Alternatives to Bank finance: Role of Carbon Tax and Hometown Investment Trust Funds in Development of Green Energy Projects in Asia

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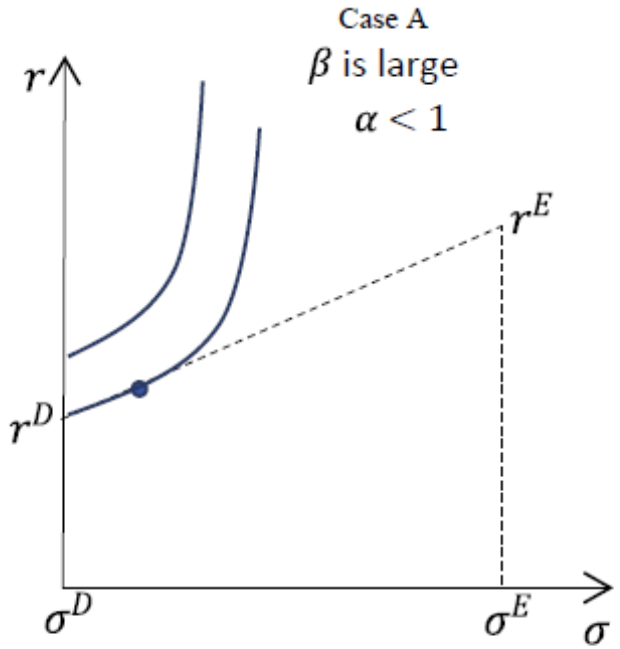
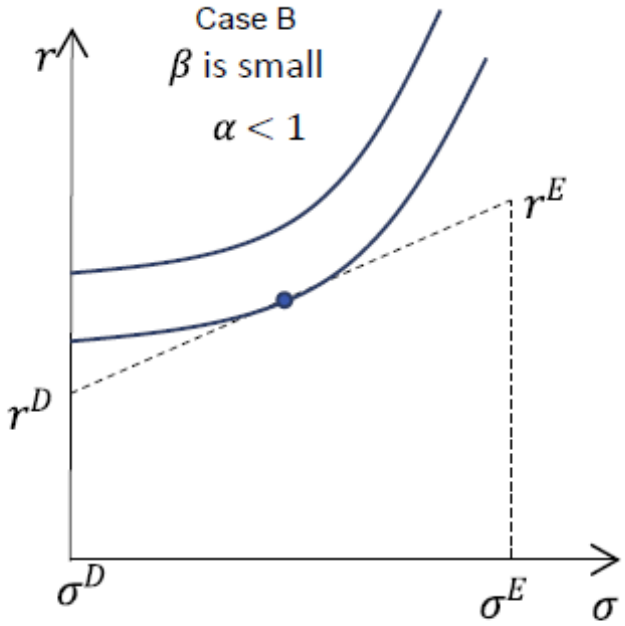
Infrastructure Investment Needs by Sector, 2016-2030

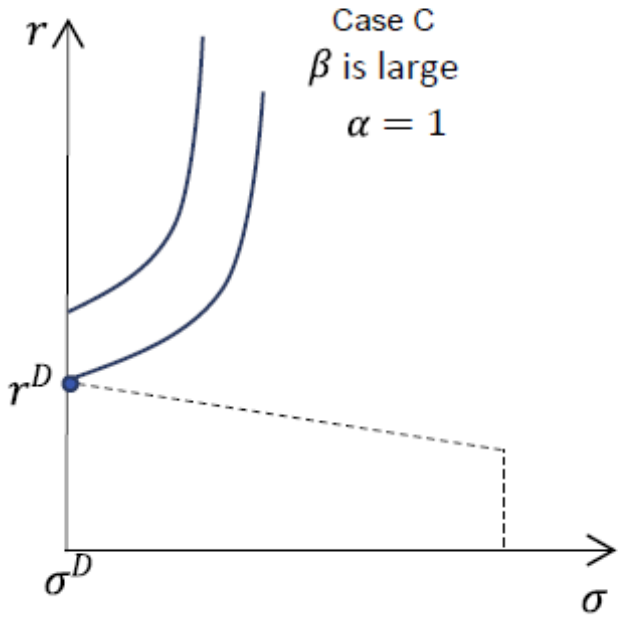
($ billion in 2015 prices)

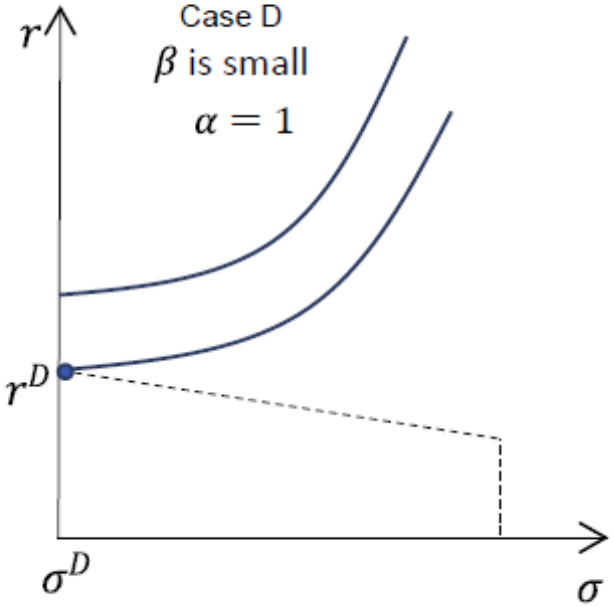
Sector	Baseline estimates		
	Investment Needs	Annual average	% share to total
Power	11689	779	51.8
Transport	7796	520	34.6
Telecommunications	2279	152	10.1
Water and Sanitation	787	52	3.5
Total	22551	1503	100

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


Case A
β is large
$\alpha < 1$
r
r^E
r^D
σ^D
σ^E
σ


Case B
β is small
$\alpha < 1$
r
r^E
r^D
σ^D
σ^E
σ


Case C
β is large
$\alpha = 1$
r
r^D
σ^D
σ


Case D
β is small
$\alpha = 1$
r
r^D
σ^D
σ

$$U = U(r_t, \sigma_t) = r_t - \beta\sigma_t^2 \tag{1}$$

where r_t denotes the rate of return, σ_t denotes the risk and β is the weight for the risk. If investor gives more weight to the risk, then β will be larger. Smaller β means that the investor is not so much concerned about risk.

Eq. (2) shows the total rate of return of households' investment. We are assuming that households are putting their money either in bank deposit or in HIT funds that will be invested into green energy projects.

$$r_t = \alpha_t r_t^D + (1 - \alpha_t) r_t^E \tag{2}$$

In Eq. (2), we are assuming that α percent of the households assets is going to bank deposits and rate of return of bank's deposit or the deposit interest rate is r_t^D . On the other hand $(1 - \alpha)$ percent of their assets are investing in HIT funds and r_t^E denotes rate of return of HIT funds.

$$\sigma_t^2 = \alpha_t^2 \left(\sigma_t^D\right)^2 + (1 - \alpha_t)^2 \left(\sigma_t^E\right)^2 + 2\alpha_t (1 - \alpha_t) \sigma_t^D \sigma_t^E \tag{3}$$

Various Private Financial Investors in Asia

1, **Banks --- Safer projects**

Brown field (infrastructure)

Invest into operation period

Securitization after certain period of time

Privatized projects by the government

2, **Insurance and Pension funds** (Brown fields)

Long term projects (10 years –20- 30 years)

3, **Revenue Bonds (floating interest rate)**

uncertain income streams

4, **Equity Investments**

Construction period and Green fields

Green energy projects categorized into two groups based on scale:

A) large projects, such as Hydro-power:
B) Community type green energy project (Hometown Crowd Funds)

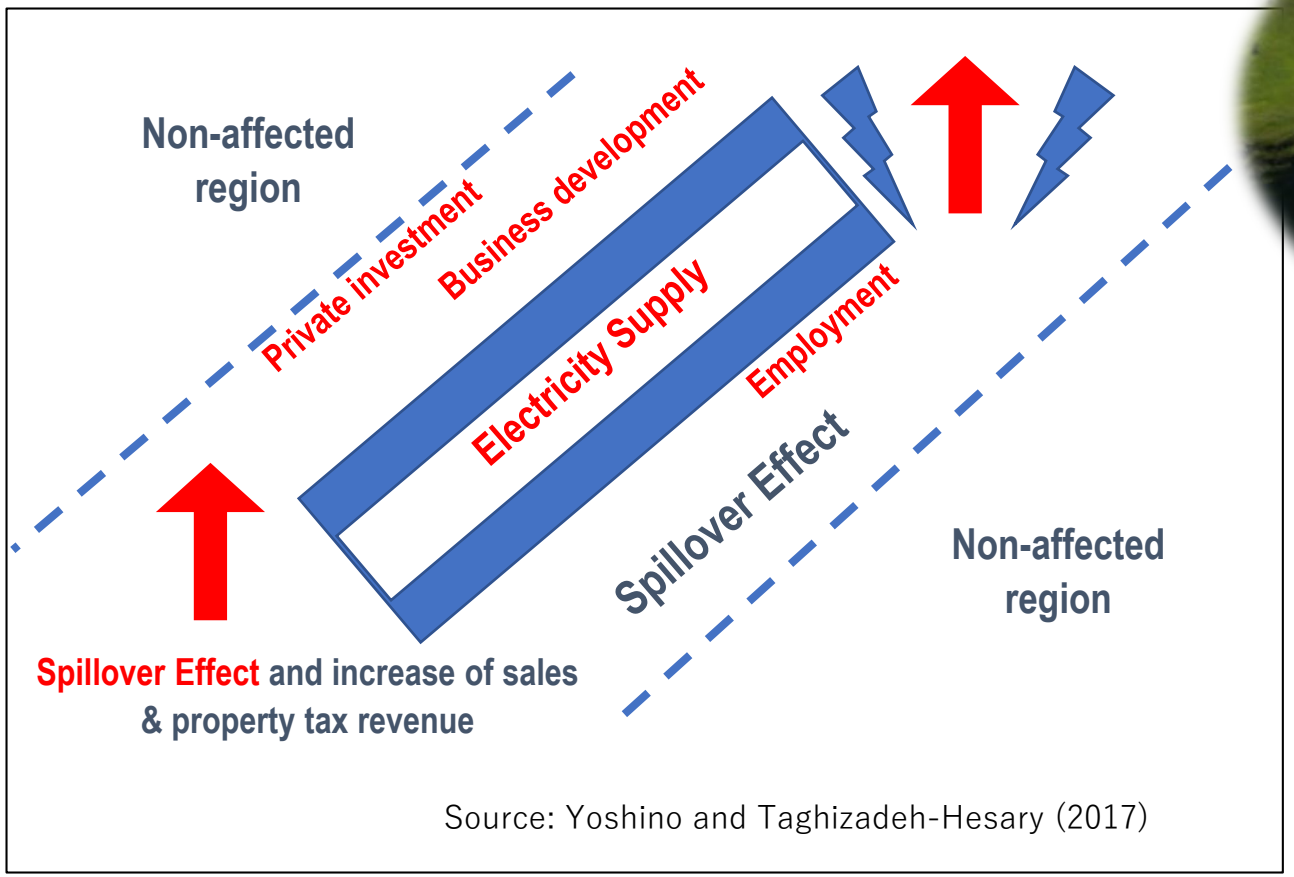
Large projects can be financed by **i) insurance and pension funds,** that have long-term Financing.

Bank loans are not so much suitable for these project, because energy projects are long-term (10-20 years),
However bank deposits are short to medium-term (1-5 years).

Hydropower plant

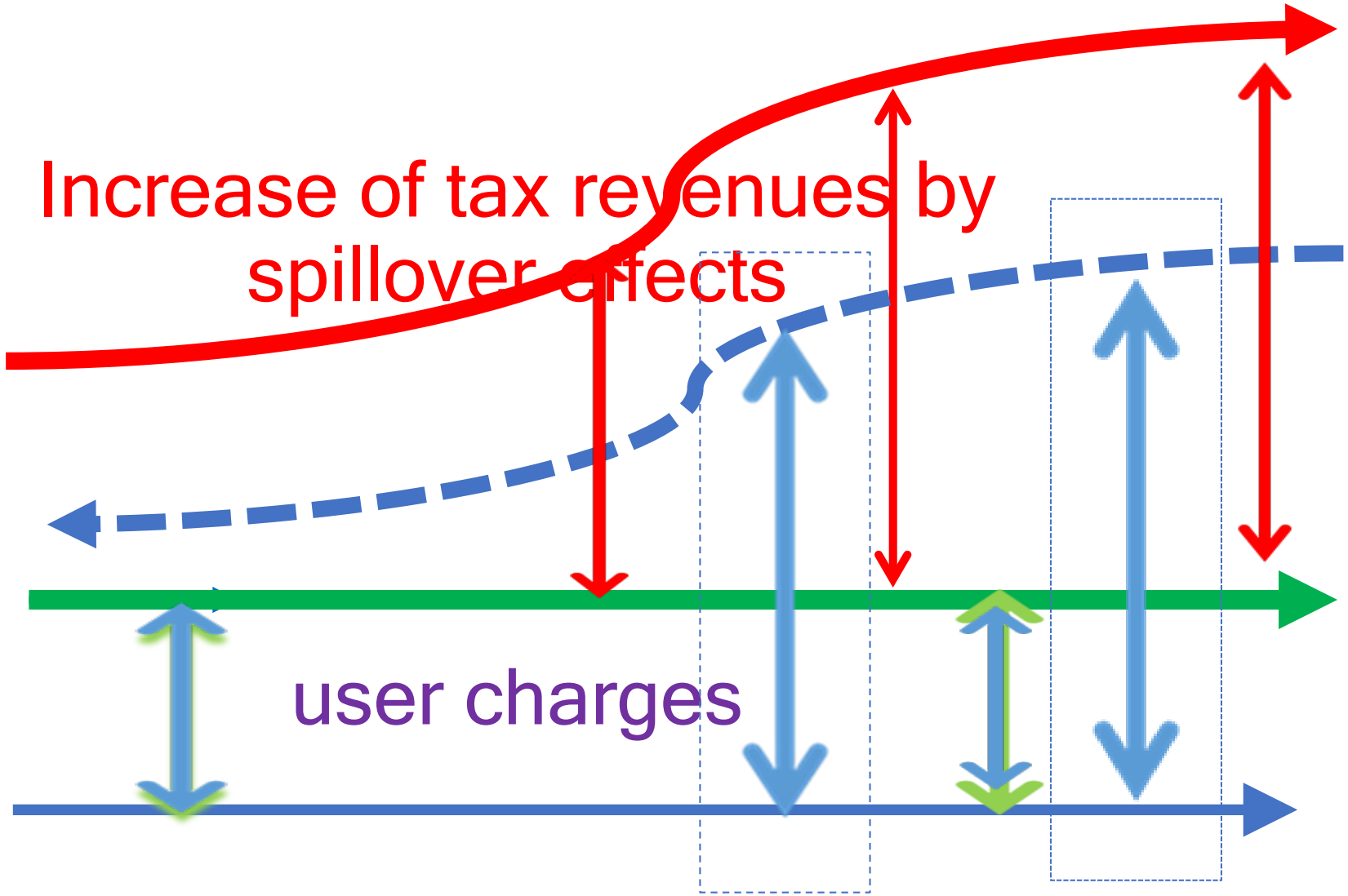
Injection of Increased tax revenues from the spillover effect into energy projects in order to increase the rate of return for private investors

Spill over effects of electricity supply

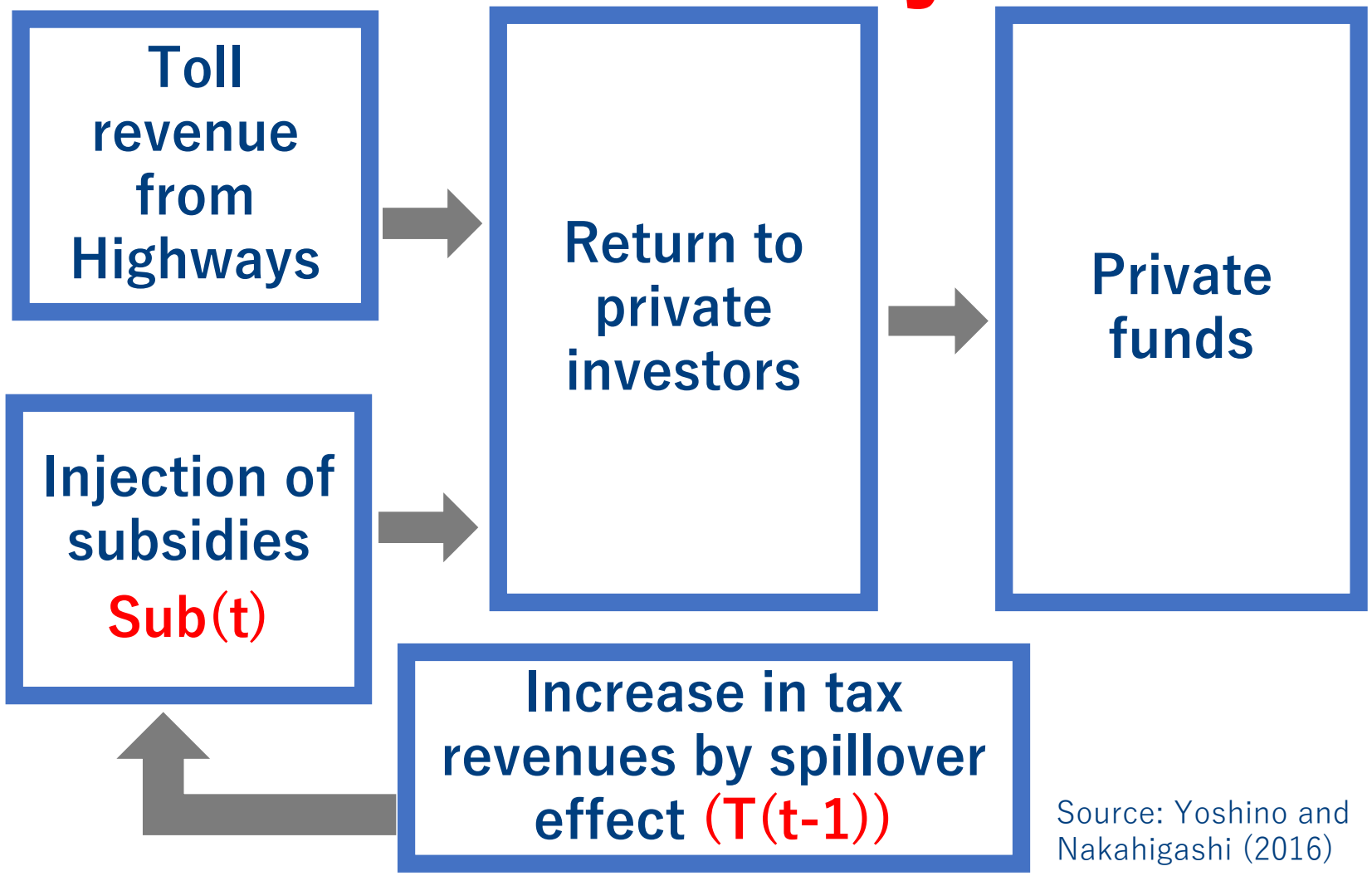


Source: Yoshino and Taghizadeh-Hesary (2017)

Injection of Increased Tax revenues



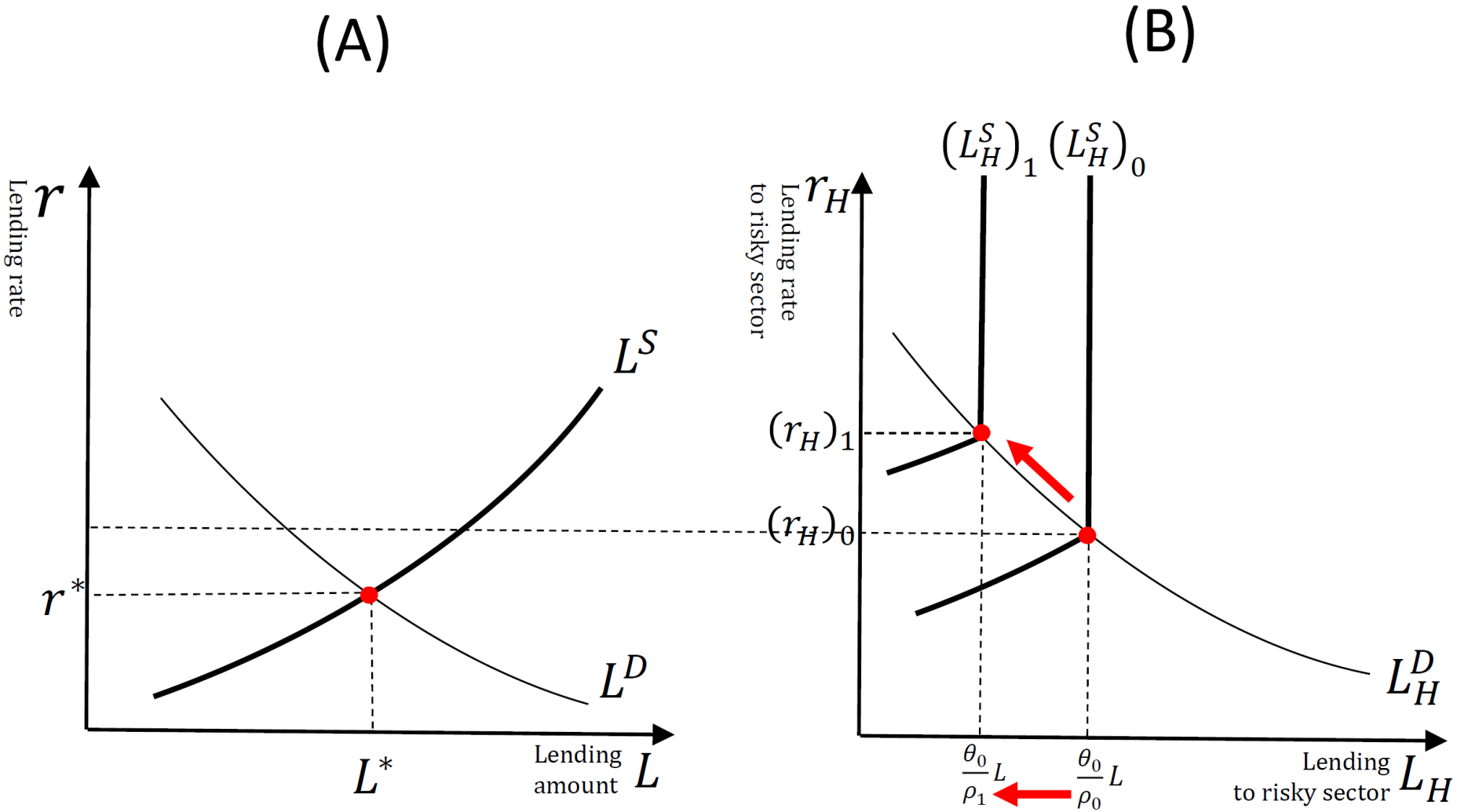
Injection of fraction of tax revenues as subsidy



Source: Yoshino and Nakahigashi (2016)

Basel Capital requirement:

Lending to Riskier Sectors and Lower Upper Lending Limit for Banks



Theoretical Model for Implementation of HITs

In this sub-section we will explain theoretically why banks are not able to lend to smaller-scale risky sectors such as green energy projects (e.g., solar and wind).

Equation 1 and Equation 2 present the profit maximization behaviour of banks:

$$\textbf{Max } \pi = r_L L_1 + (r_H - \rho_H) L_H - r_D D - C(L_1, L_H)$$

$$\textbf{Banks's balance sheet} \quad L_1 + L_H = D + A \qquad (2)$$

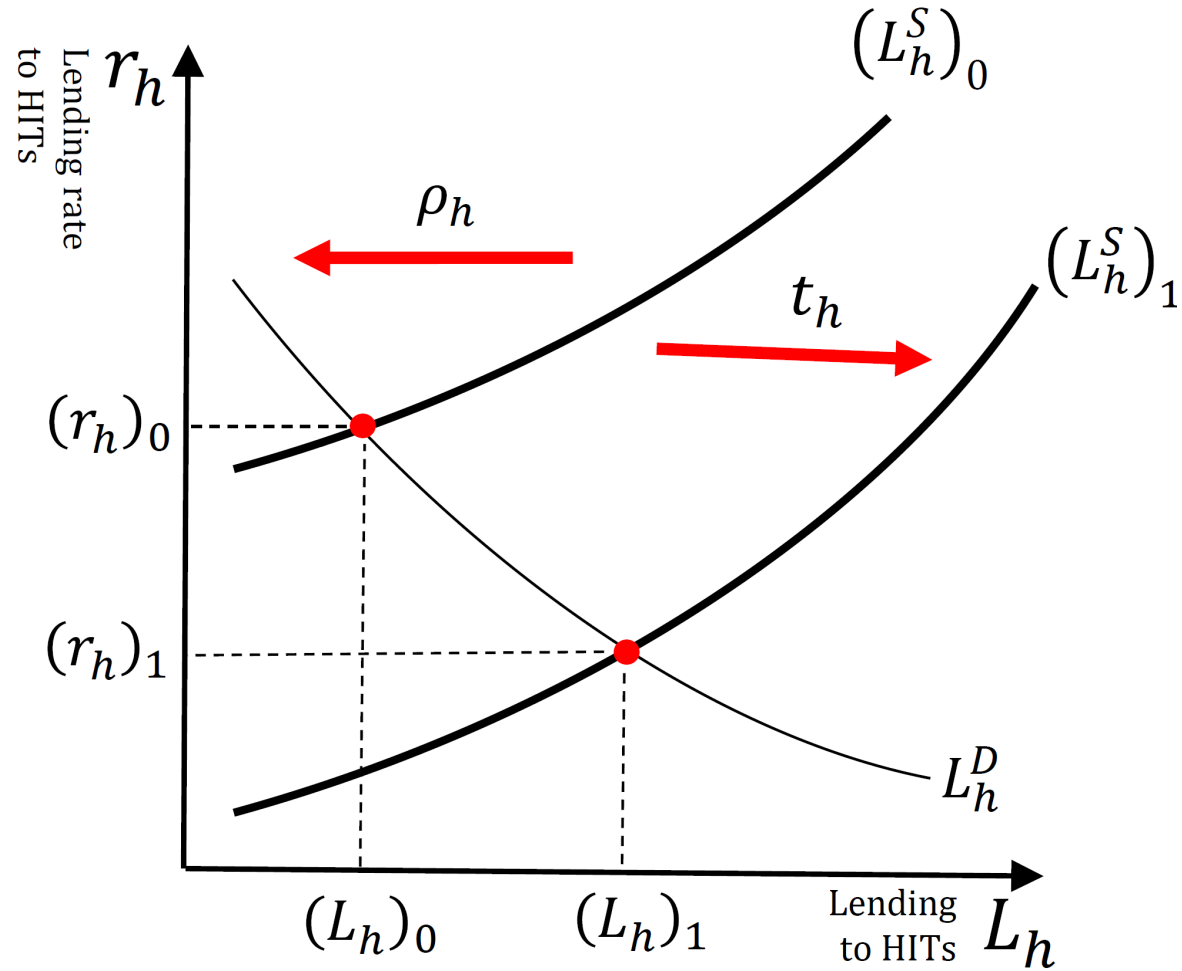
Equation 1 shows the profit equation of bank (π). We are assuming there are two kinds of loans banks are providing—the first kind are zero default risk loans (L_1) which are ordinary loans provided at a lower interest rate (r_L); the second kind are loans to risky sectors (L_H) at a higher interest rate (r_H). We are assuming that the first group of loans are zero risk and the second group has risk of default (ρ_H). In this equation D denotes total deposits and r_D is the interest rate on deposits. In addition, banks' profits is also a function of banks' operational costs (C) such as employee wages and computer and equipment costs, which is a function of both groups of loans. The profit maximization of banks is subject to banks' balance sheets (Eq. 2) where A is the banks' capital.

$$\rho_H . L_H \leq \theta . L = A \qquad (3)$$

Each bank has to have enough capital (A) to be able to cover its possible default loan losses ($\rho_H . L_H$). As the risk of default exists only for the second group of loans (high risk loans), the total amount of default loan losses are $\rho_H . L_H$. Total lending to both groups is denoted by : $L = L_1 + L_H$.

We assume that banks are subject to capital requirement rules (Eq. 3), i.e., according to the Basel capital requirement there is an 8% capital requirement ratio, ($\theta = 0.08$). Equation 3 means that the default amount needs to be less than 8% of the total loans (total assets) and banks need to reserve at least an equal amount of capital. This means that based on the given amount of capital, if ρ_H goes up, lending to risky sectors (L_H) should go down.

Injection of Carbon Tax into Green HITs and Higher Supply of Money to Green Projects



Government Financing (Externality Effects)

1, Measure the negative external effects of CO_2 and NOX

2, Levy Tax on CO_2 and NOX

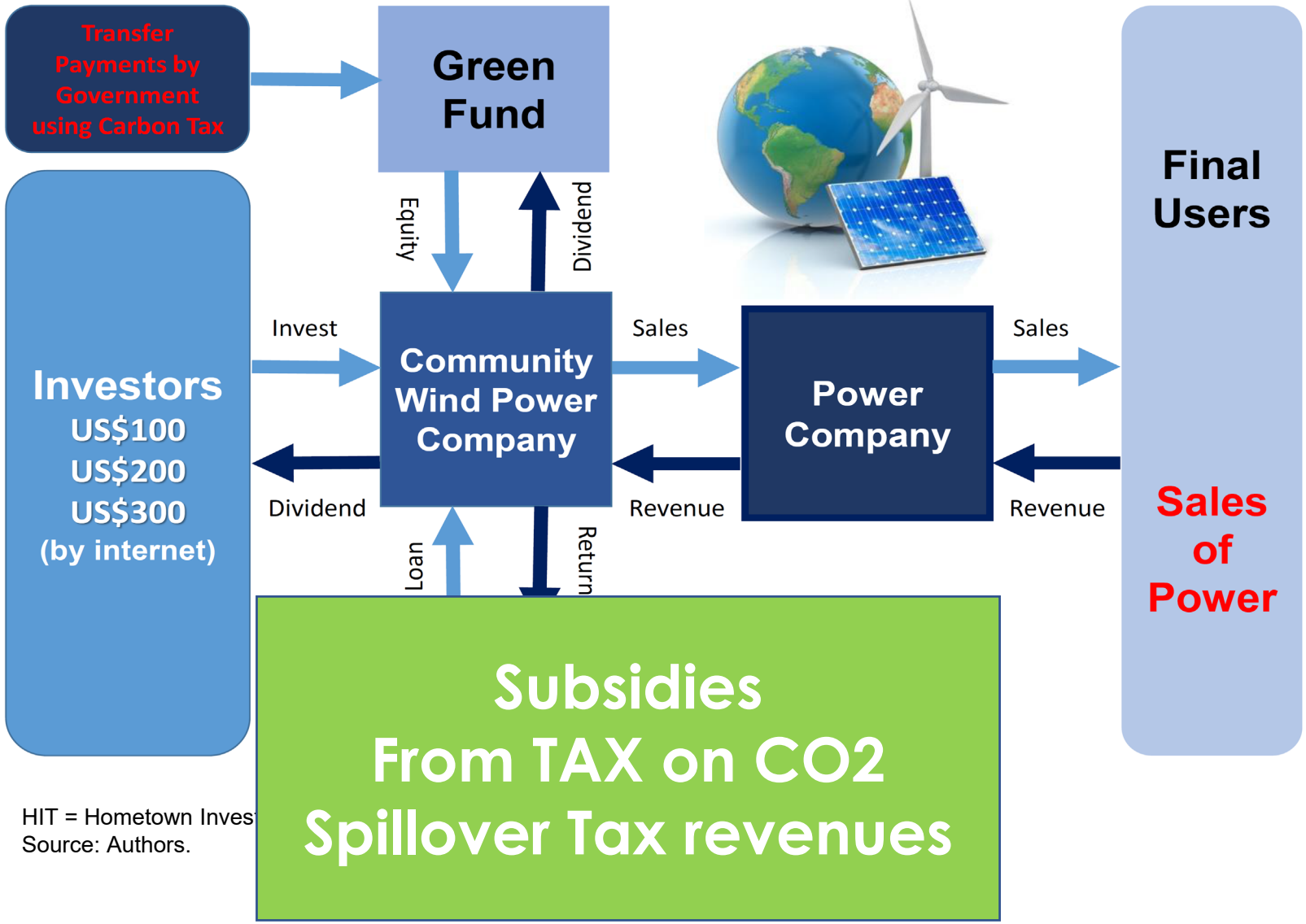
→ Transfer subsidies to renewable energy

3, Provide subsidy to renewable energy projects

→ Injection of tax revenues to investors in renewables

→ R&D (renewable energy sector)

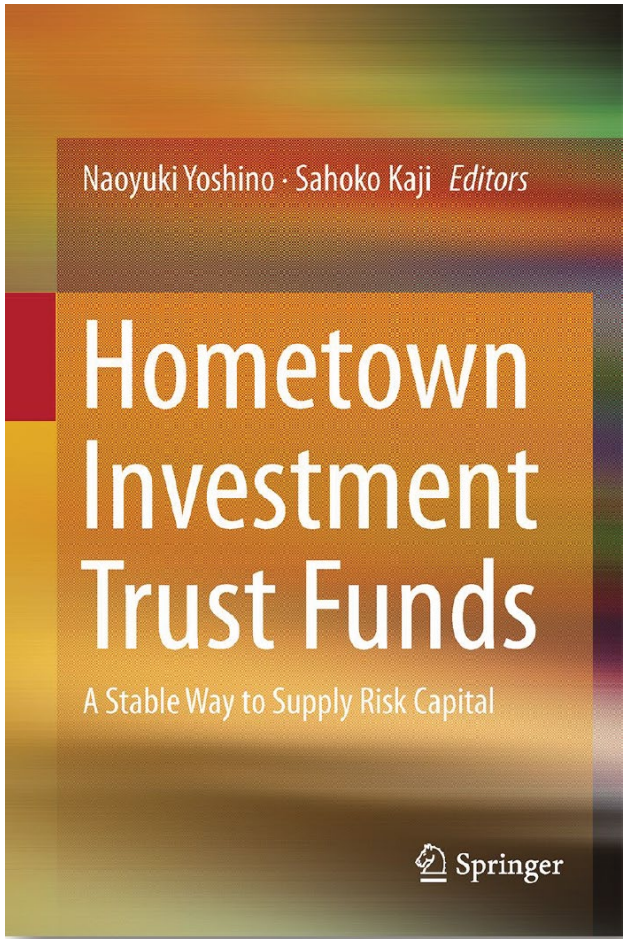
Financing Scheme for Renewable Energy Projects Using HITs and Carbon Tax

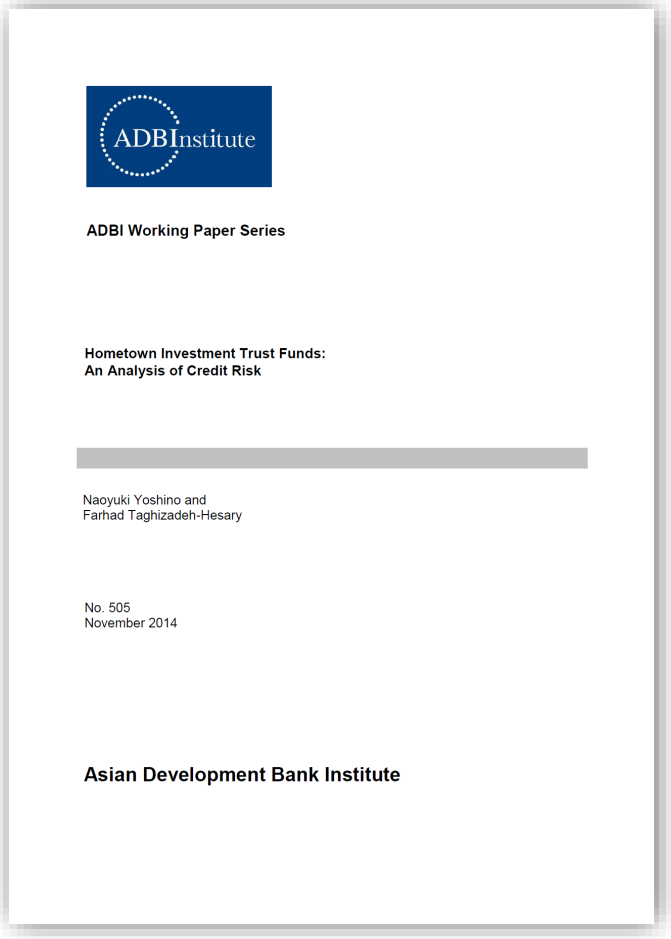


HIT = Hometown Inves
Source: Authors.

Springer

Possible Solutions
by use of community funds
For Risky businesses





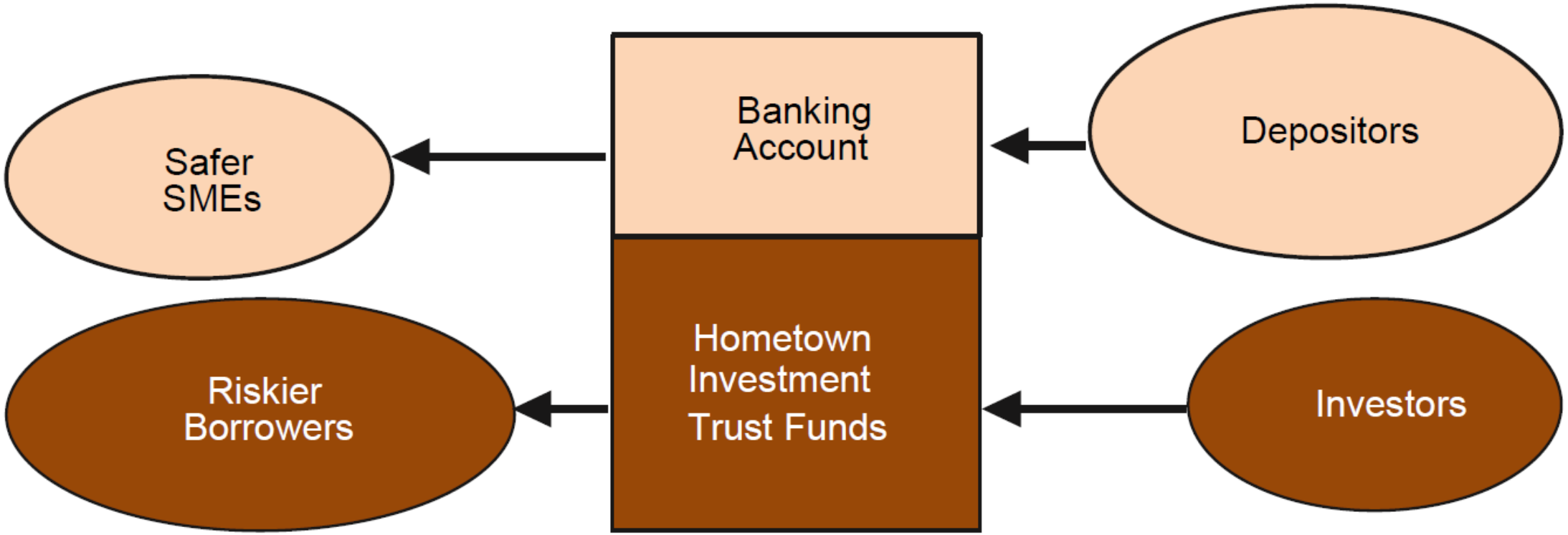
Hometown Investment Trust Funds

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

ADBI Working Paper Series

Naoyuki Yoshino and
Farhad Taghizadeh-Hesary

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).

Structure of Wind Power Fund

249 people participated (donation and investment)

Total cost of one wind power = 2 million US $

5% extra price is charged = (1+0.05)X PE

People should reduce Energy consumption by 5%

so that total energy costs remain the same

<Bank Loans to environmental projects>

Revenue : **sales price**

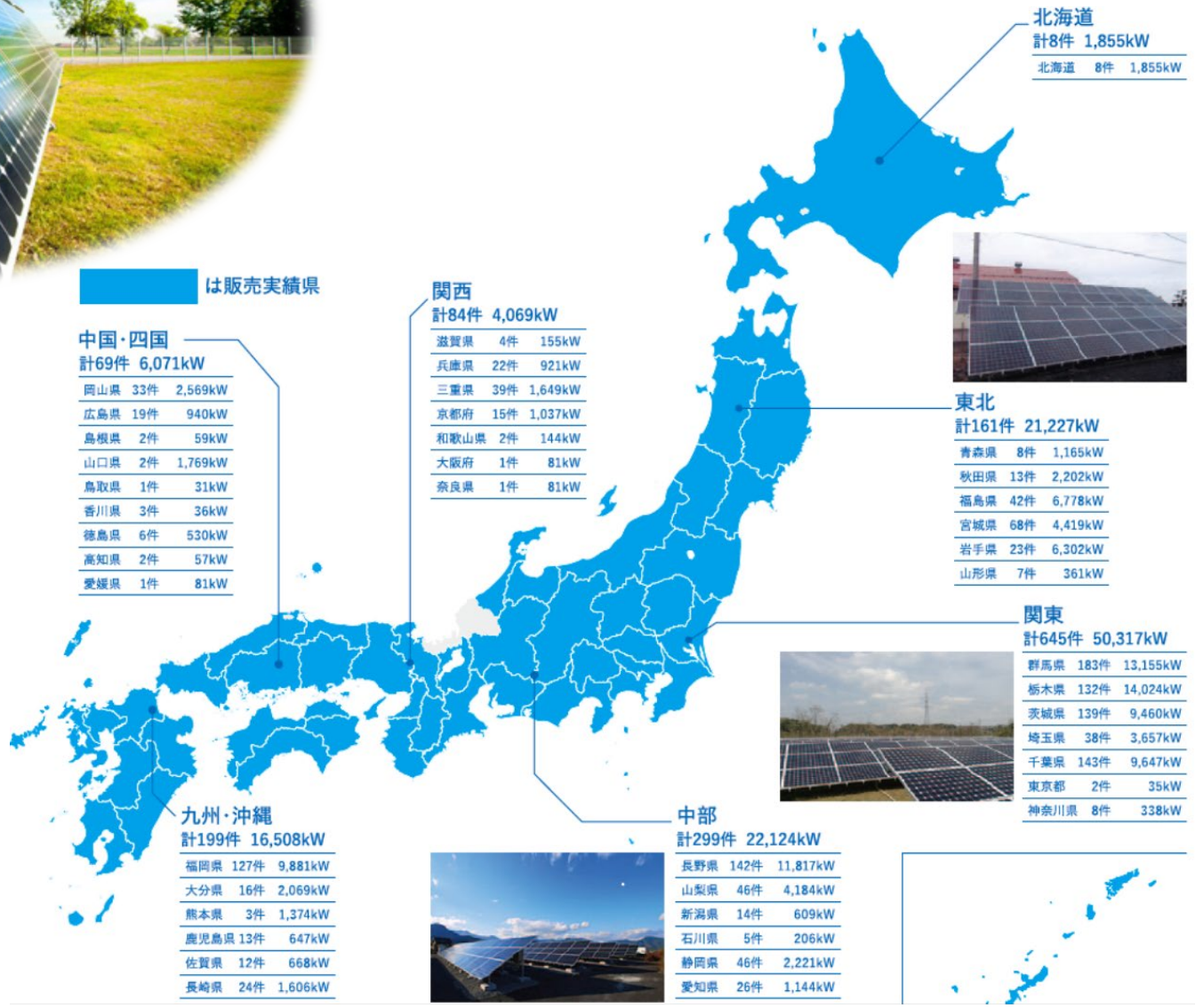
of electric power supply

cannot set the price

based on MC

(Price=MC)

Solar Power projects in Japan



Scheme of Financing Power Panels

Local Government Subsidies (2/3)

377 Solar power plants

Power Company

Private Individuals

Hometown Trust Funds

1000 US$ – 5000 US $

Village Funds for Green Energy

1, Collect Small Amount of Money

2, Solar power panel with battery

3, Use solar power for local manufacturing

4, Use solar power for agriculture

5, Sales of village products will increase

6, Construct Another solar power plant

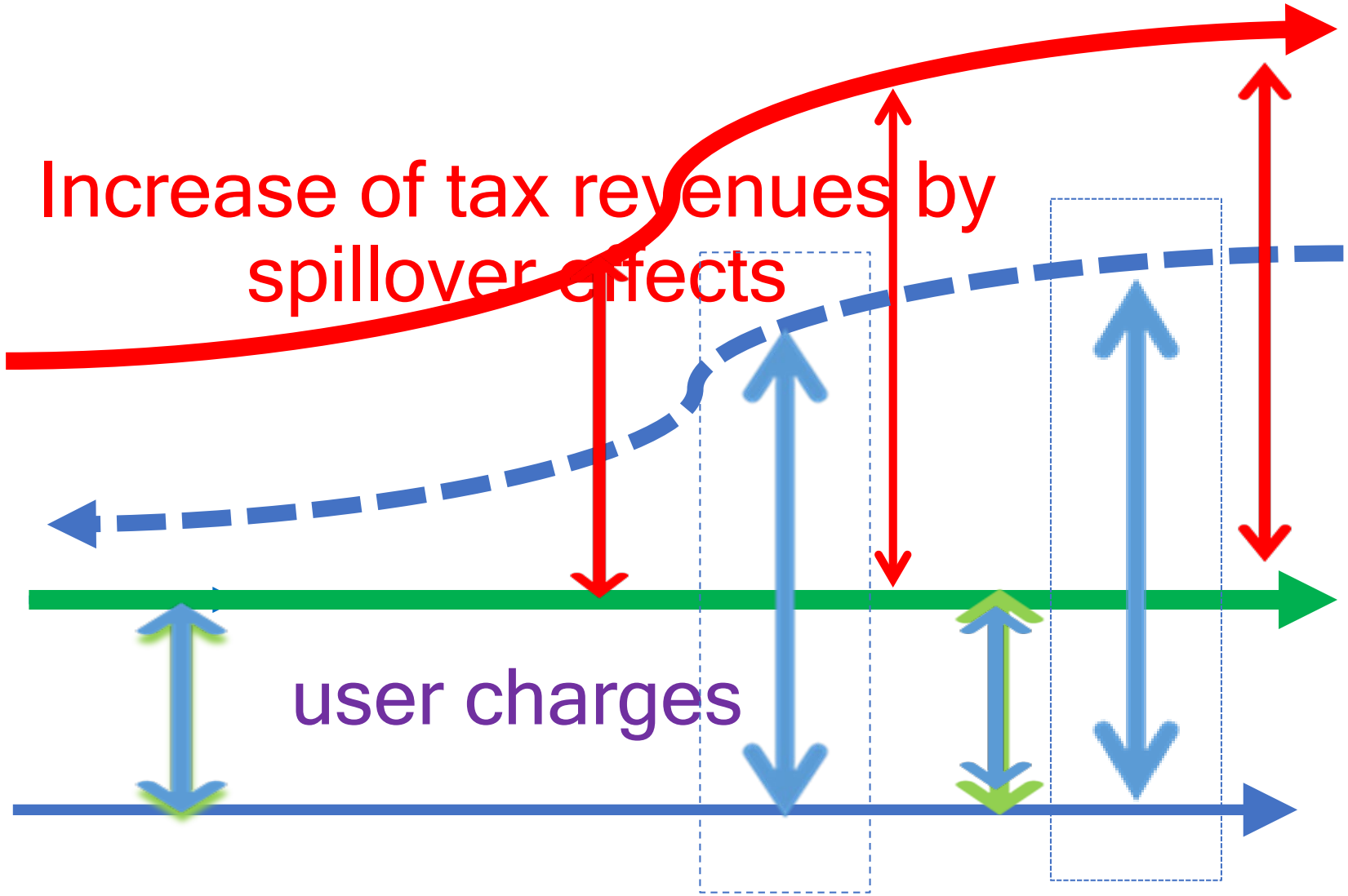
7, Step by step approach to increase electricity in the village

Revitalization of Tsukubane Hydro Power (Nara state)

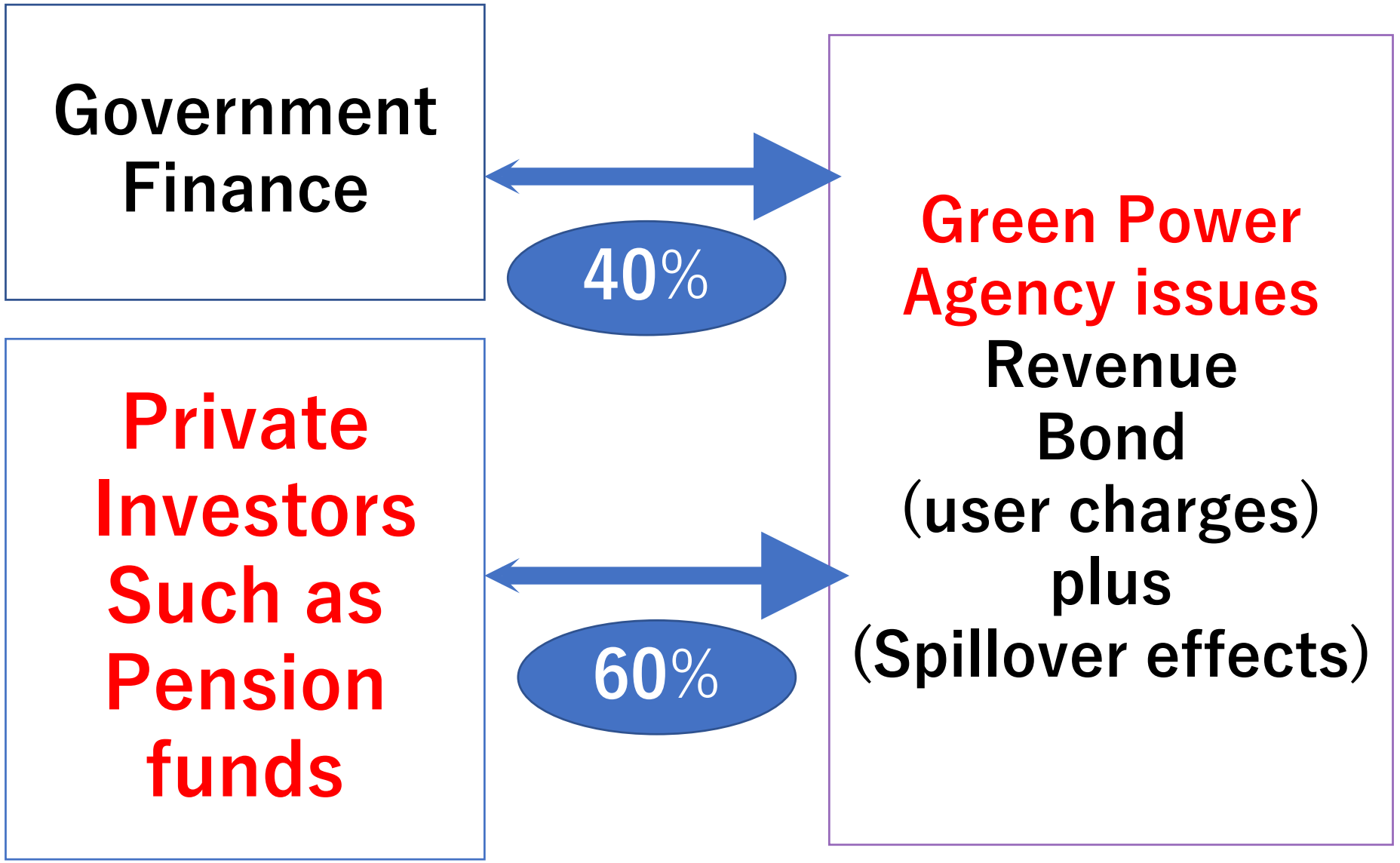
250 investors, total 525 thousand US dollars, Japan

Original Dam was constructed more than 100 years ago

Injection of Increased Tax revenues



Revenue Bond for Infrastructure Investment



Macroeconomic Effect of Infrastructure Investment

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

Thank you for your Attention

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ALTERNATIVES TO BANK FINANCE: ROLE OF CARBON TAX AND HOMETOWN INVESTMENT TRUST FUNDS IN DEVELOPMENT OF GREEN ENERGY PROJECTS IN ASIA

By Naoyuki Yoshino and Farhad Taghizadeh-Hesary