Economic Effects of Infrastructure

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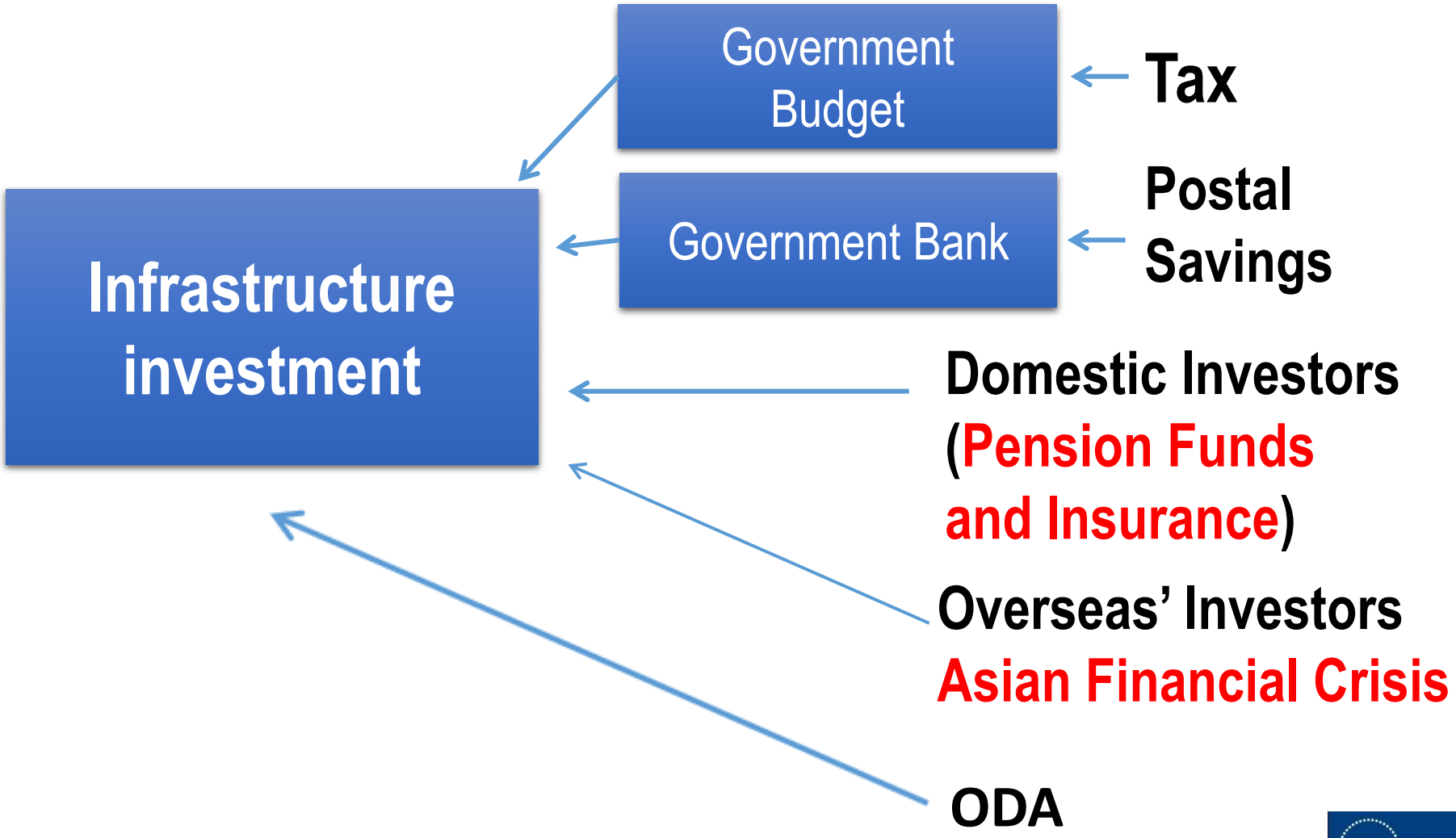
Infrastructure Finance: Use of long term domestic savings



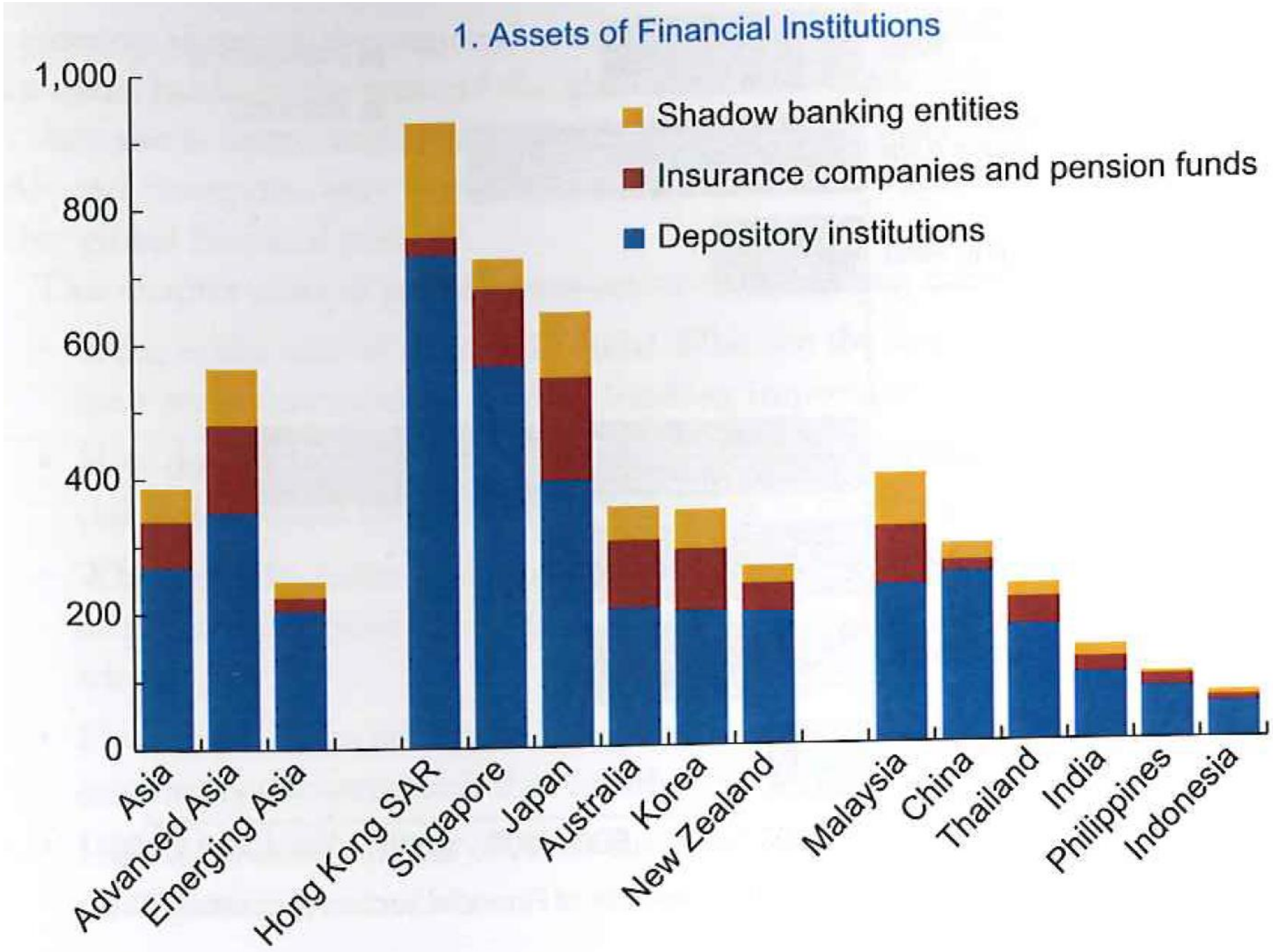
Long term and Patient investors are needed

1. Bank deposits – Bank loans (2-5 years)
2. Life insurance (20 years, 30 years)
3. Pension funds (20, 30, 40 years)

Long term financing

4, Asset Management of long term instruments

5. Financial education has to be developed

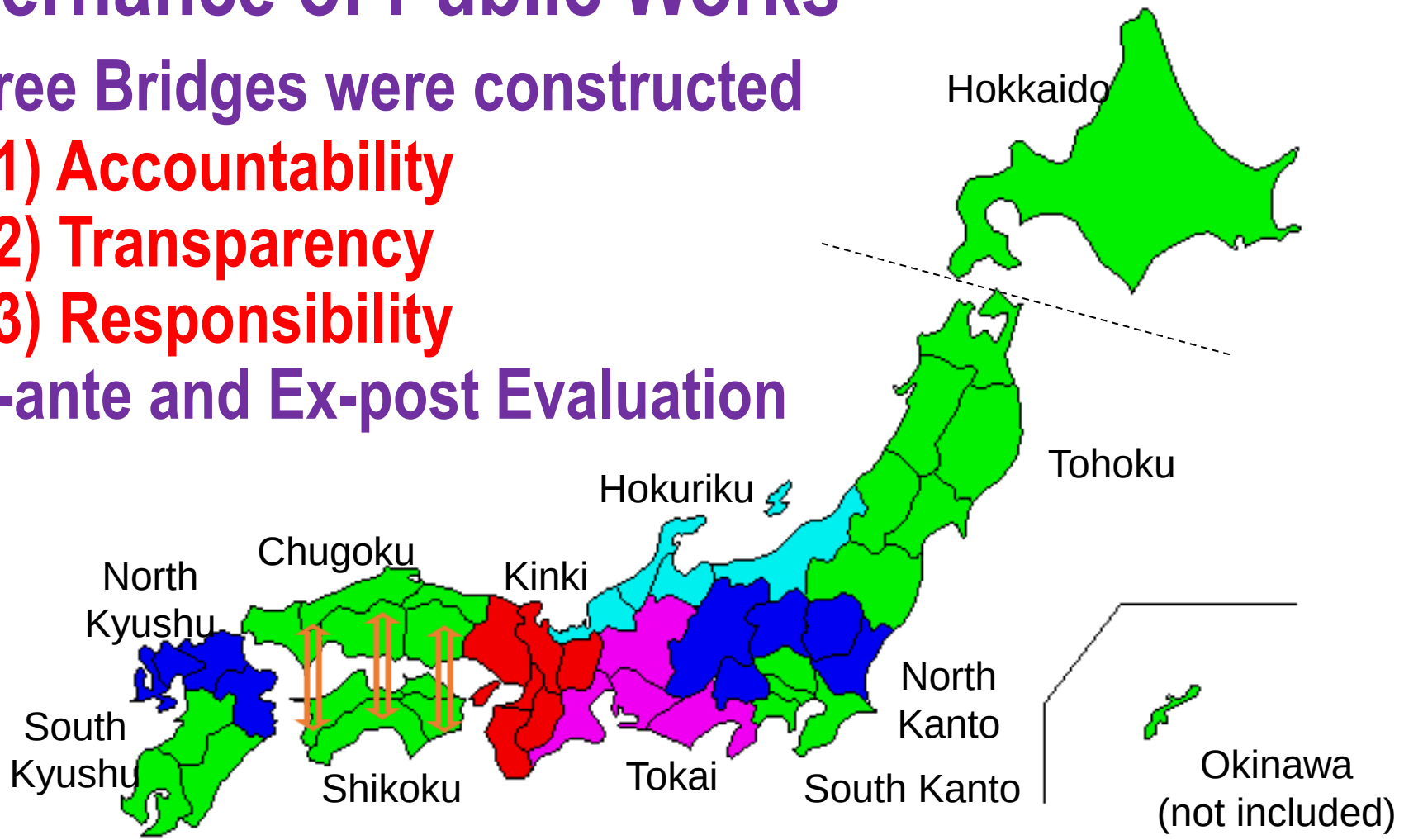

1. Assets of Financial Institutions
1,000
800
600
400
200
0
Shadow banking entities
Insurance companies and pension funds
Depository institutions
Asia
Advanced Asia
Emerging Asia
Hong Kong SAR
Singapore
Japan
Australia
Korea
New Zealand
Malaysia
China
Thailand
India
Philippines
Indonesia

Map of Japan
Governance of Public Works

Three Bridges were constructed

- (1) Accountability
- (2) Transparency
- (3) Responsibility

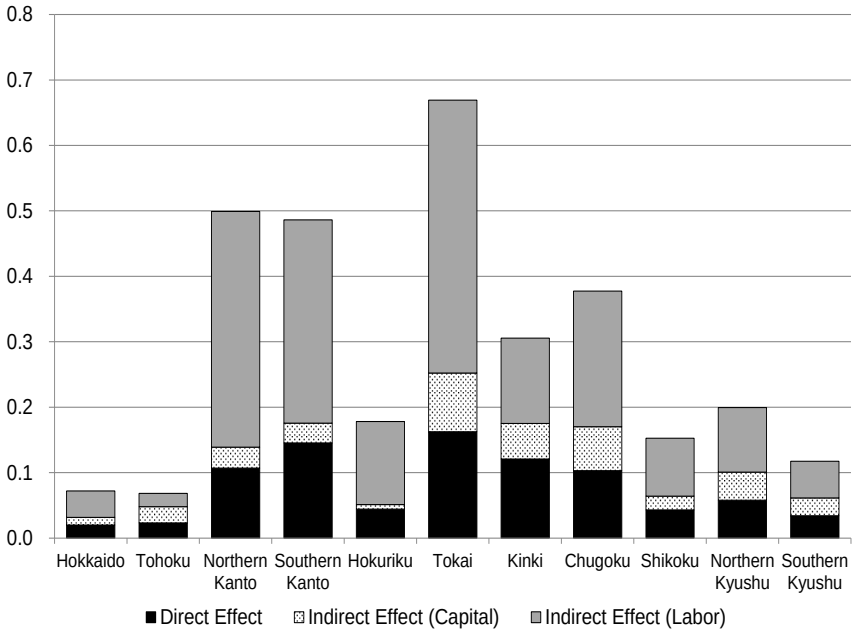
Ex-ante and Ex-post Evaluation



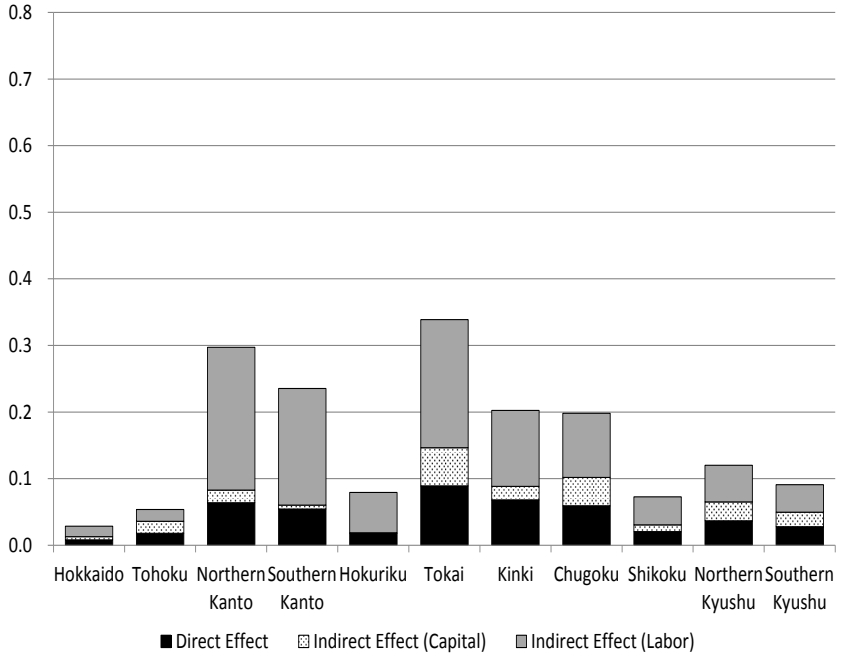
Regional Disparities of Economic Effects

large differences in Spillover effects

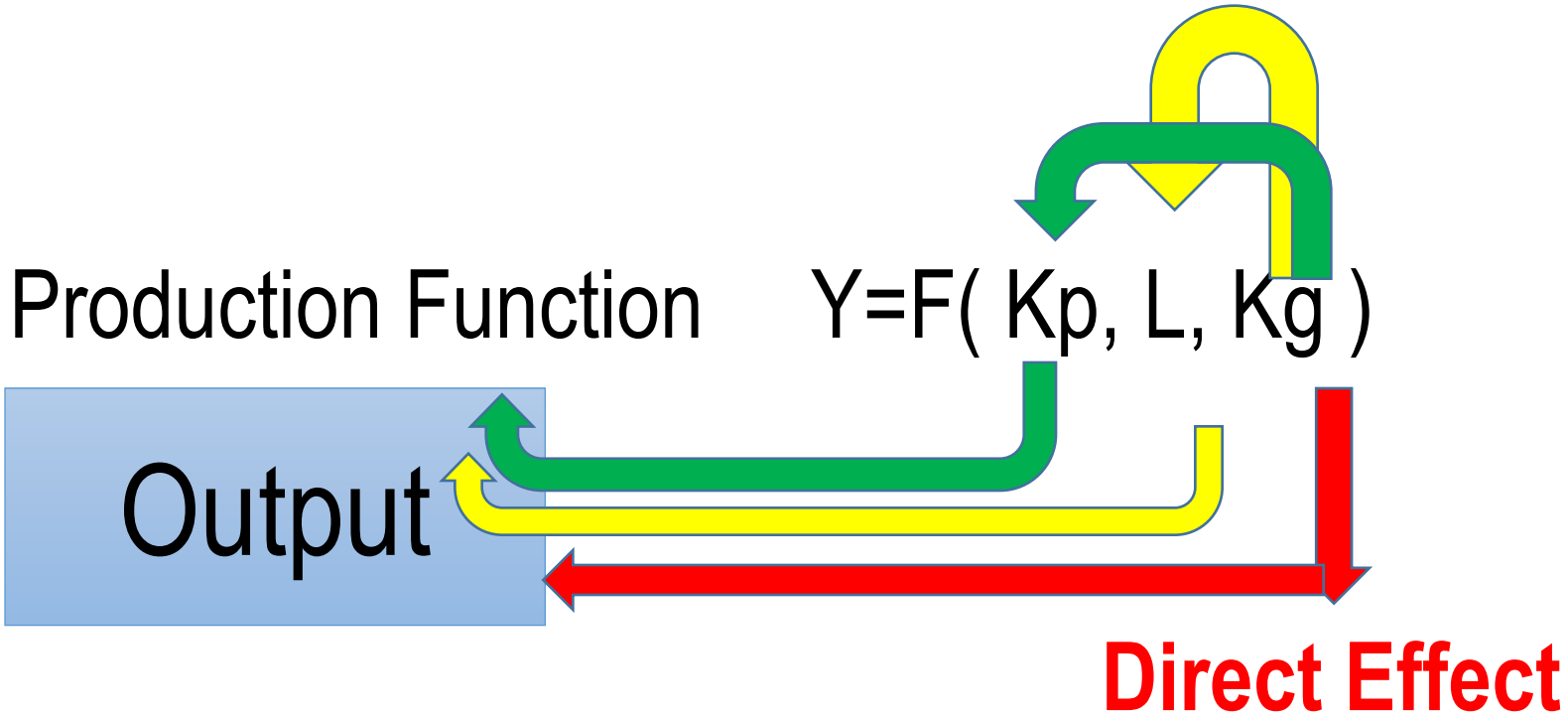
1990



2010

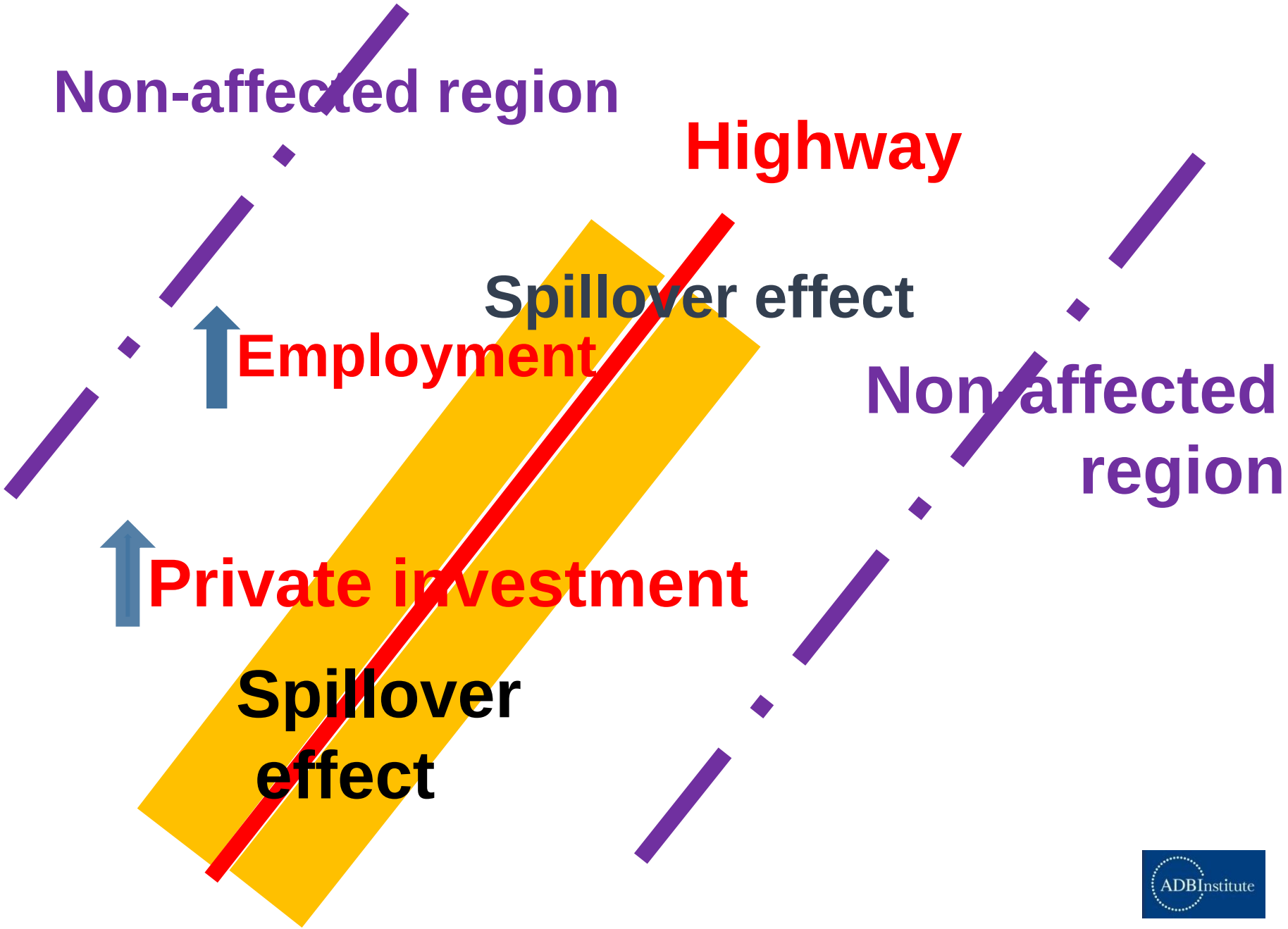


Direct Effect and Spill-over Effects



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

Kg = public capital (infrastructure)


Non-affected region
Highway
Spillover effect
Employment
Non-affected region
Private investment
Spillover effect

Spillover effects → Return to investors

	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
Direct Effect (Kg)	0.696	0.737	0.638	0.508	0.359	0.275
Indirect Effect (Kp)	0.453	0.553	0.488	0.418	0.304	0.226
Indirect Effect (L)	1.071	0.907	0.740	0.580	0.407	0.317
20%Returned	0.3048	0.292	0.2456	0.1996	0.1422	0.1086
%Increment	43.8	39.6	38.5	39.3	39.6	39.5

1986-90	1991-95	1996-00	2001-05	2006-10
0.215	0.181	0.135	0.114	0.108
0.195	0.162	0.122	0.1	0.1
0.193	0.155	0.105	0.09	0.085
0.0776	0.0634	0.0454	0.038	0.037
36.1	35.0	33.6	33.3	34.3

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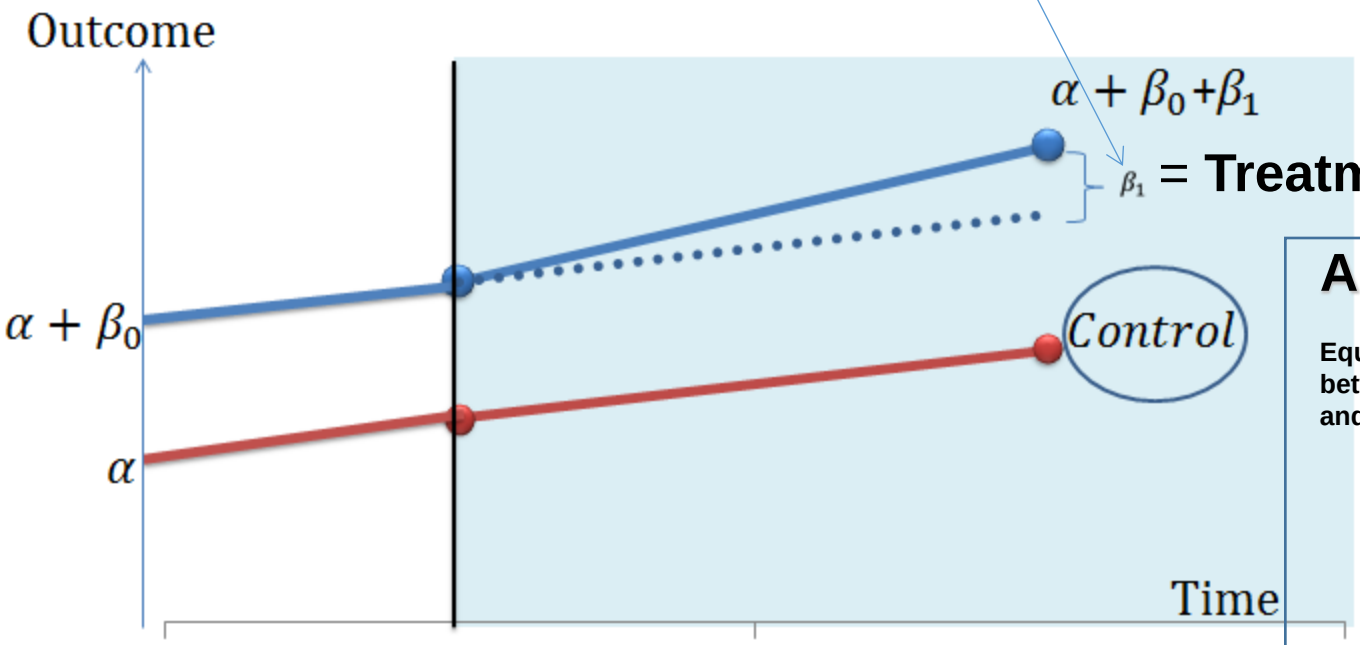
Case Study: Southern Tagalog Arterial Road (STAR) , Philippines Micro-data

- 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

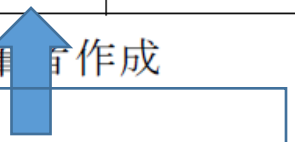
Yoshino and Pontines (2015) ADBI Discussion paper 549

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

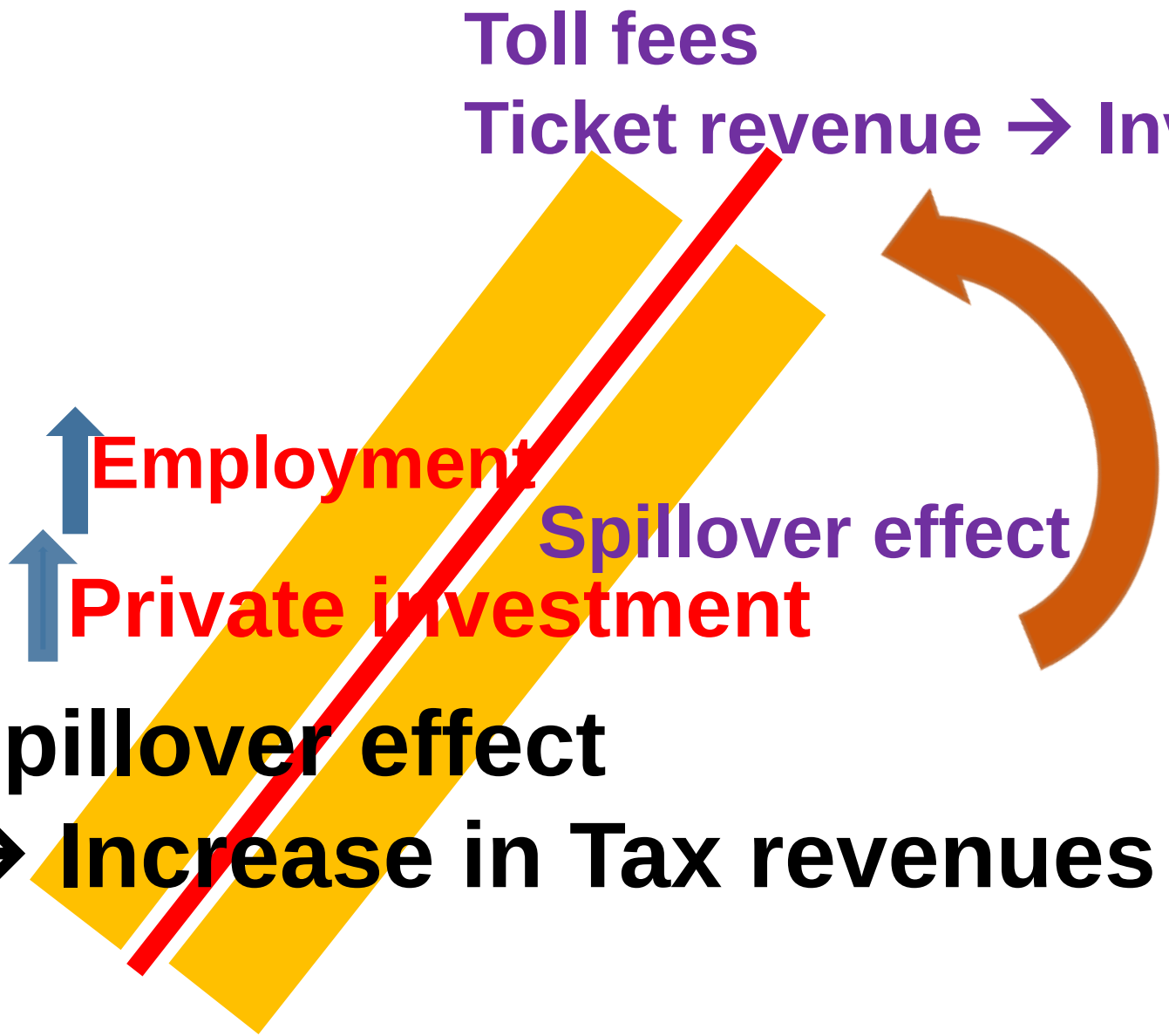
（出所）Yoshino and Pontines (2015)より筆者作成



Completion

Fees + Additional return from tax revenues

→Increase rate of return on investment



Spillover effect

→ Increase in Tax revenues

Return the spillover effects to Investors

The production technology of the private sector is represented by the following production function.

$$Y = f(K_p, L, K_G) \tag{1}$$

where Y denotes output (in value added) in the private sector. The output is produced by combining private capital stock, Kp, labor input, L, and infrastructure stock, K_G.

In this paper, we assume the translog production function.

$$\begin{aligned} \ln Y = {} & \alpha_0 + \alpha_K \ln K_p + \alpha_L \ln L + \alpha_G \ln K_G \\ & + \beta_{KK}(1/2)(\ln K_P)^2 + \beta_{KL} \ln K_P \ln L + \beta_{KG} \ln K_P \ln K_G \\ & + \beta_{LL}(1/2)(\ln L)^2 + \beta_{LG} \ln L \ln K_G + \beta_{GG}(1/2)(\ln K_G)^2 \end{aligned} \tag{2}$$

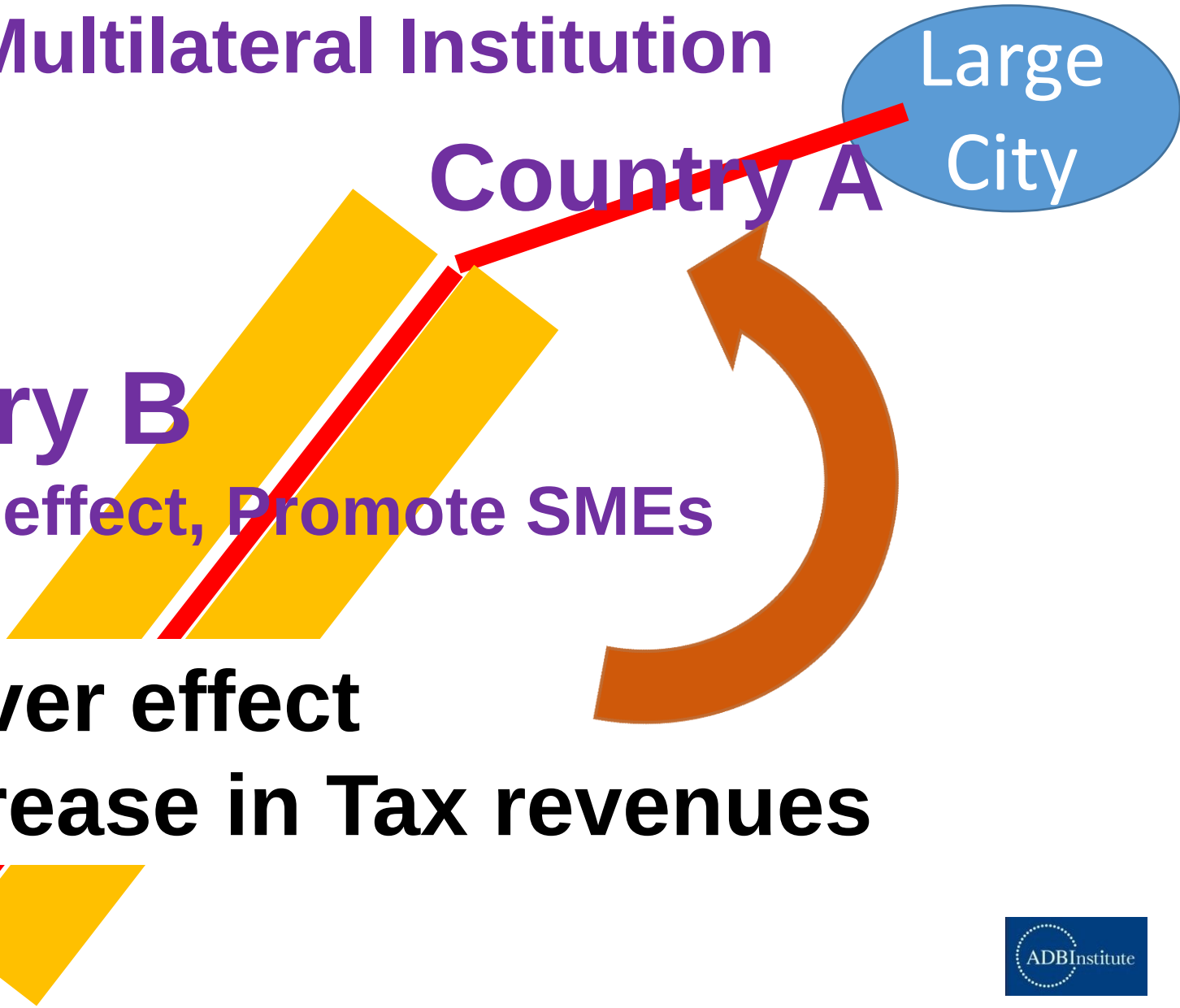
Assuming the production function represented by equation (1), and that factor prices and infrastructure are given for producers in the private sector, the effect of infrastructure on productivity is expressed as:

$$\frac{dY}{dK_G} = \frac{\partial Y}{\partial K_G} + \frac{\partial Y}{\partial K_P}\frac{\partial K_P}{\partial K_G} + \frac{\partial Y}{\partial L}\frac{\partial L}{\partial K_G} \tag{9}$$

Here, the effect of infrastructure is divided into three parts; the first term on the right hand side of equation (9) represents *direct effect;* the second term is the *indirect effect* on output with respect to the resulting change in the input of private capital and the third term is the *indirect effect* on output with respect to the resulting effect on labor input.

Cross-border Infrastructure Investment

Role of Multilateral Institution



Spillover effect

→ Increase in Tax revenues

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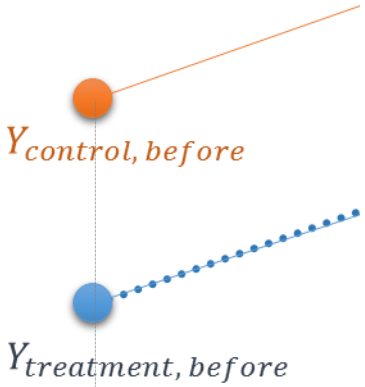
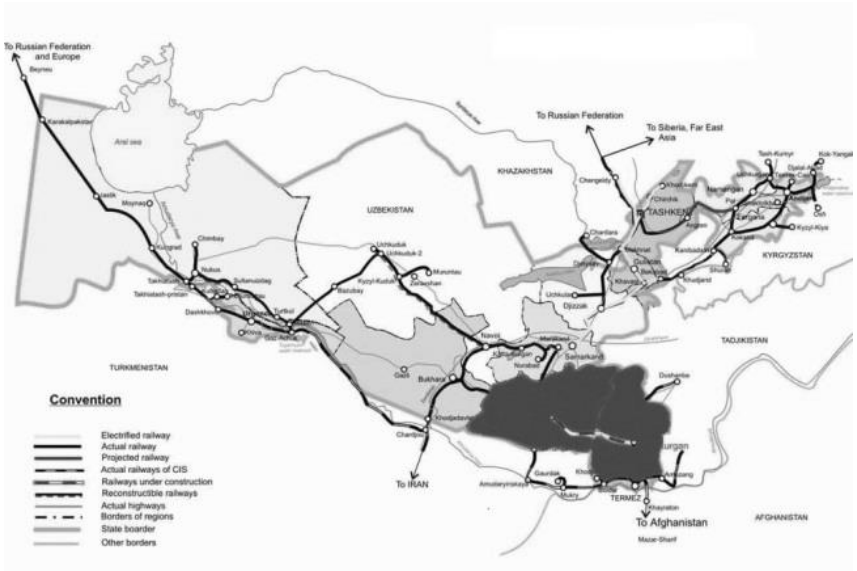
Uzbekistan Railway

GDP growth rate





Time

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

Difference-in-difference: regression

- incorporating time varying covariates

  Control group $E[\Delta Y_{0it}|i,t,X_{it}] = \alpha + \gamma_i + \varphi_t + X'_{it}\beta$

  Treated group $E[\Delta Y_{1it}|i,t,X_{it}] = E[Y_{0it}|i,t,X_{it}] + \delta$

- $\Delta Y_{it} = \alpha_i + \varphi_t + X'_{it}\beta + \delta\left(D_{rail} \times D_{post}\right)_{it} + \epsilon_{it}$

  ΔY_{it} - GDP growth rate

  α_i - sum of autonomous (α) and region specific(γ_i) rate of growth

  φ_t- year specific growth effect

  X_{it}-time varying covariates

  $\left(D_{rail} \times D_{post}\right)_{it}$-dummy variable indicating that observation belong to treated group after treatment period

  δ- difference in difference coefficient

  ϵ_{it}- error term

GDP



	GDP	Term	Connectivity effect	Regional effect	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' calculatios

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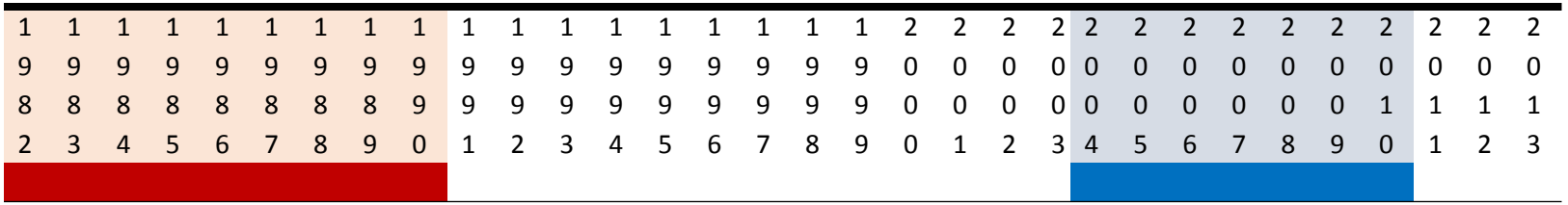
Japanese Bullet Train

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

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



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	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

Impact of Kyushu Shinkansen Rail on CORPORATE TAX revenue during 2nd PHASE OF OPERATION period

{2011-2013} , mln. JPY (adjusted for CPI, base 1982)

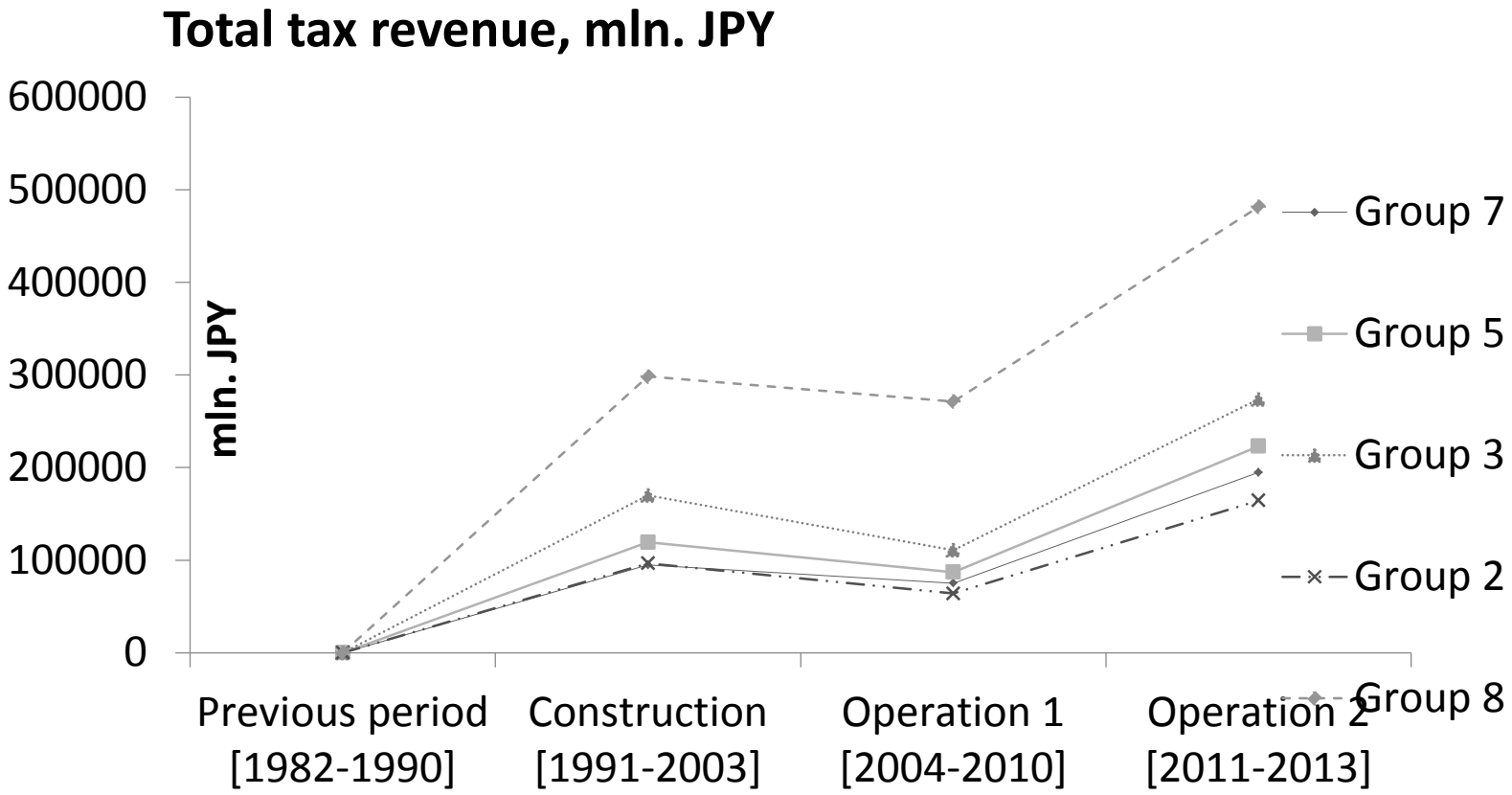
1	1	1	1	1	1	1	1	1	1	1	1	19	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
9	9	9	9	9	9	9	9	9	9	9	9	94	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0
8	8	8	8	8	8	8	8	9	9	9	9		9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	1	1	1
2	3	4	5	6	7	8	9	0	1	2	3		5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3

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

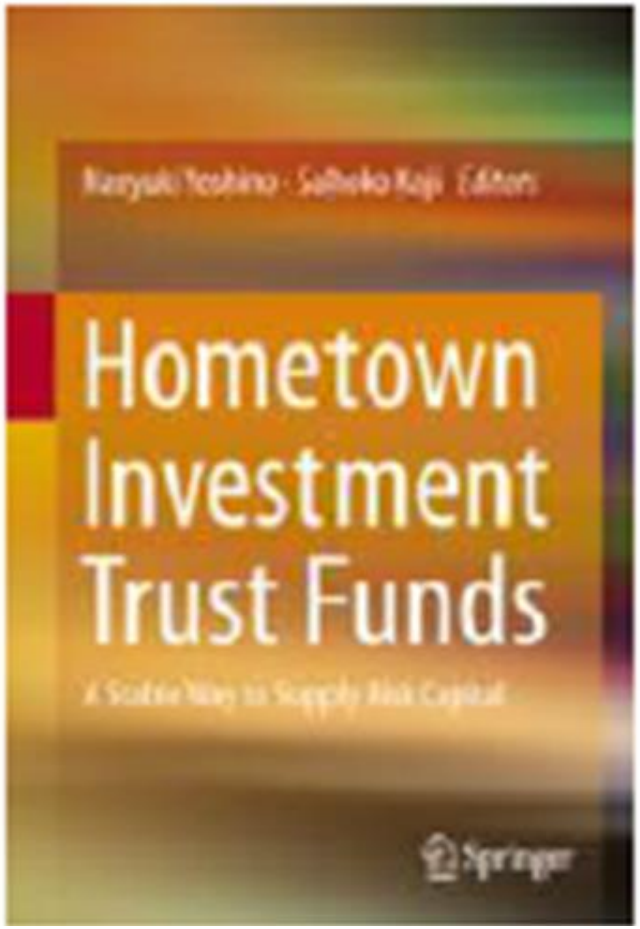

Total tax revenue, mln. JPY
600000
500000
400000
300000
200000
100000
0
mln. JPY
Previous period [1982-1990]
Construction [1991-2003]
Operation 1 [2004-2010]
Operation 2 [2011-2013]
Group 7
Group 5
Group 3
Group 2
Group 8

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

Payoff table for infrastructure operating entity and investors

	Normal Case	Effort Case
Normal Case	$(50, r)$ Operating Entity Investors	$(50, \alpha r)$ Operating Entity Investors
Effort Case	$(100, r)$ Operating Entity Investors	$(100, \alpha r)$ Operating Entity Investors

Possible Solutions
Start up businesses, farmers



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

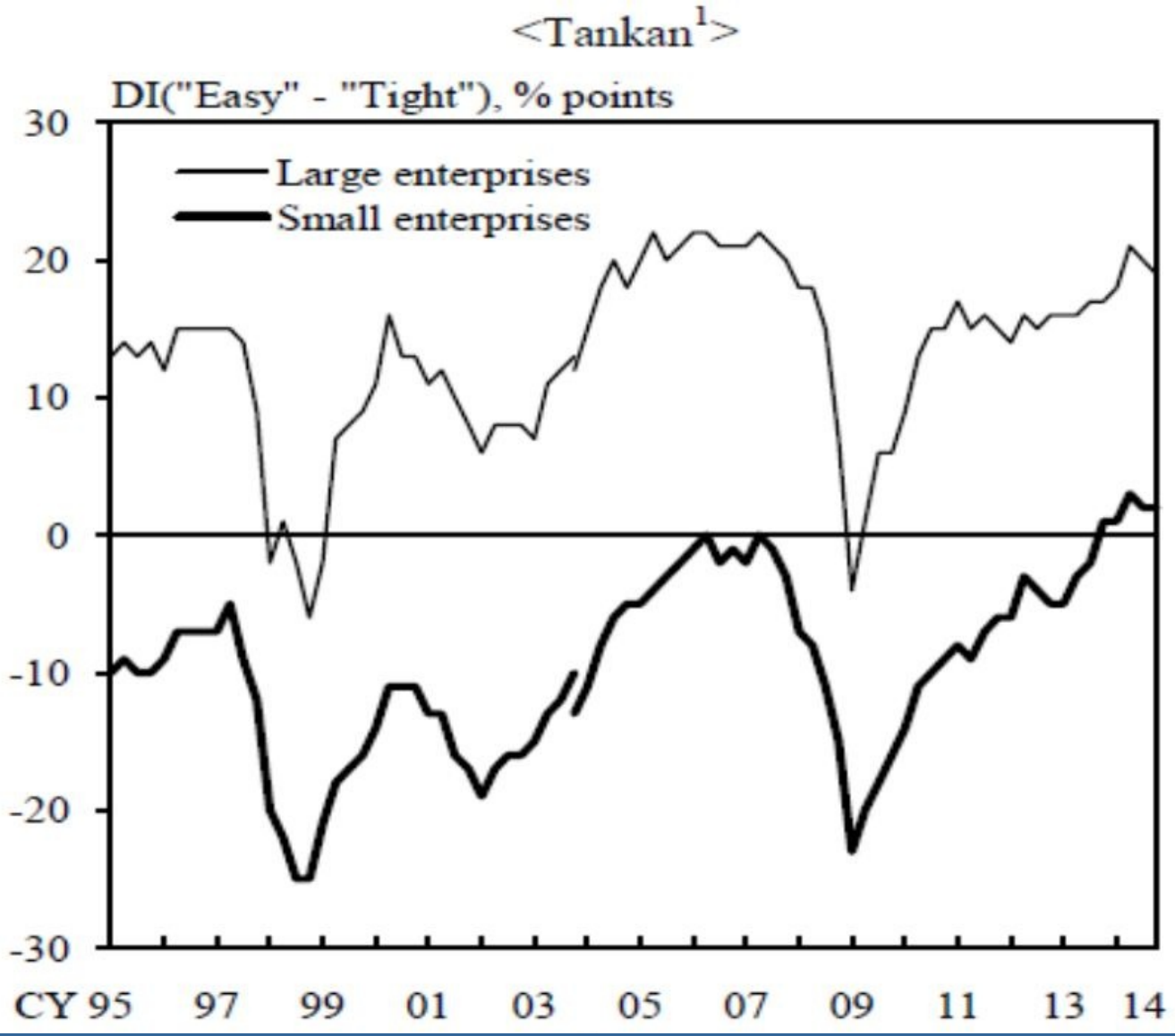
Investment in SMEs and start up businesses

すべてを失い再起を断念しそうになった時。

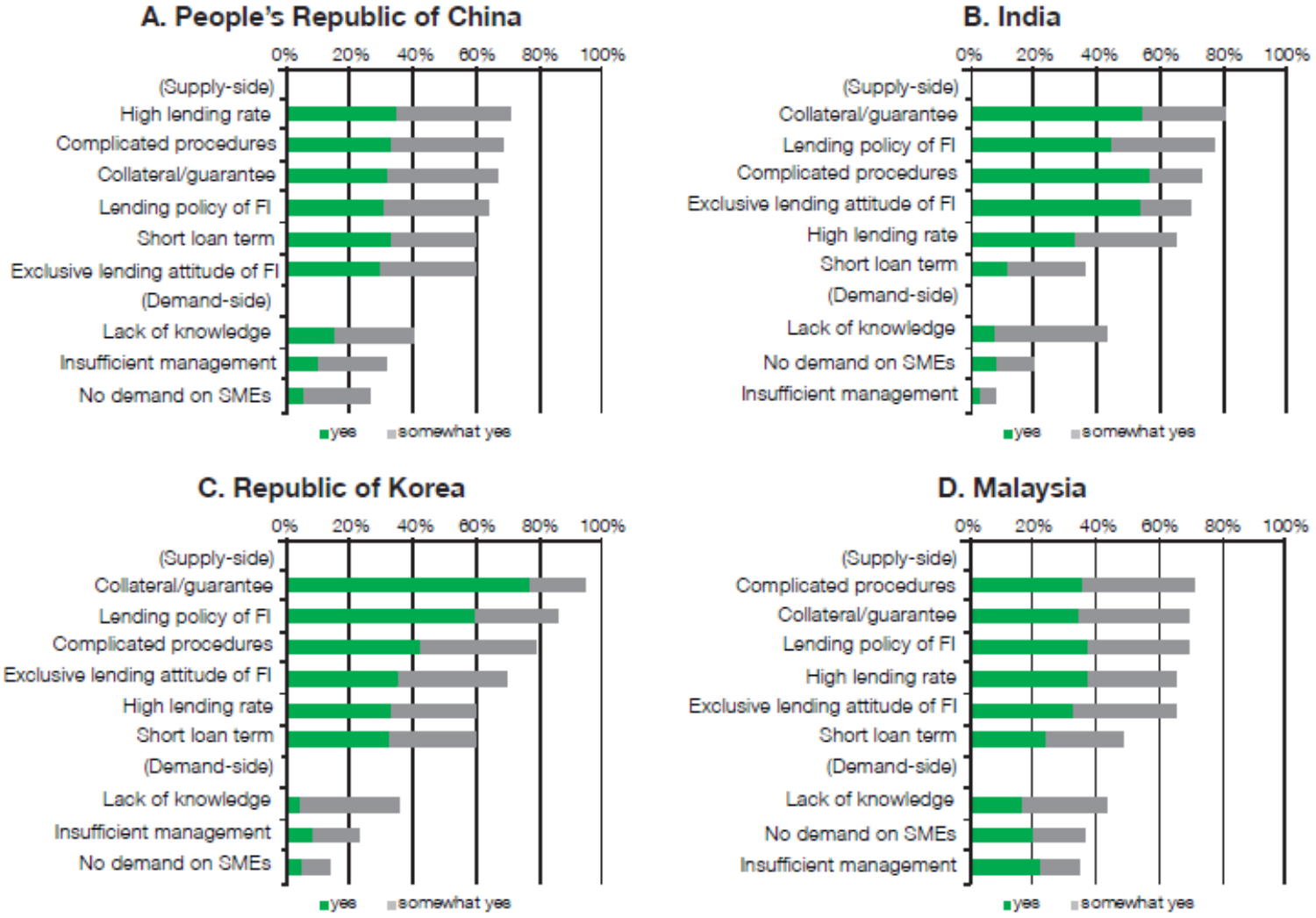
Agricultural Funds

Beans and Wine

Access to Finance by SMEs and Large Firms in Japan



Barriers for SMEs in Accessing Financial Institutions



Source: ADB–OECD study on enhancing financial accessibility for SMEs: Lessons from recent crises. Mandaluyong City, Philippines: Asian Development Bank, 2013

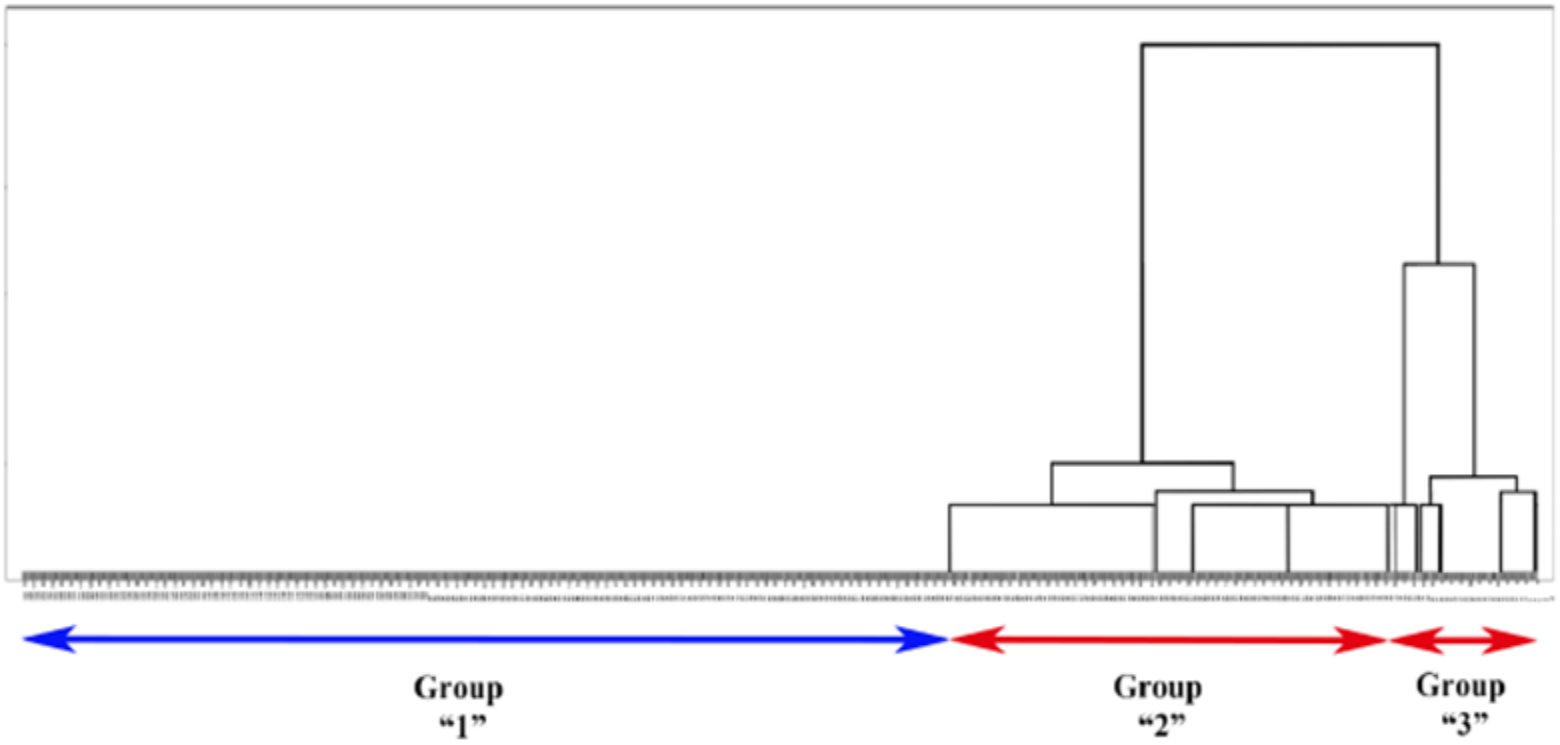
Examined Variable

No.	Symbol	Definition	Category
1	Equity_TL	Equity (book value)/total liabilities	Leverage
2	TL_Tassets	Total liabilities/total assets	
3	Cash_Tassets	Cash/total assets	Liquidity
4	WoC_Tassets	Working capital/total assets	
5	Cash_Sales	Cash/net sales	
6	EBIT_Sales	Ebit/sales	Profitability
7	Rinc_Tassets	Retained earnings/total assets	
8	Ninc_Sales	Net income/sales	
9	EBIT_IE	Ebit/interest expenses	Coverage
10	AP_Sales	Account payable/sales	Activity
11	AR_TL	Account receivable/total liabilities	

Note: Retained earnings = the percentage of net earnings not paid out as dividends, but retained by the company to be reinvested in its core business or to pay debt. It is recorded under shareholders' equity in the balance sheet. Ebit = earnings before interest and taxes. Account payable = an accounting entry that represents an entity's obligation to pay off a short-term debt to its creditors. The accounts payable entry is found on a balance sheet under current liabilities. Account receivable = money owed by customers (individuals or corporations) to another entity in exchange for goods or services that have been delivered or used, but not yet paid for. Receivables usually come in the form of operating lines of credit and are usually due within a relatively short time period, ranging from a few days to a year.

Cluster analysis: the average linkage method

Dendogram Using Average Linkage



Factor Loadings of Financial Variables after Direct Oblimin Rotation

Variables (Financial Ratios)	Component			
	Z1	Z2	Z3	Z4
Equity_TL	0.009	0.068	0.113	**0.705**
TL_Tassets	-0.032	**-0.878**	0.069	-0.034
Cash_Tassets	-0.034	-0.061	**0.811**	0.098
WoC_Tassets	-0.05	**0.762**	0.044	0.179
Cash_Sales	**-0.937**	0.021	0.083	0.009
EBIT_Sales	**0.962**	0.008	0.024	-0.004
Rinc_Tassets	0.014	**0.877**	0.015	-0.178
Ninc_Sales	**0.971**	-0.012	0.015	0.014
EBIT_IE	0.035	0.045	**0.766**	-0.098
AP_Sales	**-0.731**	-0.017	-0.037	-0.016
AR_TL	0.009	-0.041	-0.104	**0.725**

Note: The extraction method was principal component analysis, The rotation method was direct oblimin with Kaiser normalization.

Credit Rating of SMEs using Asian Data

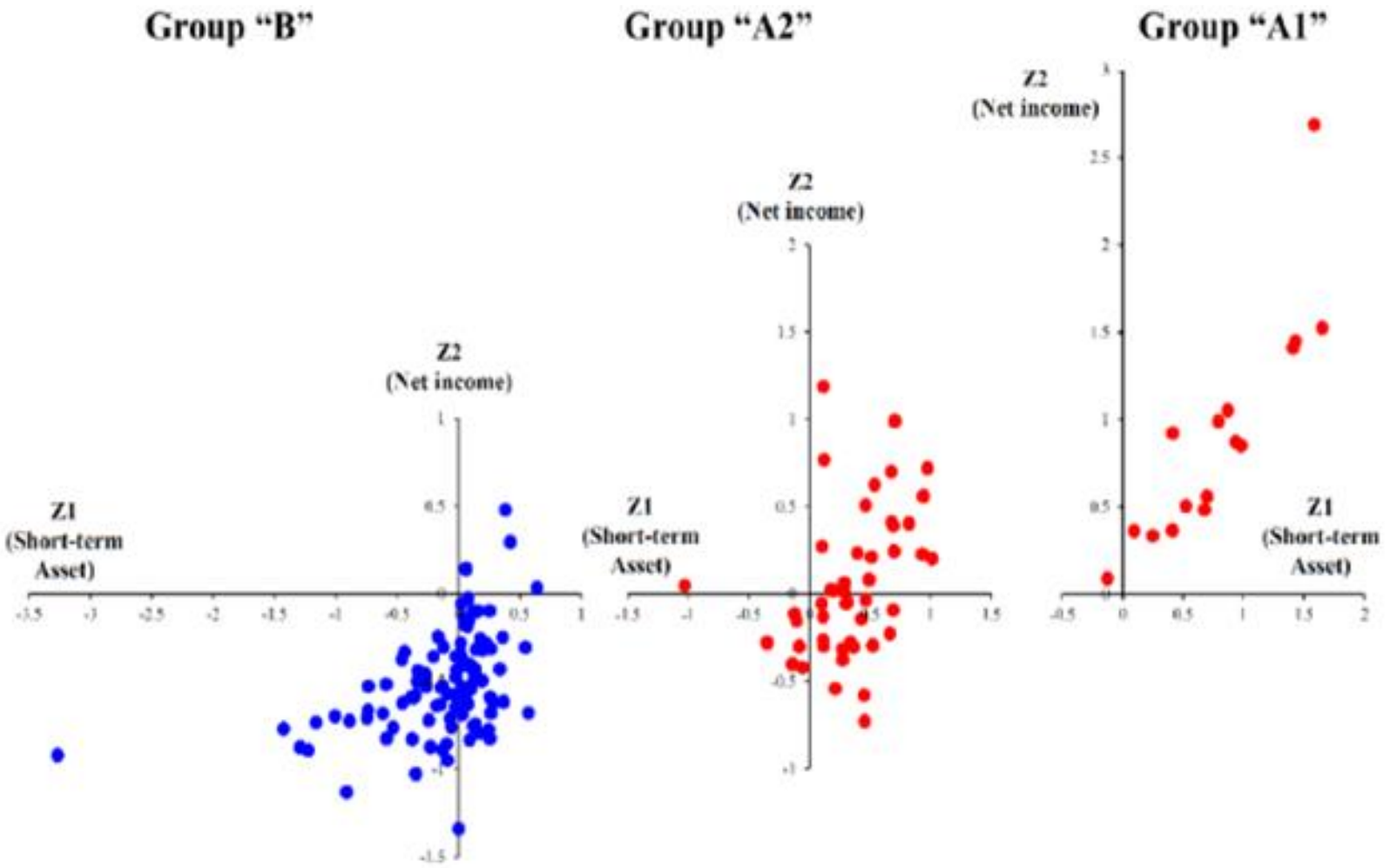
(i) Sales

(ii) Assets

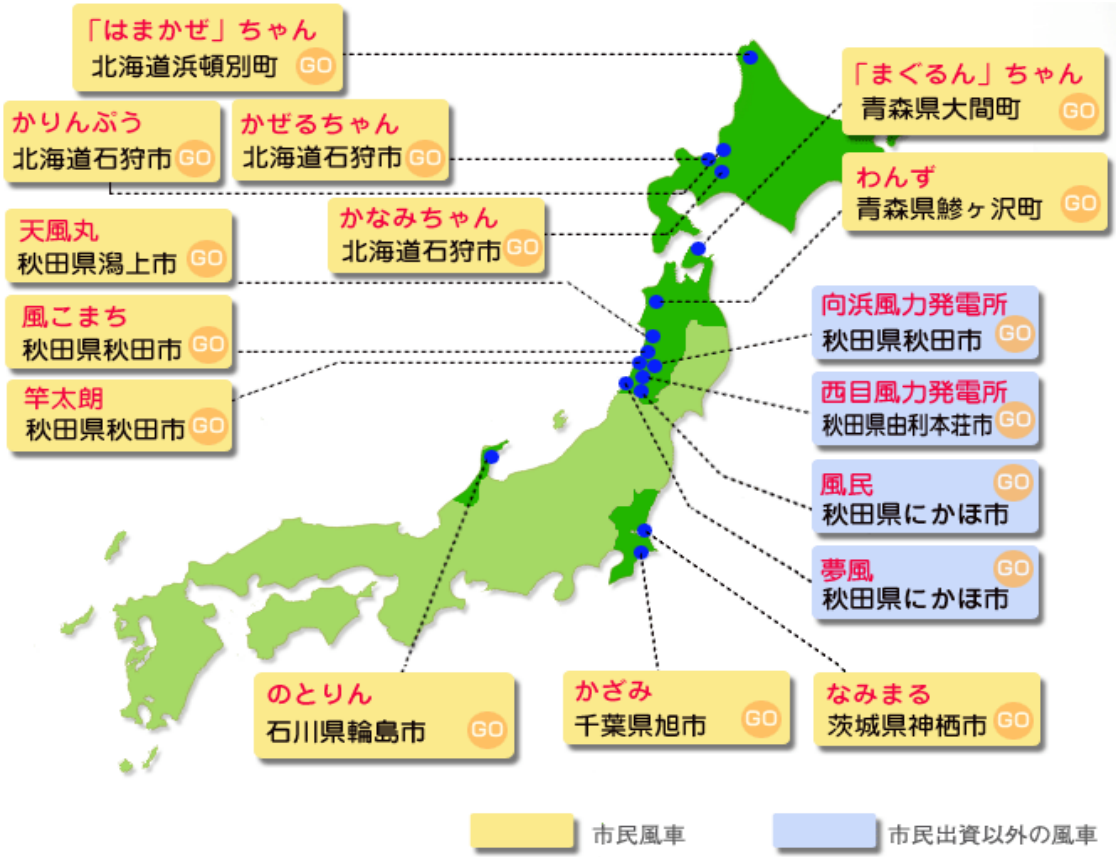
(iii) Liquidity (Cash)

(iv) Total Debt

Grouping Based on Principal Component (Z1-Z2) and Cluster Analysis



Wind Power Fund
Construction costs = 2 million US $



Various Wind power generators were constructed in Japan

The fund constructed more than 16 areas of wind powers

ADBInstitute

Private Financial Scheme of Wind Power Collected by Individuals (started in 2001-9)

Investors
2000 people

Each person
1000 US$

Hokkaido Green Fund

Construction Costs =
2million US $

Sell to Power Company

Final User

PE
1+0.05
5%
surcharge

Financial Scheme of Wind Power Collected by Individuals

Donation

Investors

Hokkaido Green Fund (60%)

Senior Bank Loans (20%)

Government Fund, Carbon Tax (20%)

Sell to Power Company

Final User

PE=5% surcharge

Sales Of Power

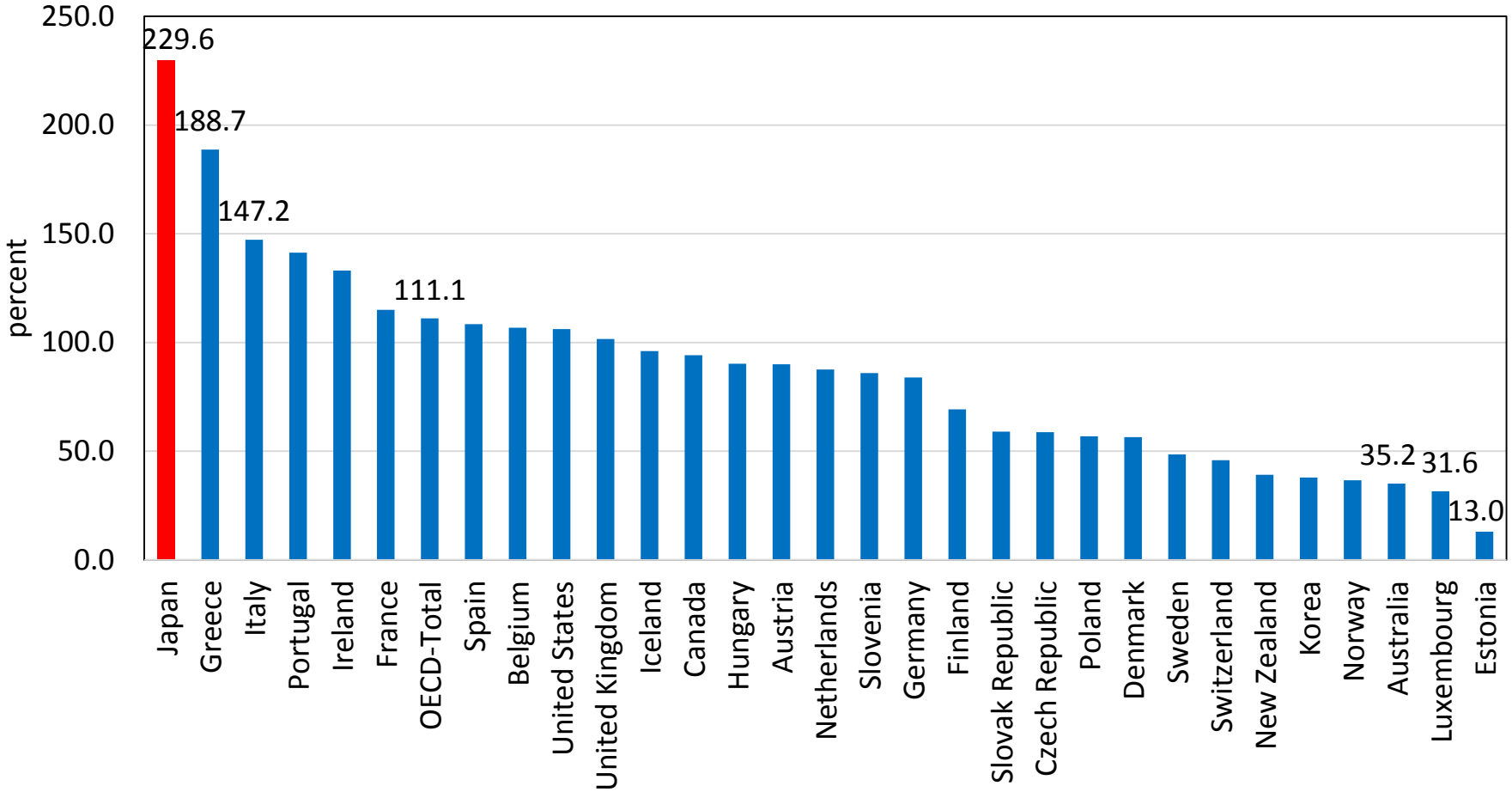
ADBInstitute

Solar Power Panel

Funds in Japan

ADBInstitute

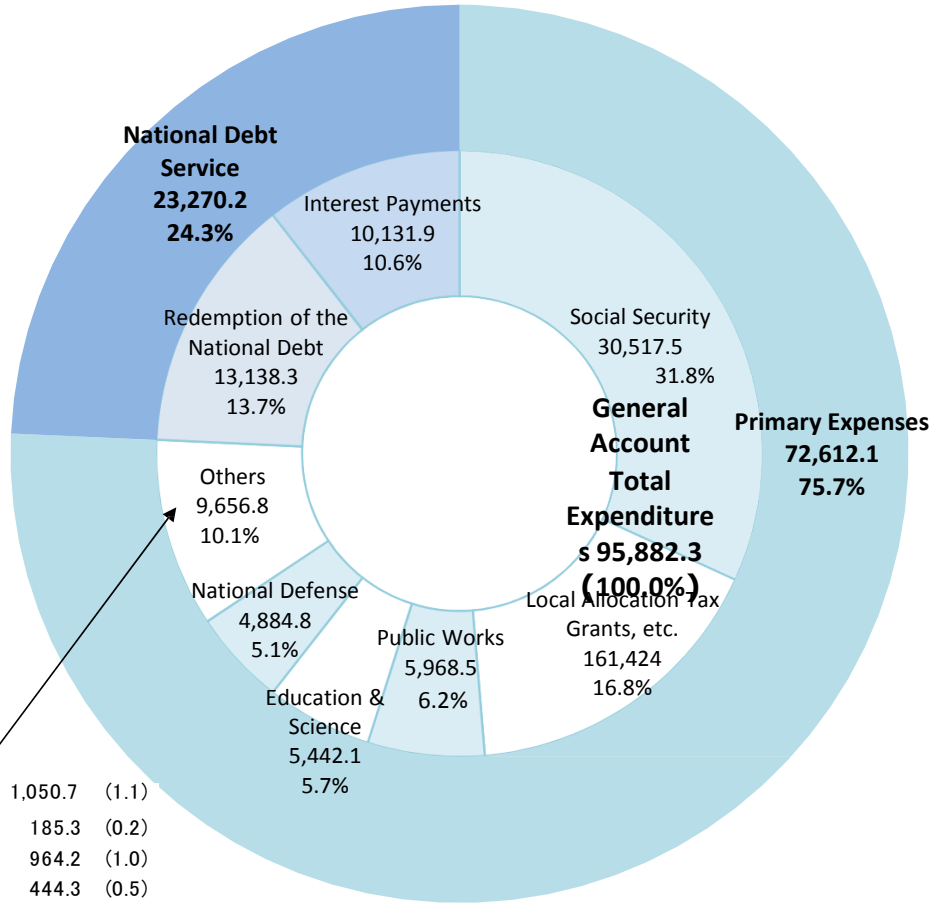
Gross Debt / GDP of selected OECD Countries 2014



Note: General government gross financial liabilities as a percentage of GDP

Source: OECD Economic Outlook No. 95 (database), **Publication Date:** 06 May 2014 **DOI:** 10.1787/gov-debt-table-2014-1-en

General Account Budget -Breakdown of Expenditure



Food Supply	1,050.7	(1.1)
Promotion of SMEs	185.3	(0.2)
Energy	964.2	(1.0)
Former Military Personal Pensions	444.3	(0.5)
Economic Assistance	509.8	(0.5)
Miscellaneous	6,152.6	(6.4)
Contingency Reserves	350.0	(0.4)

(Note1) Figures may not add up to the totals due to rounding.

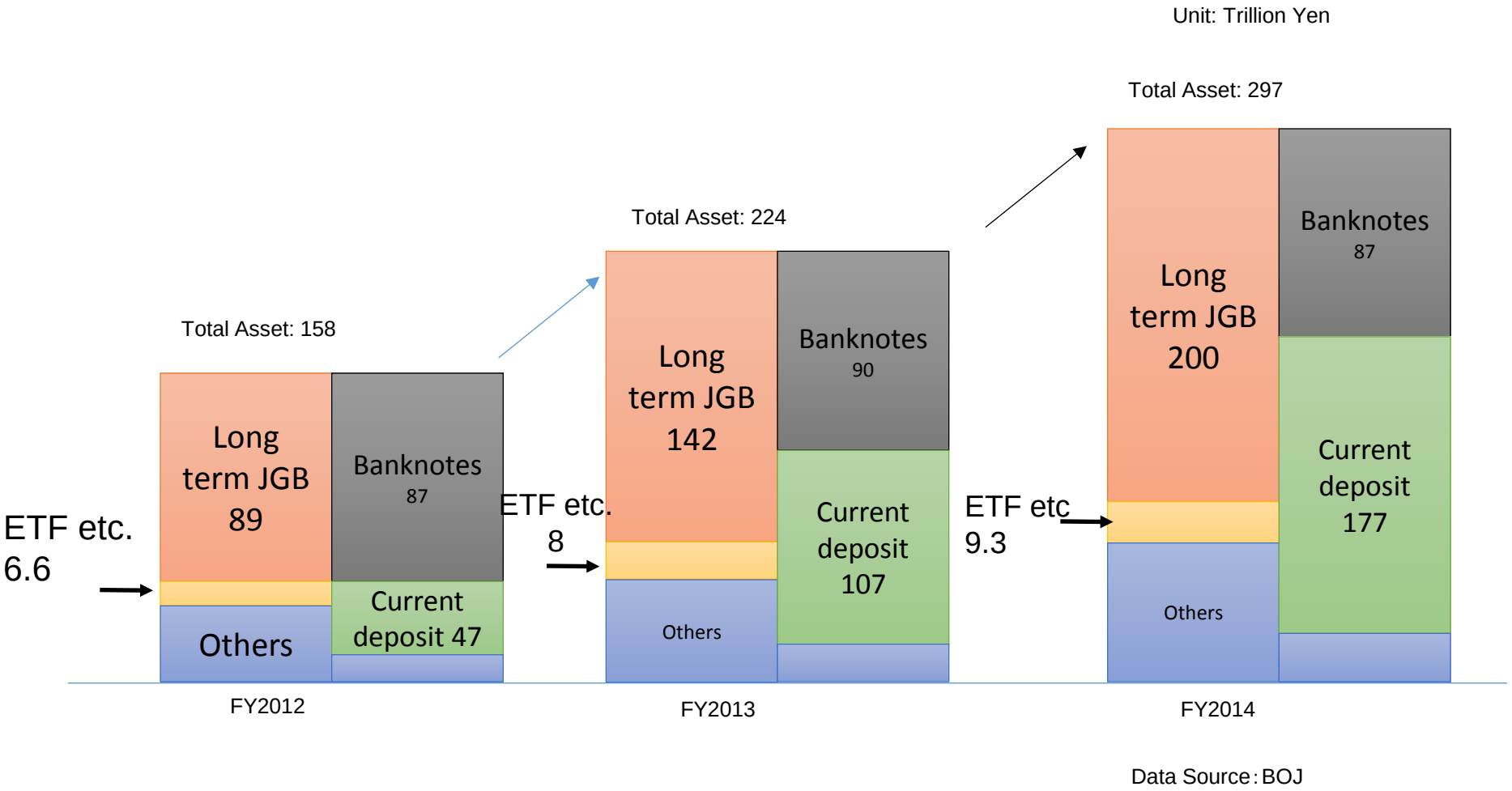
(Note2) The ratio of Social Security expenses to General Expenditures* : 54.0%
*General Expenditures equals to the Primary Expenditure minus Local Allocation Tax Grants, etc.

Table 1: Holders of Japanese and Greek Government Bonds, 2011

Holders of Japanese Government Bonds	% of Total	Holders of Greek Government Bonds	% of Total
Bank and postal savings	45	Overseas investors	33
Life and non-life insurance	20	Domestic investors	21
Public pension funds	10	European Central Bank	18
Private pension funds	4	Bilateral loans	14
Bank of Japan	8	Social pension funds	6
Overseas investors	5	International Monetary Fund	5
Households	5	Greek domestic funds	3
Others	3		

Banks and Postal Savings (2015)	**JAPAN**	**27.8%**
Bank of Japan (2015)	**JAPAN**	**21.2%**
Life and Non-life Insurances (2015)		**19.3%**
Overseas' Investors (2015)		**8.5%**
Public Pension funds (2015)		**6.4%**
Private Pension Funds (2015)		**3.4%**

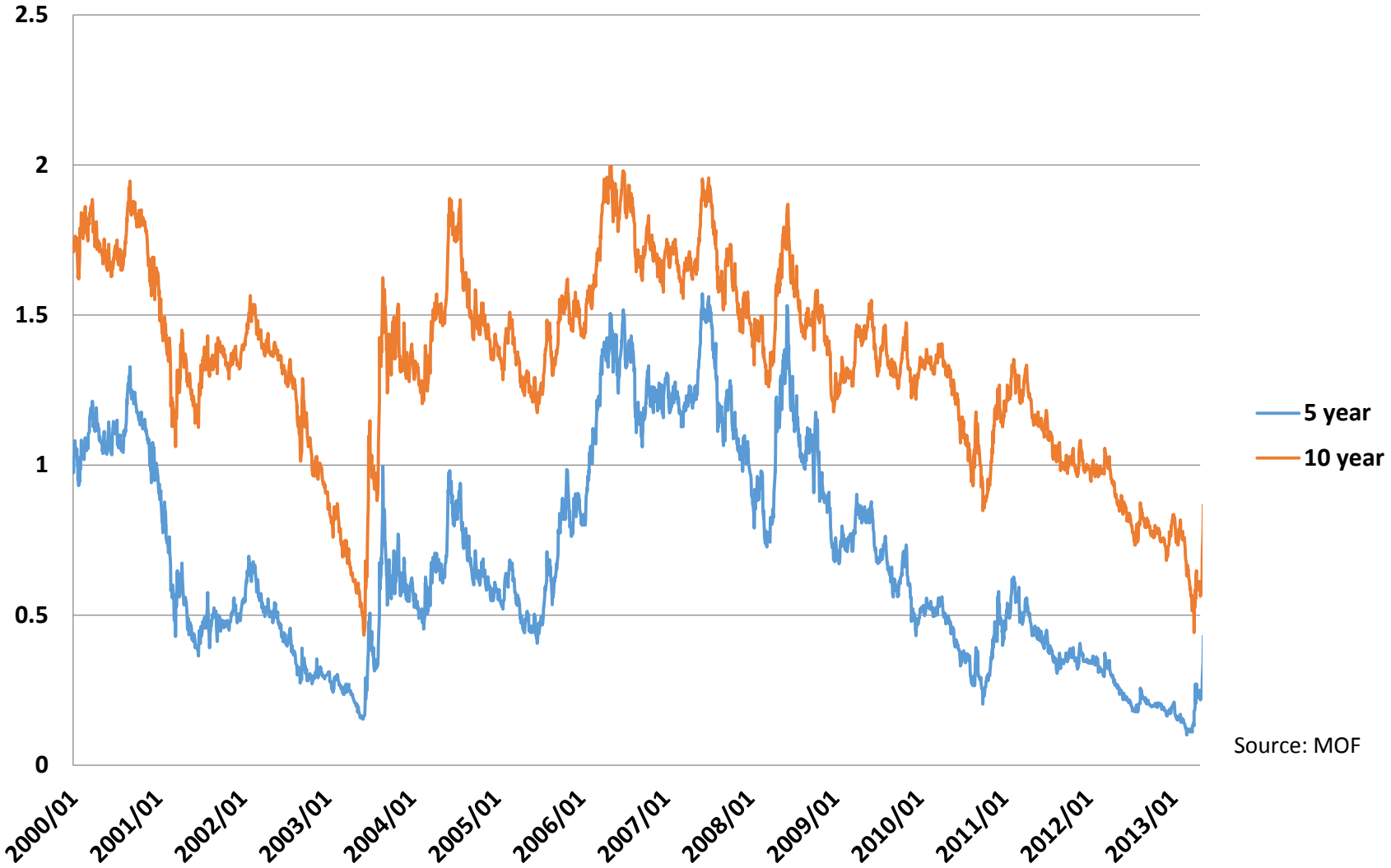
Balance Sheet of BOJ



Data Source：BOJ

ADBInstitute

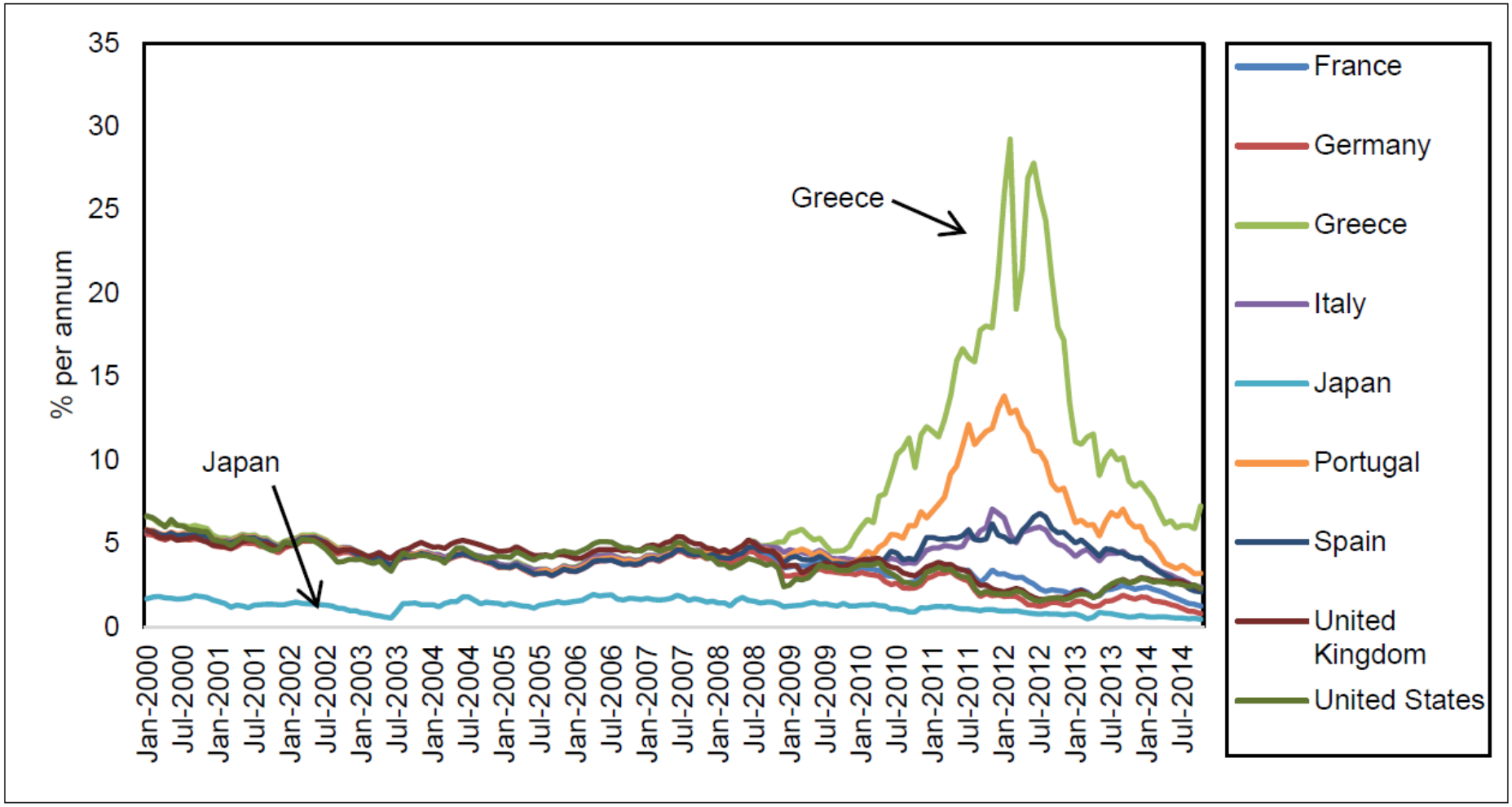
Japanese Government Bond Yields



Source: MOF

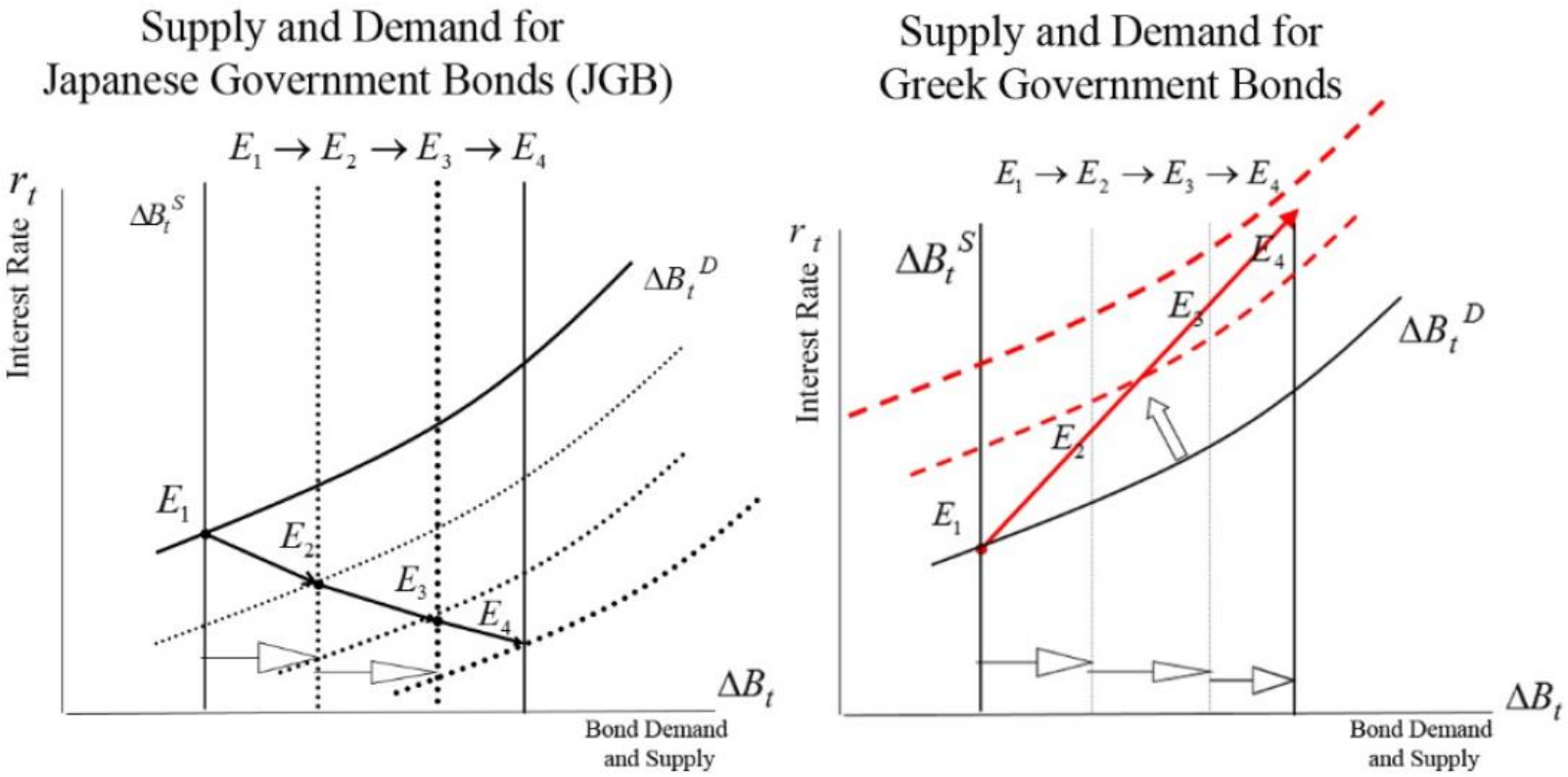
ADBInstitute

Figure 4: Interest Rates in Selected OECD countries



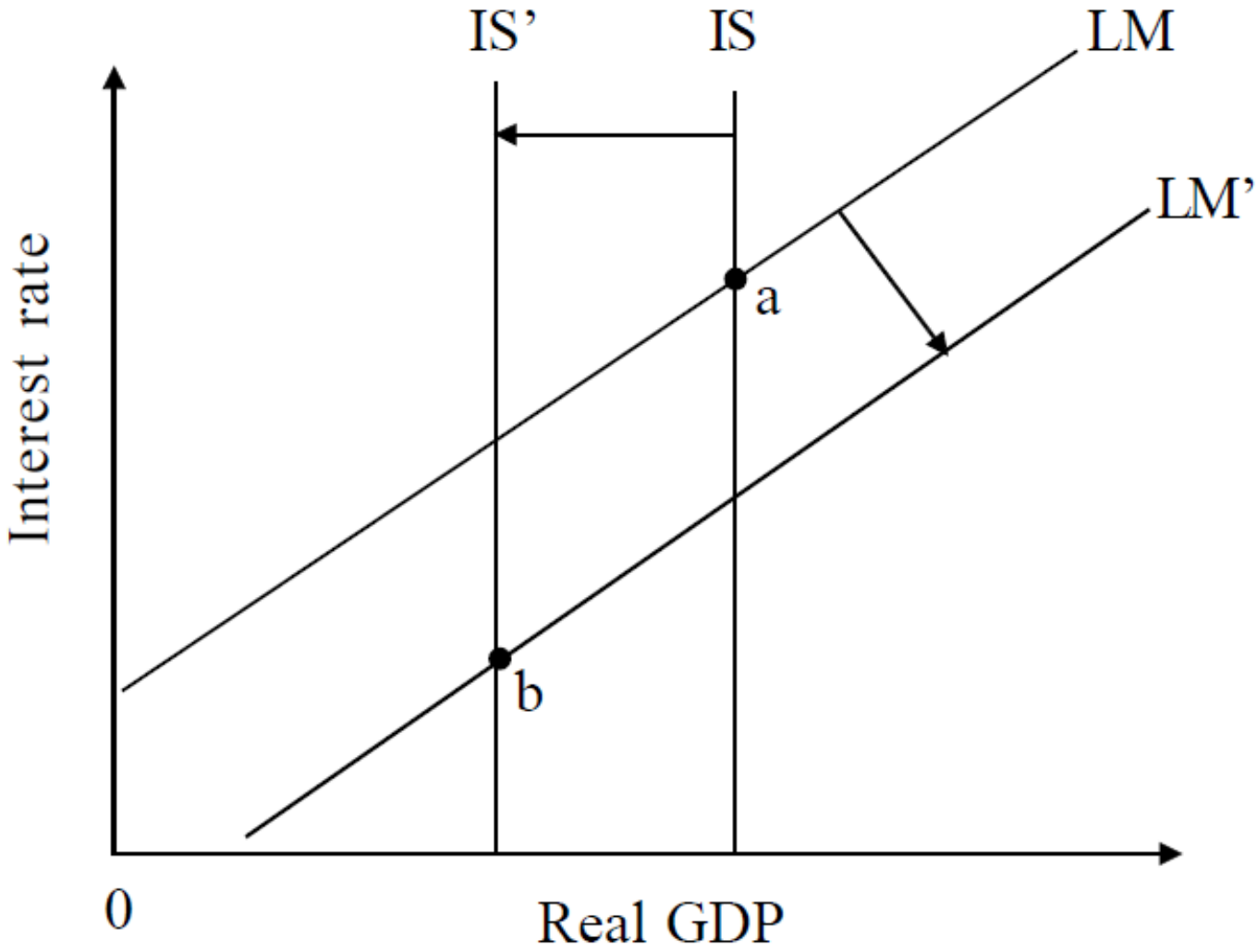
OECD = Organisation for Economic Co-operation and Development.

Figure 2: Government Bond Markets of Japan and Greece



Source: Yoshino and Taghizadeh-Hesary (2014a).

Figure 6. The Ineffectiveness of Monetary Policy in Japan



Yoshino and Sakakibara (2002) "The Current State of Japanese Economy and Remedies",
***Asian Economic Papers*, MIT Press, Vol.1, No.2.**

Table 3. Empirical Results
(Sample: Q2 1990–Q4 2013)

$$y_t = -0.16 - 0.0002(i - E\Delta p_{+1}) + 1.01 y_{t-1} \qquad \text{(IS equation-1)}$$

(–1.98)* (–0.53) (147.63)**

$R^2 = 0.99$ adjusted $R^2 = 0.99$ Durbin-Watson Statistic=1.70 Standard Error of regression=0.01

$$y_t = -0.15 + 0.0002(i - E\Delta p_{+1}) + 1.01 y_{t-1} \qquad \text{(IS equation-2)}$$

(–2.36)* (1.17) (188.23)**

$R^2 = 0.99$ adjusted $R^2 = 0.99$ Durbin-Watson Statistic =1.62 Standard Error of regression=0.01

$$(m-p)_t = 0.02 + 0.70 y_t - 0.025 i_t + 0.99 (m-p)_{t-1} \qquad \text{(LM equation)}$$

(0.11) (2.67)** (–2.72)** (171.06)**

$R^2 = 0.99$ adjusted $R^2 = 0.99$ Durbin-Watson Statistic =1.93 Standard Error of regression=0.03

Yoshino, N., Taghizadeh-Hesary, F. (2015), 'An Analysis of Challenges Faced by Japan's Economy and Abenomics'. *Journal of Japanese Political Economy*. Routledge: Taylor and Francis, DOI: 10.1080/2329194X.2014.998591
Yoshino, N., Taghizadeh-Hesary, F. (2016). *'Causes and Remedies of Japan's Long Lasting Recession: Lessons for China'. China & World Economy. Vol 24 (2): 2016*

Reasons for Vertical IS curve

There are several reasons behind the vertical IS curve. First, excess capacity was created during the bubble period when companies invested significantly in various sectors, but demand suddenly slowed. Second, the high foreign direct investment of Japan in other Asian countries (because of the high appreciation of the yen and the high wage rates in Japan and because other Asian countries' growth was higher) reduced the domestic investment. Third, the marginal productivity of capital declined because profitable companies started to leave the country and invest abroad, while weaker companies remained in the country. Finally, startups could not grow because banks were reluctant to lend to them due to the strict Basel capital requirements, causing technological progress to slow down. These reasons will be further discussed in the following subsections.

China & World Economy / 1–25, Vol. 24, No. 1, 2016

Causes and Remedies of the Japan's Long-lasting Recession: Lessons for China

*Naoyuki Yoshino, Farhad Taghizadeh-Hesary**

Domar Condition

The Domar condition is obtained from the government budget constraint as follows.

$$G_t + r_t B_{t-1} = \Delta B_t + T_t \qquad \text{Government Budget Constraint (1)}$$

Equation (1) states that government spending (G_t) + interest payments $(r_t B_{t-1})$ = new issue of government bonds (ΔB_t) + tax revenue (T_t).

Dividing Equation (1) by GDP (Y_t) and rewriting Equation (1), we get

$$b_t - b_{t-1} = \frac{(r_t - \eta_t)}{1+\eta_t} b_{t-1} + g_t - t_t \qquad \text{Domar Condition (2)}$$

where $b_t = B_t/Y_t$, $\eta_t = \Delta Y_t/Y_t$, $g_t = G_t/Y_t$, and $t_t = T_t/Y_t$

Bohn's Condition

- $PB_t = g_t - t_t$ Primary Balance (PB)
- $PB_t = PB_1 + \mu(b_{t-1} - b_0)$ Bohn's Rule: Primary Balance improvement Rule at t

$$\sum_{t=1}^{\infty} \frac{PB_t}{(\lambda)^t} = b_0$$

- Bohn's Rule satisfied with "transvesarity condition".

Disposable income is defined as income (Y_t) plus g, the interest received from government bonds by households ($r_t^B B_{t-1}$), minus the tax payment (T_t) as follows. The disposable income is divided into consumption (C_t) and savings (S_t)

$$YD_t = Y_t - T_t + r_t^B B_{t-1} = C_t + S_t$$
$$\text{where } S_t = \Delta B_t + \Delta M_t + \Delta W_t^D \quad (6)$$

Savings(S_t) = Government bonds(ΔB_t) + money demand (ΔM_t) + domestic deposits(ΔW_t^D).

$$I_t = i_0 - i_1 r_t \quad \text{Investment Function} \quad (7)$$
$$C_t = c_0 + c_1 YD_t \quad \text{Consumption Equation}^1 \quad (8)$$
$$\Delta W_t^D = d_0 + d_1 YD_t + d_2 r_t \quad \text{Deposit equation} \quad (9)$$

From Equations (6)-(9), we have the IS-balance equation.

$$(1 - c_1)Y_t - c_1 r_t^B B_{t-1} + i_1 r_t = c_0 + i_0 + G_t - c_1 T_t \quad \text{IS-Balance} \quad (10)$$

We assume that investment in the private sector will be financed by deposits in the banking sector. For convenience, with regards to the banking sector's behavior, it is simply assumed that savings are used for the purpose of investment.

$$\Delta W_t^D = I_t \quad \text{Saving-Investment Equilibrium} \quad (11)$$

By using Equations (10) and (11), we obtain income and the interest rate in the short-run equilibrium as follows:

$$Y_t^* = \frac{1}{\Delta}\{(d_1 + i_1)c_0 + d_1 i_0 + i_1 d_0 + (d_1 + i_1 + d_1 i_1)G_t - \big((d_1 + i_1)c_1 + d_1 i_1\big)T_t + \big((d_1 + i_1)c_1 + d_1 i_1\big)r_t^{B^*} B_{t-1}\} \quad (12)$$

$$r_t^* = \frac{1}{\Delta}\{(1 - c_1)(i_0 - d_0) - d_1(c_0 + i_0) - d_1 G_t + d_1 T_t - d_1 r_t^{B^*} B_{t-1}\} \quad (13)$$

Government Spending and Taxation Rules

From Equation (15), we obtain our government spending rule.

$$G_t - G_{t-1} = \alpha_1(B_t - B_t^*) + \alpha_2(\Delta B_t - \Delta B_t^*) + \alpha_3\left(Y_t - Y_t^f\right)$$

Government Spending Rule (17)

where $\alpha_1 = \frac{w_1}{w_3}\left(\frac{B_{t-1}}{b_1 - B_{t-1}} + 1\right)$, $\alpha_2 = \frac{w_5}{w_3}\left(\frac{B_{t-1}}{b_1 - B_{t-1}} + 1\right)$, $\alpha_3 = -\frac{w_2}{w_3}\left(\frac{(d_1 + i_1) + d_1 i_1}{\Delta}\right)$

$$T_t - T_{t-1} = \beta_1(B_t - B_t^*) + \beta_2(\Delta B_t - \Delta B_t^*) + \beta_3\left(Y_t - Y_t^f\right)$$

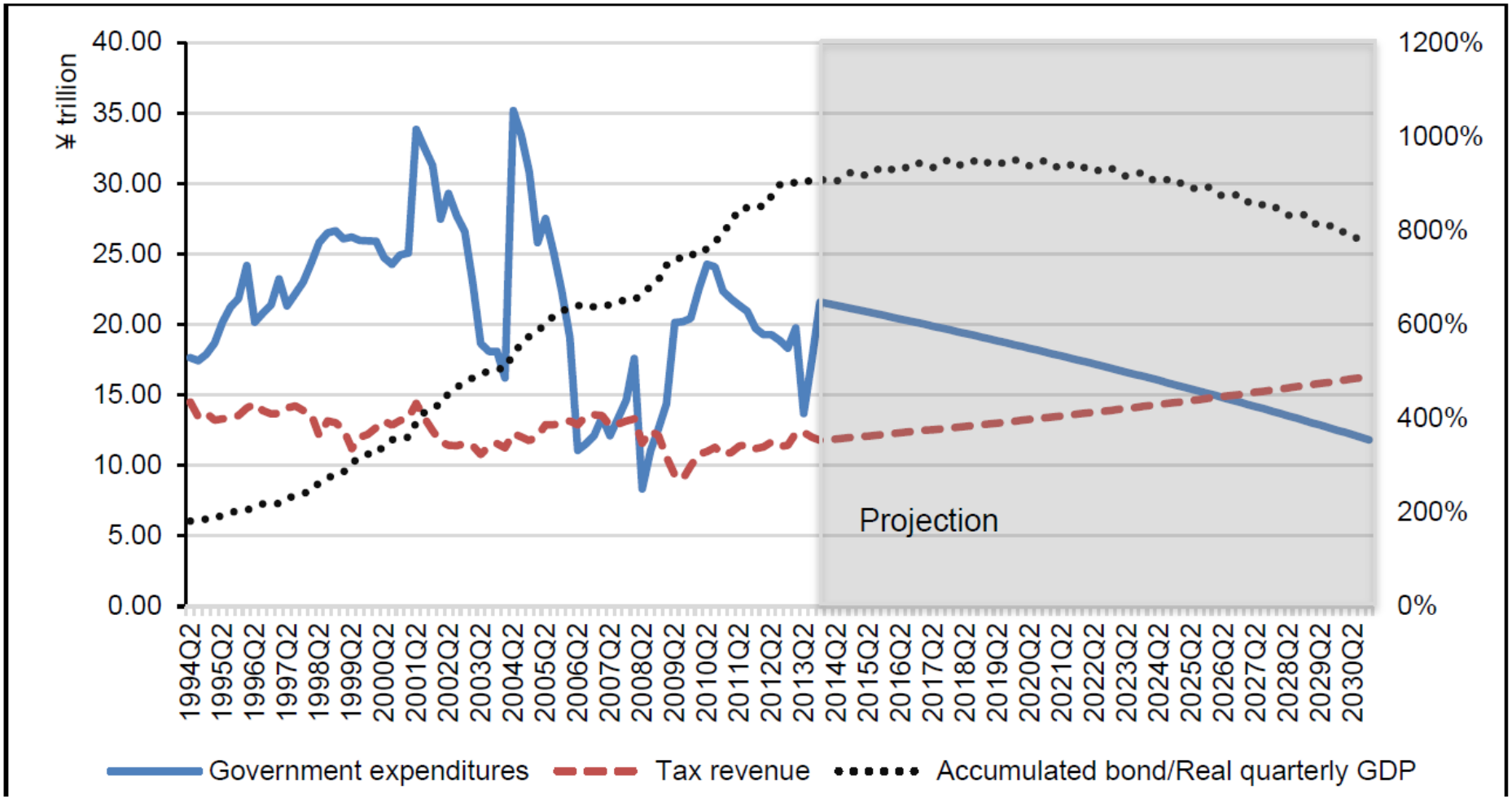
Taxation Rule (18)

where $\beta_1 = -\frac{w_1}{w_4}\left(\frac{B_{t-1}}{b_1 - B_{t-1}} + 1\right)$, $\beta_2 = -\frac{w_5}{w_4}\left(\frac{B_{t-1}}{b_1 - B_{t-1}} + 1\right)$, $\beta_3 = \frac{w_2}{w_4}\left(\frac{(d_1 + i_1)c_1 + d_1 i_1}{\Delta}\right)$.

From these two first-order conditions, we can find the relationship between $G_t, T_t, (B_t - B_t^*)$, $(\Delta B_t - \Delta B_t^*)$ and the primary balance.

$$PB_t - PB_{t-1} = (\alpha_1 - \beta_1)(B_t - B_t^*) + (\alpha_2 - \beta_2)(\Delta B_t - \Delta B_t^*) + (\alpha_3 - \beta_3)\left(Y_t - Y_t^f\right) \quad (19)$$

Figure 10: Government Expenditure and Tax Revenue



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- ***Yoshino, N., T. Mizoguchi and Taghizadeh-Hesary, F. (2015) "*Optimal Fiscal Policy Rule for Achieving Fiscal Sustainability: A Japanese Case Study', *Asian Development Bank Institute, Working Paper*, No. 531.**
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