ESG Investments, Credit Guarantee, and Debt Overhang by MSMEs

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Outline

1, ESG Investment and Needed Remedies

2, Carbon tax

3, Optimal Credit Guarantee Ratio

4, Credit Guarantee Fee

5, Green SMEs and Loan Shark

Green Banking to SMEs

Banks used to watch

"Rate of Return" and "Risks"

Attention has to be paid to "Green factors"

ESG scoring

Green Bonds (Green Credit Rating)

Carbon Pricing and Carbon Trading

Carbon Tax

Current ESG lending: distort asset allocation

1, Banks' Loan Allocation :

two-parameter approach

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

(iii) Greenness score): multi-factor approach

2, ESG criteria is different from one rating agency to another

3, Each bank changes its' asset allocation based on specific score of ESG given by the rating agency

Different Evaluation scores of ESG by various Rating Agencies

Table 1: Rating methods provided by major ESG rating agencies

ESG Score	Evaluation criteria overview
Bloomberg ESG Disclosure Scores	Evaluated based on the degree of disclosure. Environmental aspects are evaluated based on the degree of disclosure.
FTSE Russell's ESG Ratings	ESG risks are evaluated based on disclosure, commitment to policy formulation and improvement, etc. In terms of the environment, in addition to disclosure, we evaluate the existence of policies and commitments to improvement.
MSCI ESG Ratings	Evaluated based on 37 key ESG issues (ESG key issues). The environment side is also evaluated by setting a key issue.
Sustainalytics' ESG Risk Ratings	Based on ESG measures, information disclosure, and the level of problems. The same is true in terms of the environment.
Thomson Reuters ESG Scores	10 items: for the Environment factor, resource use, emissions, and innovation; for Society factor, employees, human rights, local communities, and product responsibility; and on Governance, management, shareholders, and CSR strategy. Regarding the environment, evaluated based on actual carbon emissions and whether or not there is a policy.

(Source) Created by the authors after processing part of the data of Yoshino and Yuyama (2021), Yuyama (2020), and each rating agency.

E-scores Environmental Scores

Different ESG Scores by different rating agencies

－－＞ESG rating: based on CO2 emissions

	Bloomberg	Sustainalytics	Robecco SAM
Company A	2.9	9.6	8.6
Company B	3.9	1.3	1.8

Tools to Measure CO2 Emissions in Japan

35 US $

[PR] 【月末月初11%OFF】正規品 TOAMIT 東亜産業 CO2マネージャ…

5,980円 送料無料

45 US $

[PR] 【高評価★4.54/楽天1位】二酸化炭素濃度計 CO2測定器 CO2セン…

7,480円 送料無料

20 US $

[PR] 二酸化炭素濃度計 co2モニター co2測定器 CO2マネージャー 二酸…

2,980円 送料無料

Asian Economic Papers, MIT Press, 2023

Diversified ESG Evaluation by Rating Agencies and Net Carbon Tax to Regain Optimal Portfolio Allocation*

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Pressure from the market

Large Business

Stock market

Corporate bond market

een bonds)

Banks

No market pressure,

MSMEs

Informal markets

No money, No technology

1, Lower carbon tax rate compared to Large businesses

make SMEs aware of the importance of Cabon emissions

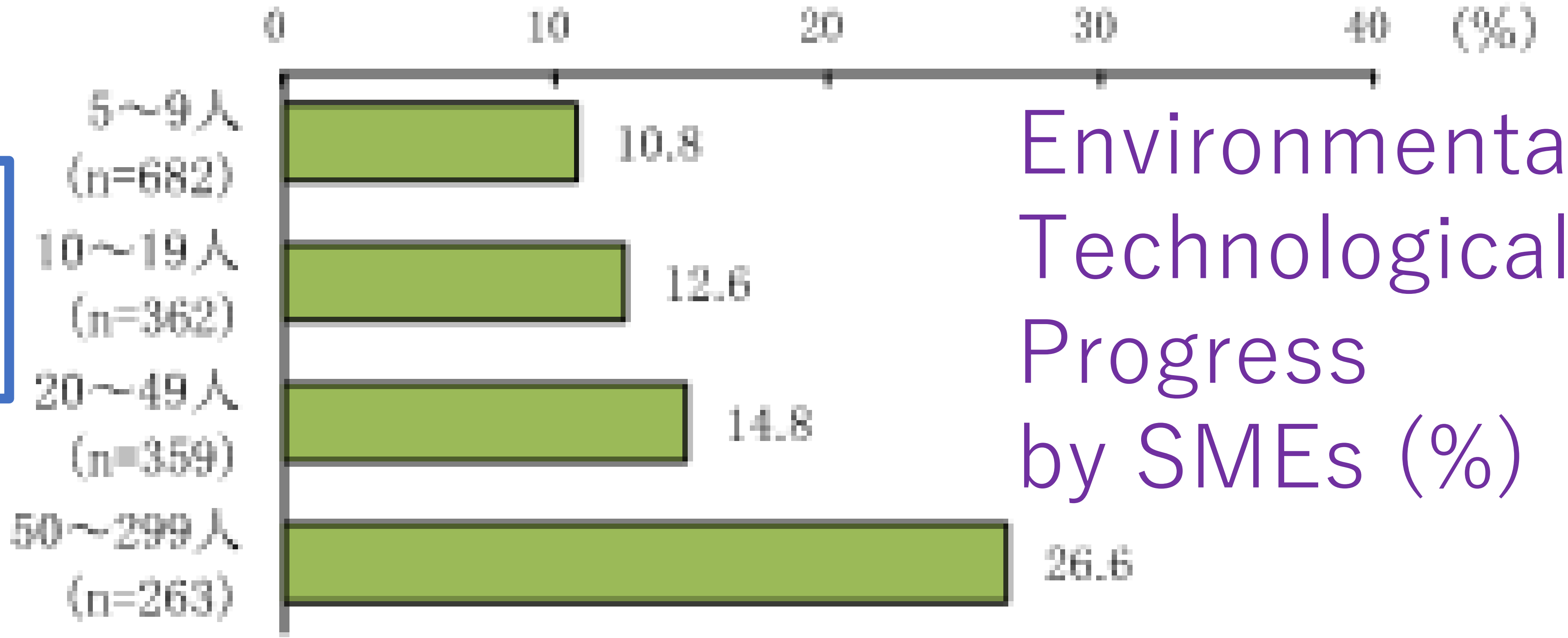
2, Net Carbon tax (CO2 emissions – Green investments)

2, Global taxation on Carbon emissions

3, Technological transfer from large businesses to SMEs

Adoption of New Environmental Technologies: Slow Progress among SMEs

Number of Employee



Environmental Technological Progress by SMEs (%)

Survey by Japan Finance Corporation, 2023

Why is it so slow by SMEs to tackle with CO_2 ?

(1) Too much costs to reduce CO_2 (23.5%)
(2) Time consuming （15.0%)
(3) Lack of financing （14.1%)
(4) Do not know what kind of technology to be introduced (13.2%)
(5) There is no knowhow (9.8%)

	コストが増える	手間がかかる	資金が不足している	どう取り組めばよいかわからない	必要なノウハウや人材が不足している
全 体	23.0	15.0	14.1	13.2	9.8

What would be needed for SMEs in Japan?

1, Subsidies from the government (21.6%)
2, Social Mechanism to introduce (9.8%)
3, Easy Access to Finance (9.0%)
4, Easy Use of technology and products (8.9%)
5, Consultation with the government (8.3%)
6, High Reputation by reducing CO2 (8.8%)
7, Cooperation within the same sector (5.2%)

	補助金・優遇税制	利用しやすい社会の仕組み	資金調達での優遇	利用しやすい商品・サービス	行政・組合・商工団体による支援・情報提供	取り組む企業への高い社会的評価	業界内の協調
全 体	21.6	9.8	9.0	8.9	8.3	5.5	5.2

Mitsui-Sumitomo Bank (private bank) starts consulting services and bank credit to SMEs

Mitsui-Sumitomo Bank

Bank

Loans

SMEs

ASUENE consulting company→

consulting services

the way to reduce GHG by SMEs

Net Carbon Tax= t x (CO2)

[Amount of Carbon emission] - [green investments]

$$\tilde{R}_t^A = R_t^A - \underline{T_t^A} \tag{11}$$

$$\tilde{R}_t^B = R_t^B - \underline{T_t^B} \tag{12}$$

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:

$$\tilde{R}_t = \tilde{\alpha}_t \tilde{R}_t^A + (1 - \tilde{\alpha}_t)\tilde{R}_t^B \tag{13}$$

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

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 $\tilde{\alpha}$:

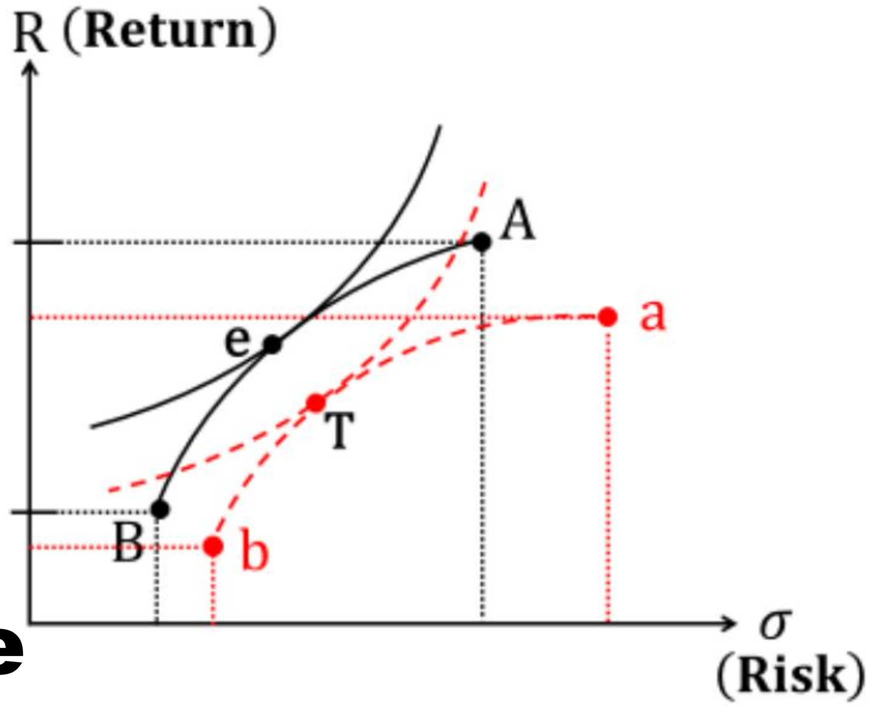
$$\frac{\partial U}{\partial \tilde{\alpha}_t} = (\tilde{R}_t^A - \tilde{R}_t^B) - \beta\{2\tilde{\alpha}_t(\tilde{\sigma}_t^A)^2 + 2(1 - \tilde{\alpha}_t)(\tilde{\sigma}_t^B)^2\} + (2 - 4\tilde{\alpha}_t)\tilde{\sigma}_t^{AB} = 0 \tag{15}$$

$$\tilde{\alpha}_t = \frac{\frac{1}{2\beta}\left(\tilde{R}_t^A - \tilde{R}_t^B\right) - (\tilde{\sigma}_t^B)^2 - \tilde{\sigma}_t^{AB}}{(\tilde{\sigma}_t^A)^2 - (\tilde{\sigma}_t^B)^2 - 2\tilde{\sigma}_t^{AB}} \tag{16}$$

Evidently, as in equation (16), investors do not need to consider ESG as an additional item, as shown in equation (7). Instead, investors maximize their utility based only on the rate of return and the risk after tax. The optimal portfolio allocation is as shown in equation (16). $\tilde{\alpha}_t$ indicates the optimal portfolio as shown in Figure 3.5 by point *f*. *f* is the optimal point after the adoption of the international GHG taxation scheme.

Banks can only pay attention to
(1)after-tax rate of return
(2)after-tax risks
without paying attention to Green scores

Net Carbon TAX = t x (CO2) (=CO2 – Greenness Efforts)



After Tax: Return and Risks

Optimal portfolio allocation can be achieved by taxing on net carbon emission

Company A’s return after carbon tax: $\underline{R_A} = R_A$ – (Carbon Tax TA)

Risks After Carbon Tax: $\underline{\sigma}\ \underline{A}$

Company B’s return after carbon tax: $\underline{R_B} = R_B$ – (Carbon Tax TB)

Risk After Carbon Tax: $\underline{\sigma}\ \underline{B}$

Carbon Tax can be used as subsidies

1, Lower carbon tax rate compared to Large businesses (Gradual increase in tax rate)

make SMEs aware of the importance of Carbon emissions

2, Net Carbon Tax

(CO2 emissions – Green investments)

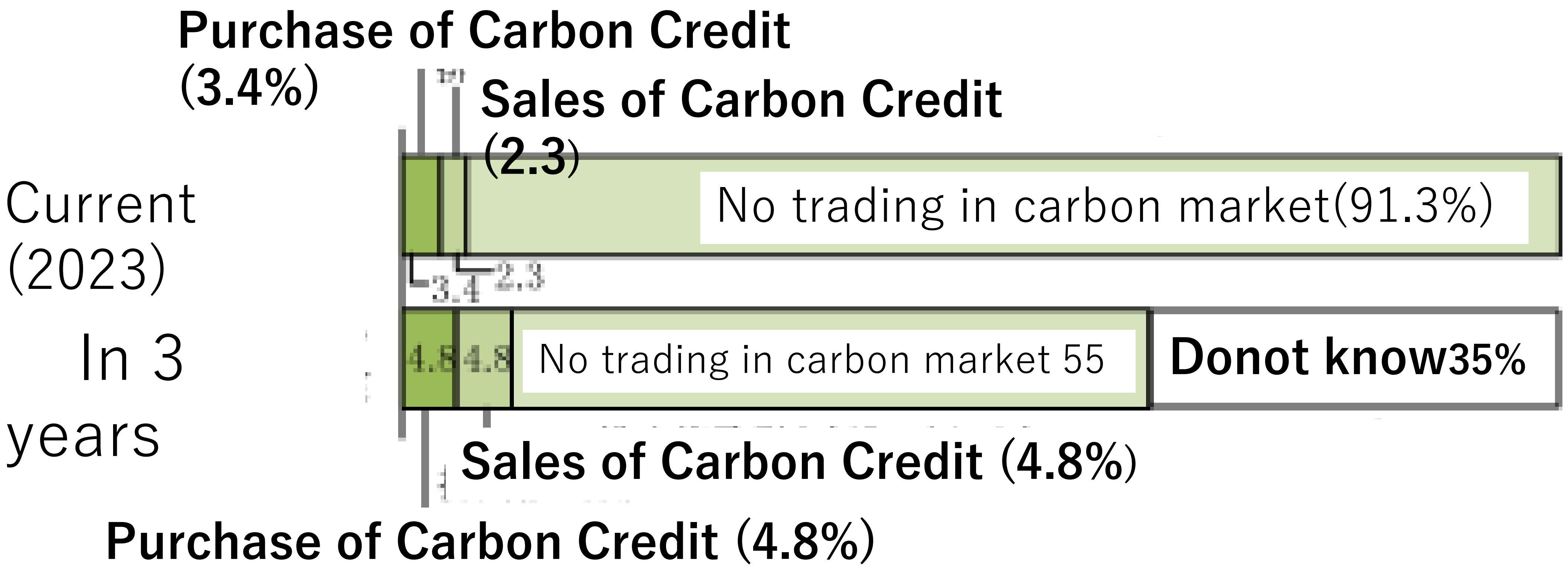
3, Global taxation on Carbon emissions

4, Technological transfer from large businesses to SMEs by government subsidies

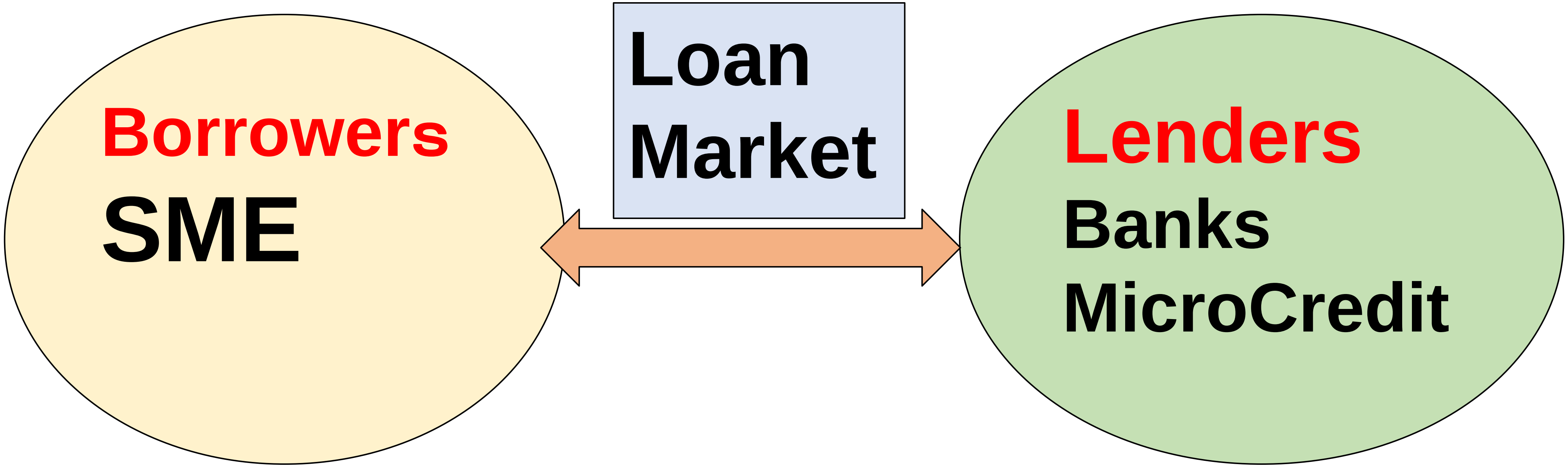
5, Investors can only attention to R and Risk

Carbon Trading and Carbon Pricing by SMEs

Current status of carbon trading in Japan



Credit Guarantee for MSMEs
Borrower, Lender and Loan Market

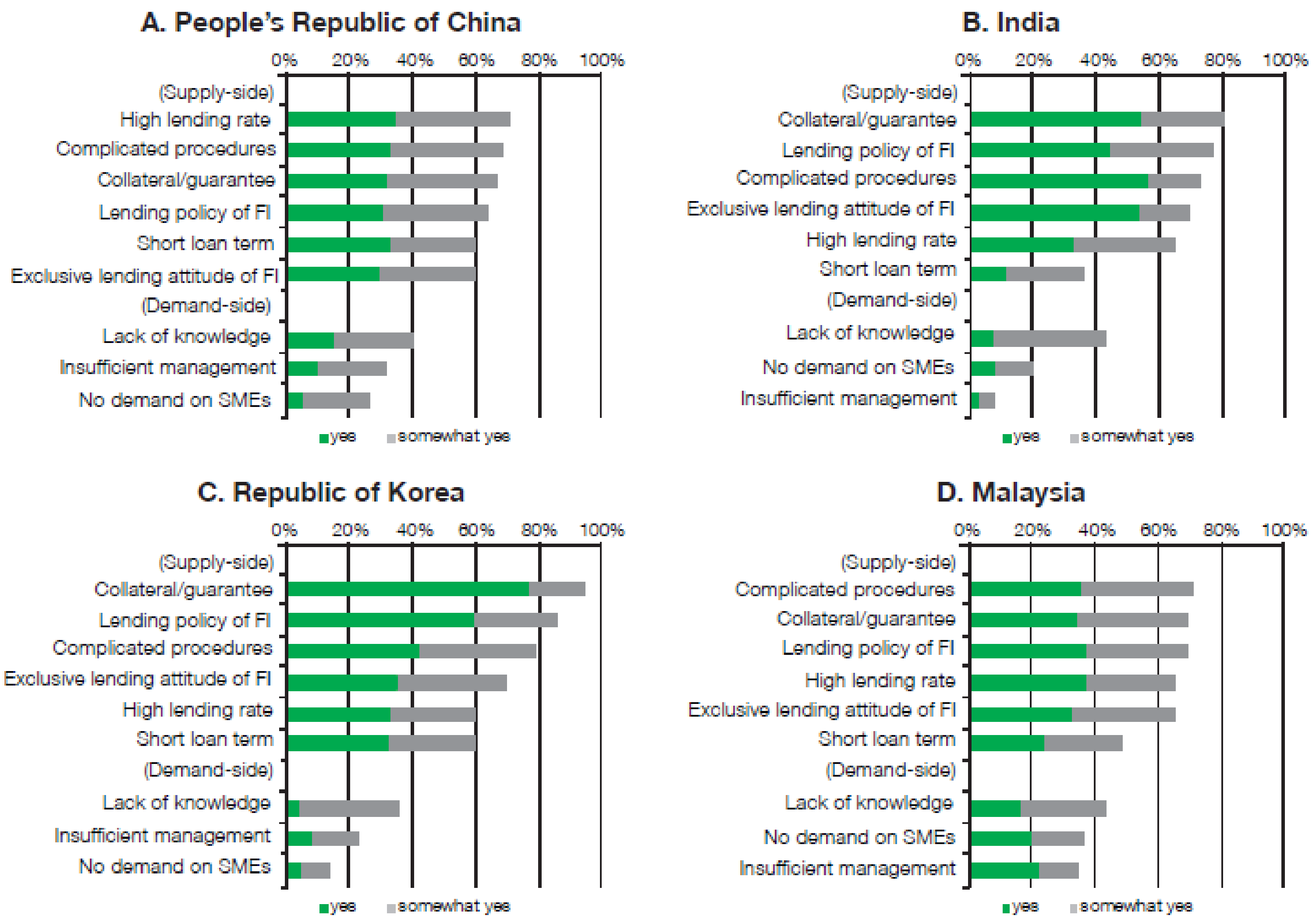


Information Asymmetry between Lenders and Borrowers
Especially in MSMEs' market

Four Accounts by SMEs

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

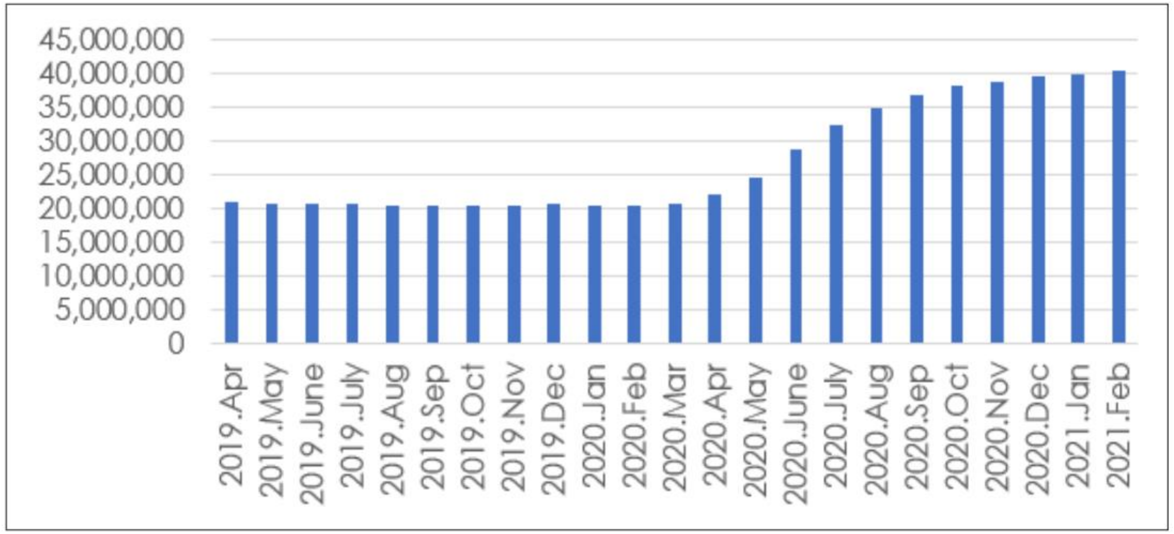
Barriers for SMEs in Accessing Financial Institutions, ① Collateral, ② Higher interest rate, ③ long term process



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

Increase of Credit Guarantee After Covid-19

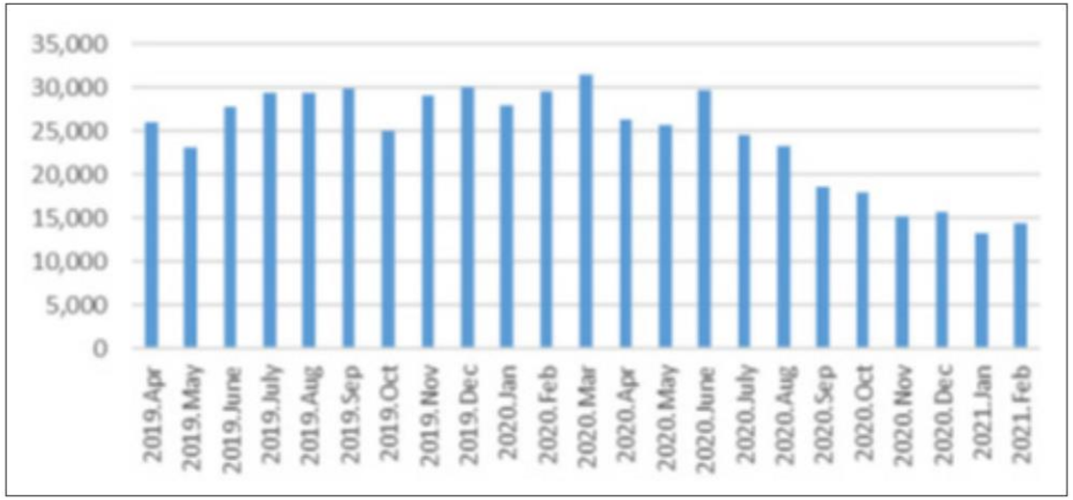
Figure 12: Accumulated amount of credit guarantees (monthly, million yen)



Source: Japan Federation of Credit Guarantee Corporations

Decline in defaults

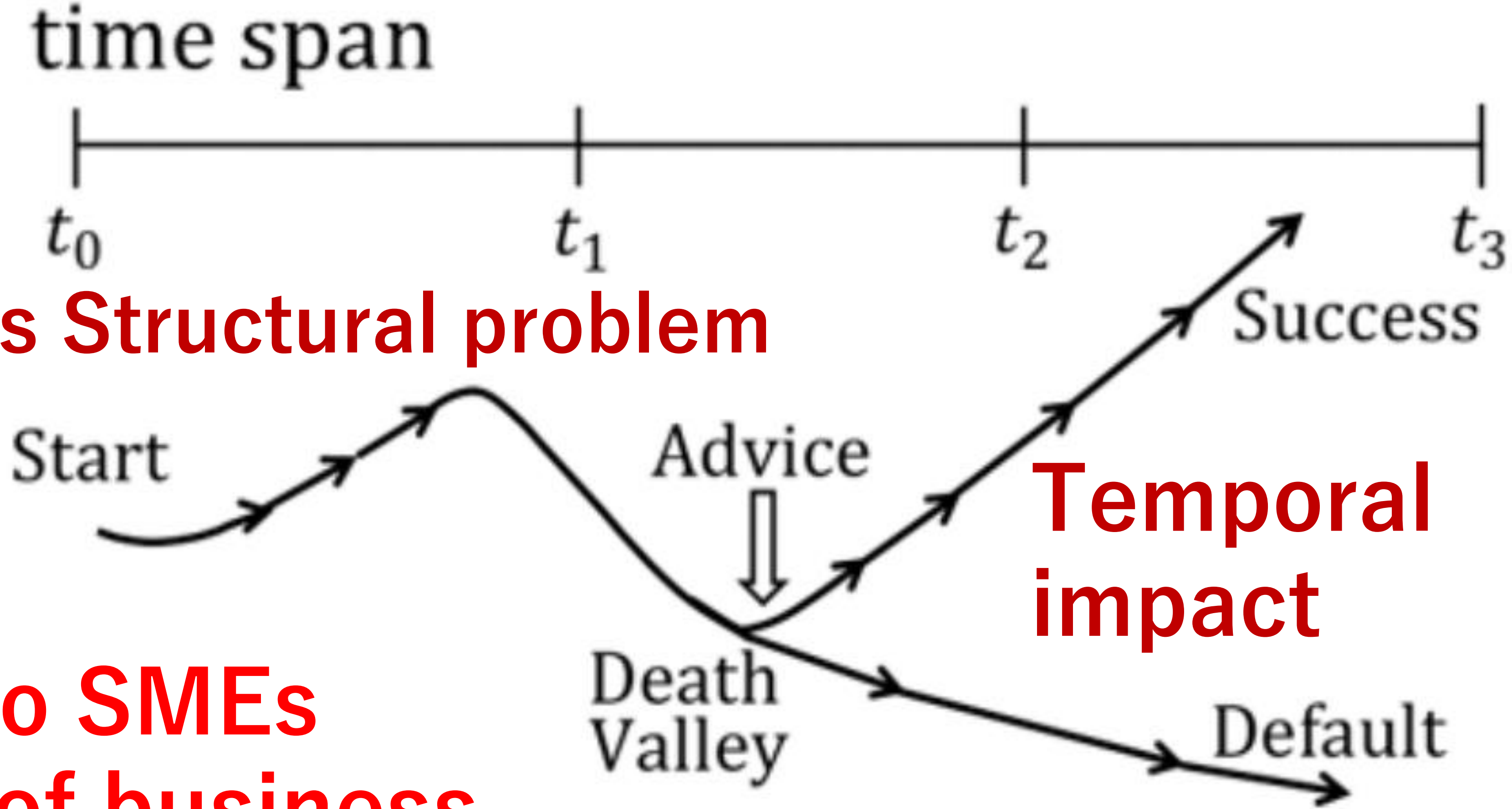
Figure 13: Actual amount of default (monthly, million yen)



Source: Japan Federation of Credit Guarantee Corporations

Temporaly affected SMEs should be rescued

Temporal impact vs Structural problem



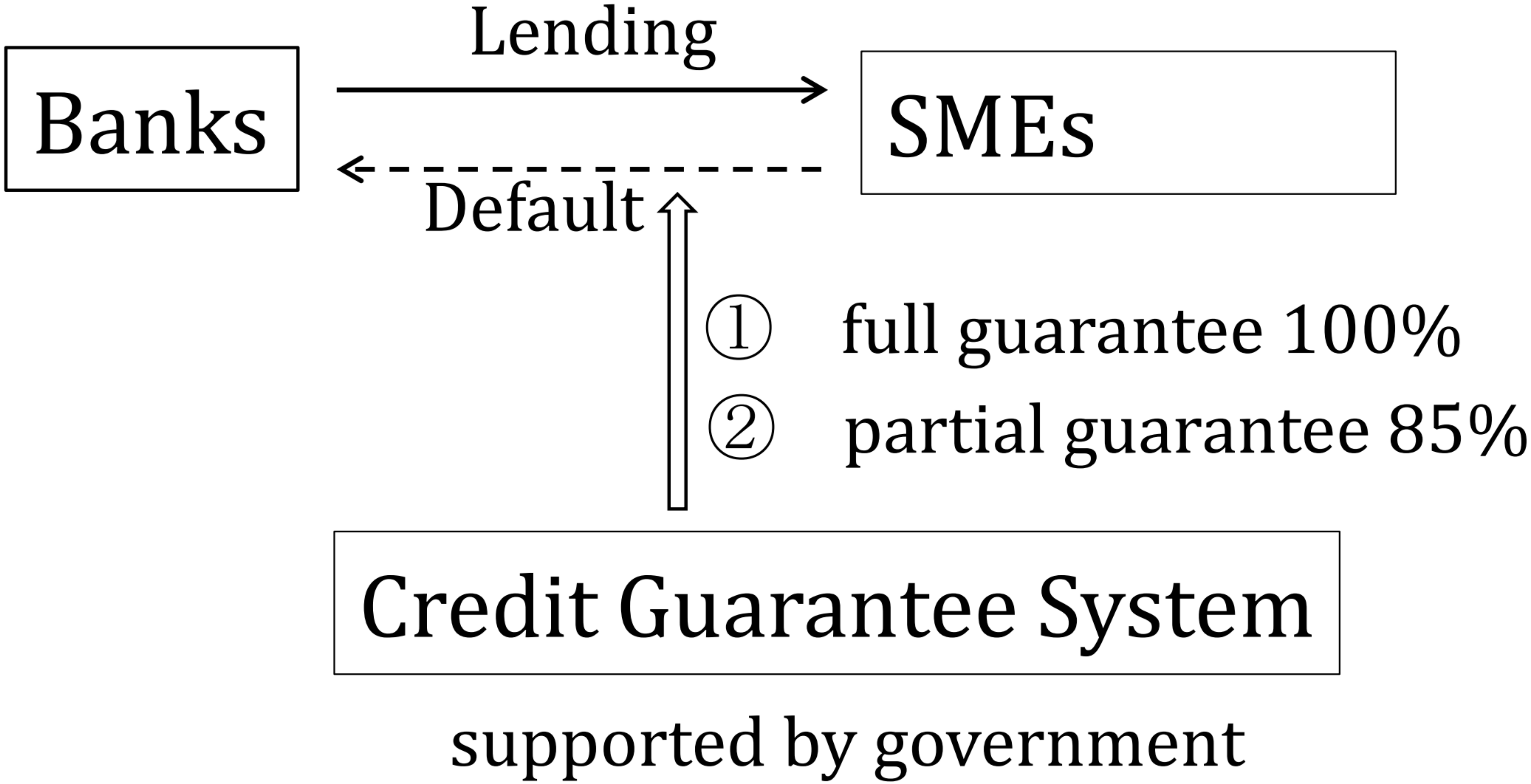
Temporal impact

→ Give advices to SMEs
→ Improvement of business

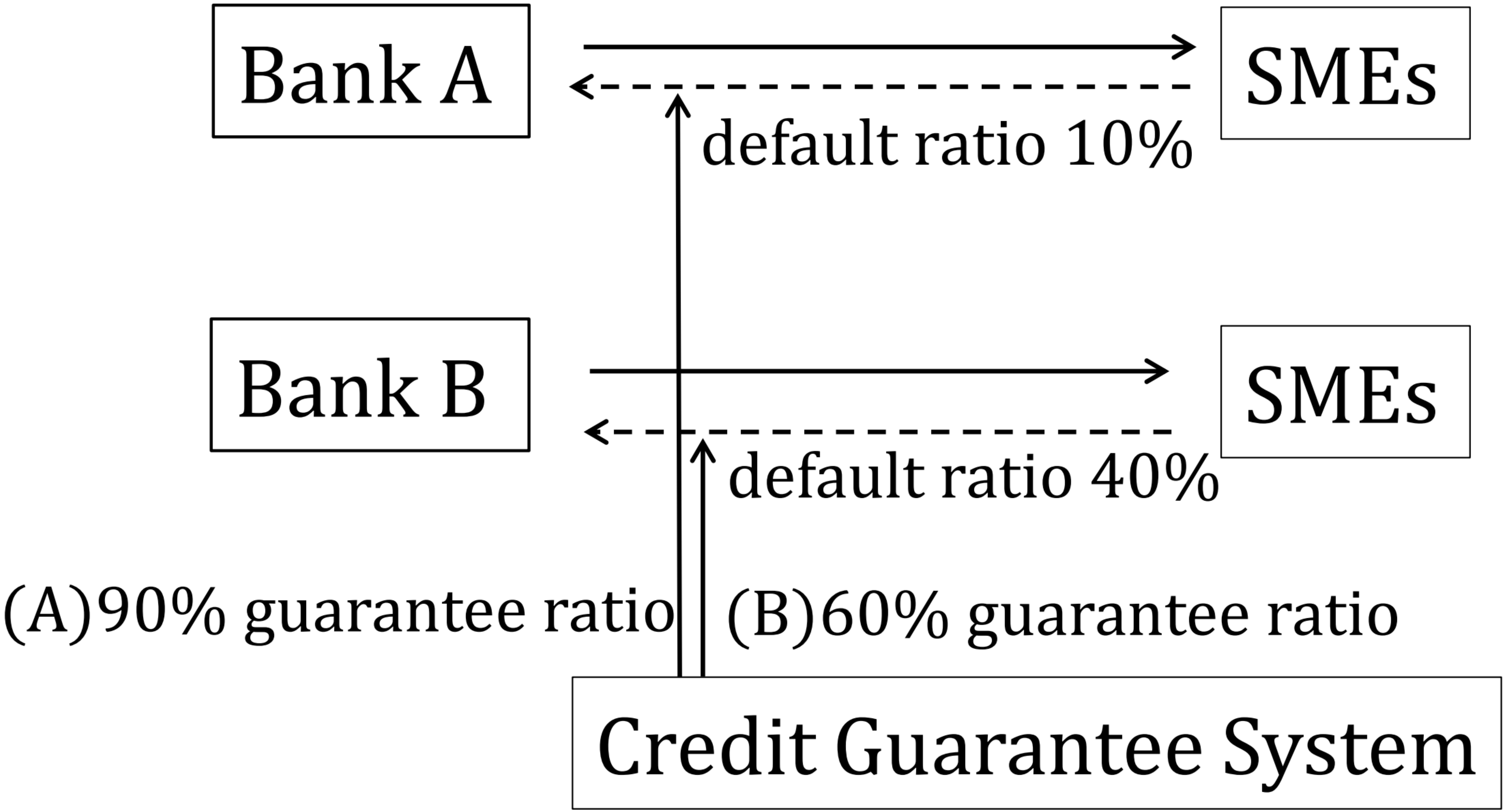
Structural Problem

Data driven analysis is needed.

<Moral Hazard Problem>



<Differentiated Credit Guarantee Ratio>



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Full length article

Optimal credit guarantee ratio for small and medium-sized enterprises' financing: Evidence from Asia

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3.1. *Policy objective function*

The equation below shows the policy objective function of the government:

$$U = w_1 \left(L - L^*\right)^2 + w_2 \left(\rho - \rho^*\right)^2 \tag{1}$$

Policy Objective Function

where U is the government objective function. Eq. (1) shows that the government has two objectives when determining the optimal credit guarantee ratio for bank loans to SMEs. The first objective is to stabilize the quantity of loans to SMEs $(L - L^*)$, where L is actual SME loans and L^* is desired SME loans. The second objective of the government is to set the nonperforming loans ratio to a desired ratio$(\rho - \rho^*)$, where ρ is the current default risk ratio of loans, and ρ^* is the desired default risk ratio of loans. w_1 and w_2 in Eq. (1) are the policy weights for the two objectives. w_1 is the weight for stabilizing SME loans, and w_2 is the weight for reducing the nonperforming loan ratio. If the two objectives have equal weight, then $w_1 = w_2 = 0.5$.

In the next step, we insert the loan demand function from Eq. (2) in Eq. (9), and write the expanded version of ρ as in Eq. (11), in Eq. (9) and then write it for g, yielding the result below:

$$g = -\frac{1}{\alpha_1 \left(\frac{w_1 l_1^2}{4} + w_2\right)} . w_1 \frac{l_1^2}{4} \left(\frac{l_0}{l_1} + \frac{l_2}{l_1} y^e - r_D - \rho_L'\right) + \frac{l_1}{2\alpha_1} L^* - \frac{w_2}{\alpha_1} \rho^* - \frac{\alpha_2}{\alpha_1} Y - \frac{\alpha_3}{\alpha_1} P_L - \frac{\alpha_4}{\alpha_1} P_S + \frac{\alpha_5}{\alpha_1} M + \frac{\alpha_6}{\alpha_1} Z \tag{12}$$

Optimal Credit Guarantee ratio

were not accessible for us such as government policies, we set assumptions. Results shows that for Group 1 the optimal credit guarantee ratio is 0.775% and for Group 2 (banks that are less healthy), the calculated optimal credit guarantee ratio is 0.683%. There is clearly a significant difference between the two rates. It means governments, to avoid moral hazard and incentivize Group 2 banks to raise their level of healthiness and manage their nonperforming loans, should give different rates to each group.

From Eq. (2), we can write the interest rate on the loan as below:

$$r_L = \frac{1}{l_1}\left(l_o + l_2 Y^e - L\right) \tag{5}$$

Loan Demand by SMEs

In the next step, to get the amount of loan in equilibrium, we obtain first-order condition of the bank's profit function with respect to loan (L) as below:

$$\frac{\partial \Pi}{\partial L} = -\frac{1}{l_1} \times L + \left[\frac{1}{l_1}\left(l_o + l_2 Y^e - L\right)\right] - \rho\left(g, Y, P_L, P_S, M, Z\right) - r_D - \rho_L' = 0 \tag{6}$$

Oligopolistic banks

We then write Eq. (6) for L. The result is Eq. (7), which shows the amount of loan in equilibrium:

$$L = \frac{l_1}{2}\left[\frac{l_0}{l_1} + \frac{l_2}{l_1} Y^e - \rho\left(g, Y, P_L, P_S, M, Z\right) - r_D - \rho_L'\right] \tag{7}$$

Loan supply by Banks

In the last part, we obtain the first-order condition of the government policy objective function with respect to the optimal credit guarantee ratio (g):

$$\frac{\partial U}{\partial g} = 2w_1\left(L - L^*\right) . \frac{\partial L}{\partial g} + 2w_2\left(\rho - \rho^*\right) . \frac{\partial \rho}{\partial g} \tag{8}$$

which is equal to:

$$= 2w_1\left(L - L^*\right) . \left(\frac{-l_1}{2} . \frac{\partial \rho}{\partial g}\right) + 2w_2\left(\rho - \rho^*\right) . \frac{\partial \rho}{\partial g} \tag{9}$$

In Eq. (2) we showed that the profit of the bank is a function of various factors including default risk ratio ρ. The higher the default risk, the lower the profit for the bank (Yoshino and Hirano, 2011, 2013). Hence, we need to develop a model to capture the factors that affect this ratio:

$$\rho = f\left(g, Y, P_L, P_S, M, Z\right) \tag{10}$$

Default Risk Ratio

Optimal Credit Guarantee Ratio

$$\rho = f\left(g, Y, P_L, P_S, M, Z\right) = -\alpha_1 g - \alpha_2 Y - \alpha_3 P_L - \alpha_4 P_S + \alpha_5 M - \alpha_6 Z \qquad (11)$$

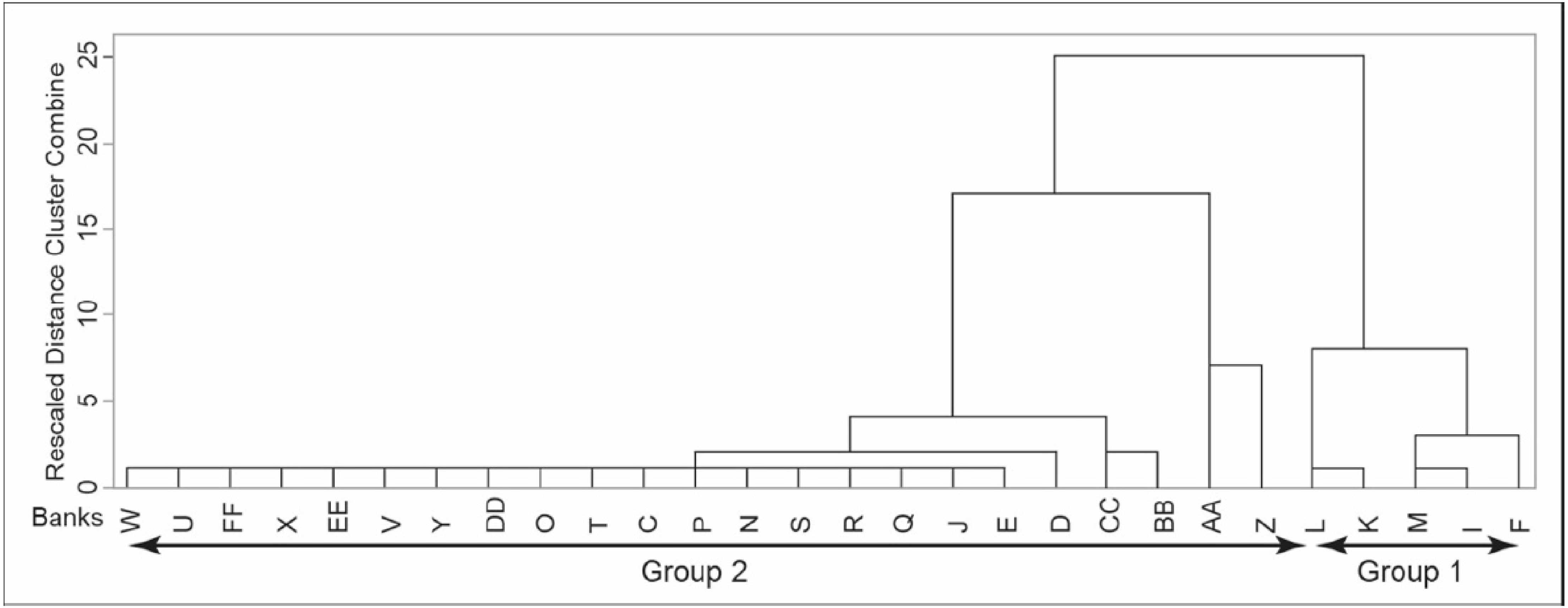
In the next step, we insert the loan demand function from equation 2 in equation 9, and write the expanded version of ρ as in equation 11, in equation 9 and then write it for g, yielding the result below:

$$g = -\frac{1}{\alpha_1\left(\frac{w_1 l_1^2}{4} + w_2\right)} . w_1 \frac{l_1^2}{4}\left(\frac{l_0}{l_1} + \frac{l_2}{l_1} y^e - r_D - \rho_L'\right) + \qquad (12)$$

$$\frac{l_1}{2\alpha_1} L^* - \frac{w_2}{\alpha_1}\rho^* - \frac{\alpha_2}{\alpha_1} Y - \frac{\alpha_3}{\alpha_1} P_L - \frac{\alpha_4}{\alpha_1} P_S + \frac{\alpha_5}{\alpha_1} M + \frac{\alpha_6}{\alpha_1} Z$$

Cluster Analysis of SMEs:NCB-Thailand

Figure 5: Dendrogram



Calculated Optimal Credit Guarantee Ratios

the optimal credit guarantee ratio in our model depends on three groups of factors:

1. **macroeconomic variables**
2. **government policies,**
3. **banking profile.**

Group 1 banks: 0.775

Group 2 banks: 0.683

These two groups consist of various variables including:price of land, price of stock, gross domestic product (GDP), money supply, actual SME loans, fixed demand for loans, deposit interest rate, expected GDP, marginal increase of nonperforming loans by increase of additional loans, desired SME loans, desired default risk ratio of loan, weight for stabilizing the SME loans, weight for reducing the nonperforming loan ratio, and financial profile of banks.

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

A model for calculating optimal credit guarantee fee for small and medium-sized enterprises

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Optimal Guarantee Fee

$$W = w_1^B\left(L_1^B - \overline{L}_1\right)^2 + w_2^B\left(L_2^B - \overline{L}_2\right)^2 + \beta w_3^R\left(L_1^R - \overline{L}_1\right) + \beta w_4^R\left(L_2^R - \overline{L}_2\right)$$

$$\frac{\partial L}{\partial \alpha_R^1} = 2w_1^B\left(L_1^B - \overline{L}_1\right)\frac{\partial L_1^B}{\partial \alpha_R^1} = 2w_1^B\left(L_1^B - \overline{L}_1\right)\left(\frac{-1}{l_1^B + 2a_1}\right)$$

$$\overline{L}_1 = L_1^B = \left(\frac{1}{l_1^B + 2a_1}\right)\left\{\left(-l_1^B L_1^B + l_2^B Y_B^e - \alpha_B^1\right) - \rho_1^B\left(1 - \theta_1^B\right) - r_D\right\}$$

$$(l_1^B + 2a_1)\overline{L}_1 = \left\{\left(-l_1^B\overline{L}_1 + l_2^B Y_B^e - \alpha_B^1\right) - \rho_1^B\left(1 - \theta_1^B\right) - r_D\right\} \tag{28}$$

Then the optimal credit guarantee fee for Group 1 SME in boom (α_1^B) is obtained from Eq. (29):

$$\alpha_1^B = (2l_1^B + 2a_2)\overline{L}_1 + l_2^B Y_B^e - \rho_1^B\left(1 - \theta_1^B\right) - r_D \tag{29}$$

Then, we can derive the other equations: i) optimal credit guarantee fee for Group 1 SME in a recession, ii) optimal credit guarantee fee for Group 2 SME in boom and iii) optimal premium fee for Group 2 SME in recession accordingly.

Credit Guarantee Fee

(Unit: annual rate %)

Classification	1	2	3	4	5	6	7	8	9
Credit Gurantee fee rate	2.20	2.00	1.80	1.60	1.35	1.10	0.90	0.70	0.50

Credit Risk Database (CRD)

Use expected default rate based on past data

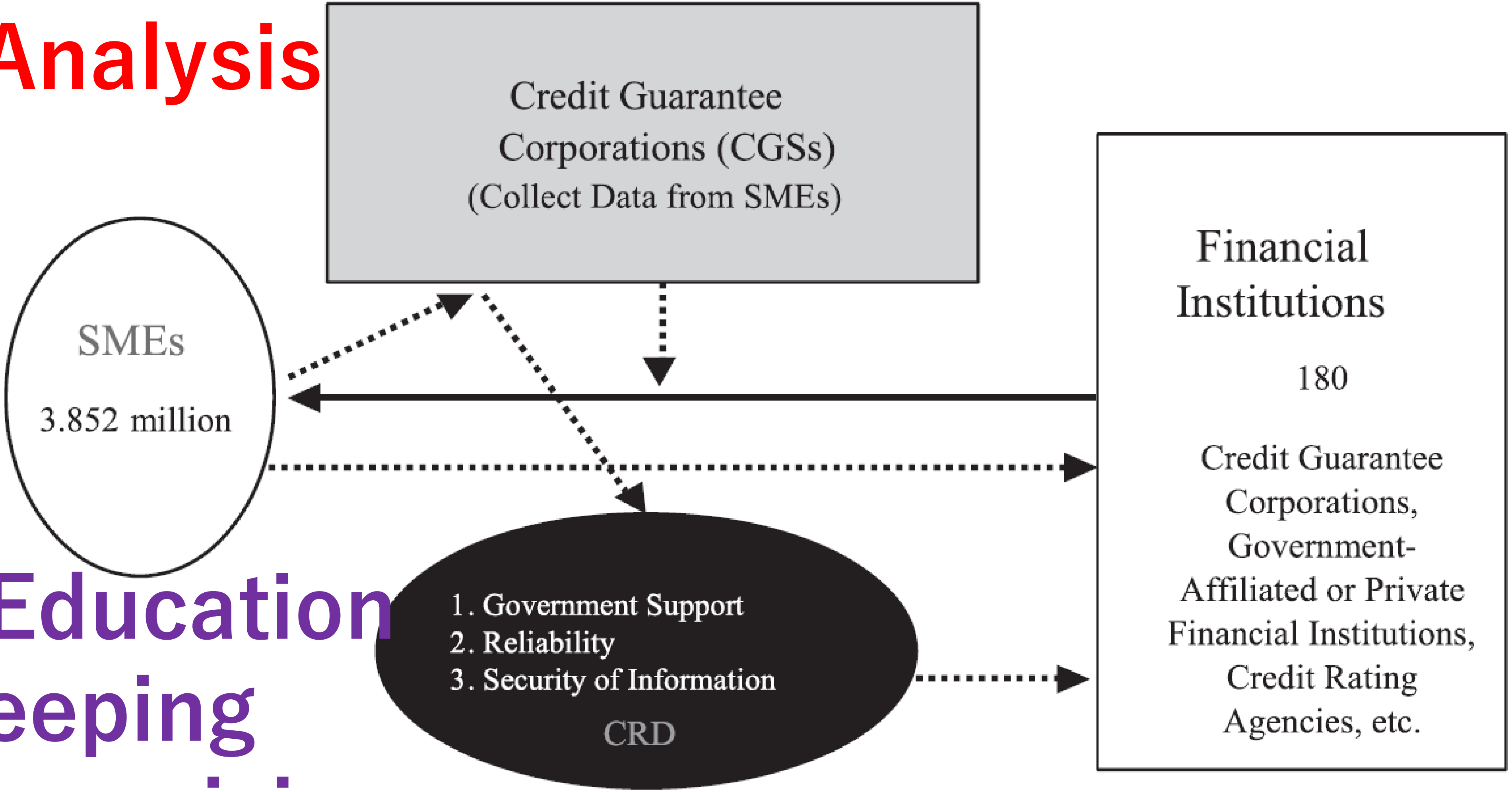
Probit Analysis

$$p = \frac{1}{1 + exp^{-(\beta_0 + \beta_1 \cdot X)}}$$

$$P = 1 \; if \; default \quad \text{and} \quad P = 0 \; if \; nondefault$$

$$\beta_0 : constant \; \beta_1 : coefficient \; X : financial \, index$$

Data Collection and Data Analysis by CRD



Financial Education
(1)Book keeping
(2)Long-term vision

Figure 1.4 Credit Risk Database of small and medium-sized enterprises

BSP: Central Bank of the Philippines

BSP setting up MSME credit risk database

August 19, 2019 | 12:33 am

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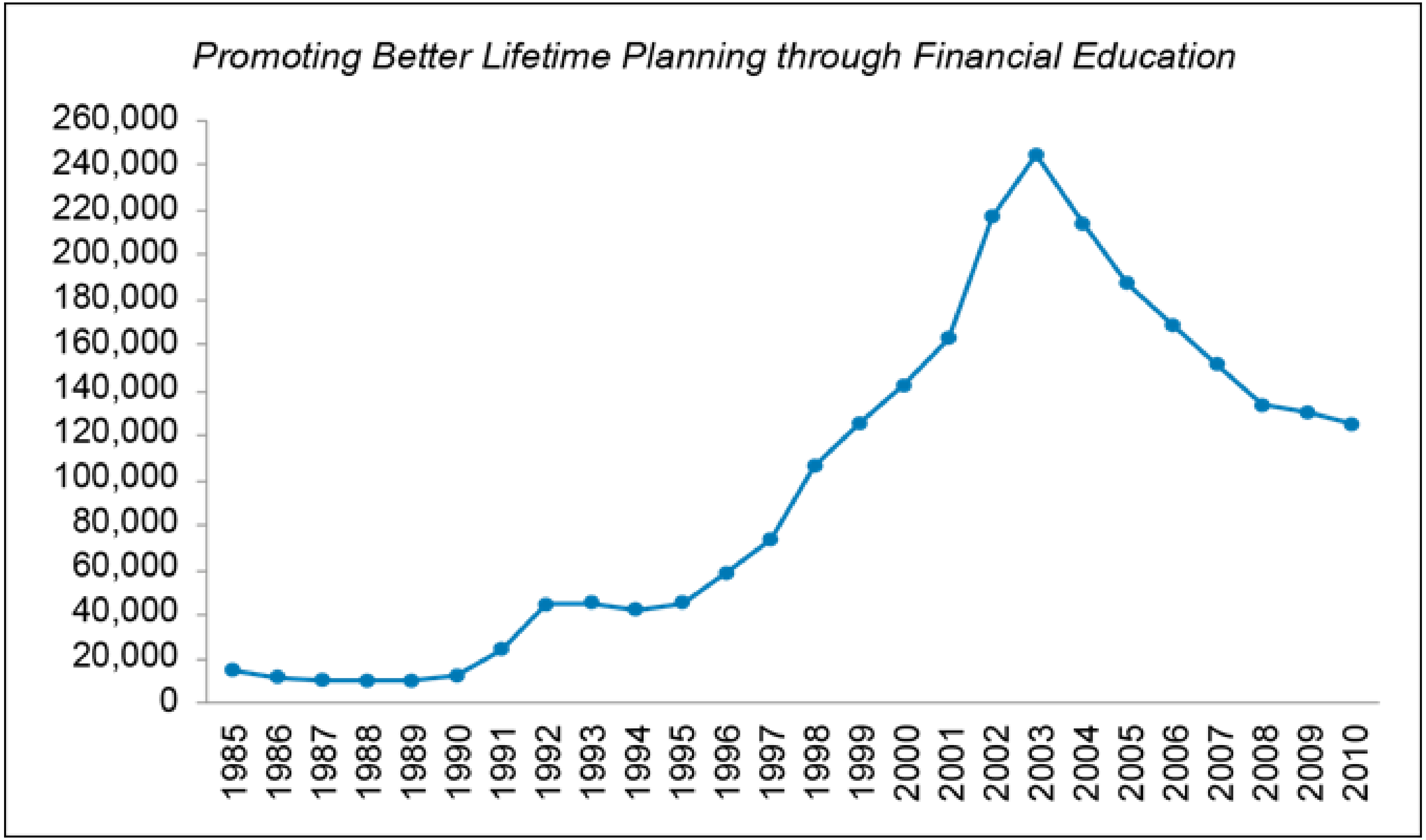
THE CENTRAL BANK has been working to establish a credit risk database to help deserving micro, small and medium enterprises (MSMEs) tap funds.

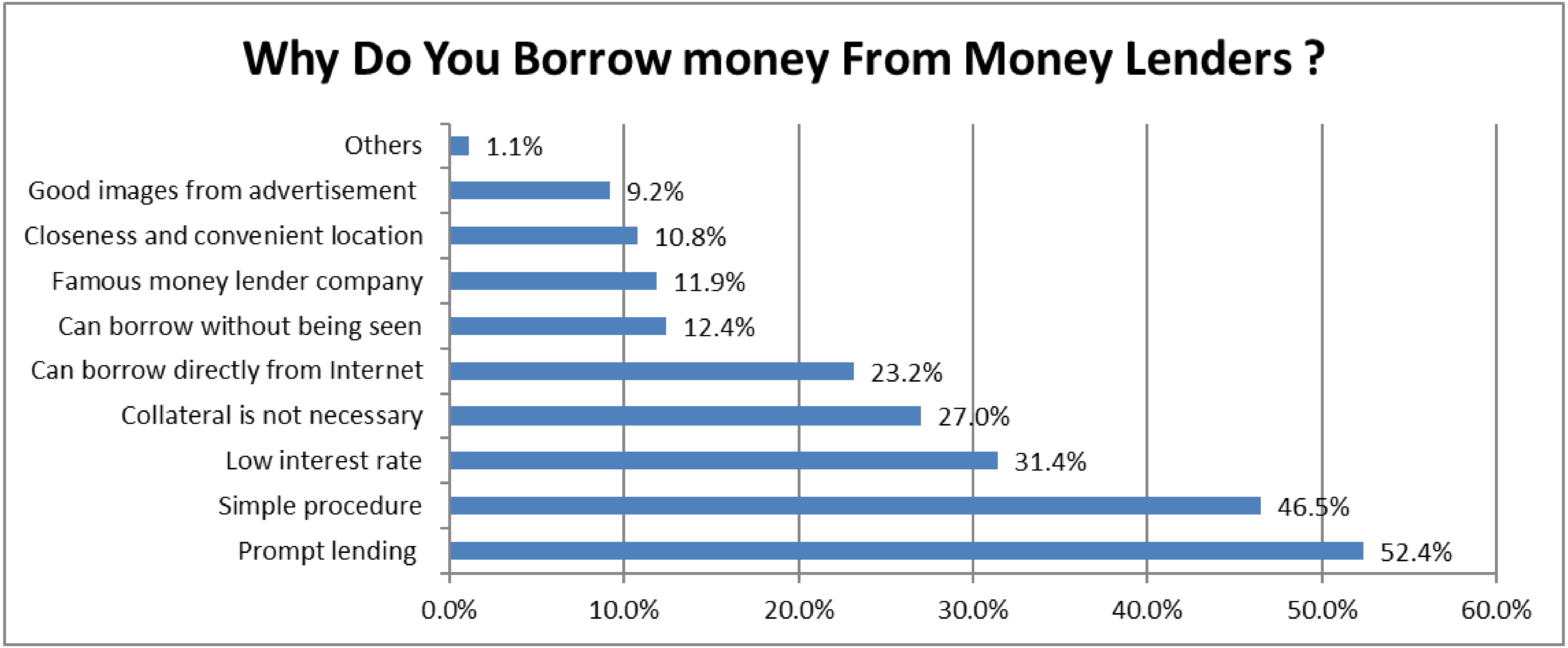
ANALYTICAL FRAMEWORK ON CREDIT RISKS FOR FINANCING SMALL AND MEDIUM-SIZED ENTERPRISES IN ASIA

*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

Loan Shark: Lessons from Japan




Why Do You Borrow money From Money Lenders ?
Others
1.1%
Good images from advertisement
9.2%
Closeness and convenient location
10.8%
Famous money lender company
11.9%
Can borrow without being seen
12.4%
Can borrow directly from Internet
23.2%
Collateral is not necessary
27.0%
Low interest rate
31.4%
Simple procedure
46.5%
Prompt lending
52.4%
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
60.0%

Theoretical Model

$$rL_{t-1} + C_t = Y_t + \Delta L_t \text{ ....} (1)$$

$$C_t = cY_t$$

$$Y_t = (1+a)Y_{t-1}$$

$$a = \frac{\Delta Y}{Y} = \frac{\Delta p}{p} + \frac{\Delta y}{y}$$

From (1), we can get -

$$rL_{n-1} + cY_n = Y_n + (L_n - L_{n-1})$$

$$\Leftrightarrow L_n = (1+r)L_{n-1} - (1-c)Y_n$$

$$\Leftrightarrow L_n = (1+r)\{(1+r)L_{n-2} - (1-c)Y_{n-1}\} - (1-c)Y_n$$

....

$$\Leftrightarrow L_n = (1+r)^n L_0 - (1-c)\{(1+r)^{n-1}(1+a) + (1+r)^{n-2}(1+a)^2 + \cdots + (1+a)^n\}Y_0$$

$$\Leftrightarrow L_n = (1+r)^n L_0 - \frac{(1-c)(1+a)}{(r-a)}\{(1+r)^n - (1+a)^n\}Y_0$$

$$L_n = (1+r)^n L_0 - \frac{(1-c)(1+a)}{(r-a)}\{(1+r)^n - (1+a)^n\}Y_0 < 0$$

$$\frac{L_0}{Y_0} < \frac{(1-c)(1+a)}{(r-a)}\left\{1 - \left(\frac{1+a}{1+r}\right)^n\right\}$$

$$\frac{L_0}{Y_0} < \frac{(1-c)(1+a)}{(r-a)} \left\{ 1 - \left(\frac{1+a}{1+r} \right)^n \right\}$$

1, L_0/Y_0 = " Loan/Sales" ratio

2, r = Interest Rate

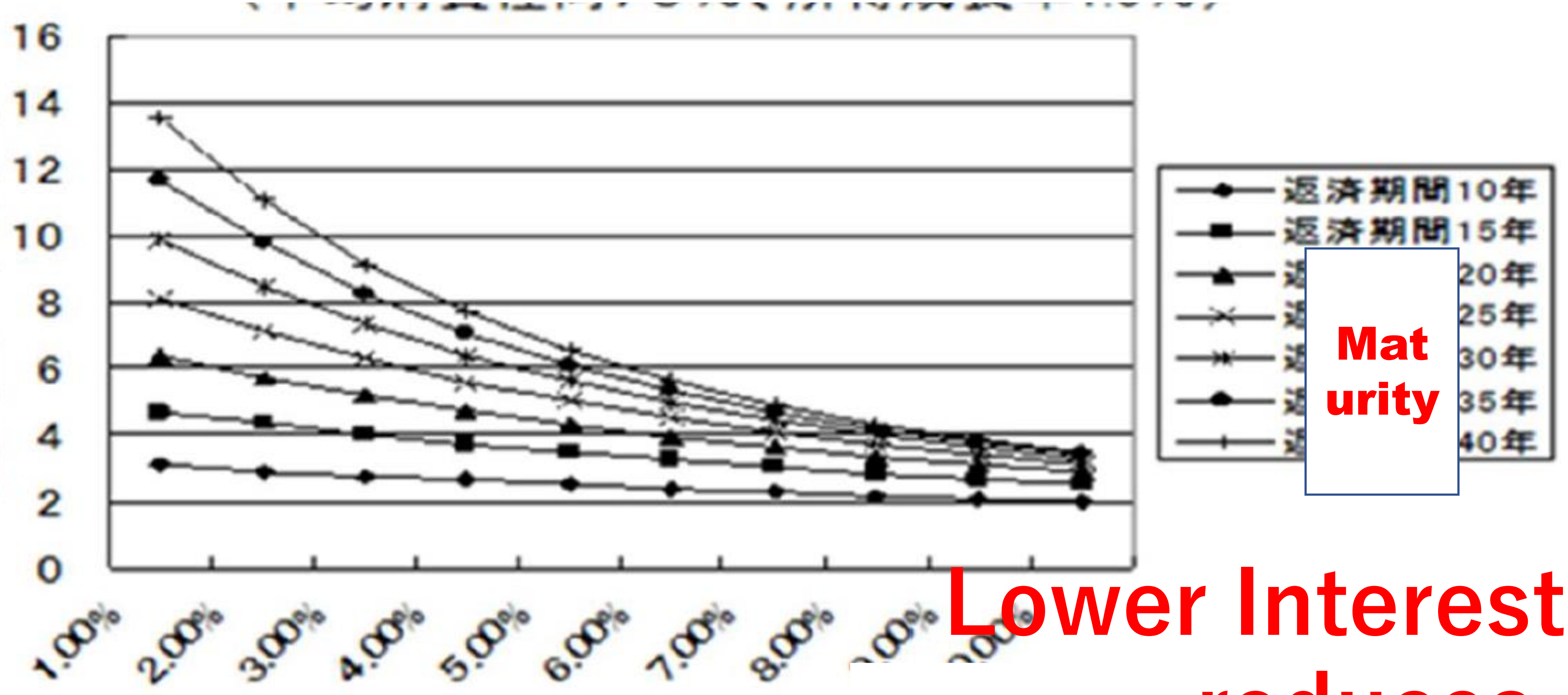
3, n = number of years of borrowing

4, a = growth rate of sales

5, c = marginal propensity to consume

“Loan/Sales” Ratio of Japan

LOAN = SALES



Lower Interest Rate
reduces
debt overhang

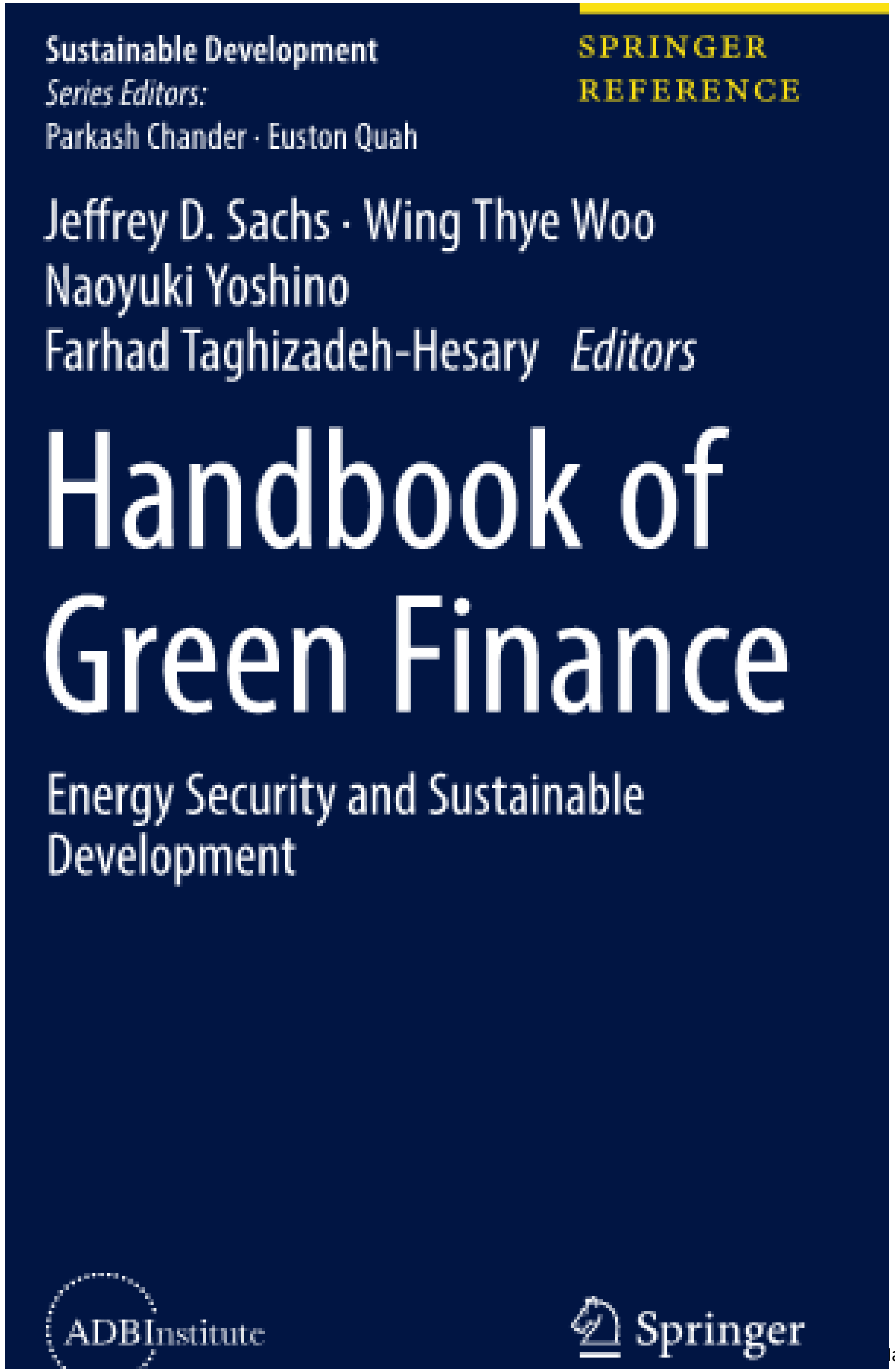
Lower Interest Rate leads to larger borrowings

Table 2. Estimated Borrowing Ratio for Different Values of r

r	β	a	n	L_0/Y_0
0.05	0.5	0.07	15	2.01
0.08	0.5	0.07	15	1.76
0.1	0.5	0.07	15	1.64
0.12	0.5	0.07	15	1.55
0.14	0.5	0.07	15	1.48
0.16	0.5	0.07	15	1.43
0.2	0.5	0.07	15	1.35
0.3	0.5	0.07	15	1.23

a. Ceiling on borrowing ratio to sales L/Y=1/3
b. Interest rate ceiling: 20%
c. Borrowers' information: The law required all individual borrowing within a household to be aggregated to obtain the total household borrowing
d. Self-regulatory association of money lenders:
   A self-regulatory association of moneylenders
e, Consumer care hotline:

Carbon Tax → Lowering interest rate (Green Investments)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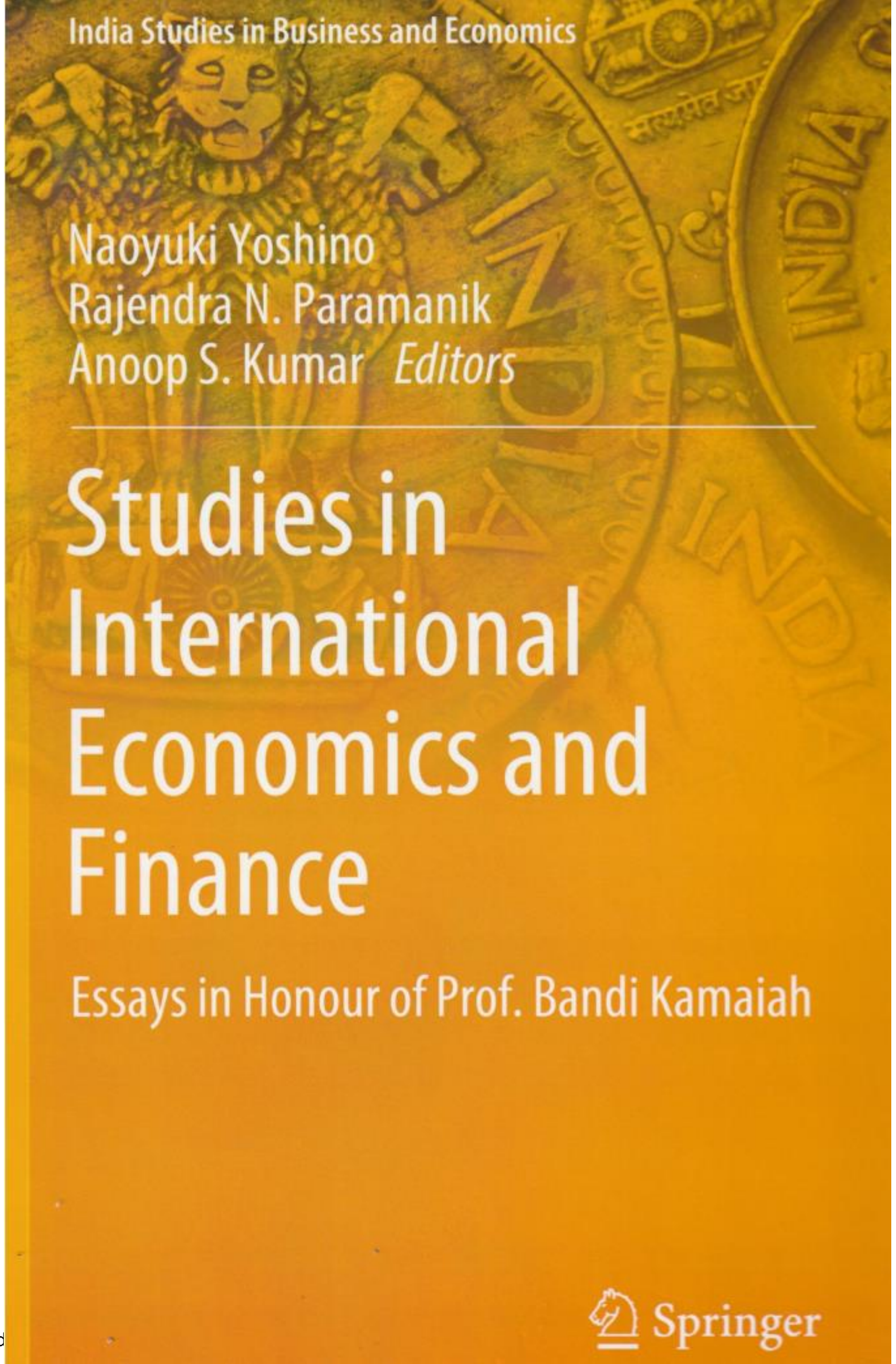
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Thank you for your attention

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Prof. Naoyuki Yoshino (PhD'79) receives the International Green Finance Lifetime Achievement Scientific Award

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