Spillover Effects of Infrastructure Investment and Sustainable Growth in Asia

NOMURA Foundation- Asian Capital Markets Roundtable

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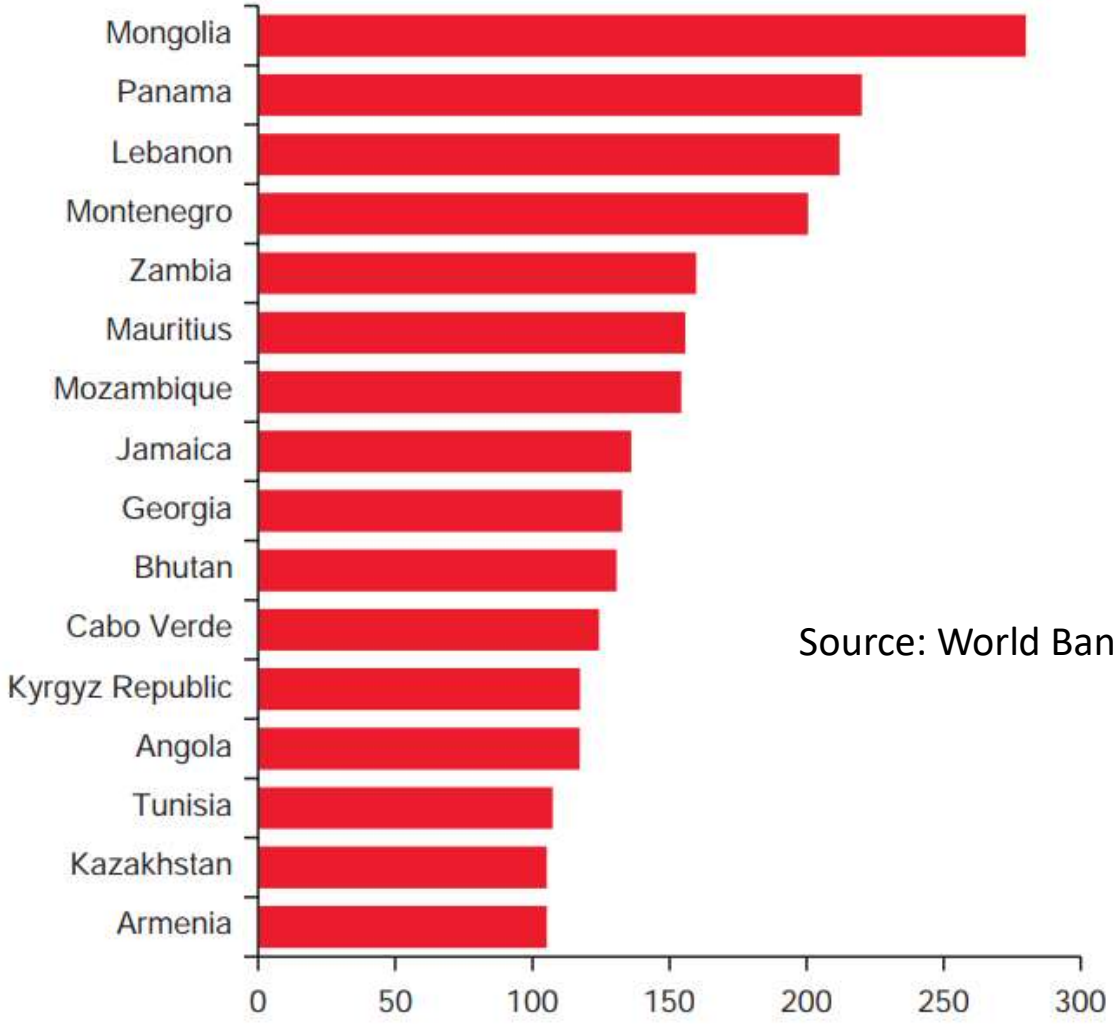
Figure O.19 Countries with 2020 Debt-to-GNI Ratios of 100 Percent or Above

Percent



Source: World Bank

PPP = Public Private Partnerships

Realizing The Potential of Public Private Partnerships to Advance Asia's Infrastructure Development

Akash Deep
Jungwook Kim
Minsoo Lee

ADB (2019)

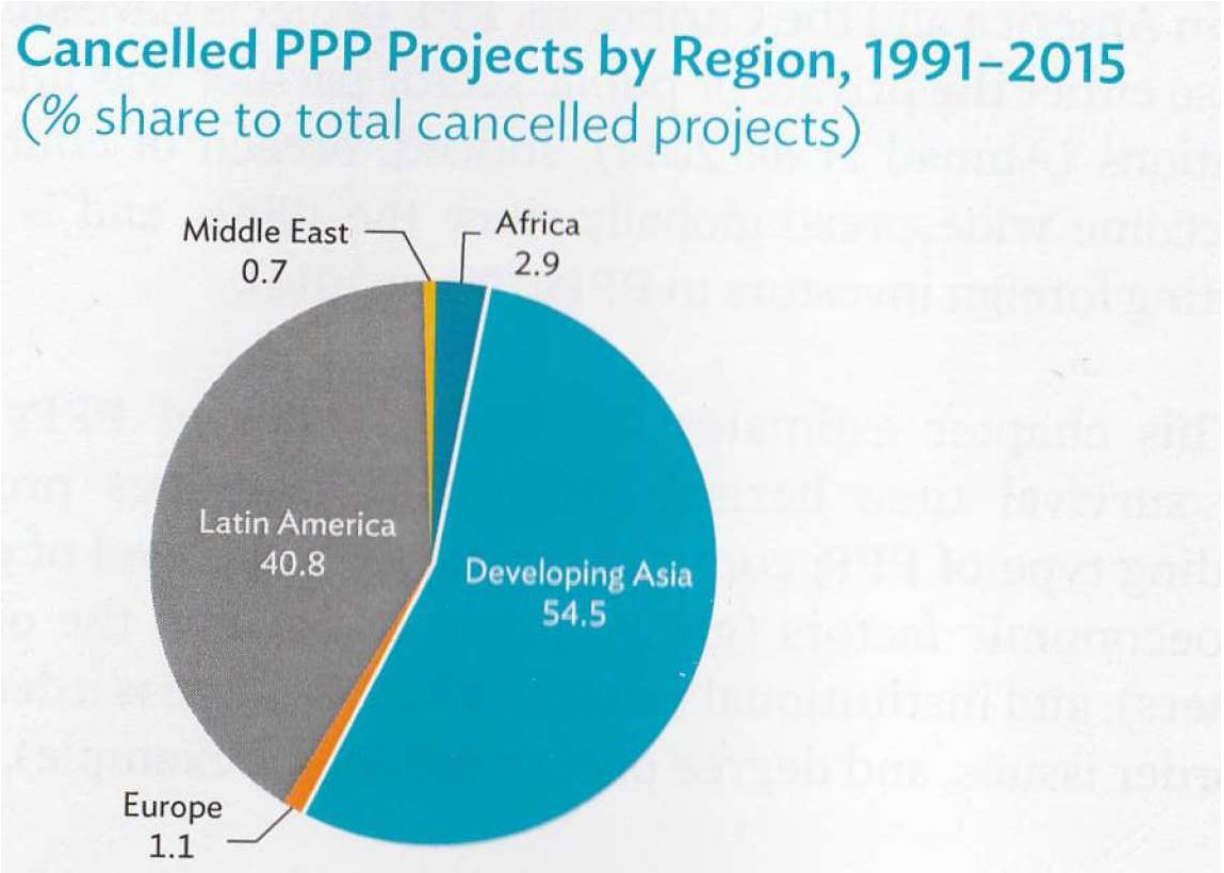


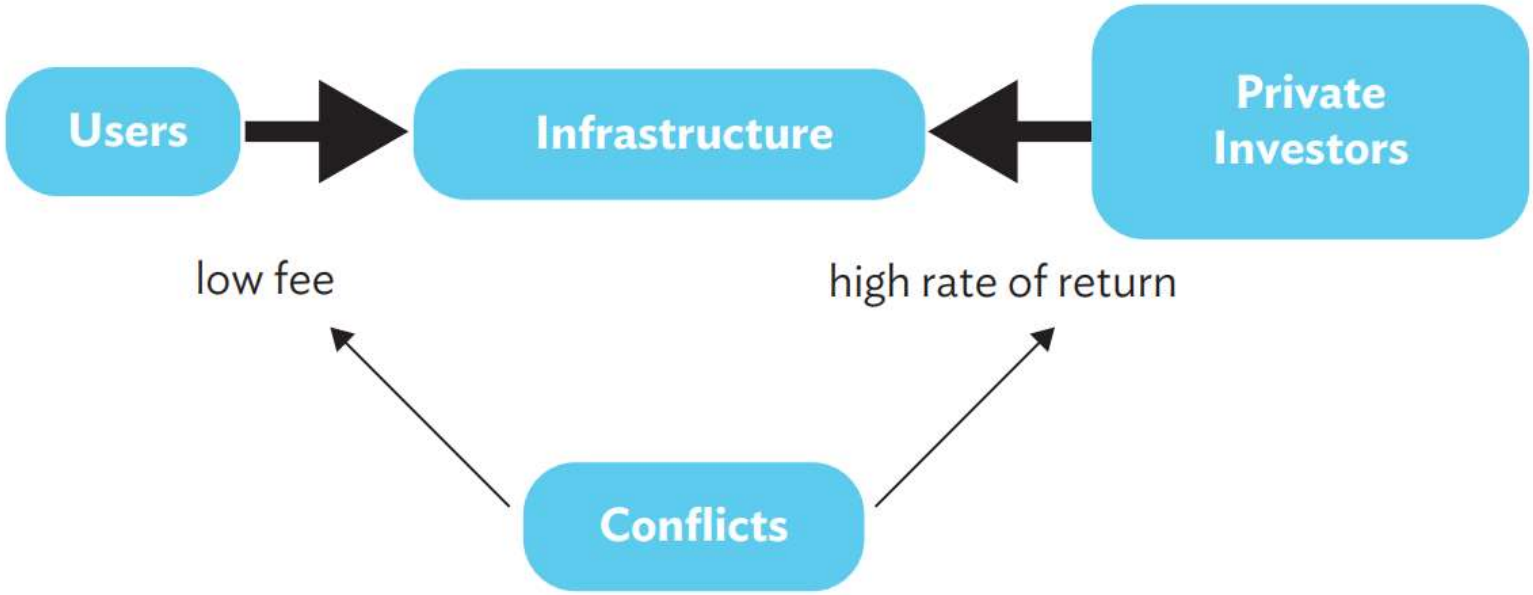
Table 5.2: Public and Private Infrastructure Investment in Asia, 2010–2014

(% of GDP)

	Private	Public
25 ADB Developing Member Countries	0.4	5.1
East Asia	app. 0	6.3
South Asia	1.8	3.0
Central and West Asia	0.3	2.6
Pacific	0.3	2.5
Southeast Asia	0.5	2.1
People's Republic of China	app. 0	6.3
Indonesia	0.3	2.3

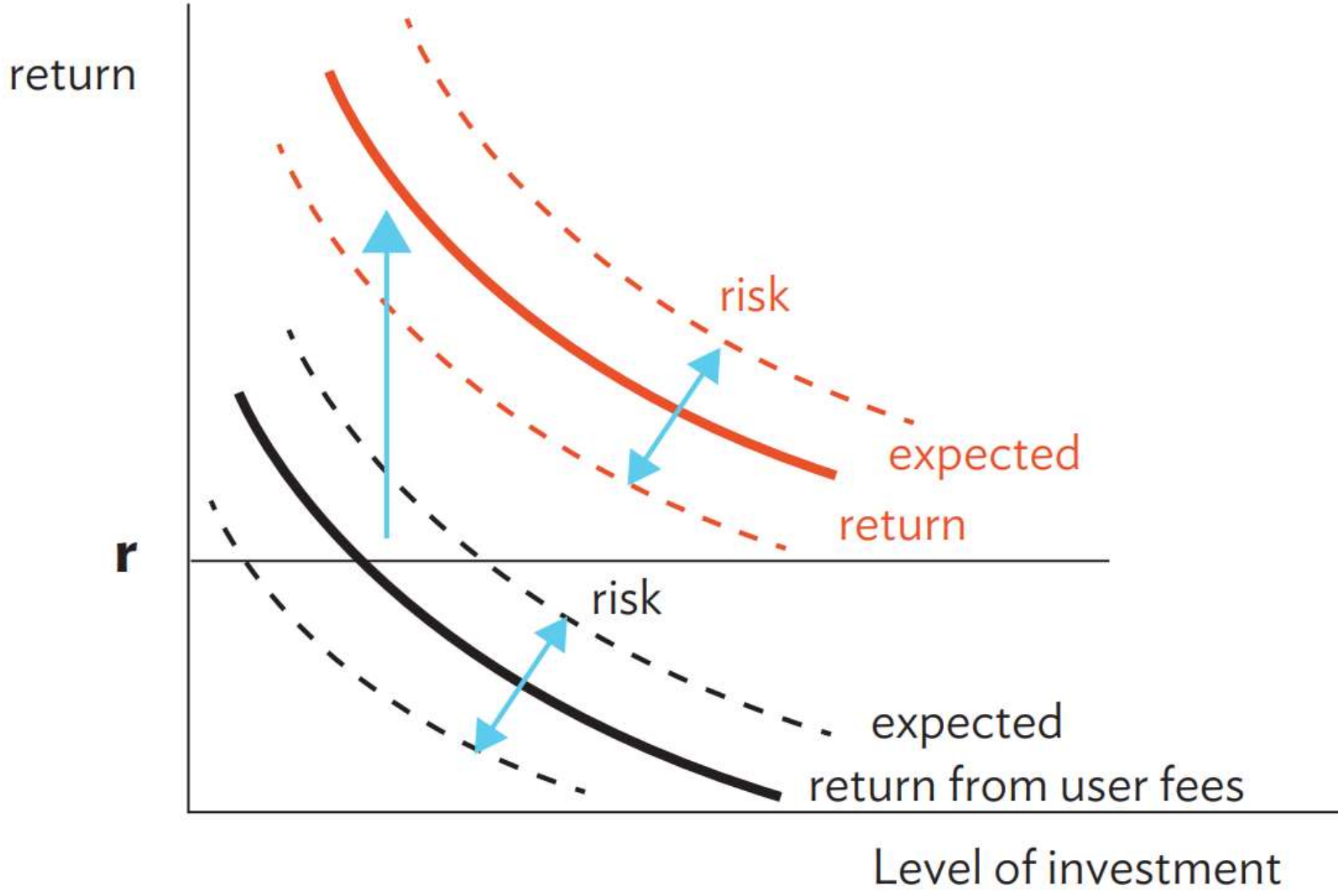
ADB = Asian Development Bank, GDP = gross domestic product.
Note: The numbers are based on 25 selected countries listed in Appendix 3.1 of ADB (2017).
Source: ADB (2017).

Figure 5.6: Conflict of Interest between Users and Investors



Yoshino, N., S. Lakhia, and J. T. Yap. (2021). **"Financing Sustainable Infrastructure Investment in ASEAN+3". in Guinigundo, D., Kawai, M., Park, C. Y., Rajan, R. S. Redefining Strategic Routes to Financial Resilience in ASEAN+3. Manila, Philippines, ADB.**

Figure 5.2: Expected Rate of Return and Risk Profile of Project Bonds versus Benchmark Yield



Spillover Effects of Water Supply and Transport Infrastructure

Increase of Spillover Tax Revenues

Research Question

How does Infrastructure development affect tax revenues?

Spillover Effects of digital infrastructure

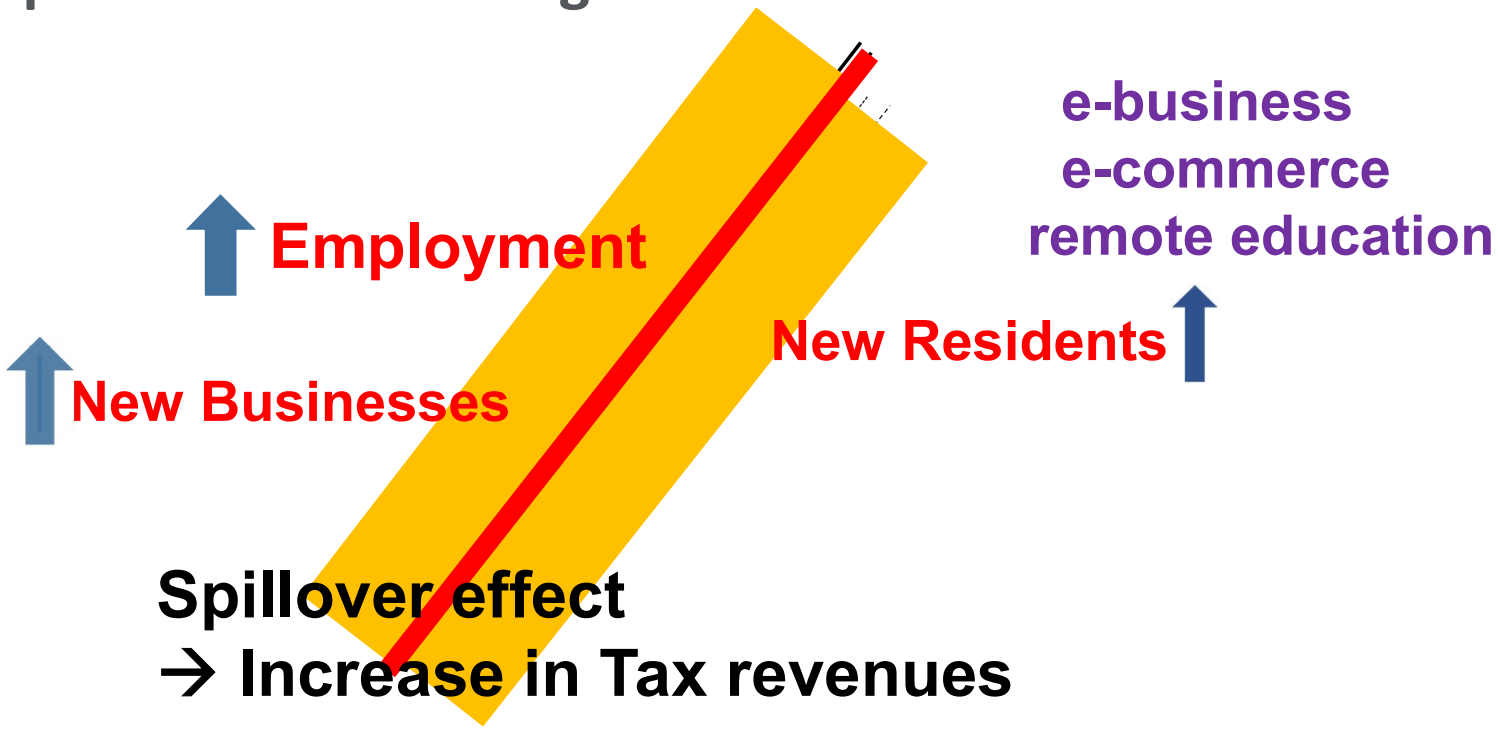


Table 3.2. Estimates of spillover effects on increased output in Japan

	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
Direct effect of infrastructure investment	0.696	0.737	0.638	0.508	0.359	0.275
Spillover effect through private capital (Kp)	0.452	0.557	0.493	0.389	0.270	0.203
Spillover effect through employment (L)	1.071	0.973	0.814	0.639	0.448	0.350
Spillover effects of infrastructure investment (percentage)	68.644	67.481	67.210	66.907	66.691	66.777
	1986-90	**1991-95**	**1996-2000**	**2001-05**	**2006-10**	
Direct effect of infrastructure investment	0.215	0.181	0.135	0.114	0.108	
Spillover effect through private capital (Kp)	0.174	0.146	0.110	0.091	0.085	
Spillover effect through employment (L)	0.247	0.208	0.154	0.132	0.125	
Spillover effects of infrastructure investment (percentage)	66.222	66.200	66.094	66.122	66.139	

Source: (Nakahigashi and Yoshino, 2016[3]).

Table 3.3. Estimated difference in gross domestic product before and after railway construction in Uzbekistan

Region group	Outcome	Pre-railway period 2005-08	Post-railway period 2009-12	Difference (percentage points)
Non-affected group	Average GDP growth rate (percentage)	8.3	8.5	0.2
Affected group	Average GDP growth rate (percentage)	7.2	9.4	2.2
		Difference	**2.0**	

Note: GDP = gross domestic product. Affected group includes the regions of Samarkand, Surkandharya, Tashkent and the Republic of Karakalpakstan.
Source: (Yoshino and Abidhadjaev, 2017[5]).

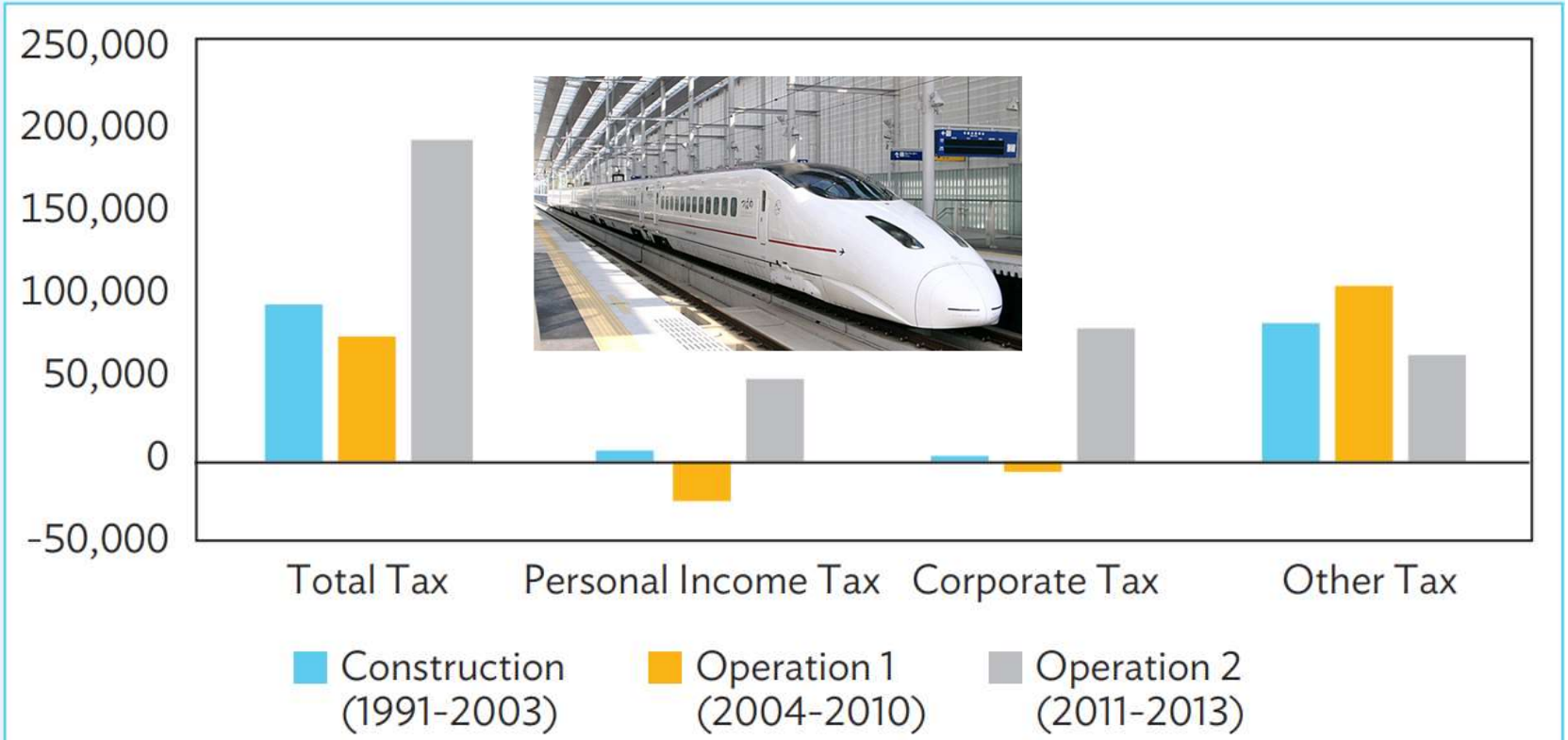
Table 3.4. Calculated increase in business tax revenues for the beneficiary group relative to non-beneficiary group

(PHP million)

Region	$t-2$	$t-1$	t	$t+1$	$t+2$	$t+3$	$t+4$
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	637.83	599.49	742.28	1 209.61

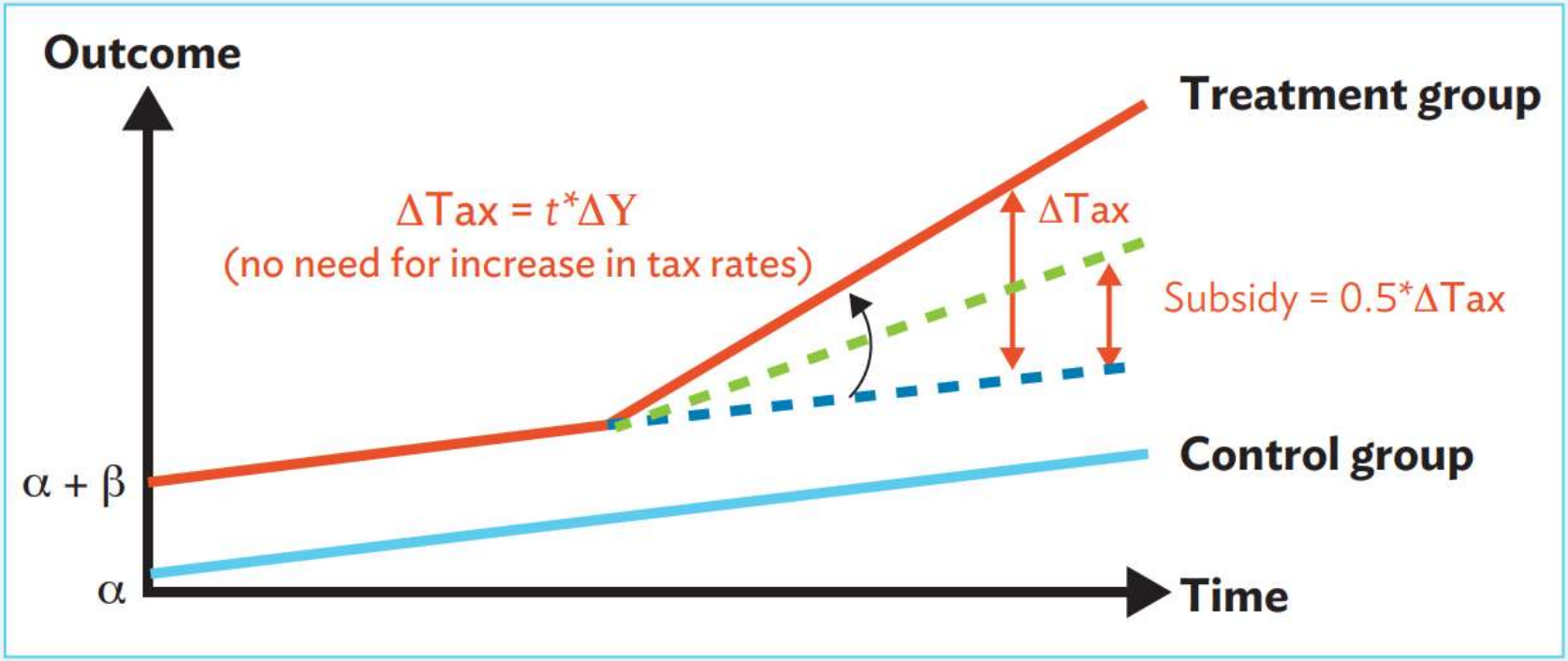
Source: (Yoshino and Pontines, 2018[4]).

Changes in Tax Revenues Resulting from the High-Speed Railway in Japan (¥ million)



Note: The first bar is the period of construction, the second bar is the period after operation without connection to large cities, and the third bar is the period after the high-speed railway is connected to large cities such as Osaka and Tokyo.
Source: Yoshino and Abidhadjaev (2017b).

Diagram of Spillover Tax Revenues



Source: Yoshino, Abidhadjaev, and Nakahigashi (2019).

Economic Effects of Digital Infrastructure

i. human capital development through online education and training programs,
ii. efficient financial activities/sector through the development of online banking and other financial products and,
iii. digital government which leads to the increased efficiency of government services.

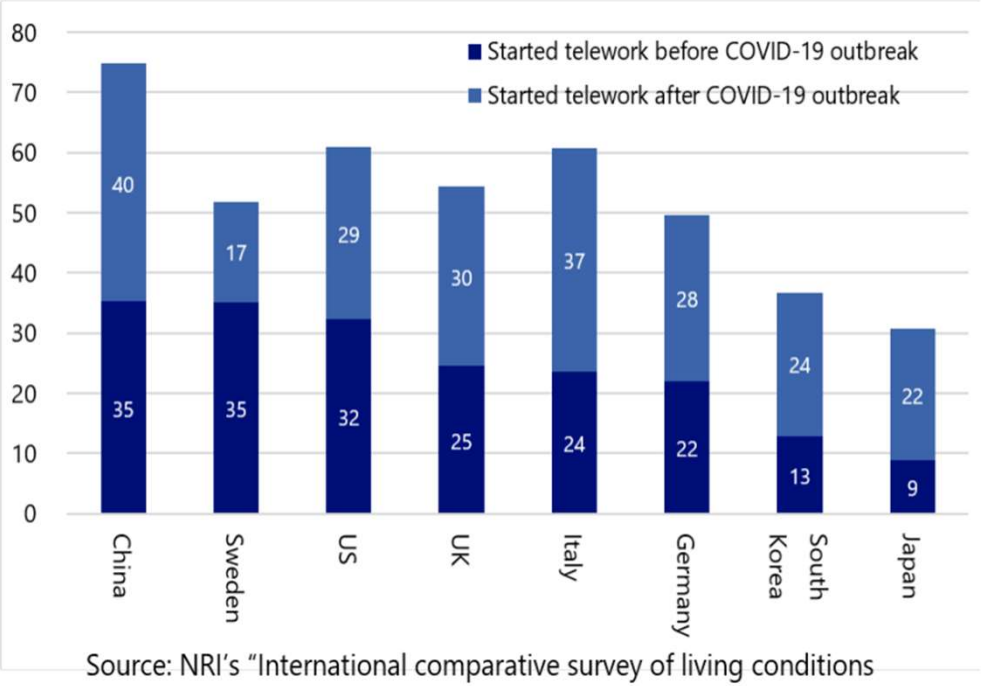
Important Role of ICT (Information and Communication Technology) during the Pandemic

- **Remote work**

During the pandemic, ICT is becoming more important → increase in the share of workers teleworking.

Digital inequality

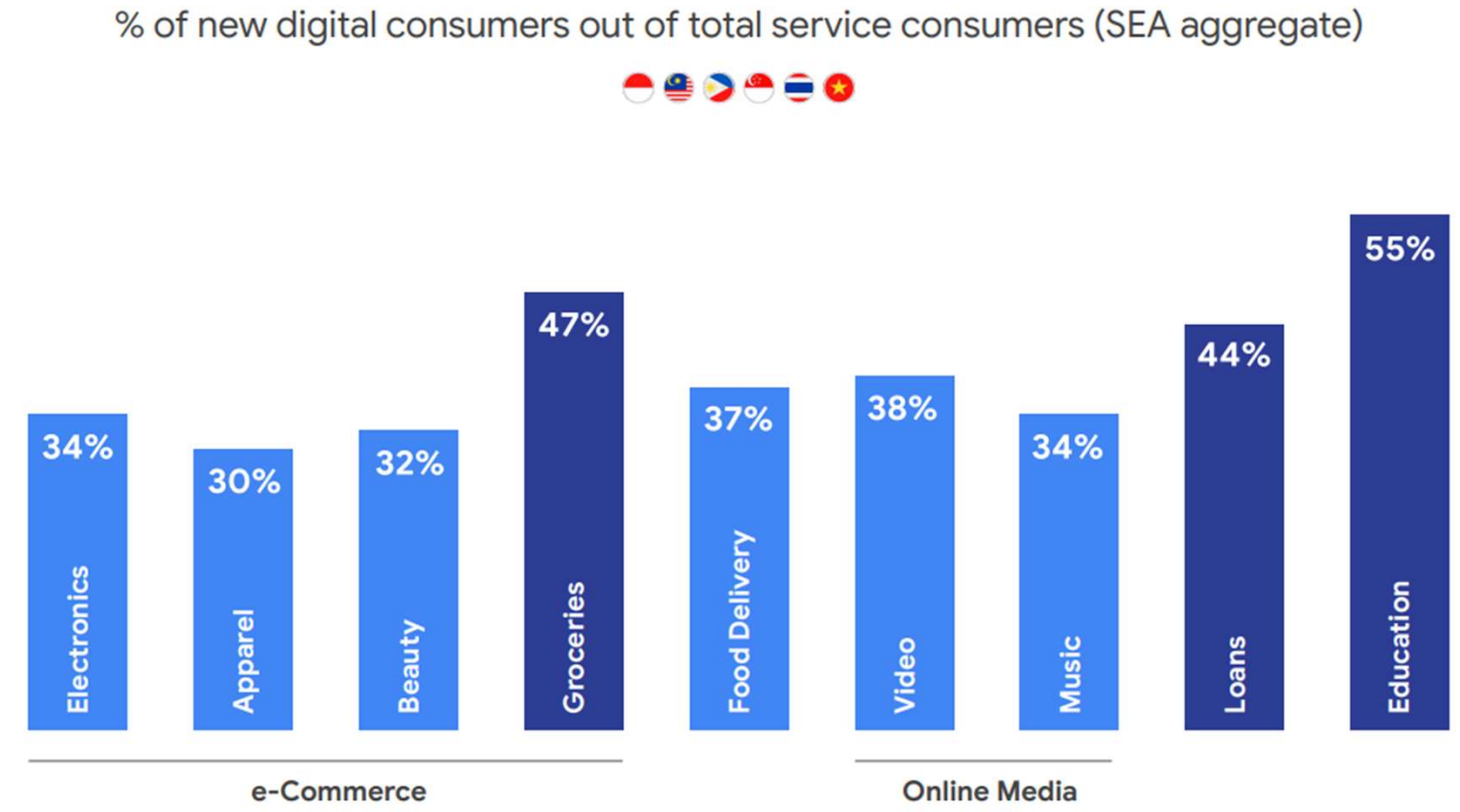
poses challenges for some workers to telework. Eg: in the survey by NRI, the results for China and South Korea are only representative for urban population due to poor connectivity in rural areas.



Source: NRI's "International comparative survey of living conditions amid COVID-19 pandemic" July 2020
In Ono, H. and Mori, T., (2021)

Important Role of E-Commerce
during the Pandemic

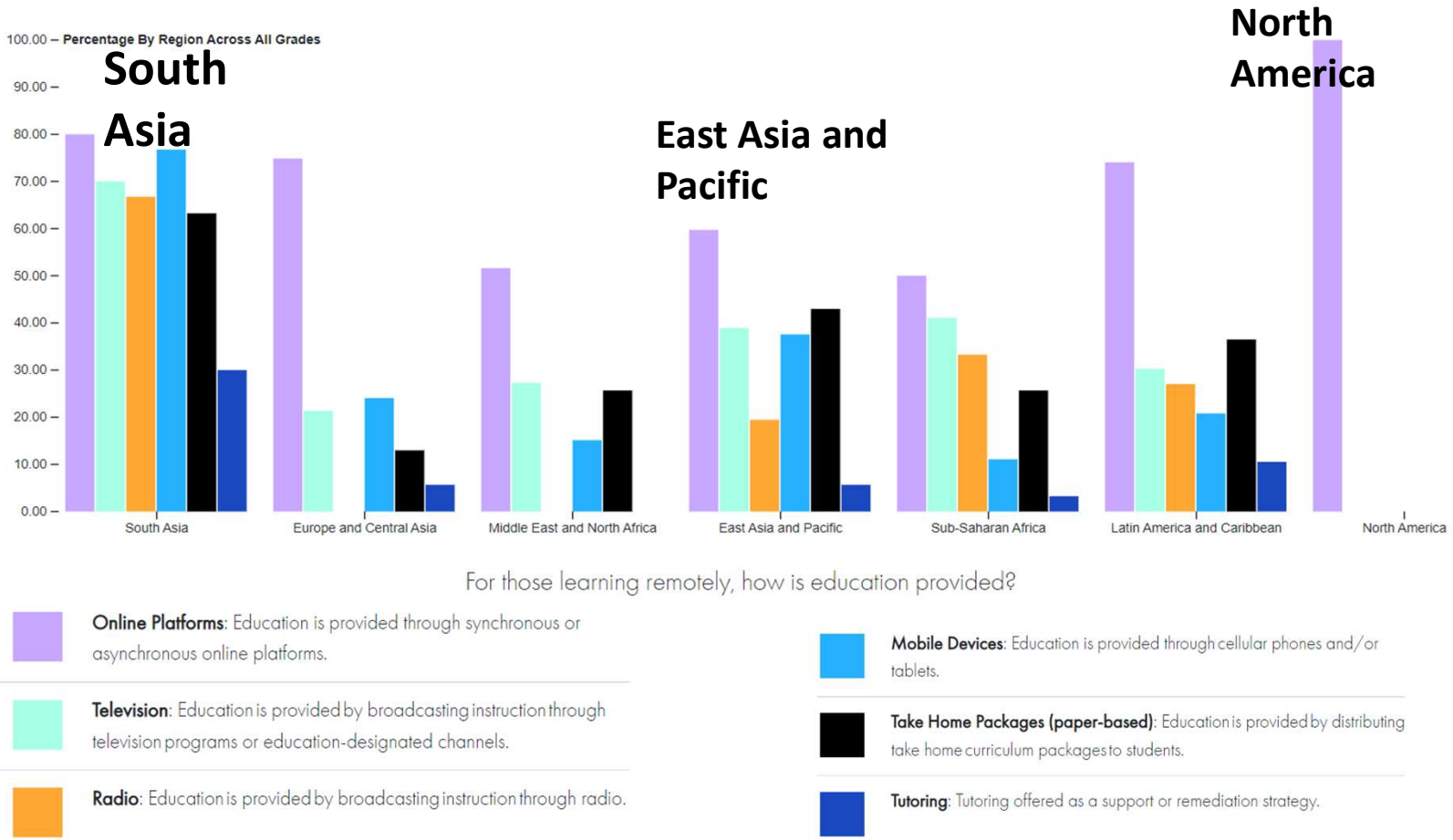
- **Share of e-commerce in global retail trade went up from 14% in 2019 to 17% in 2020 (UNCTAD 2021).**



Source: Google, Temasek, and Bain&Co (2021)

Online Education during the Pandemic

Many countries rely on multiple modes of remote learning. Many relied on the internet and mobile phones.



Source: John Hopkins University, World Bank, and Unicef (2021)

Estimation Strategy

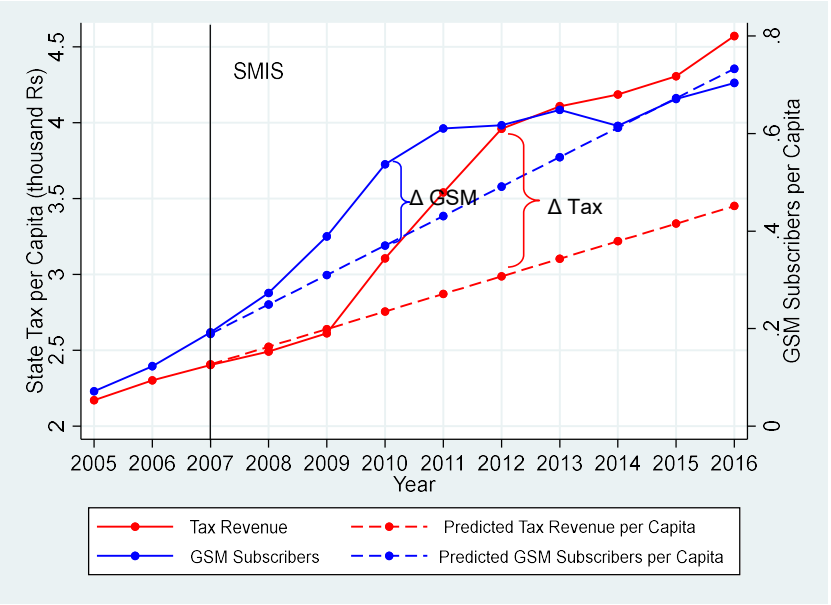
- **Fixed Effects model**
- $\Delta Tax\ per\ capita_{it} = \propto_0 + \propto_1 \Delta Subscribers\ per\ capita_{it}$
- $+\propto_2 \Delta Productive\ Capital\ per\ capita_{it}$
- $+\propto_3 \Delta Persons\ engaged\ in\ industry_{it} + v_i + \delta_t + u_{it}$

- **2SLS**

First stage:

- $\Delta GDP\ per\ capita_{it} = \beta_0 + \beta_1 \Delta Subscribers\ per\ capita_{it} + \beta_2 \Delta Productive\ Capital\ per\ capita_{it} + \beta_3 \Delta Persons\ engaged\ in\ industry_{it} + v_i + \delta_t + u_{it}$

Actual and Predicted Values of GSM Subscribers and Total State Tax Revenue



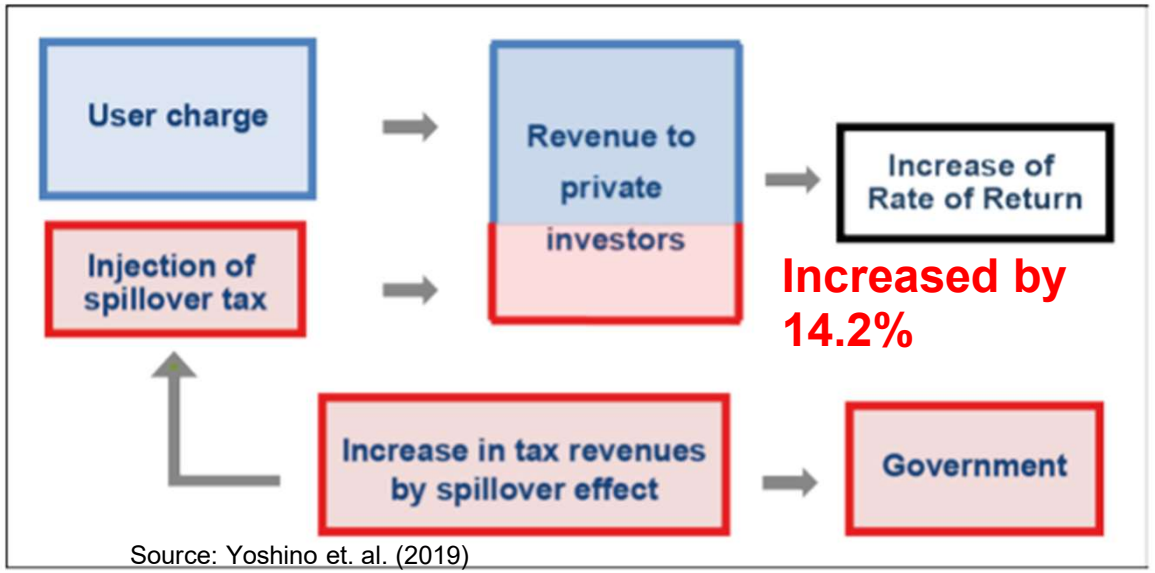
Second stage:

$$\Delta Tax\ per\ capita_{it} = \propto_0 + \propto_1 \Delta \widehat{GDP\ per\ capita_{it}} + v_i + \delta_t + u_{it}$$

Policy Implications

- One way to ensure that private sector remains attracted to infrastructure development is to provide a steady stream of income for them. We argue that that could be achieved by sharing the spillover effects of ICT infrastructure on taxes obtained by the government with the investors/operators of the infrastructure
- The amount of tax revenues to be shared by the gov't with the investors can be calculated using trans log production function (Yoshino et. al. 2019)

Based on our estimation, if 50 % of increased tax revenues were returned to mobile operators, the rate of return will rise about 14.2%



Source: Yoshino et. al. (2019)

Journal of Infrastructure, Policy and Development (2020) Volume 4 Issue 2.
DOI: 10.24294/jipd.v4i2.1236

ORIGINAL ARTICLE

Financing infrastructure using floating-interest-rate infrastructure bond†

Naoyuki Yoshino[1], Dina Azhgaliyeva[2] and Ranjeeta Mishra[2]*

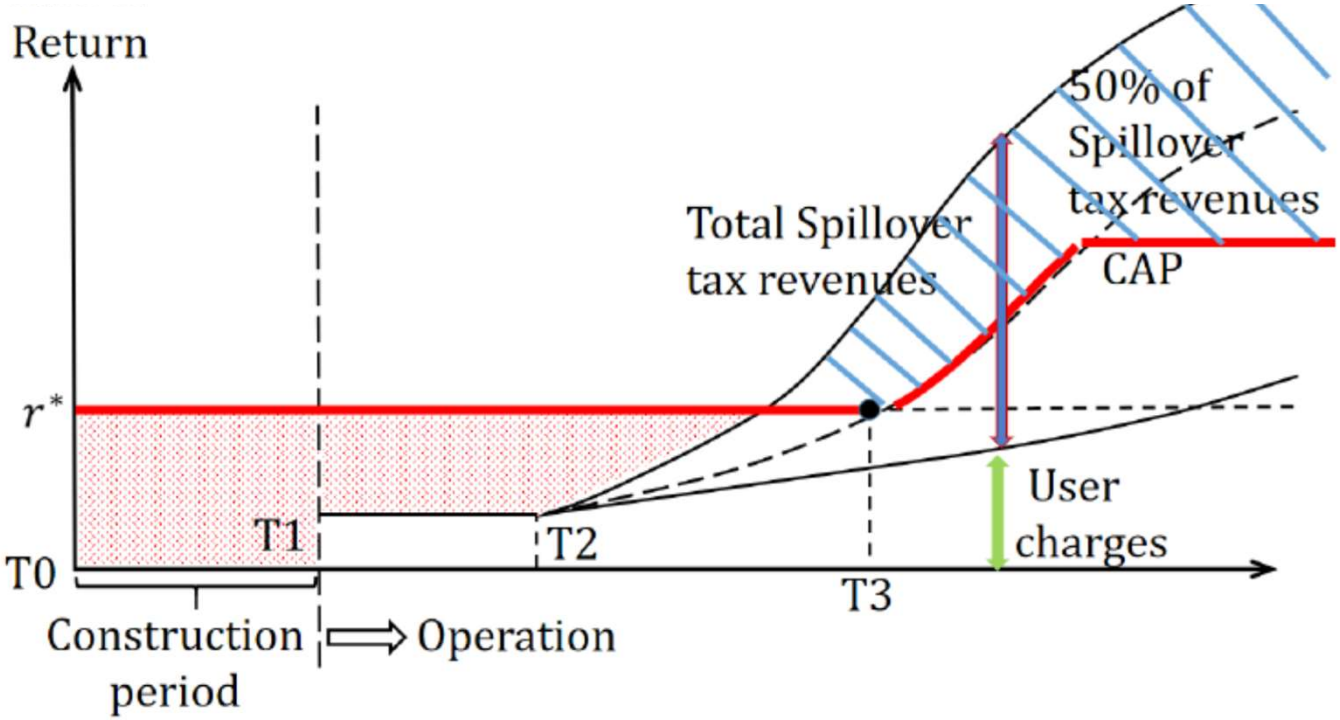
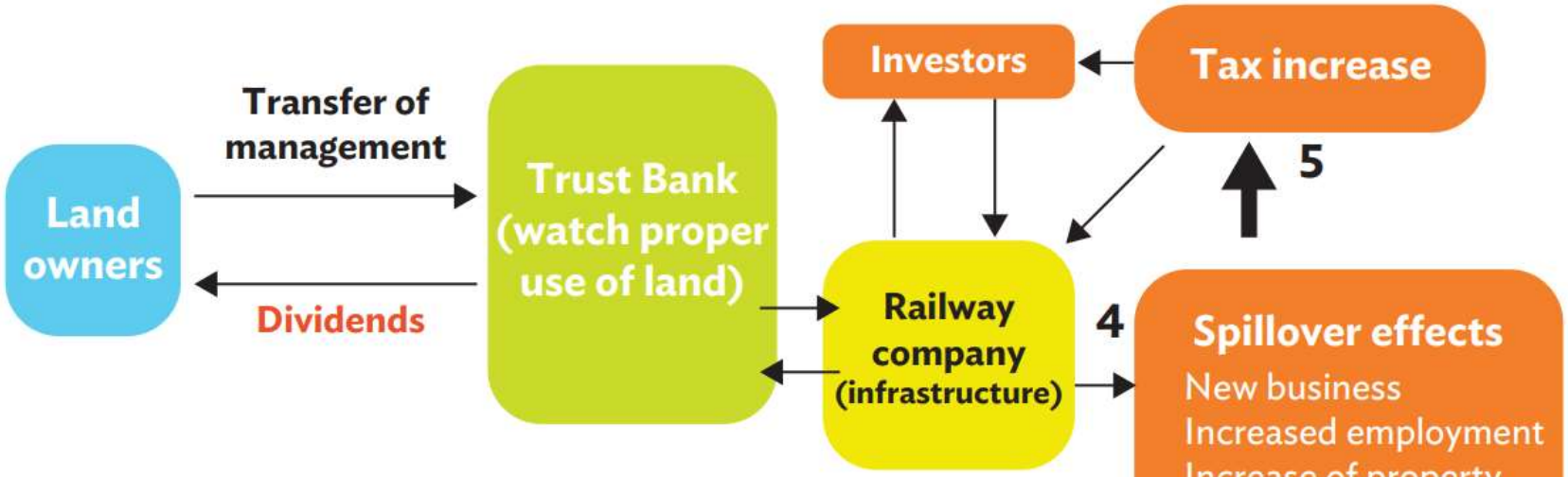


Figure 4. The proposed floating-rate infrastructure bonds to make spillover tax return in practice.

Figure 5.9: Land Trust for Infrastructure Investment



1. Reduction of costs of land purchase
2. Leasing contract
3. Future tax revenues can be used for repayment
4. Land owners keep their ownership

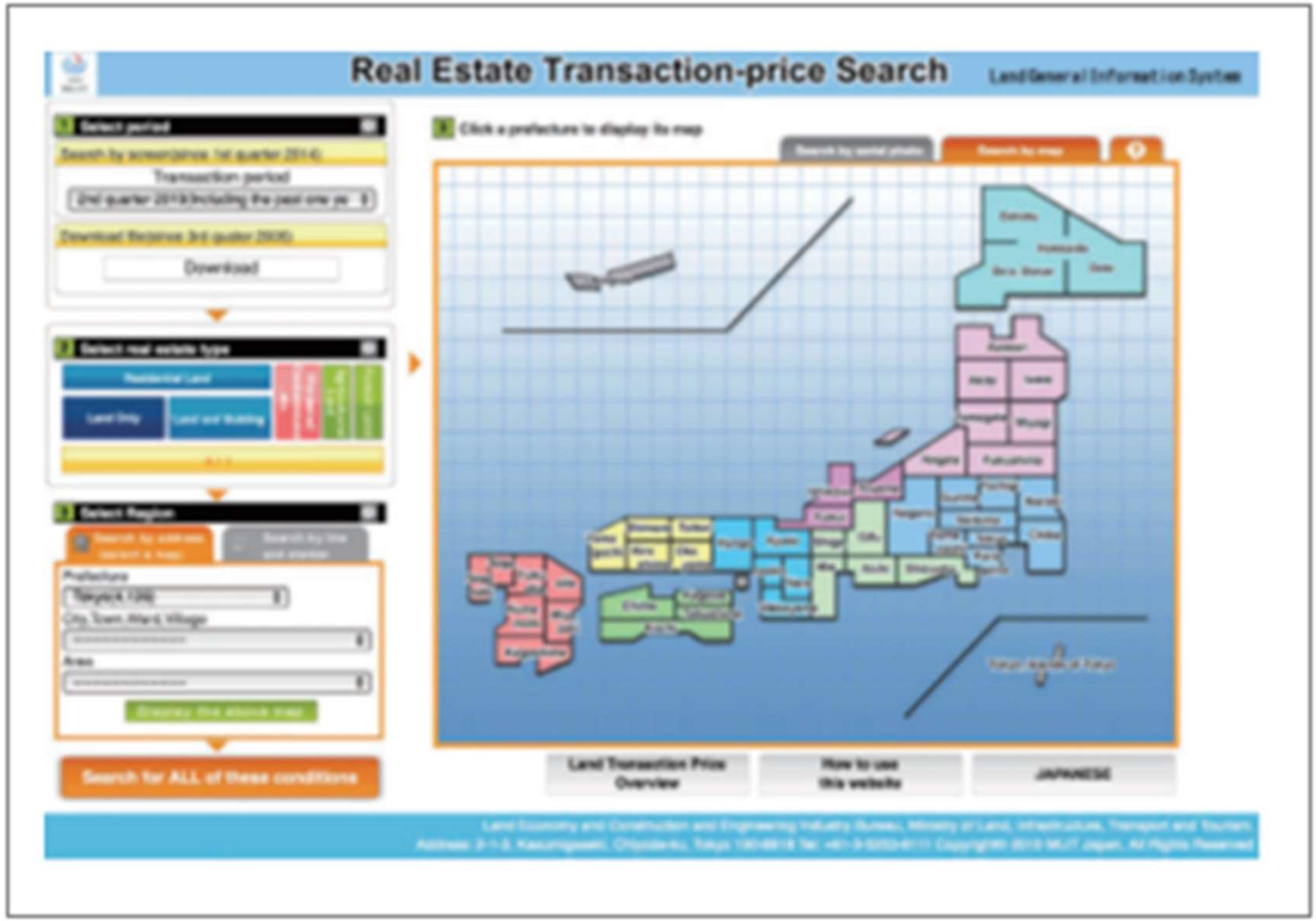
Source: Yoshino and Lakhia (2020).

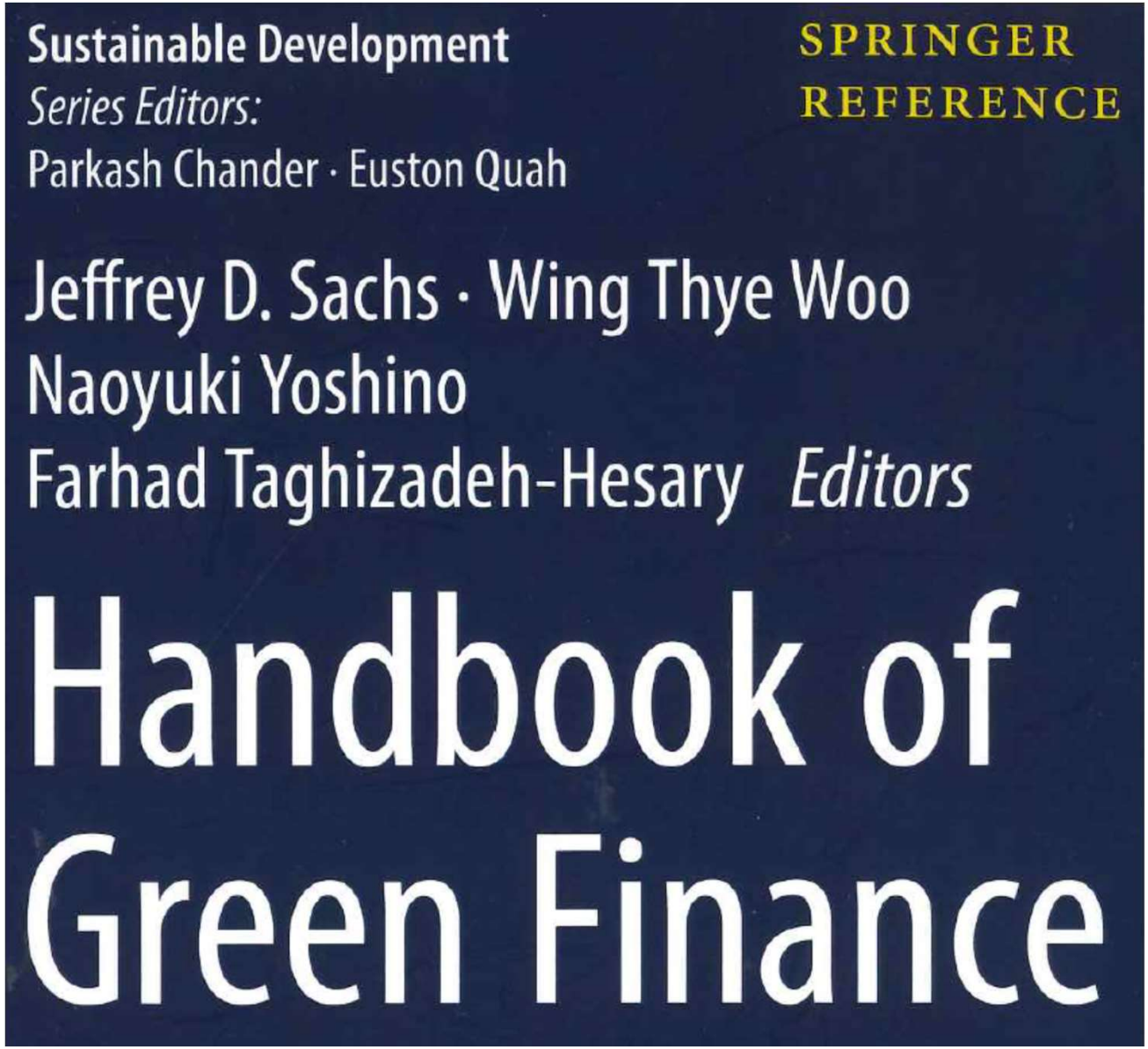
The Financial Express

Implementing land trust in Bangladesh

Monzur Hossain and Naoyuki Yoshino | Friday, 4 December 2020

Bangladesh is one of the most densely populated countries in the world but with a land-man ratio of 0.06 ha per person, it occupies the lowest rank. The increasing population begets an increasing demand for non-agricultural land which further contributes to an aberrant hike in land price. This obstructs investment opportunities


Real Estate Transaction-price Search
Land General Information System
1 Select period
Search by screen(since 1st quarter 2014)
Transaction period
2nd quarter 2019(including the past one ye
Download file(since 3rd quater 2005)
Download
2 Select real estate type
Residential Land
Land Only
Land and Building
3 Select Region
Search by address
Search by line and station
Prefecture
Tokyo(A 13k)
City, Town, Ward, Village
Area
Search for ALL of these conditions
1 Click a prefecture to display its map
Search by aerial photo
Search by map
Land Transaction Price Overview
How to use this website
JAPANESE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Handbook of
Green Finance

Environmental Issues associated with Infrastructure

$Y = F(L \ K_P \ K_g)$ **(1)**

Traditional Production Function

$F(Y, CO_2) = F(L \ K_P \ K_g)$ **(2)**

Y= Output CO_2 emission

L= labor K_P= Private capital,

K_g =infrastructure

Thank you for your attention

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Professor Emeritus of Keio University

References

- Yoshino, N., K. E. Seetharam, S. Miyazawa, and K. Xu. 2019. "Innovative Measures of Infrastructure Investments: Illustrating Land Trust Scheme and Spillover Effect". *ADBI Working Paper Series*, No. 1053. December
- Yoshino, N., D. Azhgaliyeva., and R. Mishra. 2020. "Financing infrastructure using floating-interest-rate infrastructure bond". *Journal of Infrastructure, Policy and Development.* Vol. 4(2)
- Yoshino, N., K. Xu., and K. E. Seetharam. 2020. "Land Trust Scheme and the Spillover Effects of Infrastructure Investment" in Hayashi, Y., K. E. Seetharam, S. Bharule. *Handbook on High-Speed Rail and Quality of Life*. Manila, Philippines, ADB.
- Yoshino, N., S. Lakhia, and J. T. Yap. 2021. "Financing Sustainable Infrastructure Investment in ASEAN+3". in Guinigundo, D., Kawai, M., Park, C. Y., Rajan, R. S. *Redefining Strategic Routes to Financial Resilience in ASEAN+3.* Manila, Philippines, ADB.
- Yoshino, Naoyuki. Tifani Siregar, Dina Azhgaliyeva and K.E. SeethaRam. 2022. "Spillover Effects of Digital Infrastructure and Financing". *Journal of Infrastructure, Policy and Management*, ISSN: 2599-1086, e-ISSN: 2656-1778 Vol. 5 No.1.

February 2, 2023

The way to induce private financing into Green Investments and Green Bond

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Green energy projects are categorized into two groups based on scale:

A) large projects: Hydro-power

B) Community type green energy projects (Hometown Crowd Funds)

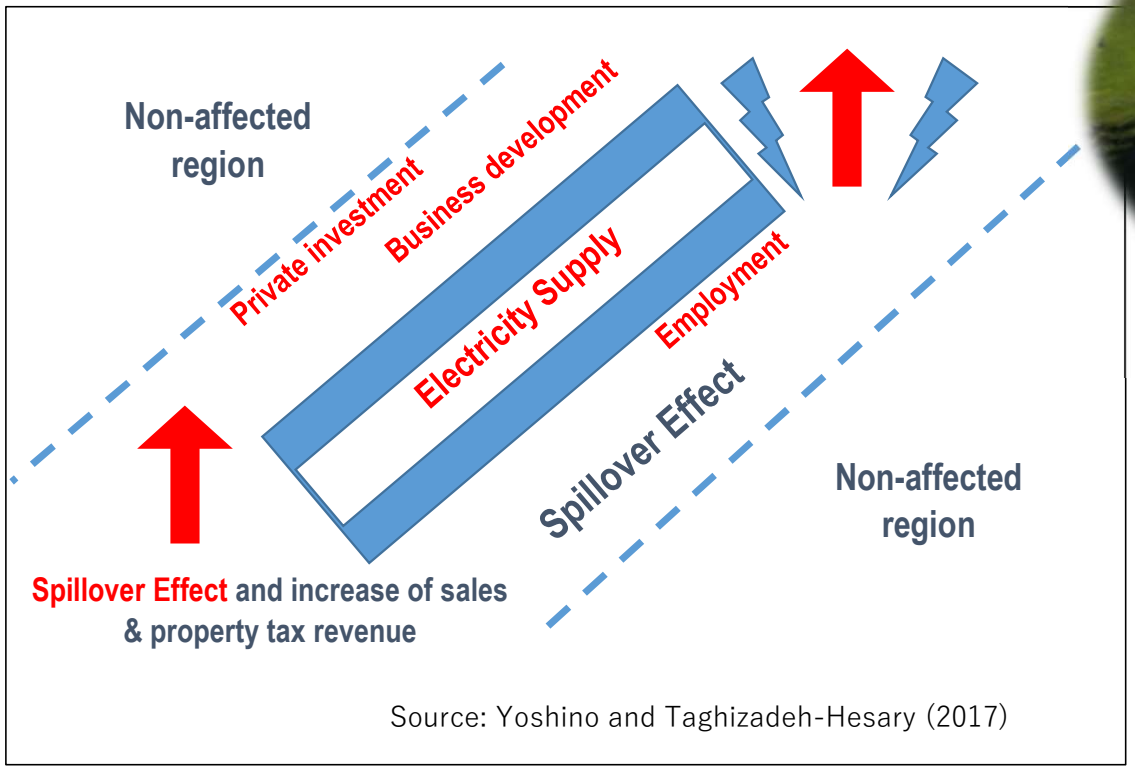
Large projects can be financed by **i) insurance and pension funds,** that have long-term Financing.

long-term Projects (10-20 years),
Bank loans (1-5 years).

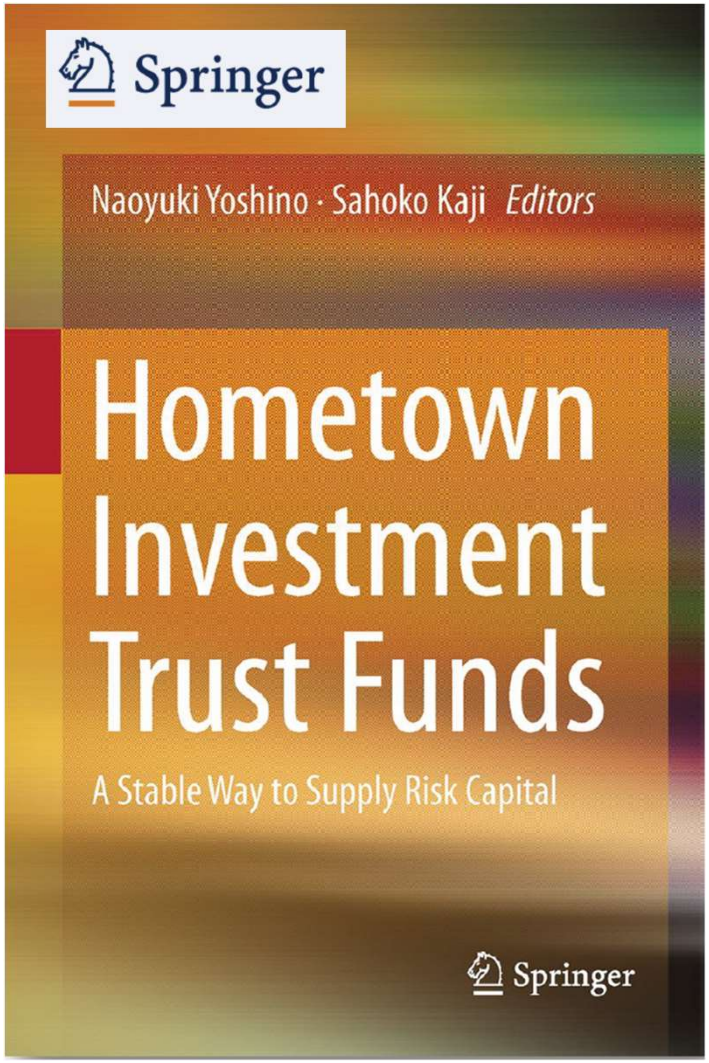
Hydropower plant

Injection of Increased tax revenues from the spillover effect into energy projects in order to increase the rate of return for private investors

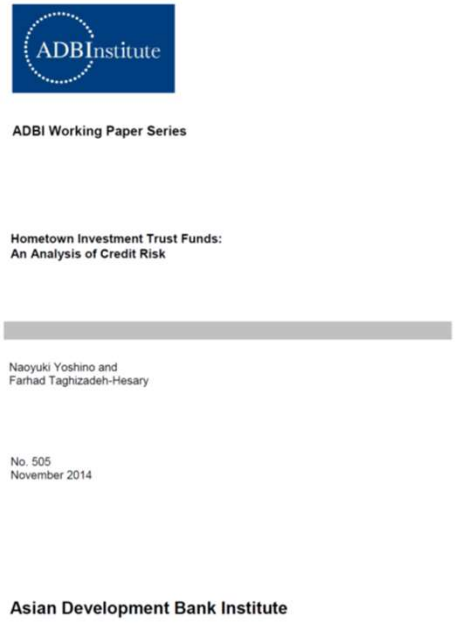
Spill over effects of electricity supply



Source: Yoshino and Taghizadeh-Hesary (2017)



Possible Solutions
by use of community funds
For Risky businesses



Hometown Investment Trust Funds

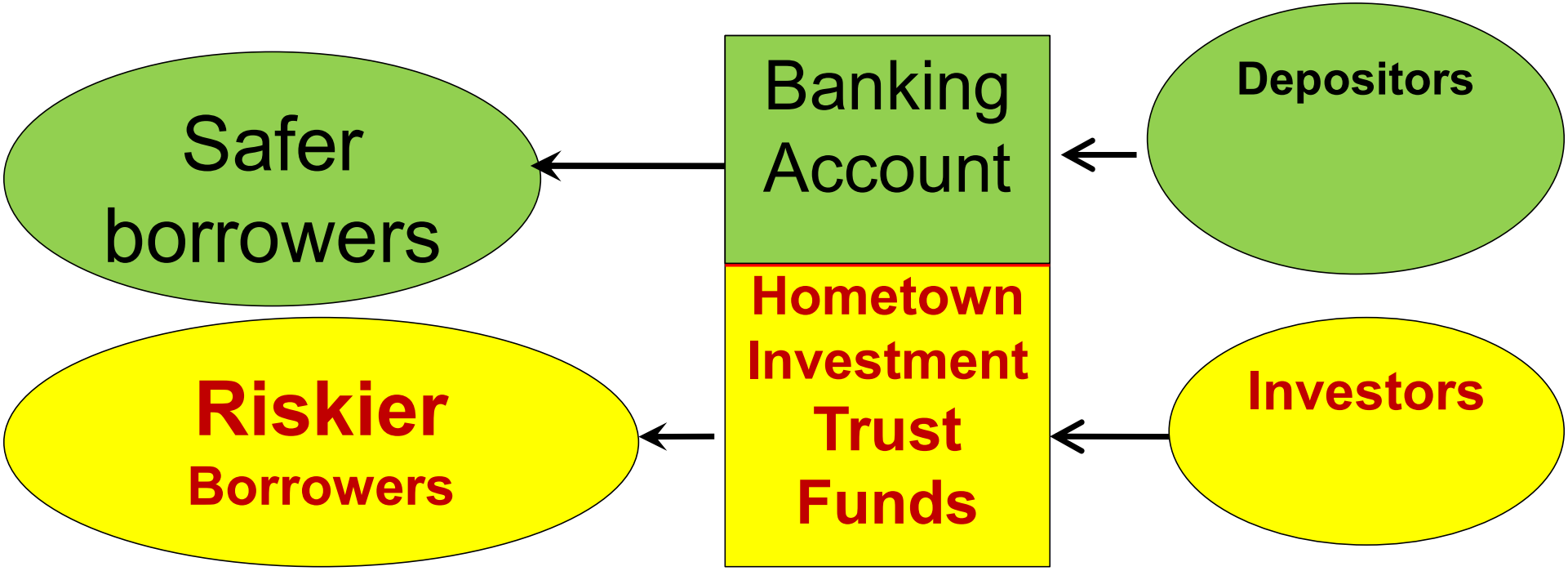
A Stable Way to Supply Risk Capital
Yoshino, Naoyuki; Kaji Sahoko (Eds.), 2013,

ADBI Working Paper Series
Naoyuki Yoshino and
Farhad Taghizadeh-Hesary

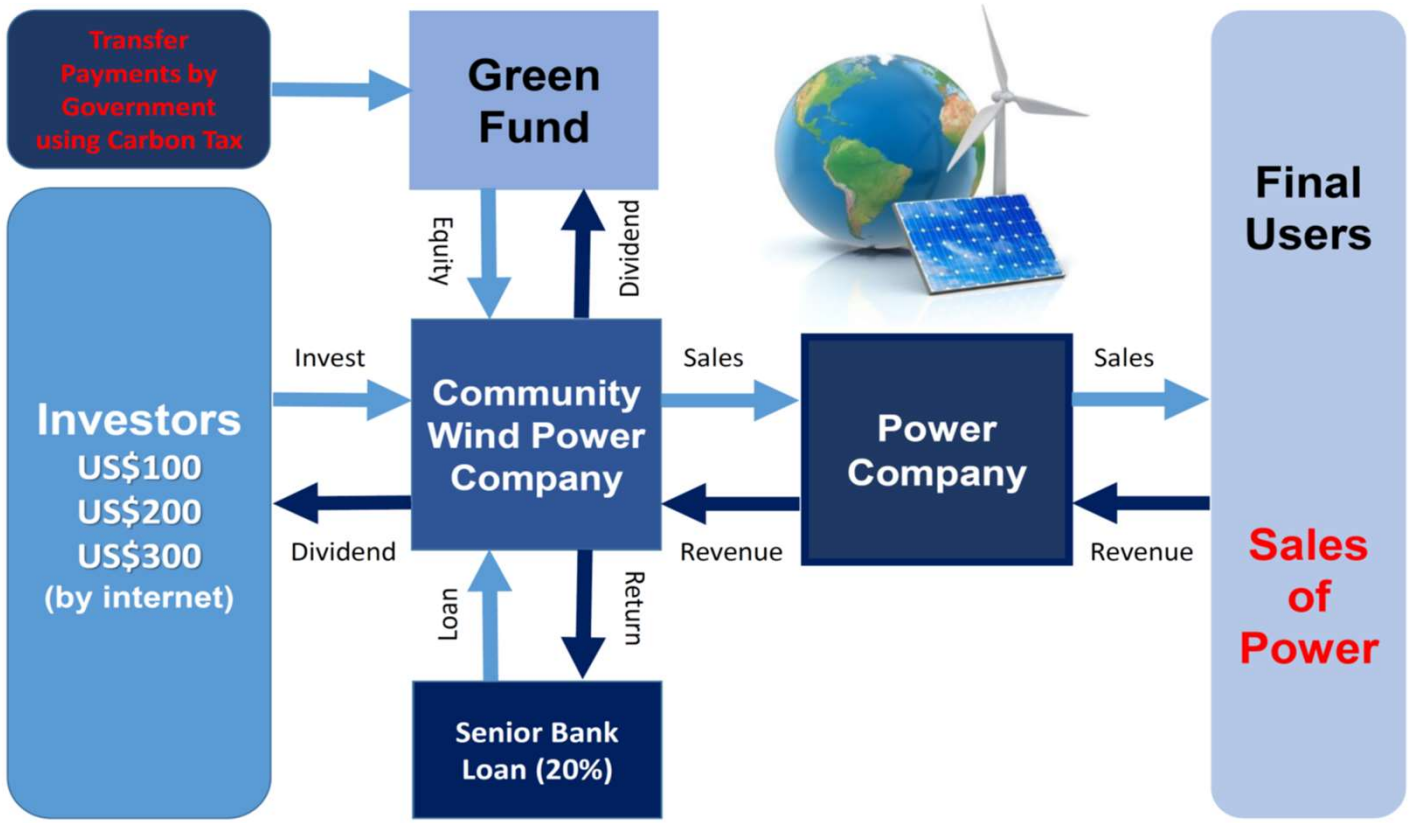
Bank-based SME financing and financing to riskier borrowers

1. **Bank Loans to relatively safer borrower**
2. **Hometown Investment Trust Funds/**

E-Finance, Internet financing



Financing Scheme for Renewable Energy Projects Using HITs and Carbon Tax



Injection of Spillover Tax revenues

HIT = Hometown Investment Trust Fund.
Source: Authors.

Current ESG investment: distorts asset allocation

1, **Traditional asset allocation :**

two parameter approach

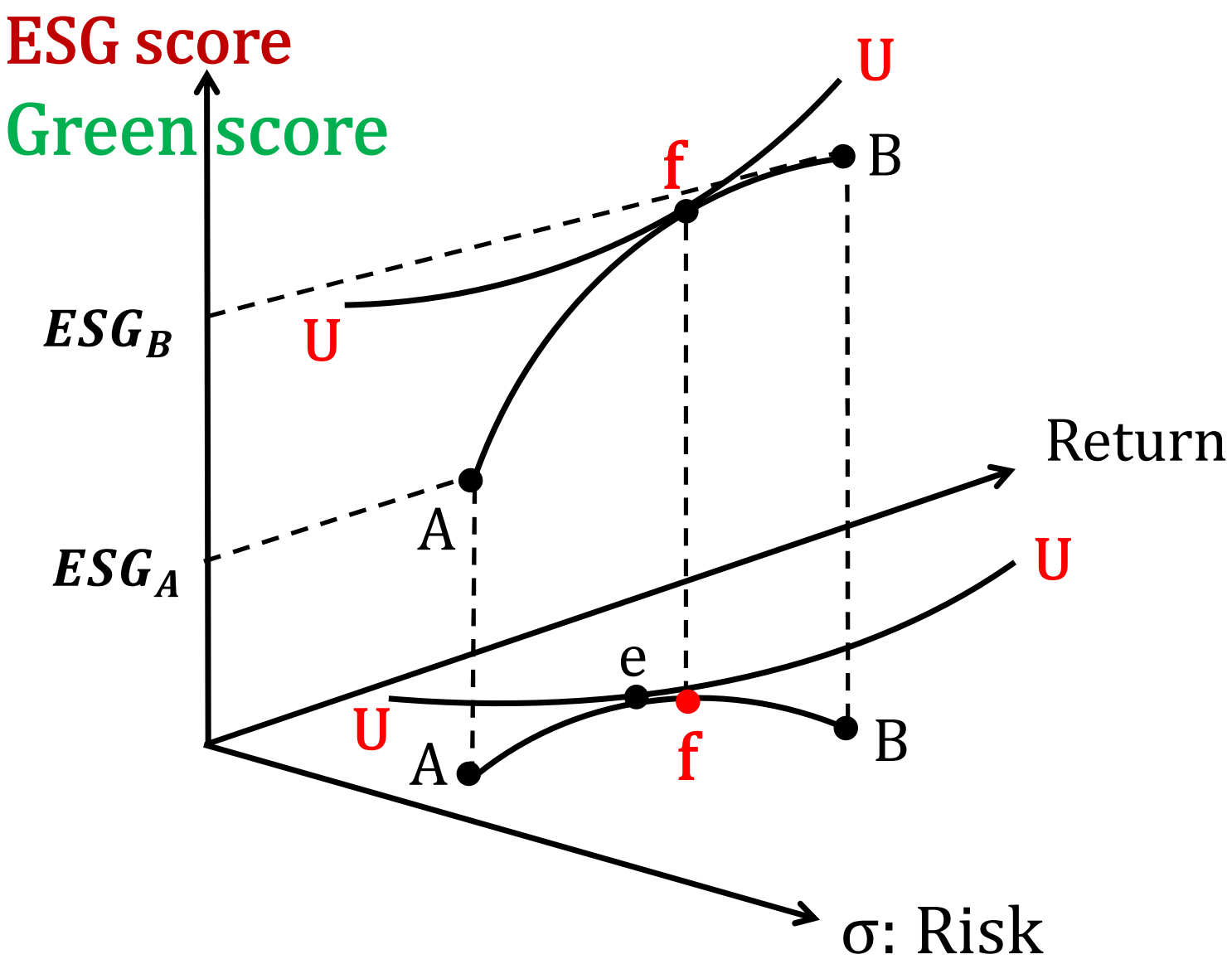
(i) Rate of return (R), (ii) Risks (σ^2)

2, **ESG component is added for the asset allocation**

(iii) ESG multi-factor model

3, **ESG criteria is different from one rating agency to another**

4, **Each investor changes asset allocation based on specific criteria of ESG given by rating agency**


ESG score
Green score
U
B
f
ESG_B
U
Return
A
ESG_A
U
e
U
A
f
B
σ: Risk

Portfolio Allocation including ESG scores

$$\mathrm{U}(R_t, \sigma_t^2, ESG_t) = R_t - \beta\sigma_t^2 + \gamma(ESG_t) \quad (1)$$

$$\text{s.t. } R_t = \alpha_t R_t^A + (1-\alpha_t)R_t^B \quad (2)$$

$$\sigma_t^2 = \alpha_t^2(\sigma_t^A)^2 + (1-\alpha_t)^2(\sigma_t^B)^2 + 2\alpha_t(1-\alpha_t)\sigma_t^{AB} \quad (3)$$

$$ESG_t = \alpha_t(ESG_t^A) + (1-\alpha_t)(ESG_t^B) \quad (4)$$

Optimal Portfolio Allocation taking into consideration of ESG scores

$$\alpha_t = \frac{\frac{1}{2\beta}(R_t^A - R_t^B) - (\sigma_t^B)^2 - \sigma_t^{AB} + \frac{\gamma}{2\beta}(ESG_t^A - ESG_t^B)}{(\sigma_t^A)^2 - (\sigma_t^B)^2 - 2\sigma_t^{AB}} \quad (7)$$

The evaluation methodologies and criteria for ESG scores vary from one evaluating organization to another. For example, (1) some agency uses its own criteria to evaluate a company's ESG efforts, (2) some agency assigns a score based on the degree of disclosure, (3) some agency uses a score based on whether or not the company has an ESG policy, (4) some agency uses a score based on actual ESG activities such as carbon dioxide reduction by judging from performance, and so on (Table 1). It also raises issues whether ESG scores actually reflect ESG activities and outcomes by companies (Chatterji et al. 2009, Drempetic et al. 2019).

Table 1: ESG scores and evaluation methodologies provided by the major ESG rating agencies

ESG Scores	Overview of Rating Methodology
Bloomberg ESG Disclosure Scores	Evaluating by degree of ESG disclosure
FTSE Russell's ESG Ratings	Evaluating by ESG risks based on disclosure and commitment to policy development and improvement
ISS Quality Score	Evaluating governance (board composition, shareholder and takeover defenses, compensation and remuneration, and audit and risk monitoring)
MSCI ESG Ratings	Evaluating by 37 key ESG issues
RobecoSAM Corporate Sustainability Assessment	Evaluating by economy, environment and society. Governance is included in the economy.
Sustainalytics' ESG Risk Ratings	Evaluating by ESG measures, disclosures, and the level of the problem
Thomson Reuters ESG Scores	Evaluating by 10 categories (environment (resource use, emissions, and innovation), society (employees, human rights, local communities, and product responsibility), and governance (management, shareholders, and CSR strategy).

Source: Bloomberg, ESG rating organization websites, and Yuyama *et al.* (2020).

Table 3: Empirical Application of the theory

ESG Score	No Rating	RobecoSAM	Sustainalytics	Bloomberg
ESG score of company A	-	8.6	9.6	2.9
ESG score of company B	-	1.8	1.3	3.9
Value of α	0.57	0.71	0.74	0.54

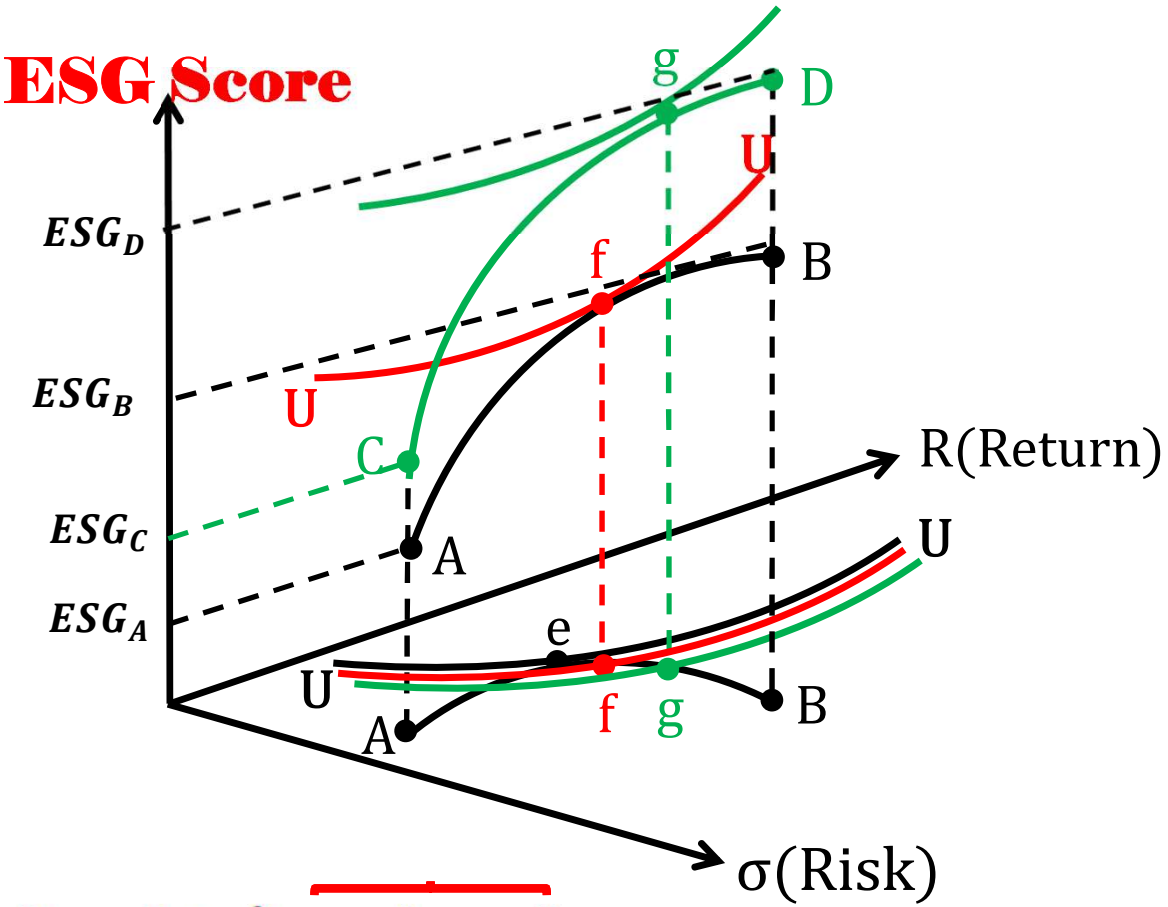
(Source) Based on each company's 2019 actual stock returns, standard deviation, covariance, and ESG score.

Author's calculations based on equation (12) from Bloomberg data

- The allocation of assets between A and B changes which ESG rating agencies' ESG score is used for the portfolio allocation.
- The higher ESG score value is the higher α, and thus the higher the investment allocation. For example, since Sustainalytics is the highest ESG score for Company A, investors following this rating will have the highest allocation to Company A.
- On the other hand, the Bloomberg score is lower for Company A than for Company B, resulting in a smaller investment allocation.
- If we do not take into account the ESG score, the investment allocation to Company A is 0.57

$$U = R - \beta\,\sigma^2 + \gamma\,(ESG)$$

SDG
ESG
Greenness



$$\alpha_t = \frac{\frac{1}{2\beta}(R_t^A - R_t^B) + (\sigma_t^B)^2 + \frac{\gamma}{2\beta}(SDG_t^A - SDG_t^B)}{(\sigma_t^A)^2 - (\sigma_t^B)^2}$$

Optimal portfolio allocation can be achieved by taxing waste products

1, By taxing wastes such as CO2, NOX, Plastics etc. by identical international tax rate, the investors can only look for “after tax rate of return” and “risks” as they were conventionally focused on.

2, Firm level - International taxation will lead to optimal asset allocation and achieve sustainable growth

Greenness Adjusted GHG Taxation

$$T_t^A = \frac{t_1\left(CO_{2\,t}^A\right) + t_2\left(NO_{X\,t}^A\right)}{Y_t^A} - Greenness^A \qquad (9)$$

$$T_t^B = \frac{t_1\left(CO_{2\,t}^B\right) + t_2\left(NO_{X\,t}^B\right)}{Y_t^B} - Greenness^B \qquad (10)$$

Equation (8) shows the new utility function of investors based on the "after-tax rate of return" and "after-tax risk." In equations (9) and (10), T_t^A and T_t^B denote the GHG tax rate charged to companies A and B, respectively. Y_t^A and Y_t^B are the total outputs of companies A and B, respectively. t_1 and t_2 show the tax rate on CO_2 and NOx, which have the same rates globally. The tax rate on CO_2 is the same for companies A and B, and the tax rate of NOx is the same for companies A and B. These rates need to be the same globally to avoid distortion of investments between different countries.

$$\tilde{R}_t^A = R_t^A - T_t^A \qquad (11)$$

$$\tilde{R}_t^B = R_t^B - T_t^B \qquad (12)$$

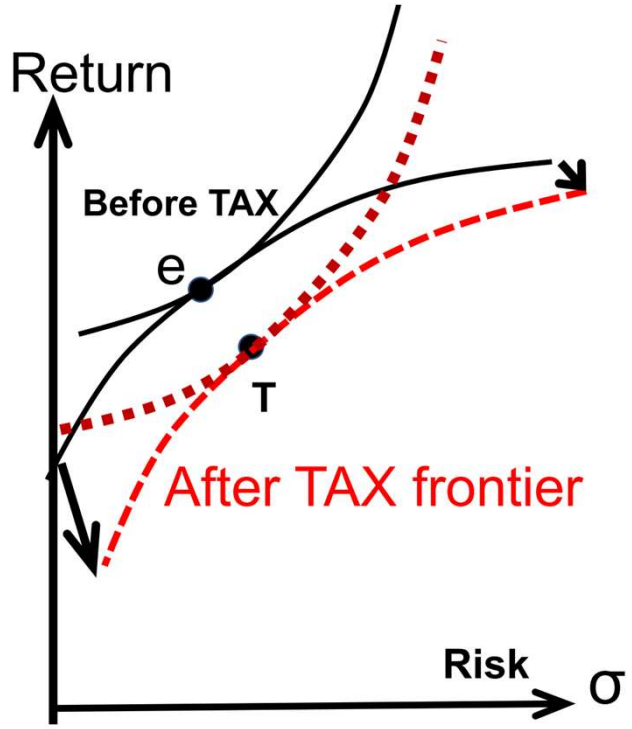
Equations (11) and (12) show the "after-tax rate of return" of company A and company B. The optimal allocation of assets between company A and B is computed as equations (13) and (14) that show the optimal rate of return and risk, respectively:

Portfolio Optimization taking into account of GHG Tax

$$U(\tilde{R}_t, \tilde{\sigma}_t^2) = \tilde{R}_t - \beta\tilde{\sigma}_t^2 \qquad \tilde{R}_t = \tilde{\alpha}_t\tilde{R}_t^A + (1-\tilde{\alpha}_t)\tilde{R}_t^B \tag{13}$$

$$\tilde{\sigma}_t^2 = \tilde{\alpha}_t^2(\tilde{\sigma}_t^A)^2 + (1-\tilde{\alpha}_t)^2(\tilde{\sigma}_t^B)^2 + 2\tilde{\alpha}_t(1-\tilde{\alpha}_t)\tilde{\sigma}_t^{AB} \tag{14}$$

Next, to find the optimal portfolio allocation ratio between asset A and asset B, we obtain the first-order condition of the utility function for $\tilde{\alpha}$:



$$\frac{\partial U}{\partial \tilde{\alpha}_t} = (\tilde{R}_t^A - \tilde{R}_t^B) - \beta\{2\tilde{\alpha}_t(\tilde{\sigma}_t^A)^2 + 2(1-\tilde{\alpha}_t)(\tilde{\sigma}_t^B)^2\} + (2-4\tilde{\alpha}_t)\tilde{\sigma}_t^{AB} = 0 \tag{15}$$

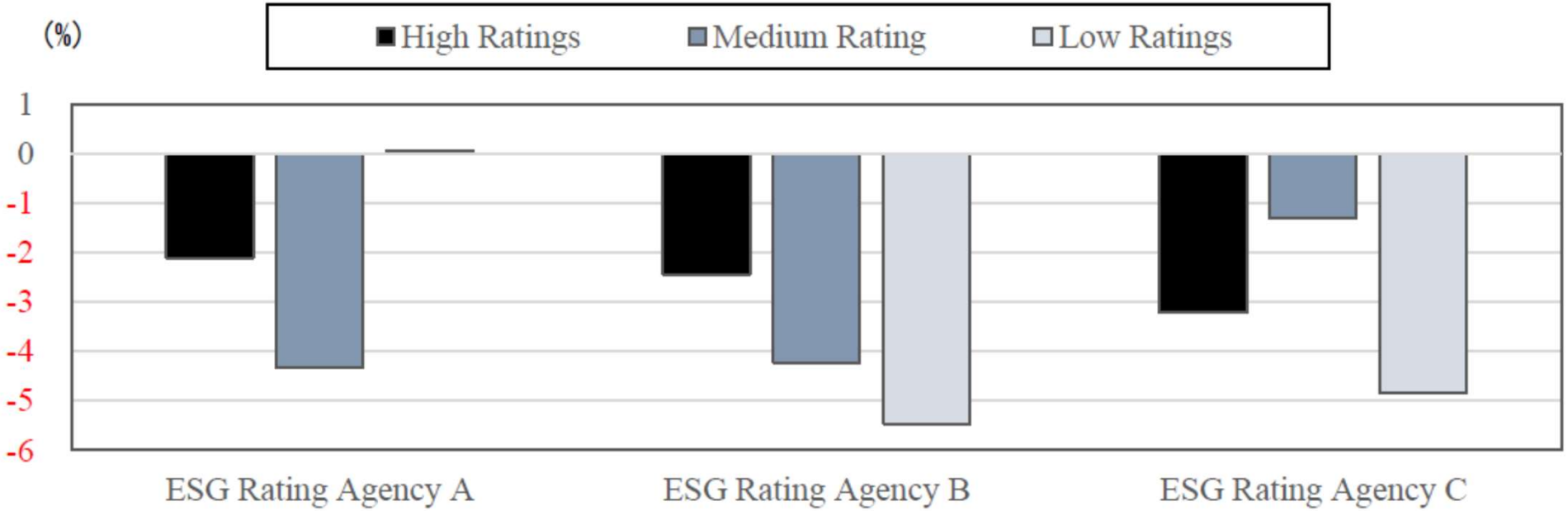
ally, we obtain the optimal level of portfolio allocation as in n (15):

$$\tilde{\alpha}_t = \frac{\frac{1}{2\beta}(\tilde{R}_t^A - \tilde{R}_t^B) - (\tilde{\sigma}_t^B)^2 - \tilde{\sigma}_t^{AB}}{(\tilde{\sigma}_t^A)^2 - (\tilde{\sigma}_t^B)^2 - 2\tilde{\sigma}_t^{AB}}$$

Satellite photo can measure the amount of CO2 emission.

All the schools at Yokohama City measure CO_2 Emission

ESG Investment and Stock Price



Note: Only stocks covered by each ESG rating agency are aggregated. The estimation period is the first quarter of 2020 (December 30, 2019 to March 31, 2020).

Source: Authors' calculations from Bloomberg data.

Figure 8: ESG score (high-medium-low quintile) and stock returns (first quarter of 2020)

June 2018
Green Bond Principles
Voluntary Process Guidelines for Issuing Green Bonds

International Capital Market Association

ICMA Paris Representative Office

62 rue la Boétie

75008 Paris

France

Tel: +33 1 70 17 64 70

greenbonds@icmagroup.org

- **renewable energy** (including production, transmission, appliances and products);
- **energy efficiency** (such as in new and refurbished buildings, energy storage, district heating, smart grids, appliances and products);
- **pollution prevention and control** (including reduction of air emissions, greenhouse gas control, soil remediation, waste prevention, waste reduction, waste recycling and energy/emission-efficient waste to energy);
- **environmentally sustainable management of living natural resources and land use**

Green Bond Principles (GBP) 2018

(i) renewable energy
(ii) energy efficiency
(iii) pollution prevention and control
(iv) environmentally sustainable management of living natural resources and land use
(v) terrestrial and aquatic biodiversity conservation
(vi) clean transportation
(vii) sustainable water and wastewater management
(viii) climate change adaptation
(iX) eco-efficient and/or circular economy adapted products, production technologies and processes
(X) green buildings which meet regional, national or internationally recognized standards or certifications.

Source: The Green Bond Principles: Voluntary Process Guidelines for Issuing Green Bonds, ICMA, June 2018

Green Bond and Optimal Portfolio Allocation

$$\mathrm{U}(R_t, \sigma_t^2, Green_t) = R_t - \beta\sigma_t^2 + \gamma(Green_t) \quad (17)$$

$$\text{s.t. } R_t = \alpha_t R_t^A + (1-\alpha_t)R_t^B \quad (18)$$

$$\sigma_t^2 = \alpha_t^2(\sigma_t^A)^2 + (1-\alpha_t)^2(\sigma_t^B)^2 + 2\alpha_t(1-\alpha_t)\sigma_t^{AB} \quad (19)$$

$$Green_t = \alpha_t(Green_t^A) + (1-\alpha_t)(Green_t^B) \quad (20)$$

Where greenness index is based on the following two equations.

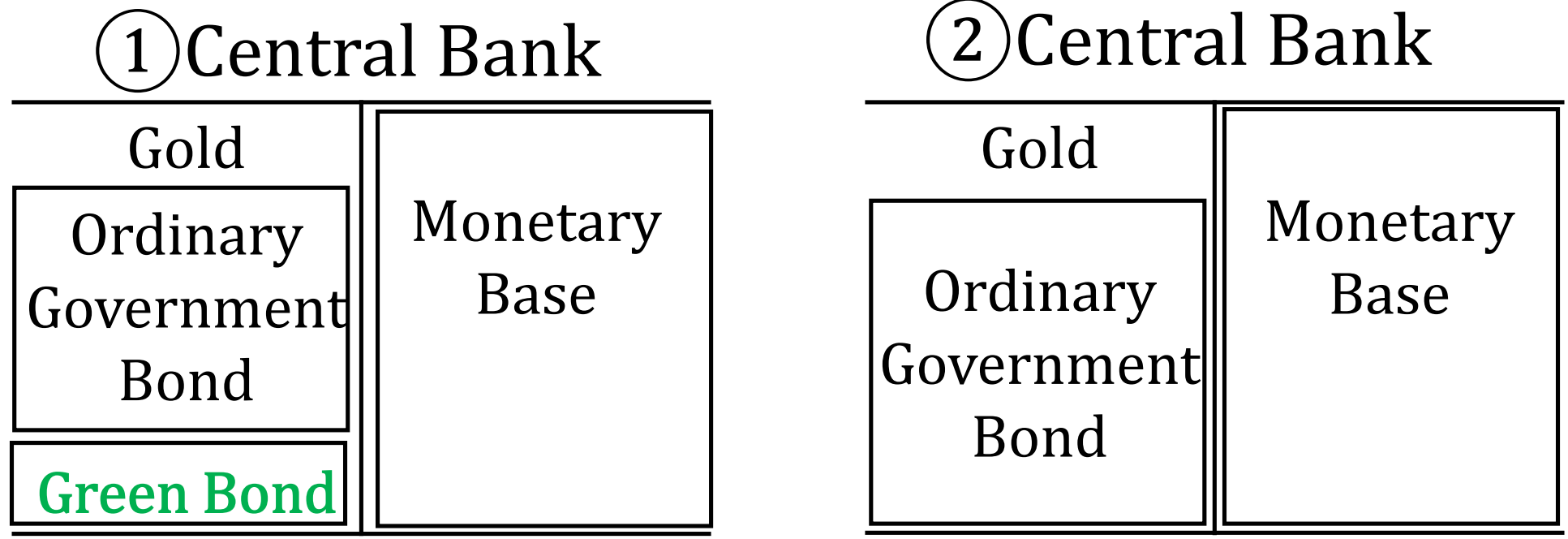
$$Green_t^A = a_t^1\left(CO_{2\,t}^A\right) + a_t^2\left(NO_{X\,t}^A\right) \quad (21)$$

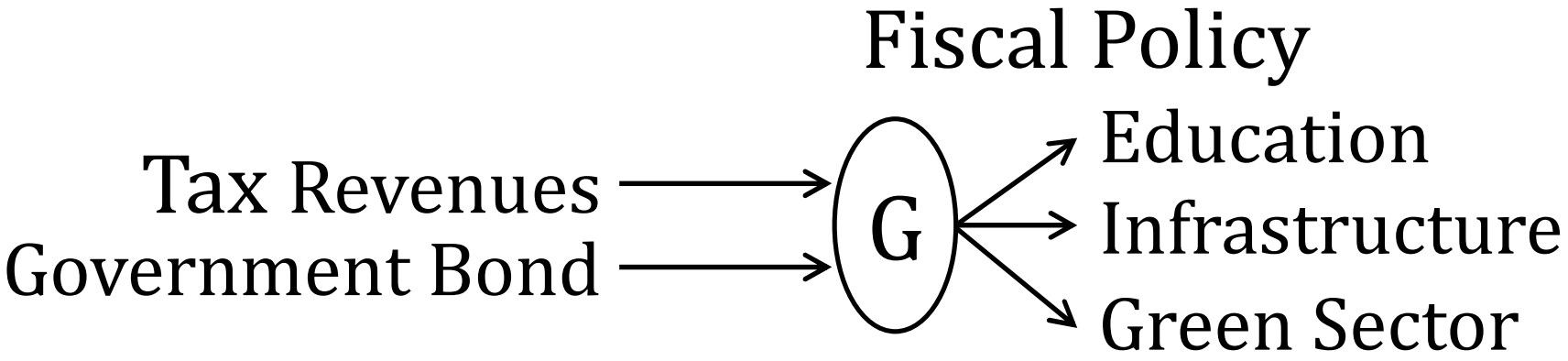
$$Green_t^B = b_t^1\left(CO_{2\,t}^B\right) + b_t^2\left(NO_{X\,t}^B\right) \quad (22)$$

Optimal portfolio allocation now depends not only on rate of return and risks but also depends on greenness index $Green_t^A$ and $Green_t^B$.

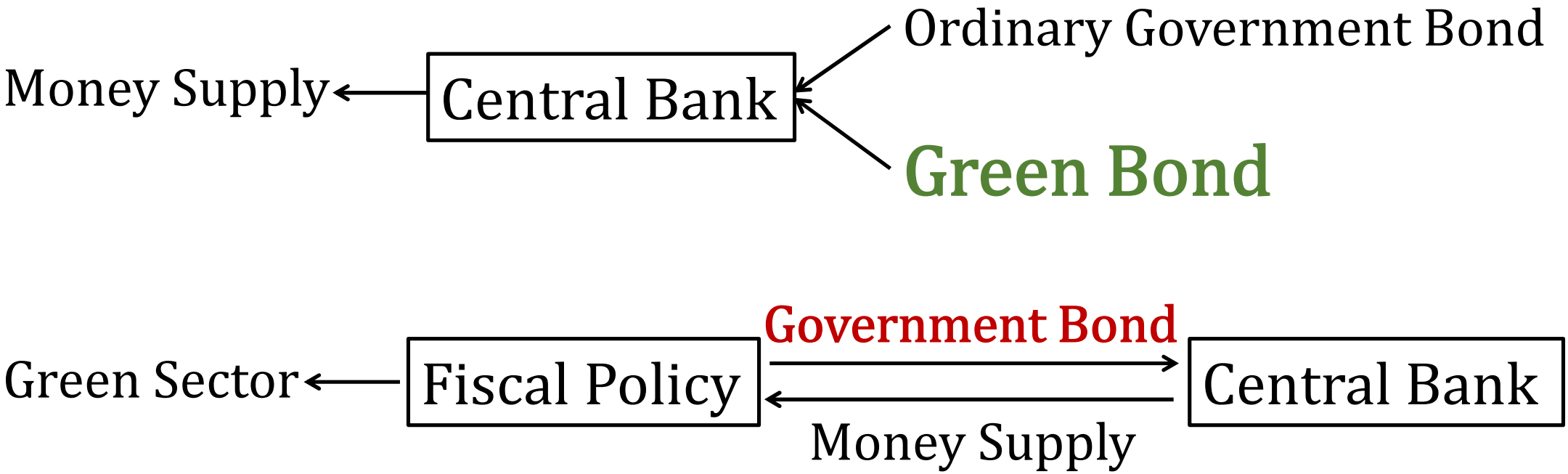
$$\alpha_t = \frac{\frac{1}{2\beta}(R_t^A - R_t^B) - (\sigma_t^B)^2 - \sigma_t^{AB} + \frac{\gamma}{2\beta}(Green_t^A - Green_t^B)}{(\sigma_t^A)^2 - (\sigma_t^B)^2 - 2\sigma_t^{AB}} \quad (23)$$

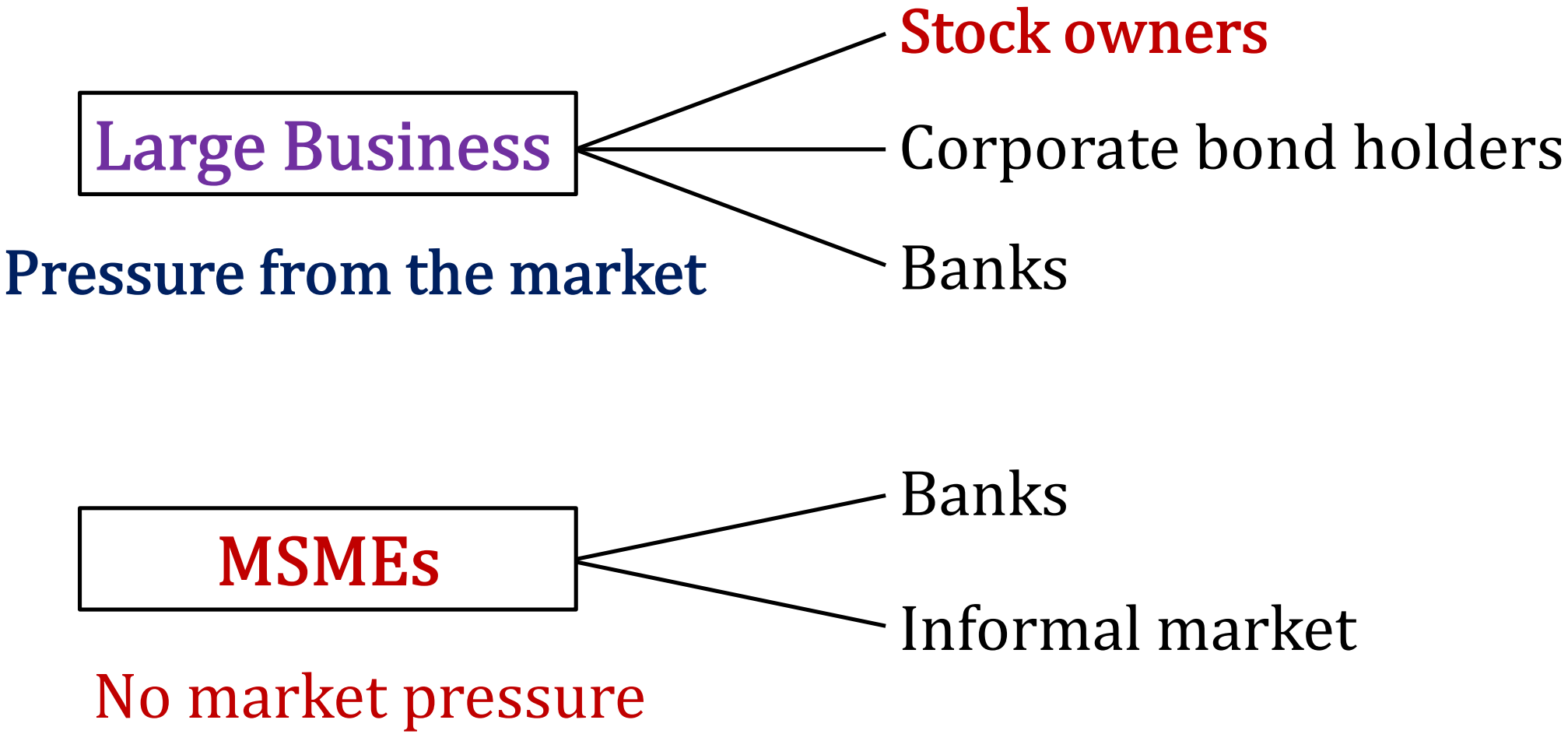
Green Central Banking





<Green Bond purchased by the Central Bank>




Large Business
Stock owners
Corporate bond holders
Banks
Pressure from the market
MSMEs
Banks
Informal market
No market pressure

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The way to induce private participation in green finance and investment

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[b] *Asian Development Bank Institute (ADBI), Tokyo, Japan*
[c] *Keio University, Tokyo, Japan*

energies

Article

Sustainable Solutions for Green Financing and Investment in Renewable Energy Projects

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Covid-19 and Optimal Portfolio Selection for Investment in Sustainable Development Goals

Naoyuki Yoshino [a], Farhad Taghizadeh-Hesary [b,*], Miyu Otsuka [c]

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Monographic Section

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ESG/Green Investment and Allocation of Portfolio Assets[1]

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SME Credit Data Analysis

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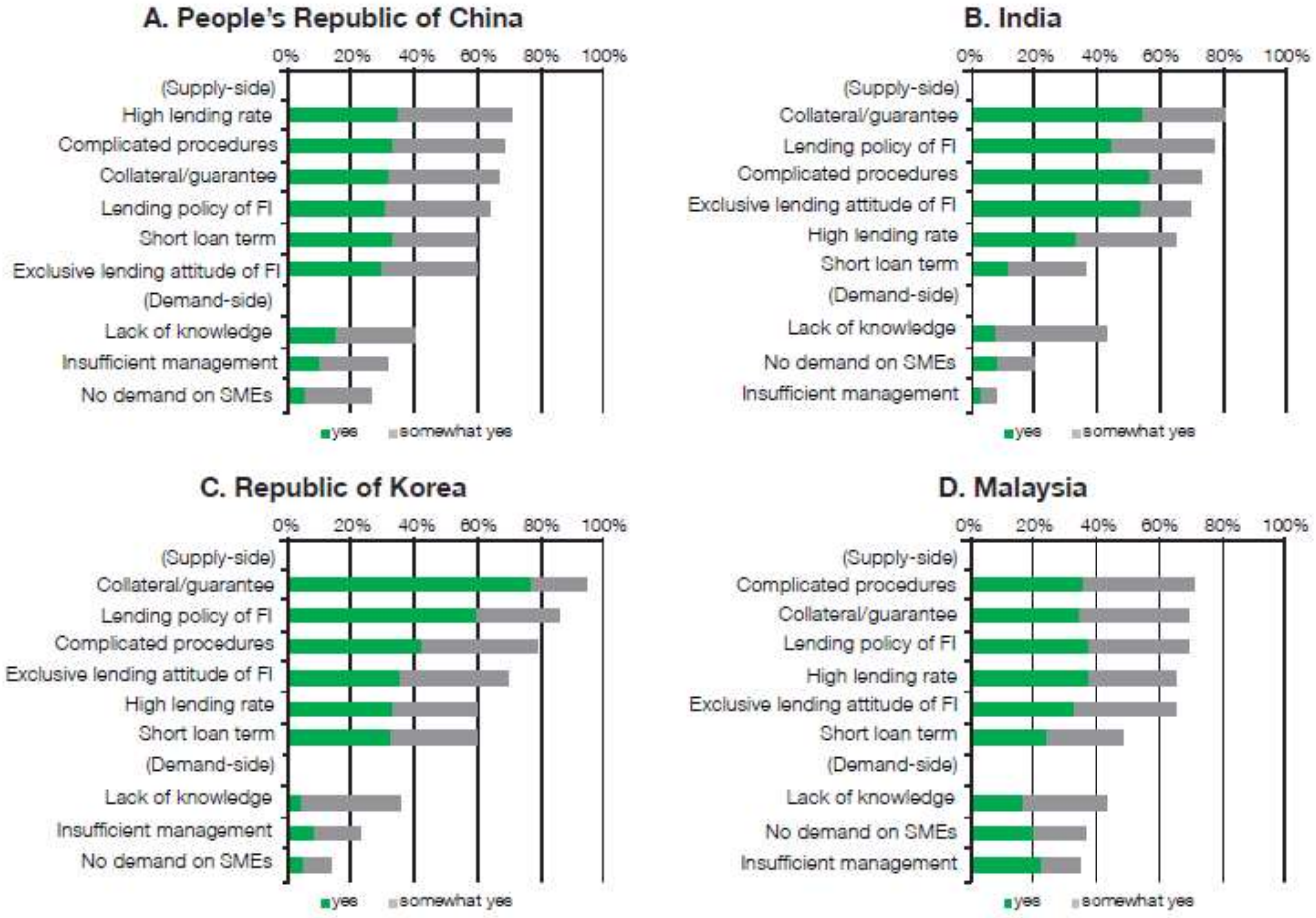
former Dean/CEO ADBI
yoshino@econ.keio.ac.jp

Table 1.2 SME employment share, selected Asian economies

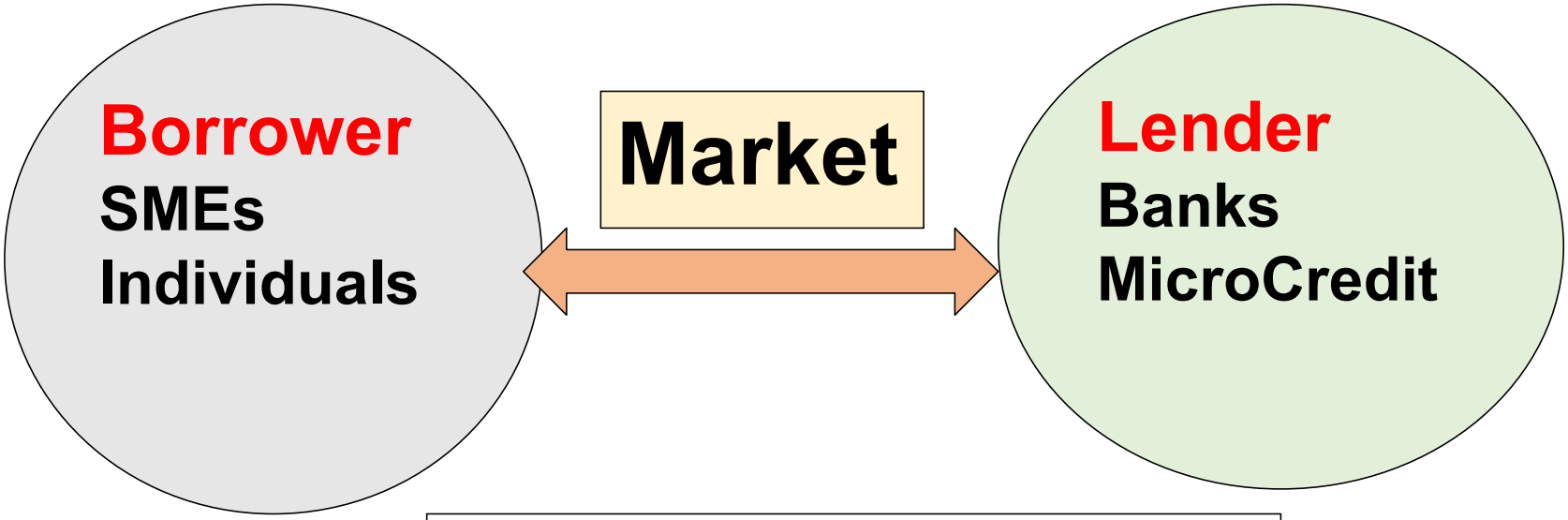
	SME Employment as a Share of:	*SME Share (%)*	*Year*
Rep. of Korea	Enterprise employment	87.7	2012
Thailand	Enterprise employment	80.3	2014
Uzbekistan	Total employment	78.2	2016
Bangladesh	Non-agricultural employment	75.0	2014
Cambodia	Enterprise employment	71.8	2014
Japan	Enterprise employment	69.7	2012
PRC	Industry employment	64.7	2011
Philippines	Enterprise employment	63.7	2013
Singapore	Total employment	68.0	2012
Malaysia	Total employment	65.0	2014
Viet Nam	Total employment	46.8	2012
Kazakhstan	Total employment	35.9	2016
Sri Lanka	Total employment	35.0	2013

Barriers for SMEs in Accessing Financial Institutions, Collateral, Higher interest rate, long term process



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

Borrower, Lender and Market

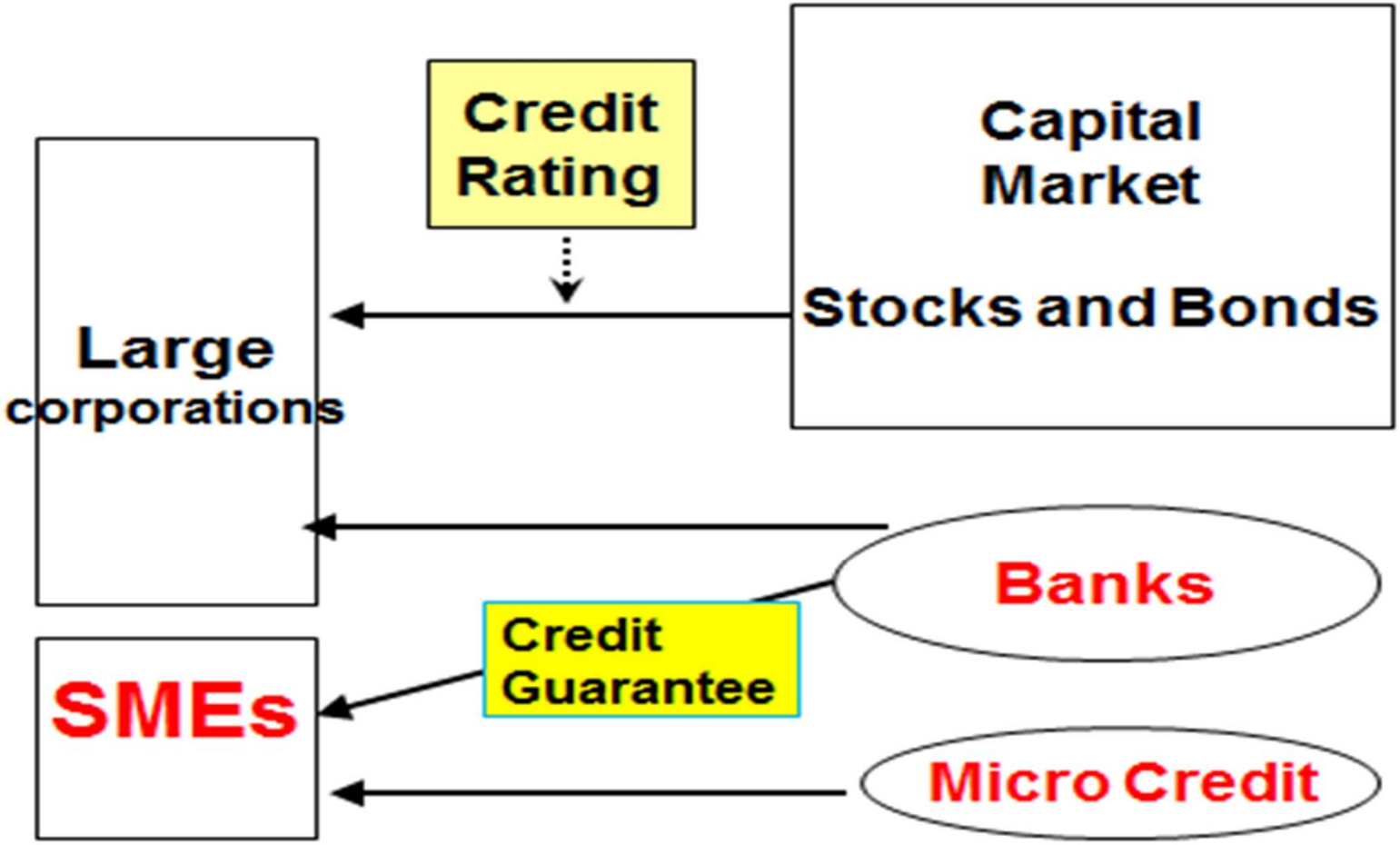


Information Asymmetry
Especially SME market

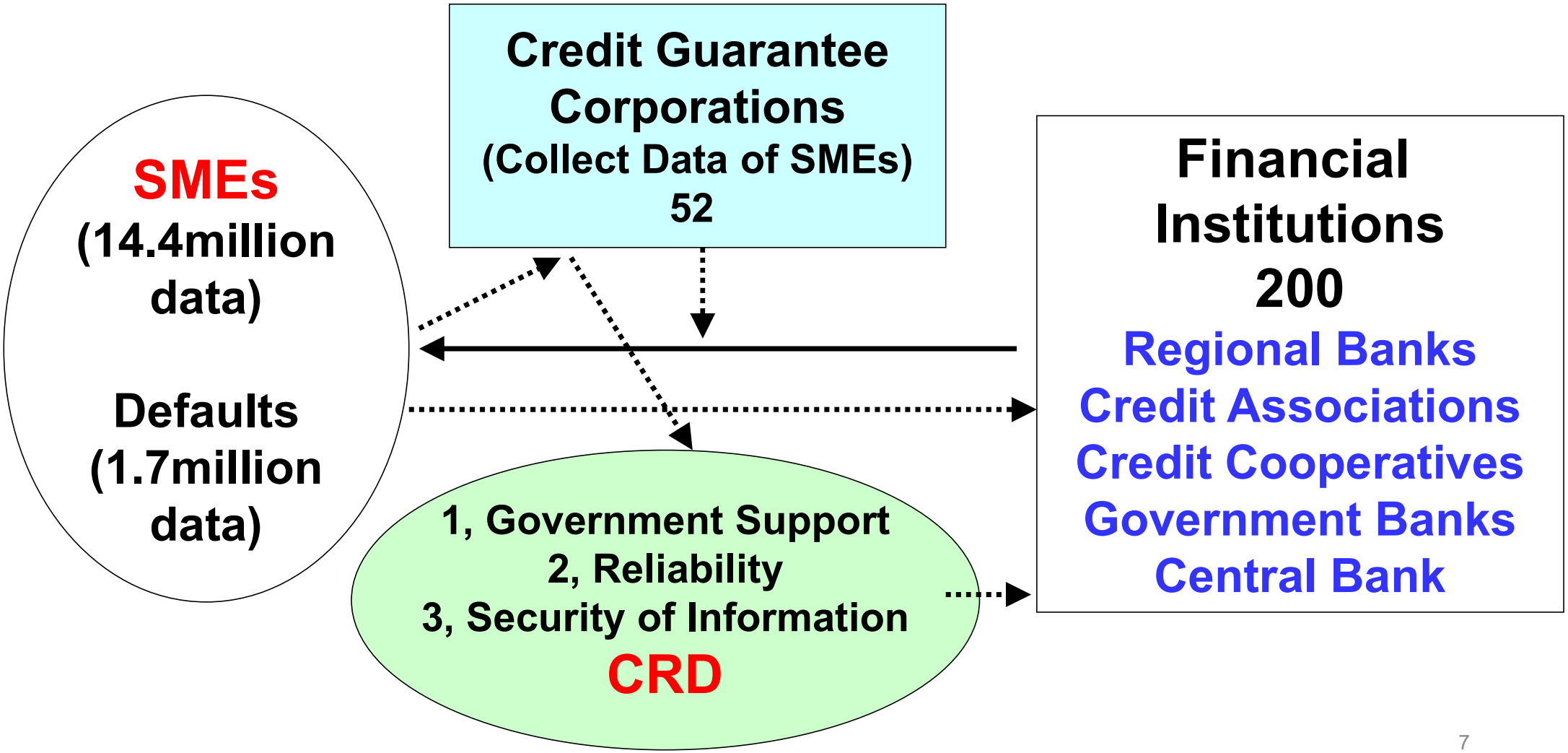
Four Accounts by SMEs in Japan

1, Account to show Bankers
2, Account to show tax authority
3, Account to show to his wife
4, His own account

Lack of Data for SMEs



SME Data base (CRD Data base)



CRD Database

1, Sector, Location, Year of Establishment

2, Real estates, Age of Owner

3, Successor or not

4, Financial Data

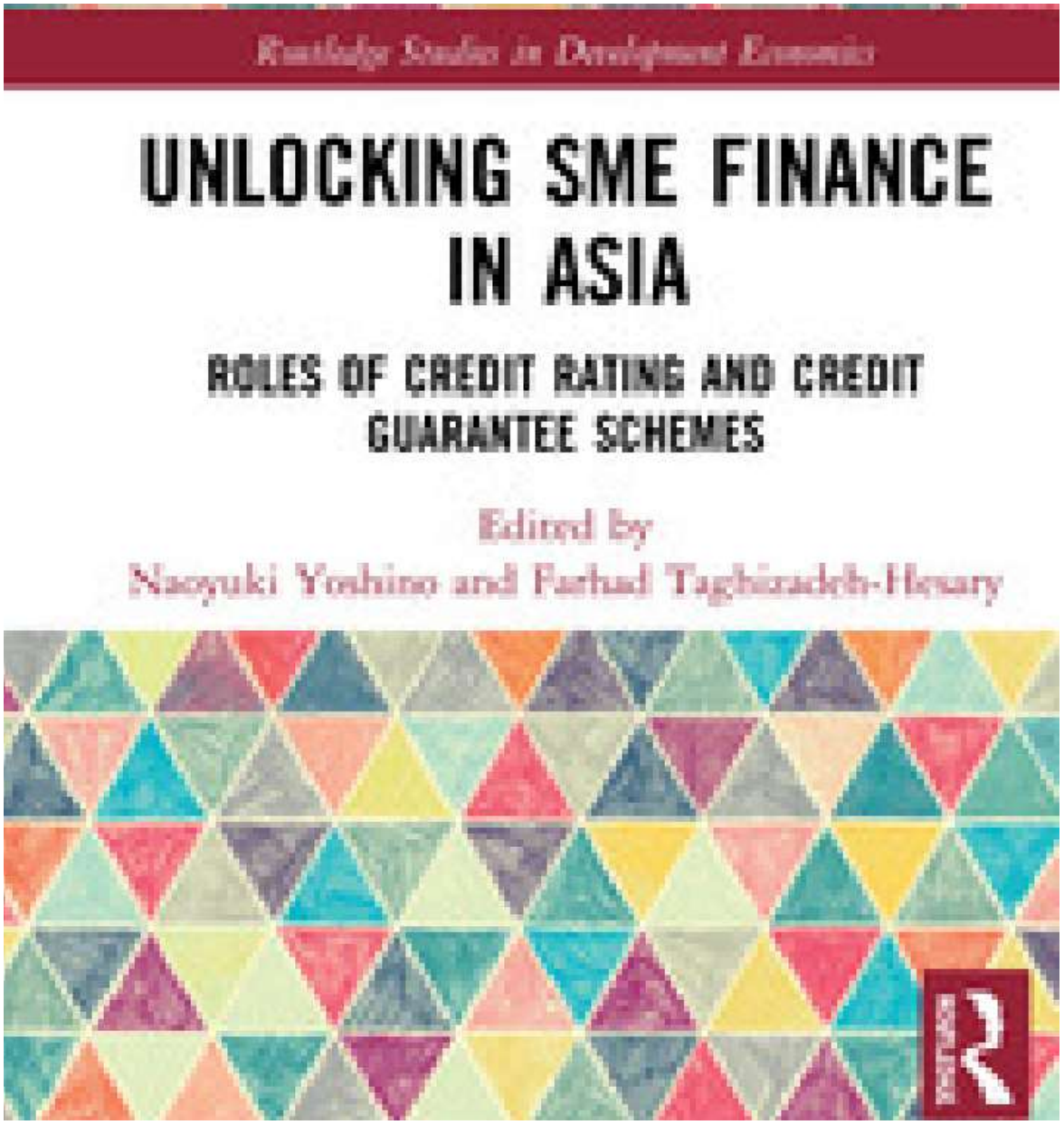
(i) Cash & Deposits,

(ii) Liquidity Assets and Fixed Assets

(iii) Total Assets

(iv) Short term and long term borrowings

(v) Sales, Profits



Chapter 5

Establishment of the Credit Risk Database

Concrete use to evaluate the creditworthiness of SMEs

Satoshi Kuwahara, Naoyuki Yoshino, Megumi Sagara, and Farhad Taghizadeh-Hesary

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.

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**

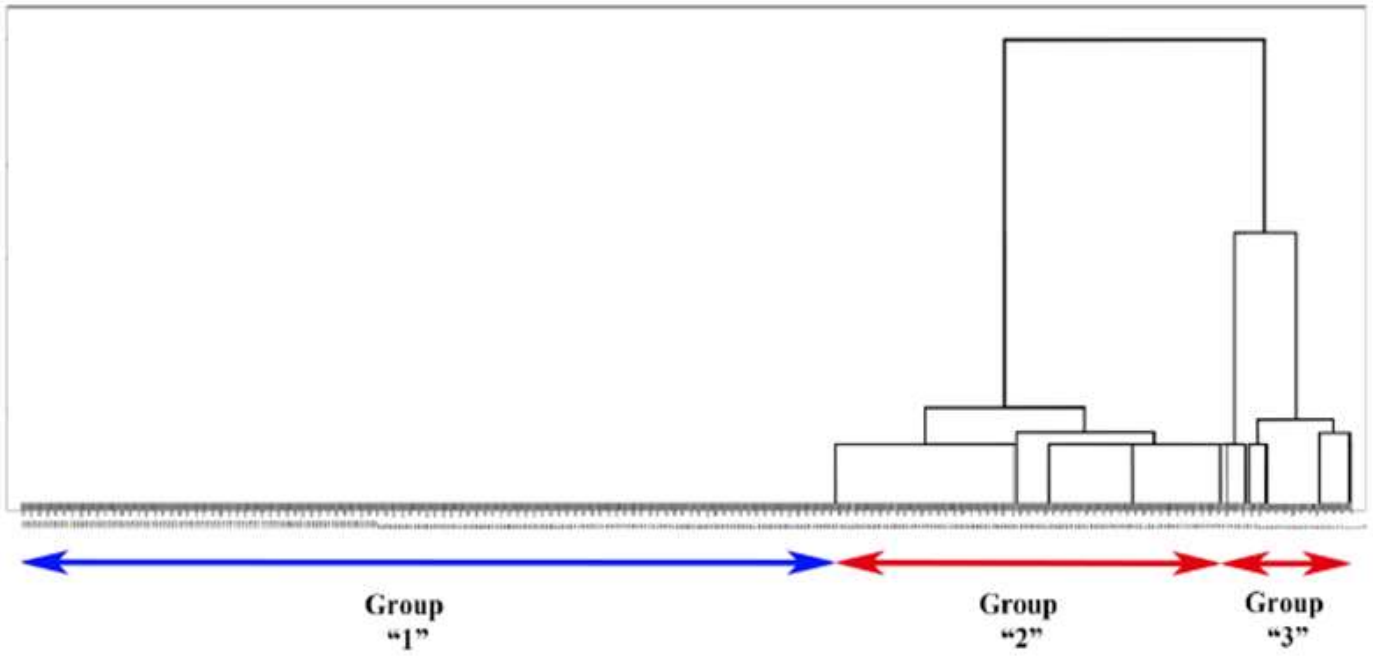
Note: The extraction method was principal component analysis. The rotation method was direct oblimin with

Credit Rating of SMEs using Asian Data

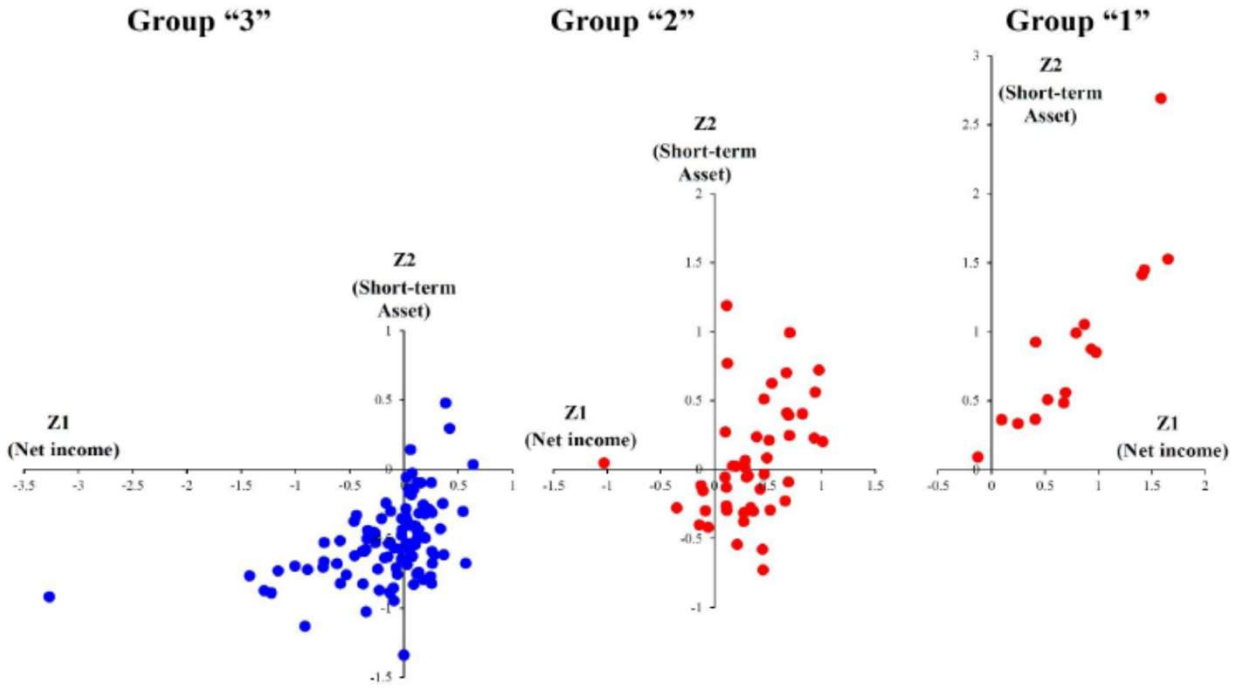
(i) Sales
(ii) Assets
(iii) Liquidity (Cash)
(iv) Total Debt

Cluster analysis: the average linkage method

Dendogram Using Average Linkage



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



Note: Group 1 = healthiest SMEs; group 2 = in-between SMEs; group 3 = least healthy SMEs.

Credit Rating for SMEs
by Use of SME Database

1, Credit Rating is only applicable to large companies

2, Credit Rating for SMEs based on SME Data

3, Three ranking of SMEs (Asian country)

Five ranking of SMEs (Japan's case)

4, SME data can produce default risk ratio

5, Risk based Interest rate

Financial Education for SMEs
Education Program and Textbooks

1, Financial Planners Association

Individual Borrowing

2, Central Bank of Japan

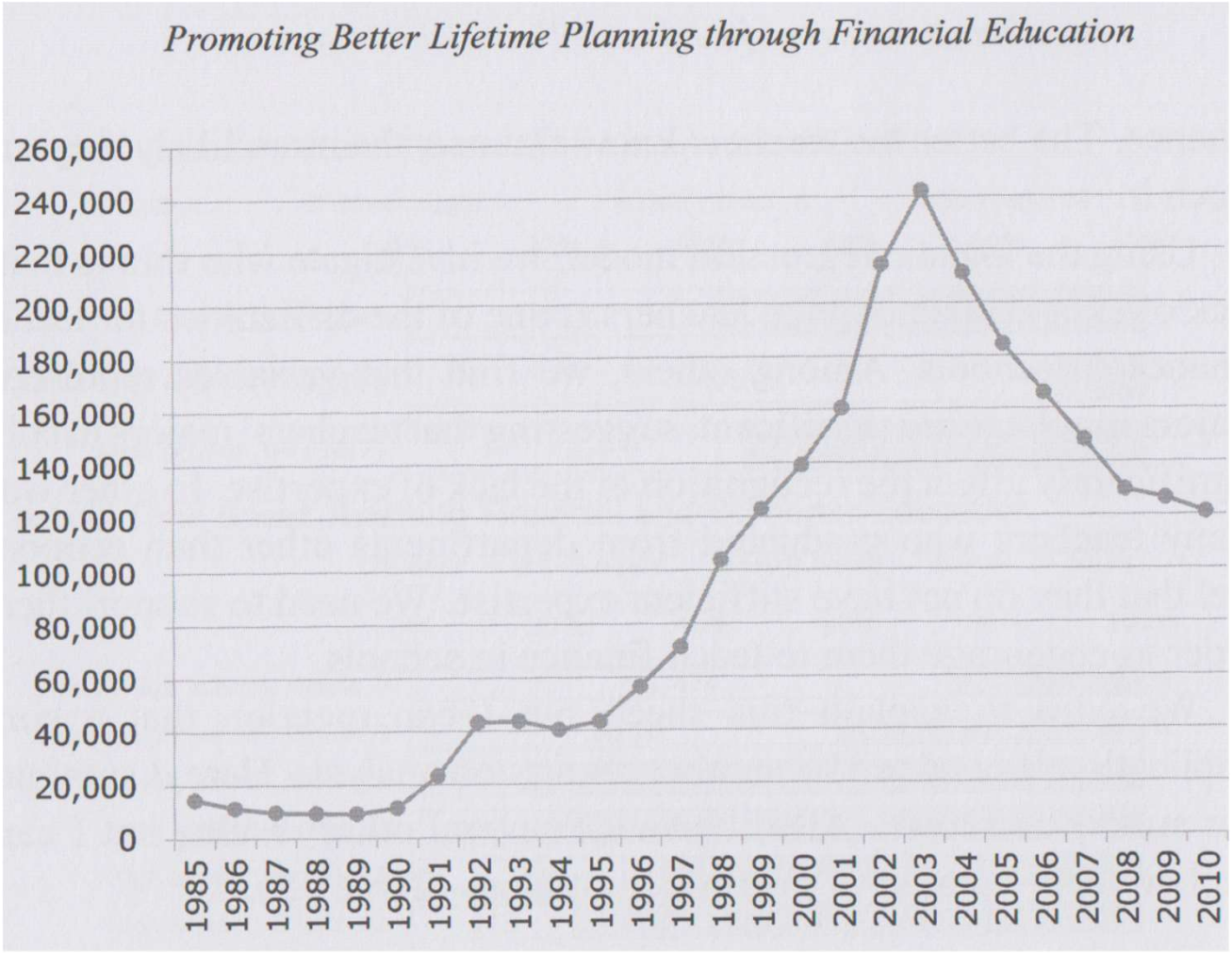
Text books, Educate School teachers

Regional Education Program (MANEBITA)

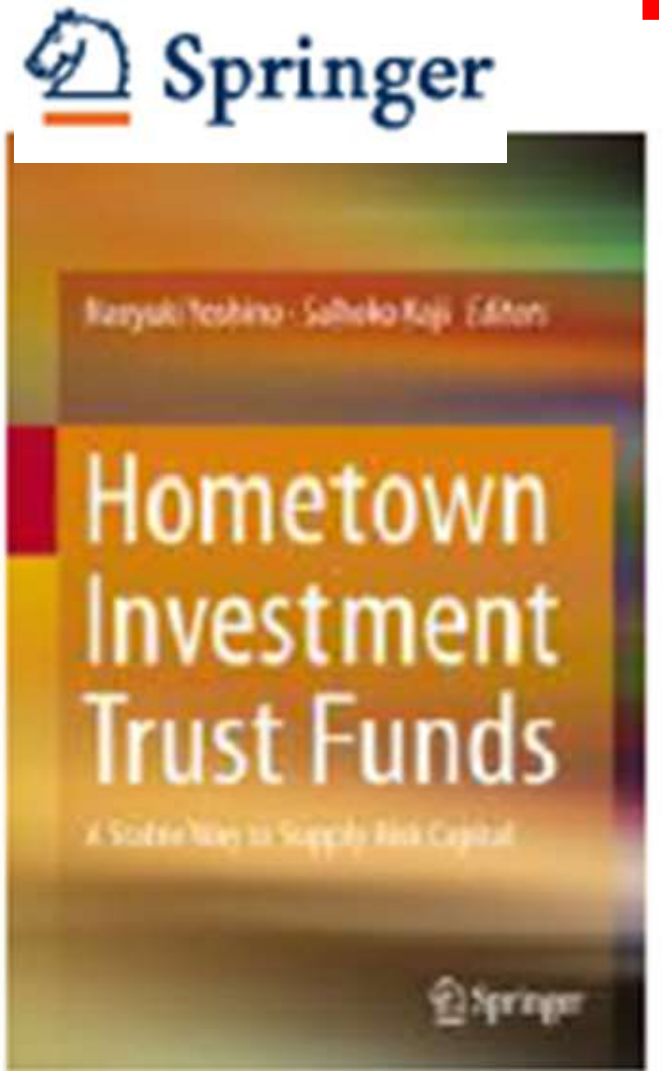
3, Various Financial Associations

Bankers Association, Stock Exchange

SMEs' Debt Overhand



Start up businesses and farmers



Hometown Investment Trust Funds (Springer)

A Stable Way to Supply Risk Capital

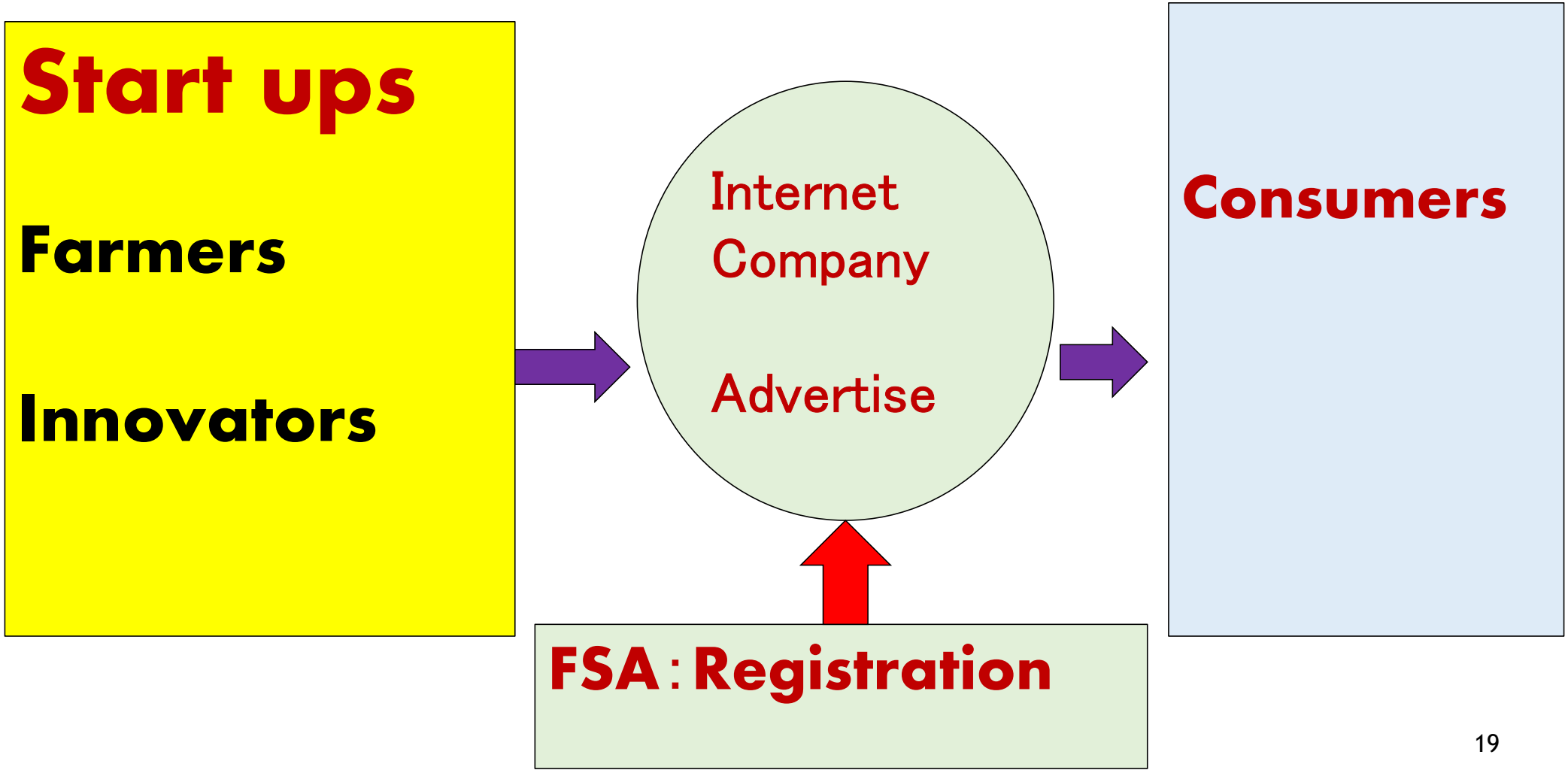
Yoshino, Naoyuki; Kaji Sahoko (Eds.) 2013,

Japan, Cambodia Vietnam, Peru

Access to Digital Technology, Internet

(1) Purchasing Type of Hometown Trust
(2) Investment Type of Hometown Trust

Internet On-line trade



Financing for Start-ups along Railway (Hometown crowd funding)


しんざいけ
新在家
Shinzaike
Ishiyagawa
Oishi おおい

References

Yoshino N. Kaji, S. (2013) *Hometown Investment Trust Funds*, Springer, March 2013

Yoshino,N and T. Hirano (2012) "Counter-Cyclical Buffer of the Basel Capital Requirement and Its Empirical Analysis" , chapter in ***Current Developments in Monetary and Financial Law*** (Vol. 6): Restoring Financial Stability—The Legal Response, edited by the International Monetary Fund (IMF, 2012).

Yoshino, N and Farhad Taghizadeh (2015), "An Analysis of Challenges Faced by Japan's Economy and Abenomics" ***The Journal of Japanese Political Economy***, Taylor and Frances.

Yoshino, N., Taghizadeh Hesary, F. (2015), 'Analytical Framework on Credit Risks for Financing SMEs in Asia'. Asia-Pacific Development Journal. United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP)

ANALYTICAL FRAMEWORK ON CREDIT RISKS FOR FINANCING SMALL AND MEDIUM-SIZED ENTERPRISES IN ASIA

*Naoyuki Yoshino and Farhad Taghizadeh-Hesary**

Small and medium-sized enterprises (SMEs) account for the major share of employment and dominate the Asian economies. These economies are often characterized as having bank-dominated financial systems and underdeveloped capital markets, in particular venture capital. Hence, offering new methods for financing SMEs is crucial. Hometown investment trust funds are a form of financial intermediation that was started recently and has since been adopted as a national strategy in Japan. In the present paper, the authors explain the importance of SMEs in Asia and describe hometown investment trust funds. They then provide a scheme for credit rating of SMEs, employing two statistical analysis techniques, principal component analysis and cluster analysis to analyse the credit risks of a sample of Asian SMEs by using their financial variables. This comprehensive and efficient method would enable banks, to group their SME customers based on their financial health, adjust interest rates on loans and set lending ceilings for each group. Moreover, this method is applicable to hometown investment trust funds around the

Fiscal Sustainability after Covid-19: Rethinking of Domar Condition

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Former Dean & CEO, ADBI

Director, Financial Research Center/ FSA/Government of JAPAN

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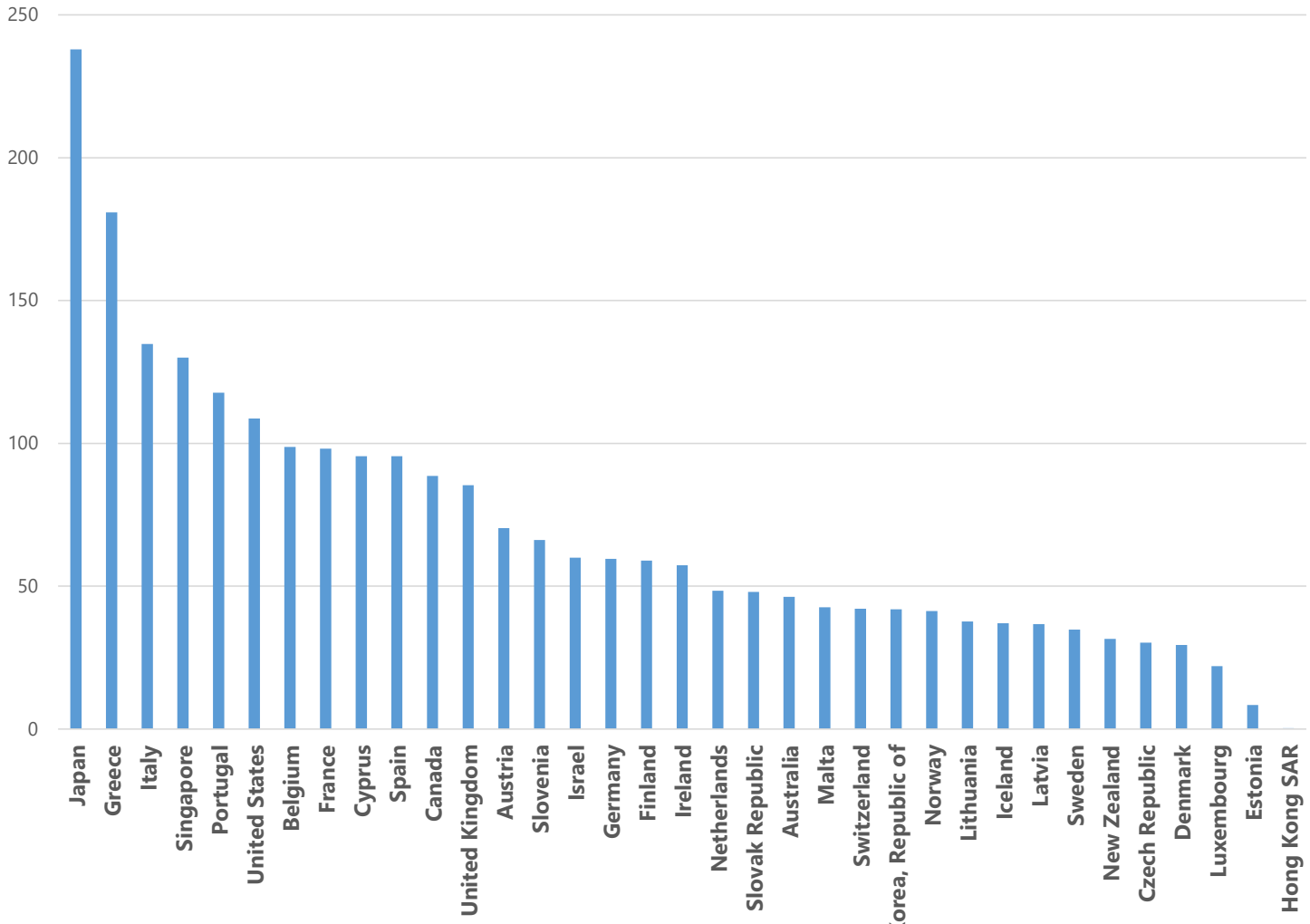
Hiroaki MIYAMOTO

Professor Tokyo Metropolitan University

Debt/GDP Ratio (IMF, 2019)

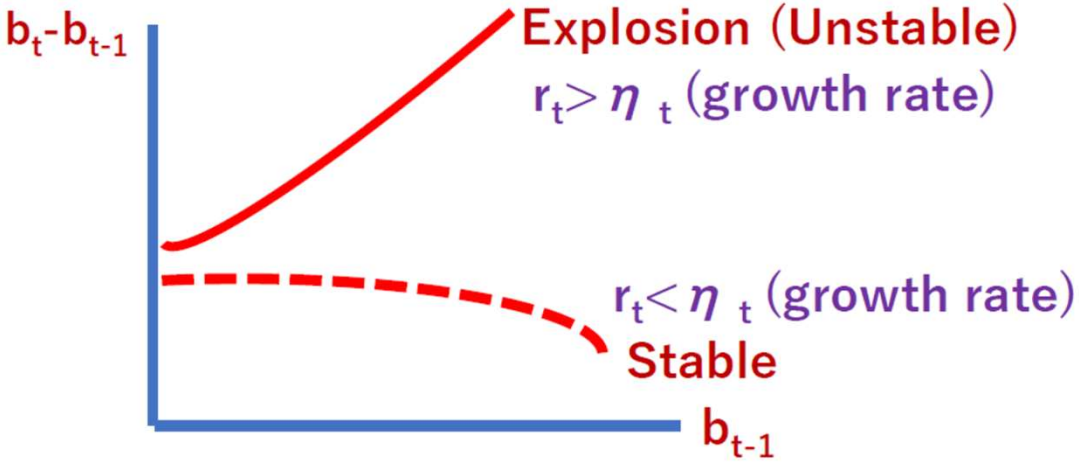


Domar Condition of Fiscal Stability

The Domar condition is often used to judge whether the budget deficit is sustainable. The Domar condition is obtained from the government budget constraint:

$$G_t + r_t^B B_{t-1} = \Delta B_t + T_t,$$

where G_{t} is government spending, B_{t} is the revenues, and r_{t} is the interest rate for public can obtain



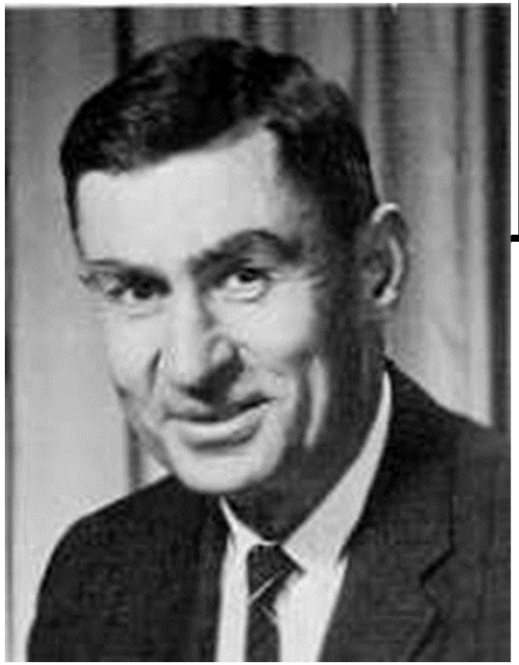
$$b_t - b_{t-1} = g_t - t_t + \frac{r_t - \eta_t}{1 + \eta_t} b_{t-1},$$

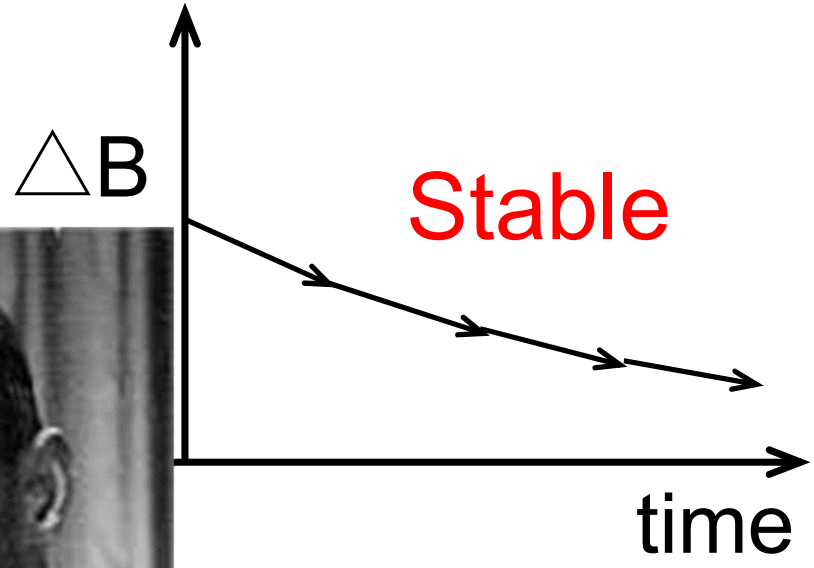
Interest Rate (r_t) > growth rate of the economy(η) → Unstable

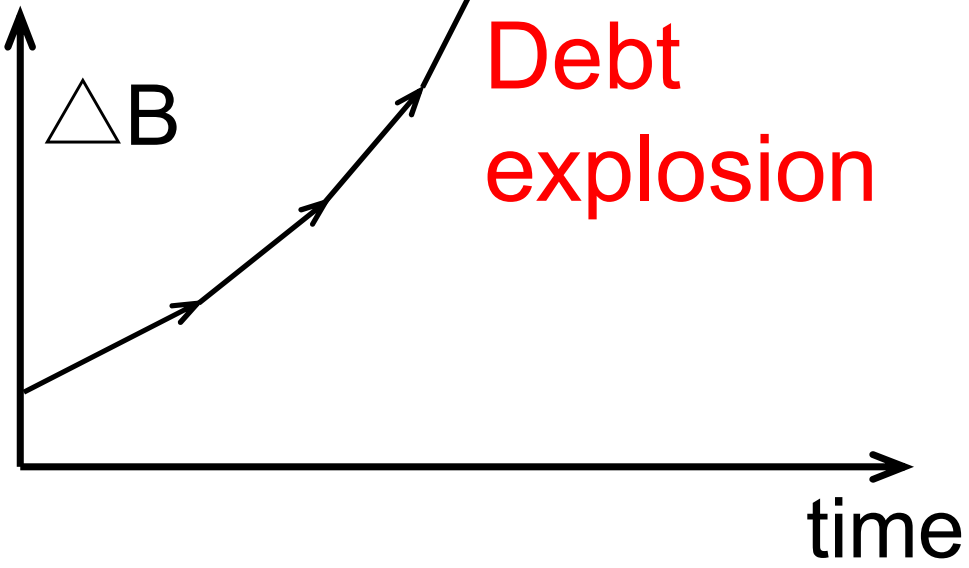
Interest Rate (r_t)< growth rate of the economy(η) → Stable

Fiscal Sustainability: Domar condition

Interest rate < Economic Growth







r > g

Revival of Domar Condition by Paul Krugman and Tirore

1. **Domar, E.D. (1944), "The Burden of Debt and the National Income", American Economic Review, 34(4), pp. 798-827.**
2. **Krugman, P. (2020), "The case for permanent stimulus", Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes, Edited by Richard Baldwinand Beatrice Weder di Mauro, A CEPR Press VoxEU.org eBook.**

Domar condition is obtained only by the supply side of government bonds and does not take into account of demand for government bonds.
US government bonds are purchased all over the world.

World Bank, Uneven Recovery, April 2021

Box II.B.5. The fiscal arithmetic of debt sustainability: How relevant is it for emerging markets and developing economies?

To understand the conditions for debt sustainability, the traditional accounting identity decomposes the changes in the government debt-to-GDP ratio into:[16]

$$d_t - d_{t-1} = \left(\frac{r_t}{1+g_t}\right) d_{t-1} - \left(\frac{g_t}{1+g_t}\right) d_{t-1} - P_t \qquad (1)$$

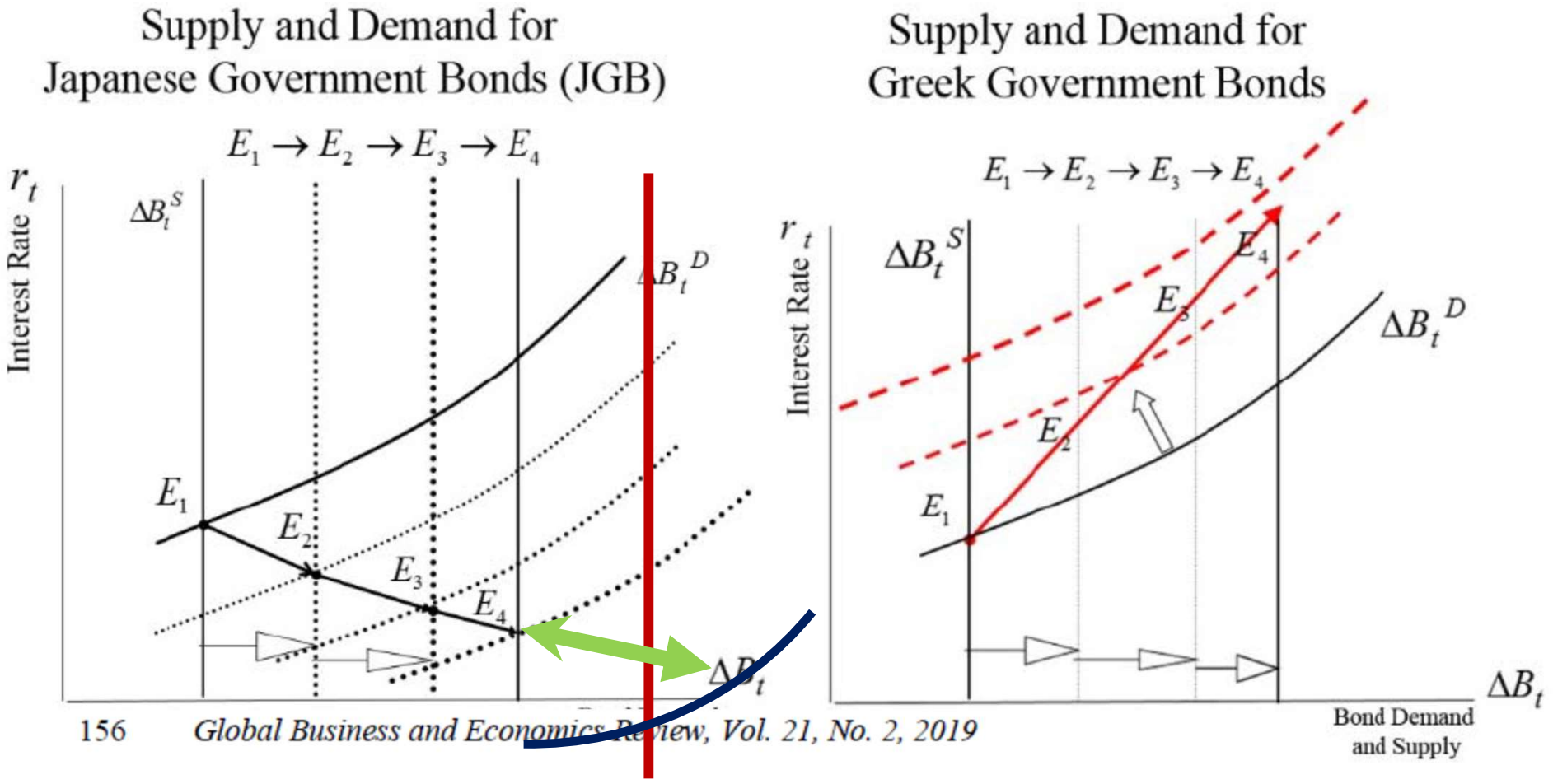
where d is the debt-to-GDP ratio, r is the real interest rate, g is the real growth rate, p is the primary surplus (the fiscal surplus excluding interest payments on the government's debt).[17] The first term on the right-hand side reflects the interest cost of financing the debt; the second term reflects the erosion of the debt ratio that stems from the growth of output (the denominator in the debt ratio). The difference between the interest rate and the rate of economic growth is a key determinant of changes in the debt-to-GDP ratio.

To avoid debt explosion:

$$d_t = d_{t-1} \rightarrow \left(\frac{r_t - g_t}{1+g_t}\right) d_{t-1} = P_t \qquad (2)$$

meaning, the primary surplus must be sufficient to pay for debt service.

Figure 1 Government bond markets of Japan and Greece (see online version for colours)



Optimal fiscal policy rule for achieving fiscal sustainability: *the Japanese case* **Yoshino-Mizoguchi-Hesary (2019)**

Japanese Debt, 92% held by Domestic Investors in 2012

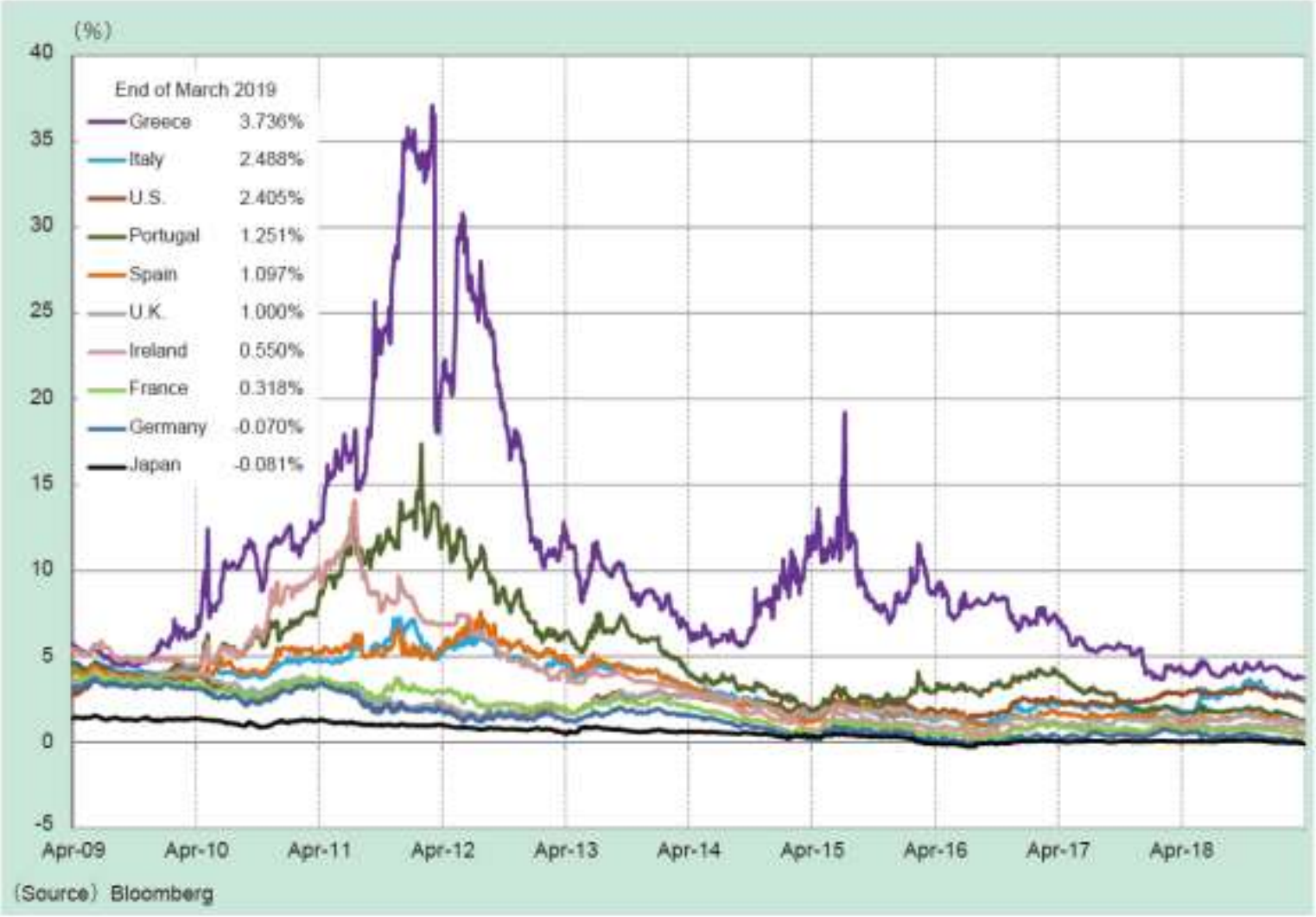
HOLDERS	%
Banks and Postal Savings	45%
Life and Non-life Insurances	20%
Public Pension funds	10%
Private Pension Funds	4%
Central Bank of Japan	8%
Overseas' Investors	8%
Households	5%
Others	3%

Source: MOF

Greece's debt 80%, held by overseas investors (2011)

HOLDERS	%
Eurozone	15%
ECB	15%
IMF	6%
Greek banks & non-banks	23%
Other European Banks	10%
Non European Banks	8%
Non-Greek non-Banks	23%

10-Year Government Bonds Yields



(Source) Bloomberg

Likewise the demand by foreign investors in government bonds can be written as follows, by taking into consideration of the interest rate parity condition.

$$\Delta B_t^f = f_0 + f_1(\sigma_t^B, \sigma_t^f)\left[r_t^B - \left\{r_t^f + \frac{(e_t^e - e_t)}{e_t}\right\}\right], \tag{9}$$

where f_0 stands for the shift parameter by foreign investors and f_1 is interest rate sensitivity of demand for government bonds.

Demand for government bonds by domestic investors and foreign investors can be added together, which will lead to the following total demand for government bonds.

$$\Delta B_t^D = (b_0 + f_0) + f_1(\sigma_t^B, \sigma_t^f)\left[r_t^B - \left\{r_t^f + \frac{(e_t^e - e_t)}{e_t}\right\}\right] + b_1(\sigma_t^B, \sigma_t^I)(r_t^B - r_t^I). \tag{10}$$

Government Bonds Market

The supply of government bonds is described by the government budget constraint:

$$G_t + r_t^B B_{t-1} = \Delta B_t^s + T_t + \Delta M_t, \qquad (5)$$

Supply of Government bonds

where ΔM_{t} is money supply which is printed by purchasing government bonds from the market as an open market operation .

From (4) and (5), we have the equilibrium interest rate of government bonds:

$$r_t^{B*} = \frac{G_t - T_t - \Delta M_t - b_0 + b_1\left(\sigma_t^B, \sigma_t^I\right) r_t^I}{b_1 - B_{t-1}}. \qquad (6)$$

Revised Domar Condition

$$\Delta B_t^d = b_0 + b_1\left(\sigma_t^B, \sigma_t^I\right)\left(r_t^B - r_t^I\right).$$
$$\Delta B_t = G_t + r_t^{B*} B_{t-1} - \overline{T}_t - \Delta M_t. \tag{9}$$

$$\frac{\partial \Delta B_t}{\partial B_{t-1}} = \frac{\partial r_t^{B*}}{\partial B_{t-1}} B_{t-1} + r_t^{B*}, \tag{10}$$

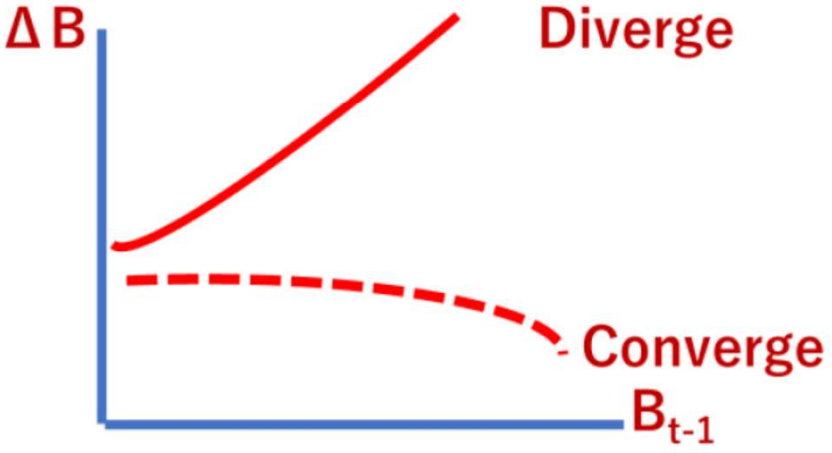
$$\frac{\partial r_t^{B*}}{\partial B_{t-1}} = \frac{G_t - \overline{T}_t - \Delta M_t - b_0 + b_1\left(\sigma_t^B, \sigma_t^I\right) r_t^I}{\left[b_1\left(\sigma_t^B, \sigma_t^I\right) - B_{t-1}\right]^2} = \frac{r_t^{B*}}{b_1\left(\sigma_t^B, \sigma_t^I\right) - B_{t-1}}.$$

Accumulated Bonds < Interest rate Sensitivity Of demand

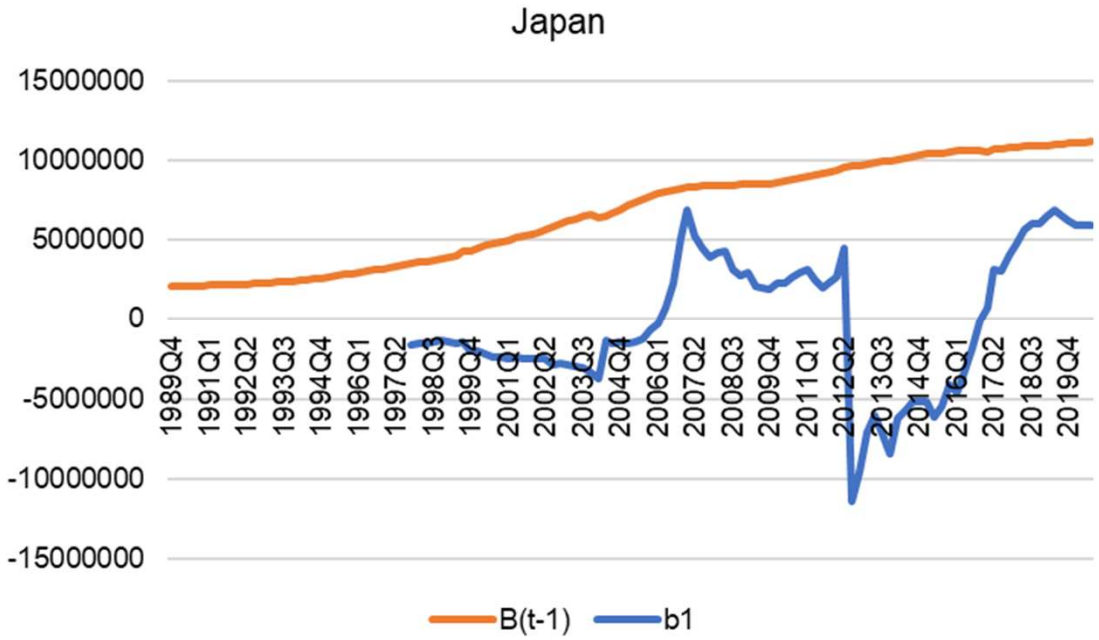
Then, (10) can be rewritten as

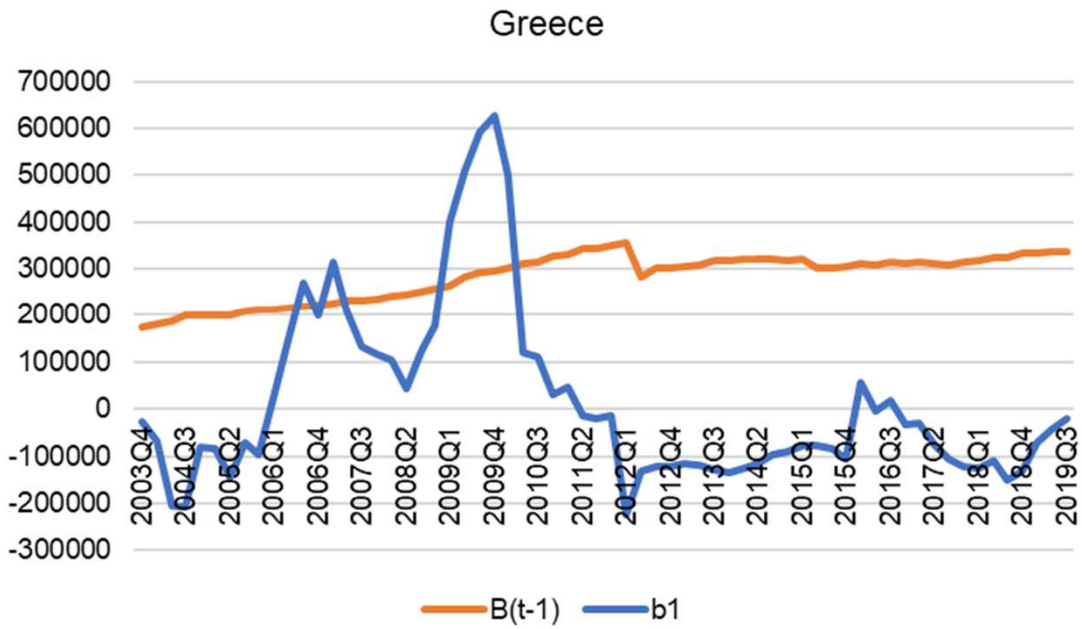
$$\frac{\partial \Delta B_t}{\partial B_{t-1}} = \left(\frac{1}{1 - \frac{B_{t-1}}{b_1\left(\sigma_t^B, \sigma_t^I\right)}}\right) r_t^{B*}.$$

$$\frac{\partial \Delta B_t}{\partial B_{t-1}} \gtreqless 0 \Leftrightarrow 1 \gtreqless \frac{B_{t-1}}{b_1}.$$



Comparison between Greece and Japan





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Revisit Public Debt Stability Condition: Rethinking of the Domar Condition

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$$\Delta B_t^f = f_0 + f_1\left(\sigma_t^C, \sigma_t^f, \rho\right)\left\{\left(r_t^C - \rho - \frac{e^e - e}{e}\right) - r_t^f)\right\}. \tag{9}$$

$$\frac{\partial \Delta B_{C,t}}{\partial B_{C,t-1}} = \frac{\partial r_t^{C*}}{\partial B_{C,t-1}} B_{C,t-1} + r_t^{C*},$$

where

Stability Condition

$$\frac{\partial r_t^{C*}}{\partial B_{C,t-1}} = -\frac{r_t^{C*}}{B_{C,t-1} - b_1 - f_1},$$

Including Foreign Investors

Thus, we have

$$\frac{\partial \Delta B_{C,t}}{\partial B_{C,t-1}} = \left(\frac{1}{1 - \frac{B_{C,t-1}}{b_1 + f_1}}\right) r_t^{C*}. \tag{17}$$

This implies

$$\frac{\partial \Delta B_{C,t}}{\partial B_{C,t-1}} \gtreqless 0 \Leftrightarrow 1 \gtreqless \frac{B_{C,t-1}}{b_1 + f_1}. \tag{18}$$

REFERENCES

Domar, E. D. 1944. The Burden of Debt and the National Income. *American Economic Review*, 34(4): 798–827.

Krugman, Paul. 2020. The case for permanent stimulus. In *Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes*, edited by Richard Baldwin and Beatrice Weder di Mauro, 213–18. London: CEPR Press.

Stiglitz, J. E., and A. Weiss. 1981. Credit Rationing in Markets with Imperfect Information. *American Economic Review*, 713: 393–410.

Yoshino, Naoyuki, Farhad Taghizadeh-Hesary, and Masaki Nakahigashi. 2019. Modelling the Social Funding and Spill-over Tax for Addressing the Green Energy Financing Gap. *Economic Modelling*, 77: 34–41.

Yoshino, Mizoguchi and Taghizadeh-Hesary (2019). "Optimal fiscal policy rule for achieving fiscal sustainability: the Japanese case", *Global Business and Economics Review*, Vol.21, No.2, pp.156.

Yoshino and Miyamoto (2020) "Revisit Public Debt Stability Condition: Rethinking of the Domar Condition after COVID-19", *Global Solutions Journal,* Germany.

Yoshino and Miyamoto (2021). "Reconsideration of the "Domar condition" to check sustainability of budget deficit", *Public Policy Review, Vol/17, No.3..*