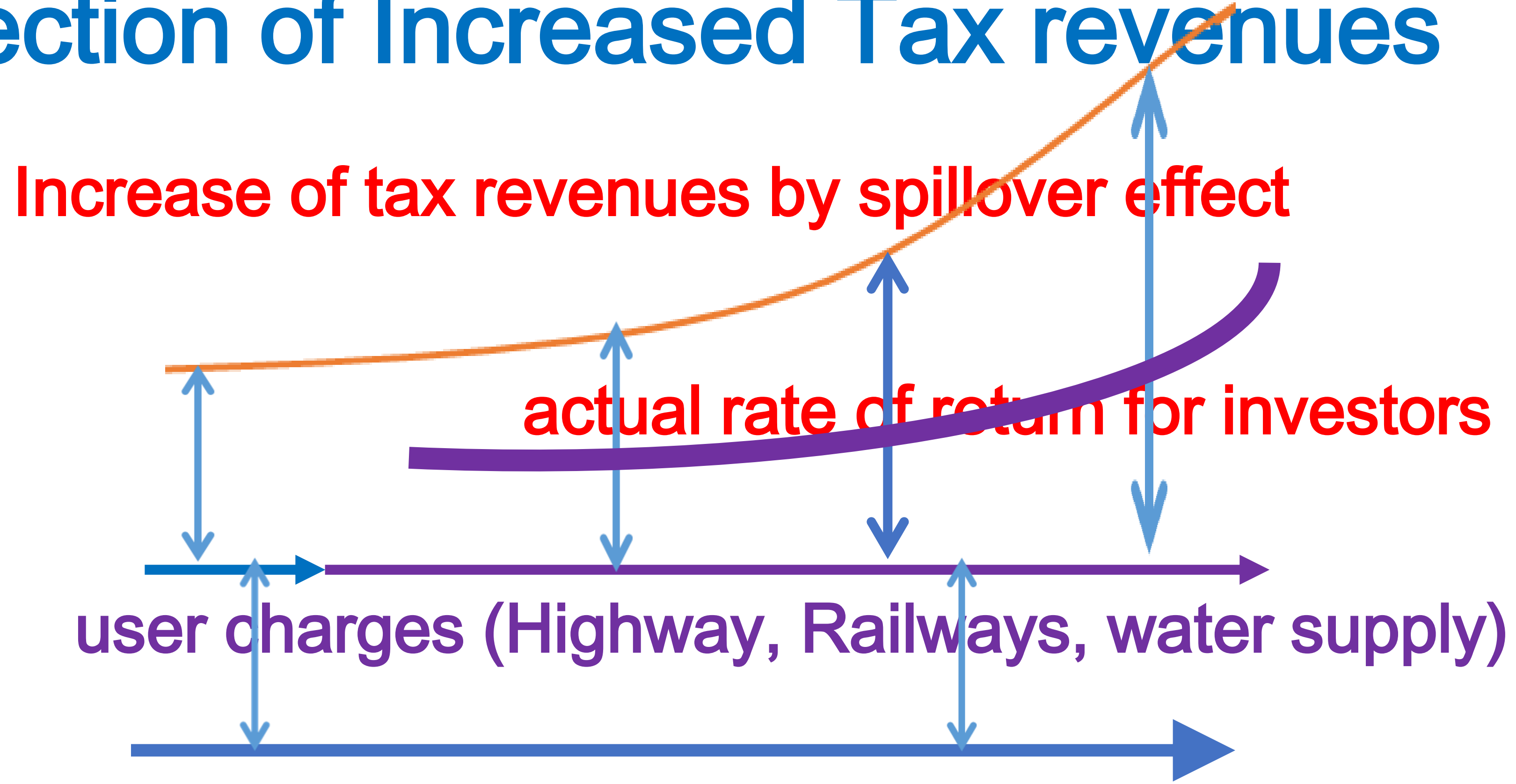
	1986-90	1991-95	1996-00	2001-05	2006-10
Direct effect	0.215	0.181	0.135	0.114	0.108
Indirect effect(Kp)	0.174	0.146	0.110	0.091	0.085
Indirect effect(L)	0.247	0.208	0.154	0.132	0.125
20% returned	0.084	0.071	0.053	0.045	0.042
increment	0.392	0.392	0.390	0.390	0.391

Source: Authors' estimation based on Nakahigashi (2015)

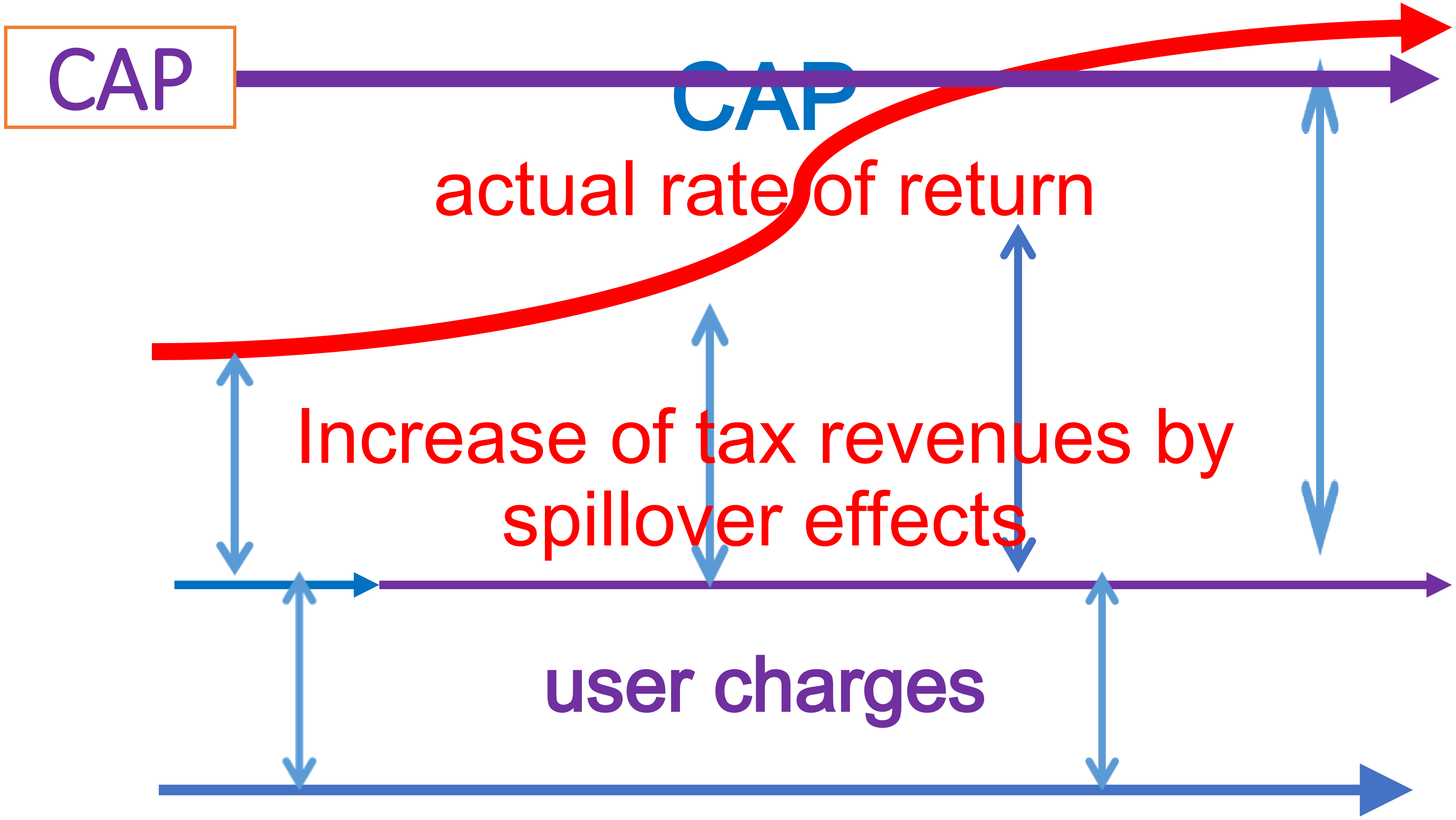
Figure 4
Injection of a fraction of tax revenues gained from spillover effect



Injection of Increased Tax revenues



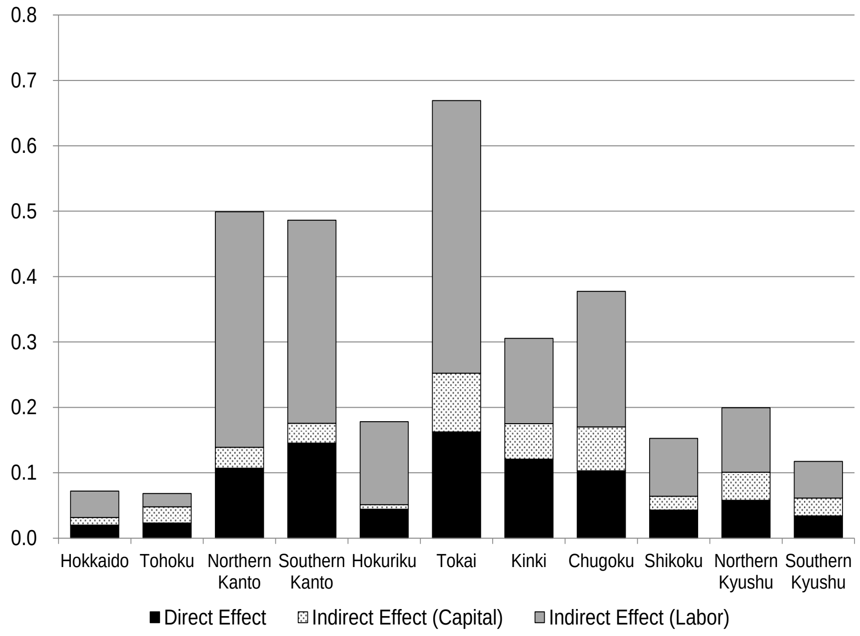
Injection of Increased Tax revenues



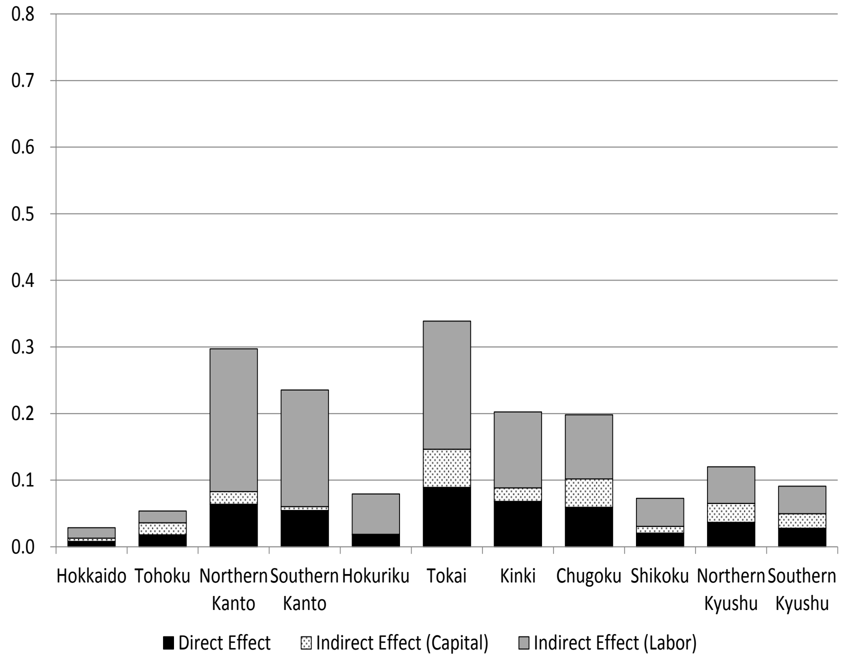
Regional Disparities of Economic Effects

large differences in Spillover effects

1990



2010



2010 Manufacturing	Private Capital	Public Capital	Direct Effect	Indirect Effect		20% Returned	Increment (%)
				Capital	Labor		
Hokkaido	0.084	0.028	0.008	0.005	0.016	0.004	50.8
Tohoku	0.111	0.054	0.018	0.018	0.018	0.007	40.0
Northern Kanto	0.068	0.297	0.064	0.019	0.215	0.047	73.2
Southern Kanto(TOKYO)	0.052	0.235	0.054	0.006	0.175	0.036	66.5
Hokuriku	0.077	0.079	0.018	0.001	0.061	0.012	69.1
Tokai	0.093	0.339	0.089	0.057	0.192	0.050	55.9
Kinki	0.056	0.202	0.068	0.020	0.114	0.027	39.5
Chugoku	0.075	0.198	0.059	0.043	0.096	0.028	47.0
Shikoku	0.089	0.073	0.021	0.010	0.042	0.010	50.8
Northern Kyushu	0.093	0.120	0.037	0.028	0.055	0.017	45.5
Southern Kyushu	0.098	0.091	0.028	0.022	0.041	0.013	45.7

Case Study: Southern Tagalog Arterial Road (STAR) , Philippines Micro-data

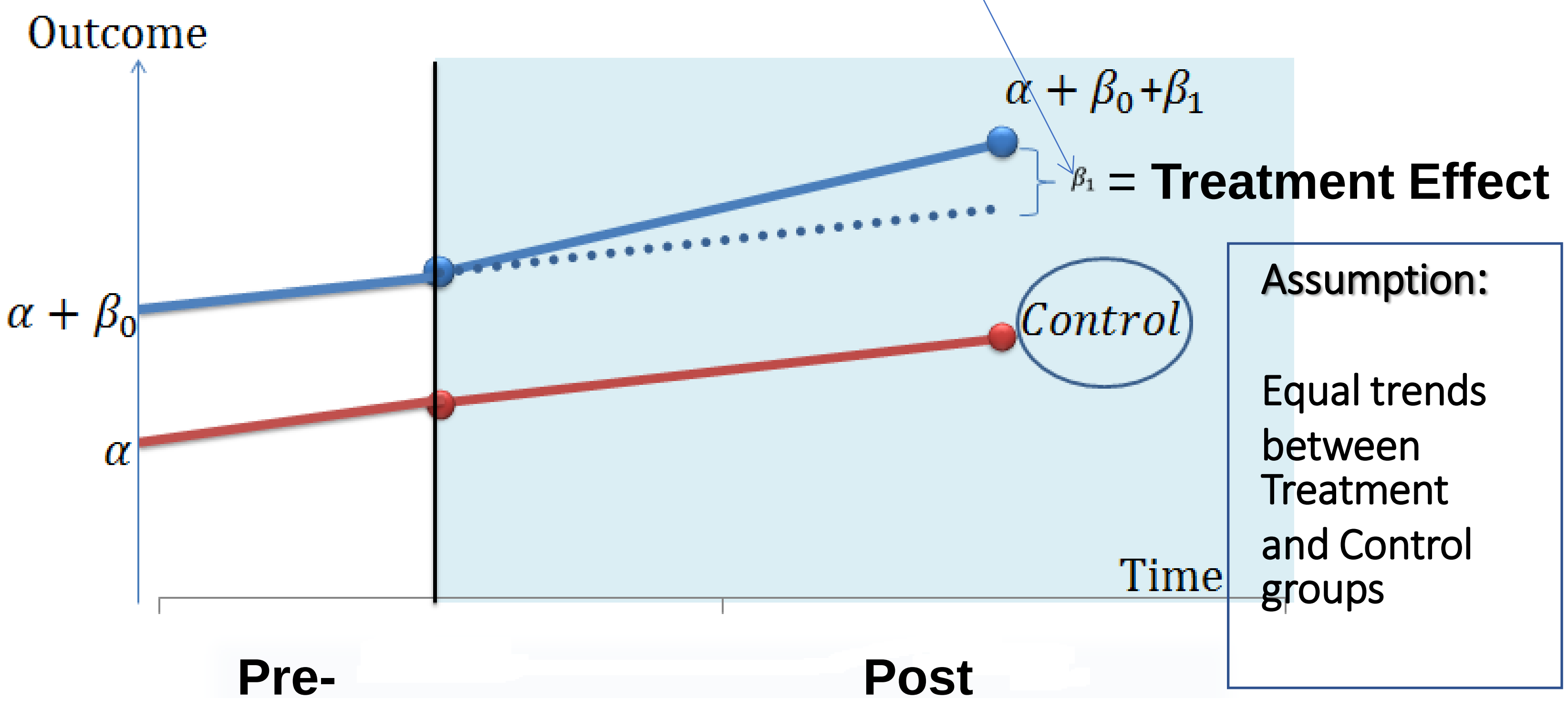
- The Southern Tagalog Arterial Road (STAR) project in Batangas province, Philippines (south of Metro Manila) is a modified Built-Operate-Transfer (BOT) project.

- The 41.9 km STAR tollway was built to improve road linkage between Metro Manila and Batangas City, provide easy access to the Batangas International Port, and thereby accelerate industrial development in Batangas and nearby provinces.

Difference-in-Difference (DiD) Analysis

$$\text{Outcome} = \alpha + \beta_0 D + \sum_{t+2}^{t-4} \beta_1 D \times T + \varepsilon$$

where: D = 1 (Treatment group) T = Treatment period
D = 0 (Control group)



Assumption:

Equal trends between Treatment and Control groups

Difference-in-Difference Regression: Spillover

	(1) Property tax	(2) Property tax	(3) Business tax	(4) Business tax	(5) Regulatory fees	(6) Regulatory fees	(7) User charge	(8) User charge
Treatment D	1.55535	0.736	1.067	0.438	1.372	0.924	0.990	0.364
	(1.263)	(0.874)	(1.316)	(1.407)	(1.123)	(1.046)	(1.095)	(1.028)
Treatment D × $Period_{t+2}$	0.421**	-0.083	1.189***	0.991**	0.248***	-0.019	0.408***	-0.010
	(0.150)	(0.301)	(0.391)	(0.450)	(0.084)	(0.248)	(0.132)	(0.250)
Treatment D × $Period_{t+1}$	0.447**	0.574***	1.264***	1.502***	0.449**	0.515***	0.317**	0.434**
	(0.160)	(0.118)	(0.415)	(0.542)	(0.142)	(0.169)	(0.164)	(0.167)
Treatment D × $Period_{t0}$	0.497***	0.570**	1.440***	1.641***	0.604**	0.642***	0.350	0.422
	(0.128)	(0.223)	(0.417)	(0.482)	(0.183)	(0.181)	(0.271)	(0.158)
Treatment D × $Period_{t-1}$	1.294**	0.387	2.256**	1.779**	1.318**	0.838*	0.959	0.197
	(0.674)	(0.728)	(0.957)	(0.470)	(0.649)	(0.448)	(0.714)	(0.560)
Treatment D × $Period_{t-2}$	1.163*	0.336	2.226**	1.804**	1.482**	1.044**	0.941	0.247
	(0.645)	(0.594)	(0.971)	(0.531)	(0.634)	(0.413)	(0.704)	(0.531)
Treatment D × $Period_{t-3}$	1.702*	0.450	2.785**	2.070***	1.901***	1.238***	1.732***	0.676
	(0.980)	(0.578)	(1.081)	(0.544)	(0.630)	(0.369)	(0.598)	(0.515)
Treatment D × $Period_{t-4, forward}$	2.573***	1.100	3.428***	2.560***	2.288***	1.509***	2.030***	0.787
	(0.900)	(0.758)	(0.928)	(0.350)	(0.563)	(0.452)	(0.607)	(0.745)
Construction		2.283**		1.577		1.207		1.942*
		(1.172)		(1.196)		(0.855)		(1.028)
Constant	14.69***	-2.499	14.18***	2.230	13.66***	4.597	13.08***	-1.612
	(0.408)	(8.839)	(0.991)	(9.094)	(0.879)	(6.566)	(0.649)	(7.84)
N	80	73	79	73	80	73	77	73
R^2	0.29	0.41	0.37	0.44	0.43	0.50	0.26	0.39

Clustered standard errors, corrected for small number of clusters; * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

The Southern Tagalog Arterial Road (STAR Highway), Philippines, Manila

Tax Revenues in three cities

Yoshino and Pontines (2015) ADBI Discussion paper 549

表 8　フィリピンの STAR 高速道路の影響のない地域と比較した事業税の増加額

（単位：100 万ペソ）

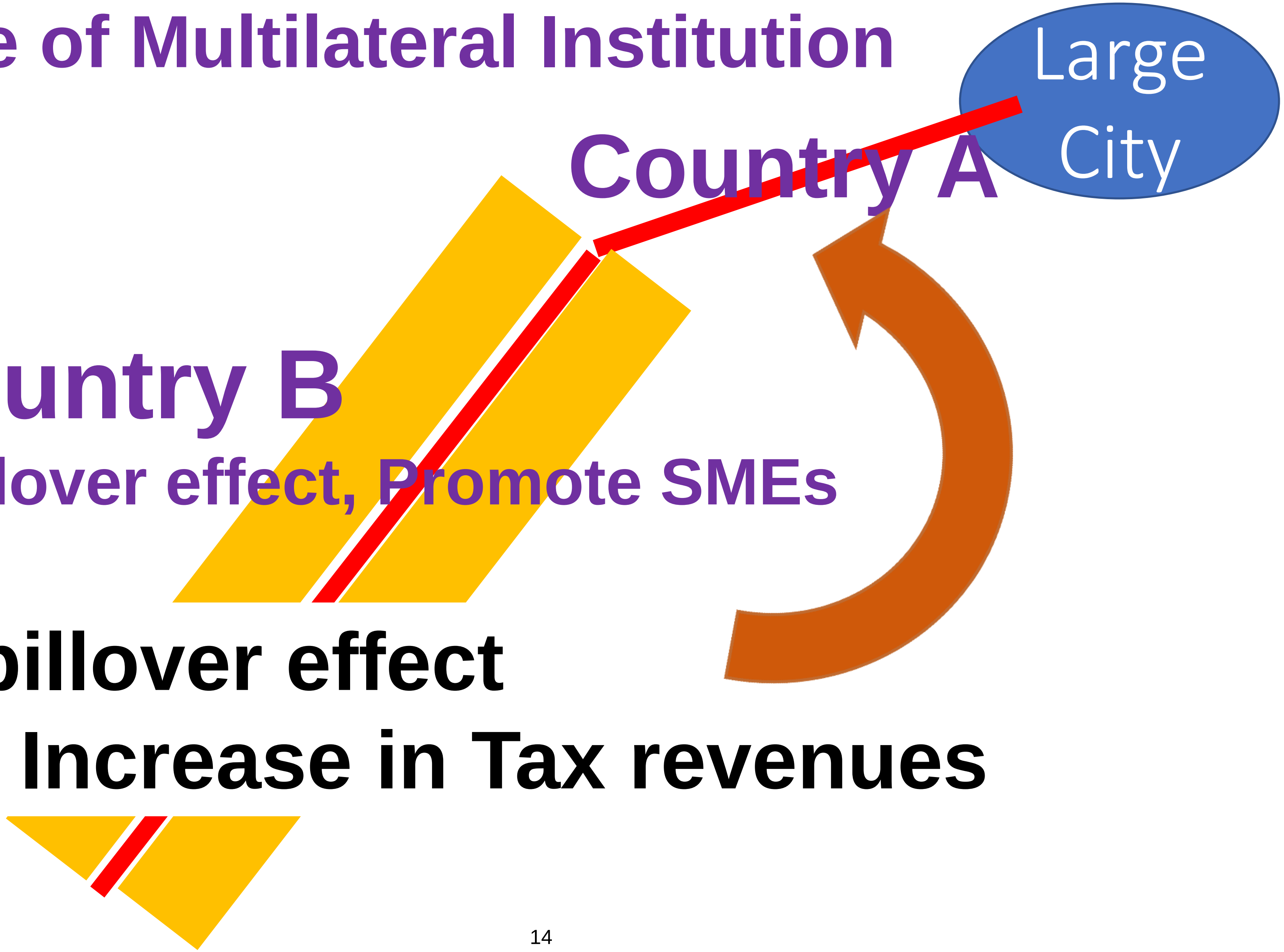
	t_{-2}	t_{-1}	t_0	t_{+1}	t_{+2}	t_{+3}	t_{+4}以降
Lipa 市	134.36	173.50	249.70	184.47	191.81	257.35	371.93
Ibaan 市	5.84	7.04	7.97	6.80	5.46	10.05	12.94
Batangas 市	490.90	622.65	652.83	637.89	599.49	742.28	1208.61

（出所）Yoshino and Pontines (2015)より筆者作成

Completion

Cross-border Infrastructure Investment

Role of Multilateral Institution



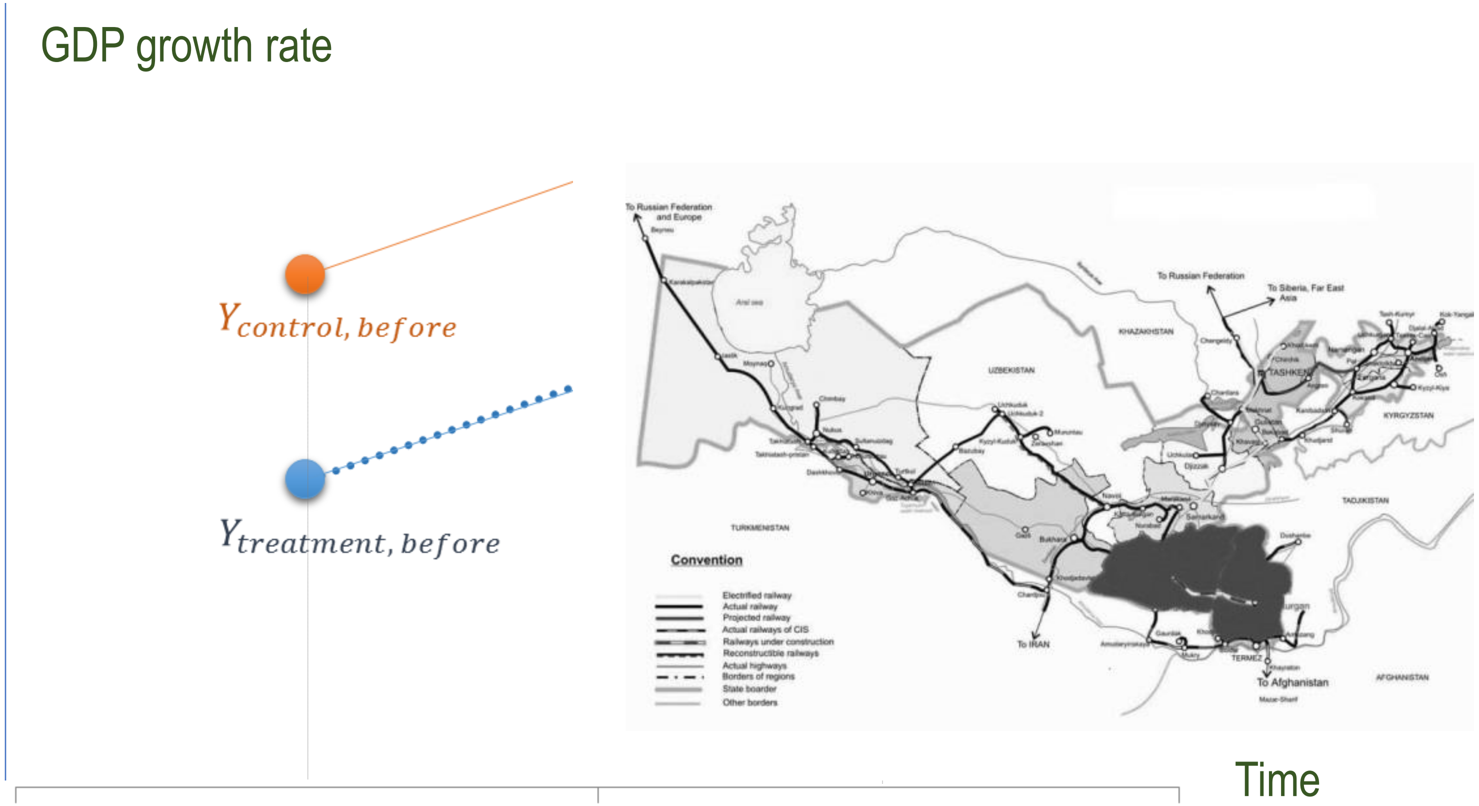
Country A

Country B

Spillover effect, Promote SMEs

Spillover effect
→ Increase in Tax revenues

Uzbekistan Railway



Divide regions affected and not affected by railway connection to “Treated group” and “Control group”

Journal of Asian Economics 49 (2017) 1–11

Contents lists available at ScienceDirect

Journal of Asian Economics

ELSEVIER

Full length article

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

Naoyuki Yoshino[a], Umid Abidhadjaev[b,*]

GDP

GDP		Term	Connectivity spillover effect	Regional spillover effect	Neighboring spillover effect
Launching Effects		Short	2.83***[4.48]	0.70[0.45]	1.33[1.14]
		Mid	2.5***[6.88]	0.36[0.29]	1.27[1.46]
		Long	2.06***[3.04]	-0.42[-0.29]	2.29**[2.94]
1 year	Anticipated	Short	0.19[0.33]	0.85[1.75]	-0.18[-0.20]
		Mid	0.31[0.51]	0.64[1.30]	-0.02[-0.03]
		Long	0.07[0.13]	-0.006[-0.01]	0.50[0.67]
	Postponed Effects		1.76*[1.95]	-1.49[-0.72]	2.58*[2.03]
2 years	Anticipated	Short	-1.54[-1.66]	1.42[0.78]	-1.32[-0.92]
		Mid	0.32[0.44]	0.84[1.42]	0.13[0.13]
		Long	0.11[0.15]	0.10[0.16]	0.87[1.19]
	Postponed Effects		-0.14[-0.20]	-1.71[-1.35]	1.05[1.44]

Note: t-values are in parenthesis. t-value measures how many standard errors the coefficient is away from zero.

legend: * p<.1; ** p<.05; *** p<.01

Additional tax revenue, Regional GDP growth and Railway Company Net Income, LCU (bln.)

Period	Coefficients	T(20)*ΔY (Tax revenue)	ΔY Affected (Direct + Spillover effects)	Company net income (Revenue - Costs)
Short term (2009-2010)	2.83*** [4.48]	**16.0**	**79.9**	**315.5**
Mid-term (2009-2011)	2.48*** [6.88]	**16.3**	**81.5**	**411.7**
Long-term (2009-2012)	2.06*** [3.04]	**14.7**	**73.5**	**509.0**

Source: Authors' calculations

Japanese Bullet Train

Journal of Infrastructure, Policy and Development (2017) Volume 1 Issue 2, pp.x-x.
doi: 10.24294/jipd.v1i2.69

ORIGINAL ARTICLE

Impact of infrastructure on tax revenue: Case study of high-speed train in Japan

Naoyuki Yoshino[1] and Umid Abidhadjaev[2]

[1] *Dean, Asian Development Bank Institute*
[2] *Researcher, Asian Development Bank Institute*

Impact of Kyushu Shinkansen Rail on CORPORATE TAX revenue during 1st PHASE OF OPERATION period

{2004-2010} , mln. JPY (adjusted for CPI, base 1982)

1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Treatment2	-4772.54				
	[-0.2]				
Number of tax payers	5.8952514*	5.8957045*	5.896112*	5.8953585*	5.8629645*
	[1.95]	[1.95]	[1.95]	[1.95]	[1.91]
Treatment3		-15947.8			
		[-0.87]			
Treatment5			-13250.4		
			[-1.06]		
Treatment7				-6883.09	
				[-0.7]	
TreatmentCon					-28030.8
					[-0.65]
Constant	-665679	-665418	-665323	-665358	-658553
	[-1.35]	[-1.35]	[-1.35]	[-1.35]	[-1.32]
N	799	799	799	799	799
R2	0.269215	0.269281	0.269291	0.269241	0.269779
F	1.934589	2.106448	2.074548	2.100607	8.497174

COMPOSITION OF GROUPS

Group2
Kagoshima
Kumamoto

Group3
Kagoshima
Kumamoto
Fukuoka

Group7
Kagoshima
Kumamoto
Fukuoka
Oita
Miyazaki
Saga
Nagasaki

Group5
Kagoshima
Kumamoto
Fukuoka
Oita
Miyazaki

GroupCon
Kagoshima
Kumamoto
Fukuoka
Osaka
Hyogo
Okayama
Hiroshima
Yamaguchi

Note: Treatment2 = Time Dummy {1991-2003} x Group2. etc. t-values are in parenthesis. Legend: * p<.1; ** p<.05; *** p<.01.
Clustering standard errors are used, allowing for heteroscedasticity and arbitrary autocorrelation within a prefecture, but treating the errors as uncorrelated across prefectures

Impact of Kyushu Shinkansen Rail on CORPORATE TAX revenue during 2nd PHASE OF OPERATION period {2011-2013} , mln. JPY (adjusted for CPI, base 1982)

1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Treatment2	72330.012**				
	[2.2]				
Number of tax payers	5.5277056***	5.5585431***	5.558603***	5.5706545***	5.9640287***
	[3.13]	[3.14]	[3.14]	[3.14]	[3.07]
Treatment3		104664.34*			
		[2]			
Treatment5			82729.673**		
			[2.1]		
Treatment7				80998.365**	
				[2.34]	
TreatmentCon					179632
					[1.58]
Constant	-568133.98**	-573747.28**	-574245.87**	-576867.56**	-642138.87**
	[-2.07]	[-2.08]	[-2.08]	[-2.09]	[-2.1]
N	611	611	611	611	611
R2	0.350653	0.352058	0.352144	0.352874	0.364088
F	5.062509	5.486197	5.351791	5.431088	16.55518

COMPOSITION OF GROUPS

Group2	Group5
Kagoshima	Kagoshima
Kumamoto	Kumamoto
	Fukuoka
Group3	Oita
Kagoshima	Miyazaki
Kumamoto	
Fukuoka	
	GroupCon
Group7	Kagoshima
Kagoshima	Kumamoto
Kumamoto	Fukuoka
Fukuoka	Osaka
Oita	Hyogo
Miyazaki	Okayama
Saga	Hiroshima
Nagasaki	Yamaguchi

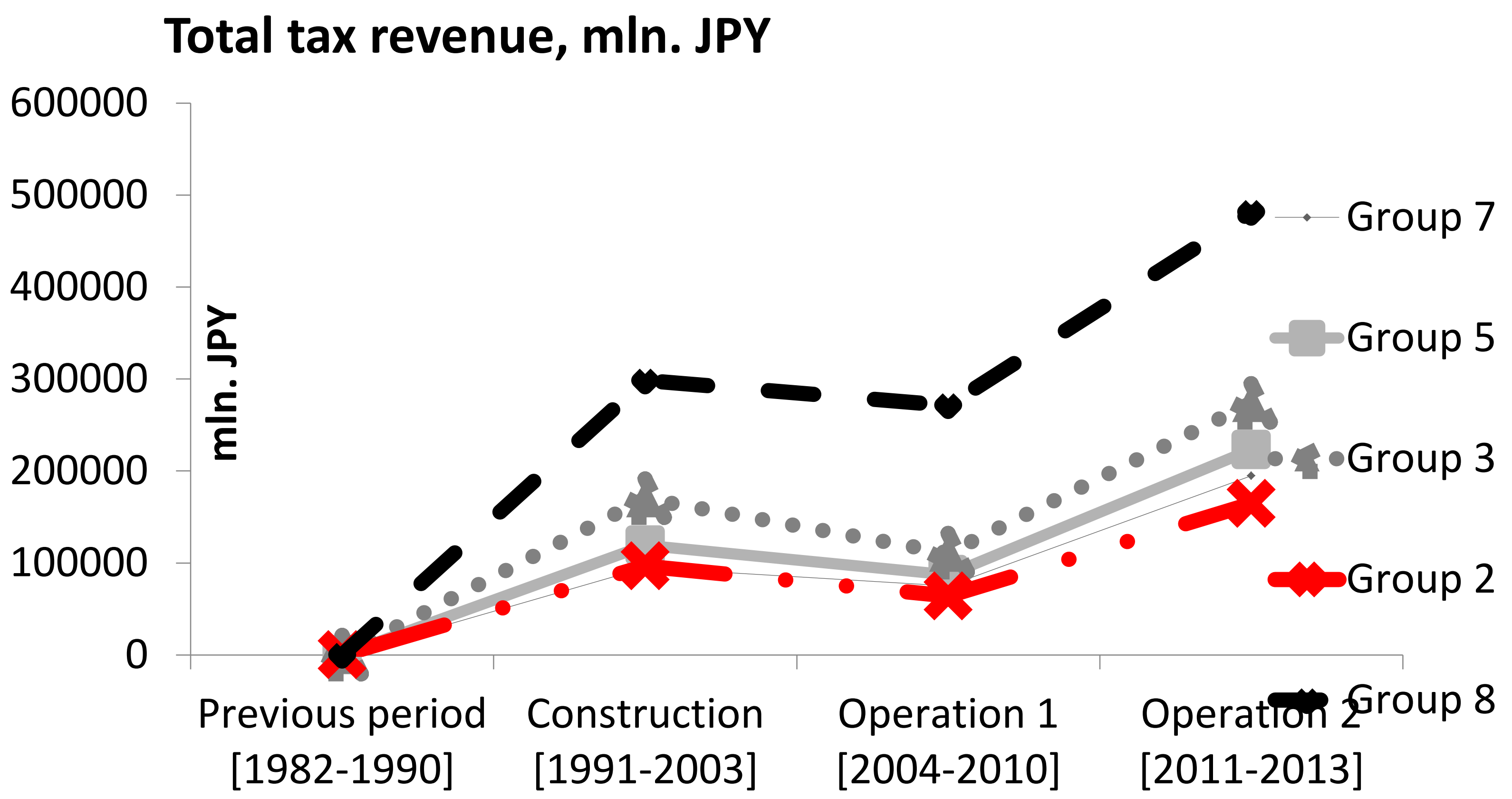
Note: Treatment2 = Time Dummy {1991-2003} x Group2. etc. t-values are in parenthesis. Legend: * p<.1; ** p<.05; *** p<.01. Clustering standard errors are used, allowing for heteroscedasticity and arbitrary autocorrelation within a prefecture, but treating the errors as uncorrelated across prefectures

Table 5. DID empirical results with outcome variable of personal income tax revenue using nearest-neighbor matching based on the Euclidian distance between mean tax revenues, 1982–1990

Scale of focus	Affected group of prefectures	Construction period (1991–2003)	Operation phase 1 (2004–2010)	Operation phase 2 (2011–2013)
Spillover effect by region	Treatment Group 1	27,822.92	–20,139.51	16,721.9
		[2.24]	[–1.81]	[1.42]
	Number of Observations	88	68	52
	Treatment Group 2	31,432.08**	–32,786.25*	51,056.62*
		[3.25]	[–2.32]	[2.42]
	Number of Observations	132	102	78
Spillover effect by adjacency	Treatment Group 3	18,821*	–26,698.04**	37,429.24**
		[2.01]	[–3.03]	[2.88]
	Number of Observations	220	170	130
	Treatment Group 4	15,472.3**	–23,431.25***	31,903.97***
		[2.26]	[–3.39]	[3.07]
	Number of Observations	308	238	182
Spillover effect by connectivity	Treatment Group 5	53,576.87**	–50,607.41**	125,253.54**
		[2.29]	[–2.52]	[2.63]
	Number of Observations	330	255	195

Table 6. DID empirical results with outcome variable of corporate income tax revenue using nearest-neighbor matching based on the Euclidian distance between mean tax revenues (1982–1990)

Scale of focus	**Affected group of prefectures**	**Construction period (1991–2003)**	**Operation phase 1 (2004–2010)**	**Operation phase 2 (2011–2013)**
Spillover effect by region	Treatment Group 1	12,132.33***	–6,292.71*	6,629.05
		[14.06]	[–2.71]	[2.04]
	Number of Observations	88	68	52
	Treatment Group 2	17,473.79**	–13,261.77	18,730.36**
		[3.56]	[–1.61]	[2.72]
	Number of Observations	132	102	78
Spillover effect by adjacency	Treatment Group 3	13,695.24***	–9,138.27	15,128.06**
		[3.37]	[–1.61]	[2.93]
	Number of Observations	220	170	130
	Treatment Group 4	10,902.40***	–6,382.728	15,794.54***
		[3.28]	[–1.54]	[3.84]
	Number of Observations	308	238	182
Spillover effect by connectivity	Treatment Group 5	–46,276.71	–46,440.24*	117,806.95**
		[–1.09]	[–1.79]	[2.28]
	Number of Observations	330	255	195



Total tax revenue, mln. JPY
600000
500000
400000
300000
200000
100000
0
mln. JPY
Previous period [1982-1990]
Construction [1991-2003]
Operation 1 [2004-2010]
Operation 2 [2011-2013]
Group 7
Group 5
Group 3
Group 2
Group 8

American Journal of Economics 2016, 6(4): 189-199
DOI: 10.5923/j.economics.20160604.02

Explicit and Implicit Analysis of Infrastructure Investment: Theoretical Framework and Empirical Evidence

Naoyuki Yoshino[1], Umid Abidhadjaev[2,*]

[1]Asian Development Bank Institute, Tokyo, Japan
[2]Keio University, Graduate School of Economics, Tokyo, Japan

Infrastructure & Education

- Steady state equation in logarithmic form

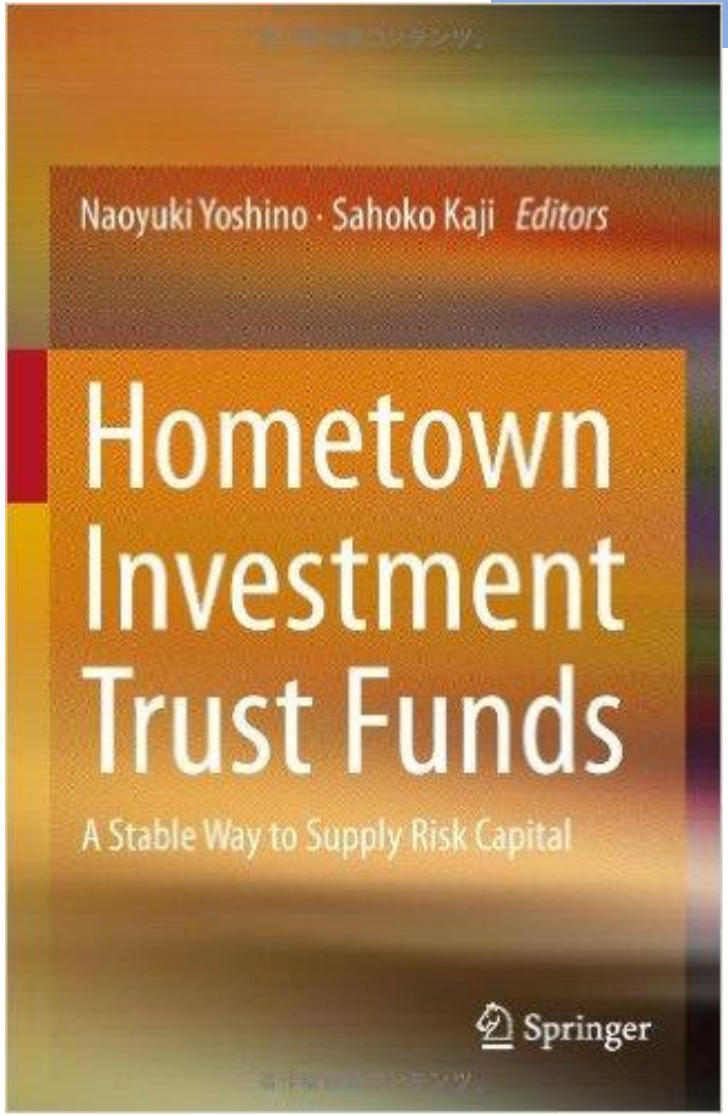
$$lny(2010) - lny(1991) =$$
$$(1-e^{-\lambda t})\left(\frac{\theta}{1-\theta-\beta-\alpha}\right)ln(\varphi) +$$
$$(1-e^{-\lambda t})\left(\frac{\beta}{1-\theta-\beta-\alpha}\right)ln(1-\varphi) +$$
$$(1-e^{-\lambda t})\left(\frac{\theta+\beta}{1-\theta-\beta-\alpha}\right)ln(\tau) +$$
$$(1-e^{-\lambda t})\left(\frac{\alpha}{1-\theta-\beta-\alpha}\right)ln(s(1-\tau)) -$$
$$(1-e^{-\lambda t})\frac{\alpha+\beta+\theta}{(1-\theta-\beta-\alpha)}ln(n+\delta+g) -$$
$$(1-e^{-\lambda t})lny(1991)$$

NOTE:
Context: 44 developing countries, 1991-2010
Methodology: Production function approach
Point of novelty and findings:
Study incorporated infrastructure variable into neoclassical growth framework and demonstrated that controlling for share of working age population with university level of education infrastructure investment to GDP ratio constituted statistically significant determinant of accumulated growth rate of GDP per capita

Estimation of The Neoclassical Growth Model with Infrastructure Investment			
Dependent variable: log difference GDP per capita in 1991-2010			
Regression number	REG.1	REG.2	REG.3
Variables	Coef.	Coef.	Coef.
lnY_1991	-0.06	-0.14	-0.14
	(-0.54)	(-1.35)	(-1.38)
ln(n+g+d)	-3.09	-5.75	-4.36
	(-0.59)	(-1.23)	(-0.77)
ln(Kg)	0.23	0.31	0.53
	(1.17)	(2.00)	(3.30)
ln(Sec)			0.00
			(0.46)
ln(Kg)xln(Sec)	0.20		
	(1.59)		
ln(Uni)			0.21
			(2.07)
ln(Kg)xln(Uni)		0.24	
		(2.76)	
Constant	-0.28	0.56	0.48
	(-0.33)	(0.69)	(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

Springer

Enhance regional economy
Start up businesses, farmers, SMEs



Hometown Investment Trust Funds

A Stable Way to Supply Risk Capital

Yoshino, Naoyuki; Kaji, Sahoko (Eds.)
2013, IX, 98 p. 41 illus.,20 illus. in color

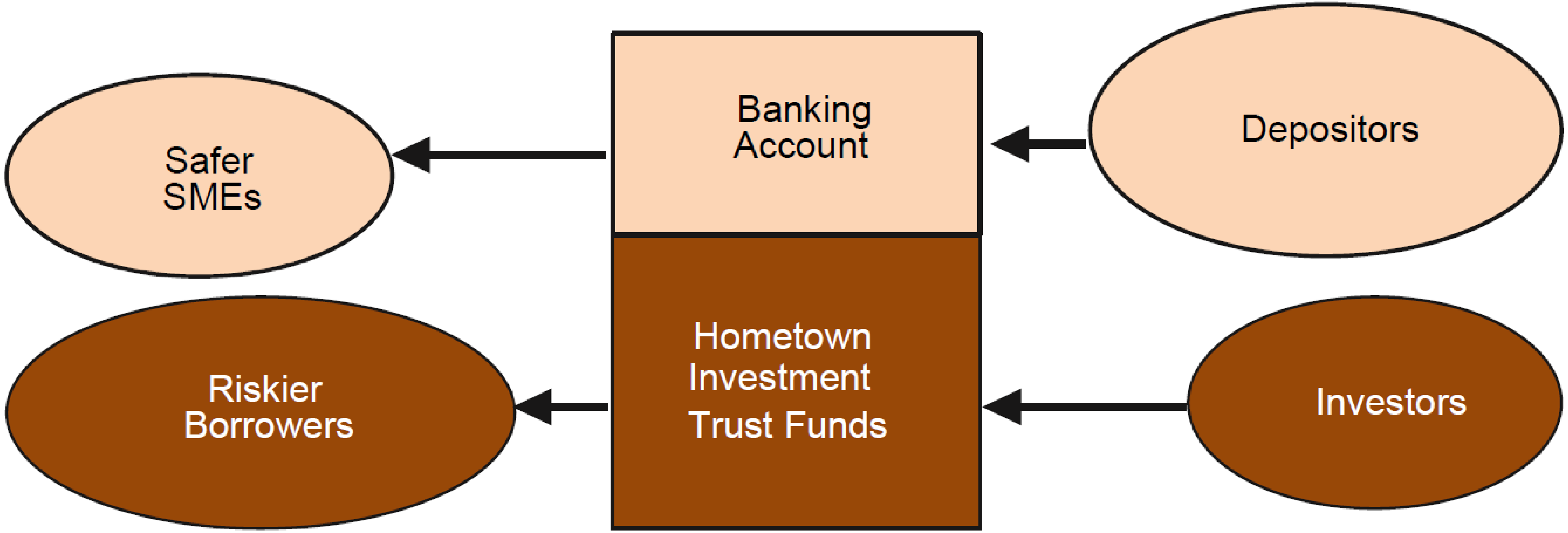
Available Formats:

ebook
Hardcover
Springer

Japan, Cambodia
Vietnam, Peru


Highway
(User charges)
(low rate of return)
Non-affected region
Spillover effect
Employment
Non-affected
region
Private investment
SME development
Spillover effect
Increase of property tax revenue

Hometown investment trust funds a new way to finance for Wind power generators, solar power panels etc.



SME =small and medium-sized enterprise.

Source: Yoshino and Taghizadeh-Hesary (2014).

Investment in SMEs and start up businesses

Agricultural Funds

Beans and Wine

Infrastructure Bond (large Investors and Individuals)

1, Various maturities (10 years, 15 years, 20 years)

2, Rate of return (+Spillover tax revenues)

Infrastructure bonds for

banks,

insurance companies,

Pension funds

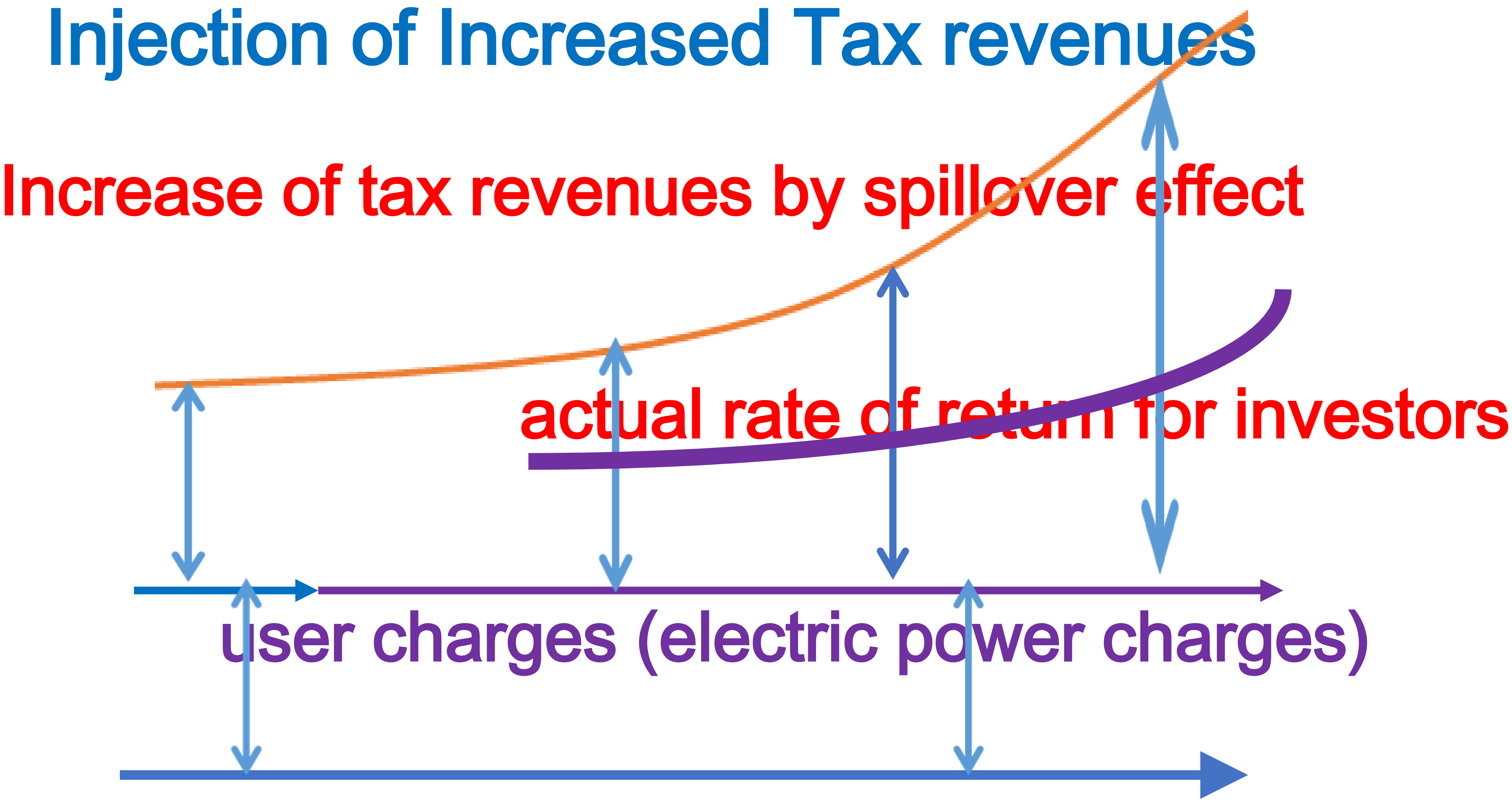
3, Sales channels to individuals(Post office, Regional banks)

4, Internet, mobile phone (For retail investors)

Hometown Investment Trust Funds

5, Small scale renewable energy

(sell through Internet)


Injection of Increased Tax revenues
Increase of tax revenues by spillover effect
actual rate of return for investors
user charges (electric power charges)

Public-Private Partnership (PPP)
Give incentives to operating companies

Payoff table for infrastructure operating entity and investors

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

Nakahigashi, M and Yoshino, N. (2016) “Changes in Economic Effect of Infrastructure and Financing Method”, Public Policy Review, Vol.12, No.1.

Yoshino, Naoyuki and Masaki Nakahigashi （2004） “The Role of Infrastructure in Economic Development”, ICFAI Journal of Managerial Economics, 2, pp. 7-24

Yoshino, N. and Pontines, Victor (2015) “The Highway-Effect on Public Finance: Case of the STAR Highway in the Phillippines”, GIE | AAA Special Kick-off Edition, GIE Network publishing.

Yoshino, Naoyuki and Victor Pontines （2015） “The Highway Effect on Public Finance: Case of the STAR Highway in the Philippines”, Asian Development Bank Institute （ADBI） Working Paper No.549.

Yoshino, Naoyuki and Umid Abidhadjaev (2017), “An impact evaluation of investment in infrastructure: The case of a rail way connection in Uzbekistan”. Journal of Asian Economics, 49, 1-11, 2017

Yoshino, Naoyuki and Umid Abidhadjaev (2017), “Impact of infrastructure on tax revenue: Case study of high-speed train in Japan”, Journal of Infrastructure, Policy and Development, Vol.1, Issue 2.

Yoshino, Naoyuki, Masaki Nakahigashi and Victor Pontines (2017), “Attract Private Financing to Infrastructure Investment by Injecting Spillover Tax Revenues”, Nomura Journal of Asian Capital Markets, Spring, Vol.1, No.2.