INSTITUTE OF DEVELOPING ECONOMIES

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DISCUSSION PAPER No. 33

Theoretical Models Based on a Flowchart Approach to Industrial Cluster Policy

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August 2005

Abstract

This article examined the issue of whether or not the currency exchange rate, country risk, and cooperate tax rate affect decisions of multinational firms to invest in industrial clusters. First, if the exchange rate between a multinational company in an industry of diminishing returns to scale and a developing country is appreciated, then production in the developing country should increase. Second, if the investment period becomes longer, the currency exchange rate of a multinational company's country should be revalued more in order for it to further invest in the developing country. Third, if the investment period becomes longer, the developing country's risk should become less. Fourth, compensation for the developing country's high risk can be made by lowering its corporate tax rate.

Keywords: flowchart approach, industrial cluster policy, capacity building, institutions, exchange rate, country risk, corporate tax rate.
JEL classification: L5, L22, R11.

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1. Introduction

Central governments in Asian countries such as Japan and Thailand are implementing industrial cluster policies. An industrial cluster is a geographic concentration of manufacturing companies, suppliers, service providers, and related institutions in a particular field. In most cases, industrial cluster policies are implemented by local governments. However, industrial policies (different from industrial cluster policies) are policies implemented by a central government to foster domestic industries through reallocation of resources. Industrial policy is a selective-intervention policy made by central governments. Scholars advocating industrial polices decreased in number following the Asian currency crisis in 1997 (see Stiglitz and Yusuf, 2001). Nevertheless, the determination of the role of central governments in the implementation of industrial cluster policies used to activate local regions still warrants analysis.

Many industrial clusters in industrial and export processing zones have been formed in Asia. The export-processing zone in Kaohsiung, Taiwan in 1965 was the original model for this. Industrial clusters in East Asia in the first half of the 1980's followed those of special economic zones in Shenzhen, China and free trade zones in Penang and Johor, both in Malaysia. The issue for central and local governments is whether or not their policies are effective in forming industrial clusters.

The industrialization of East Asia in the latter half of the 1980's appeared to be a game involving recipient countries such as Malaysia and Thailand on the one hand, and multinational corporations of South Korea, Taiwan and Japan on the other. The policies of these countries were centered on deregulation in order to attract foreign investment. This permitted 100% ownership of capital by foreign investors, not only in a few specific sectors, but also over a wide range of export-oriented industries. Further, the governments of these countries gave preferential treatment to foreign capital. This involved tax incentives such as low corporate tax rates and tax holidays (exemptions)

for a certain period. Such preferential treatment also provided industrial parks with infrastructures to entice foreign investment.

Incentives for multinational companies to establish their subsidiaries in other countries include abilities to transfer management resources (Penrose, 1956) and to reduce transaction costs (Hymer, 1960). In the case of East Asia in the 1980's, however, cost reduction was the primary objective. Evidence provided in this article supports this as the primary motivation behind the increasing number of South Korean, Taiwanese, and Japanese companies that expanded overseas production during the latter half of the 1980's. As domestic costs rose due to the increase in wage rates and the appreciation of the domestic currency rates, Asian companies reduced costs by expanding overseas production. As shown in Figure 1, Kuchiki (2005) proposed a flowchart approach and theoretically showed that industrial cluster policy is effective in forming industrial clusters by establishing export-processing zones, enlarging building capacity, and by inviting anchor firms. Capacity includes infrastructure, institutions, human resources, and living conditions. The flowchart approach emphasizes the importance of both the ordering and timing of policy measures. Kuchiki (2003, 2004) illustrated the successful cases of Canon in Hanoi, Vietnam, and Toyota in Tianjin, China. Canon and Toyota are both Japanese companies; they functioned as anchor companies in the flowchart approach. However, whether or not policies of inviting foreign direct investment to export processing zones by central governments are effective in forming industrial clusters has not been shown.

This article examined the issue of whether or not governmental exchange rate policies, preferential tax policies, and country risk management policies are effective in inviting foreign investors to industrial clusters. Both static and dynamic models were used to analyze the effectiveness of each of these policies.

A static model concludes that if the exchange rate between a multinational company in an industry of diminishing returns to scale and a developing country is appreciated, then production in the developing country should increase. A dynamic

model also shows that if the investment period becomes longer, the currency exchange rate of a multinational company's country should be appreciated more in order for it to further invest in the developing country. The dynamic model concludes that if the investment period becomes longer, the country risk of the developing country should become less. However, it can be shown that compensation for the developing country's high country risk can be made by lowering its corporate tax rate. A more realistic model of countries in East Asia in the 1980's supports this conclusion. Preferential treatment through tax reductions or exemptions given by developing countries appeared to be effective in inviting foreign direct investment. The models developed in this article imply that roles of central governments are crucial for inviting foreign direct investment that can be used to form industrial clusters by increasing the building capacity for infrastructures and institutions. This article focuses specifically on institutions of capacity building as seen in Table 1.

Section 2 of this article includes a demonstration of how deregulation and preferential tax treatment, which were selected to encourage foreign investment, played major roles in enhancing the economic growth in Kaohsiung, Taiwan, in the Chinese province of Guandong, and in areas of Malaysia and Thailand. Section 3 includes a decision-making model for multinational companies that intend to invest overseas. This model indicates that multinational companies will not become interested in foreign direct investment unless the overseas costs decrease to a certain threshold, and this depends on the tax rates of recipient countries. Preferential tax treatment is thus a crucial factor for multinational companies in making decisions regarding investment in other countries. Section 4 is devoted to conclusions.

2. Export Processing Zones

Export processing zones represent one mechanism for rapid economic growth in East Asia. The prototype version for Kaohsiung, Taiwan was modeled on those in

Malaysia and Guangdong province in China. It was applied in Thailand and other Asian countries.

This model can also be applied to East Asian countries that have established conditions of political and macroeconomic stability and public security and who wish to invite foreign investment. The main policies for encouraging foreign investment include: (1) providing production sites by the quasi-public sector, that is, industrial parks with a well-developed "infrastructure". This has been a common way of encouraging foreign investment. (2) The government selects leading industries to give preferential treatment for foreign capital. This usually involves "tax incentives" such as low tax rates and tax holidays (exemptions) for several years after the first profit has been generated. (3) At the same time, the government deregulates to allow up to 100% ownership by foreign investors. Permission reduces the investors' risk since they need not find their partners. It should be noted that a high export ratio has been the only required condition for incentives such as 100% ownership of capital and preferential tax rates.

The export processing zones with these features, however, have not been enough to attract foreign direct investment. The mechanism has no effect unless companies (usually multinational companies) become interested in increasing overseas production. To achieve this, foreign companies must have incentives to invest outside their own countries. The most important incentive is to reduce cost, and this is determined primarily by three factors: wages, exchange rates, and taxes. Smaller costs seem to have had a decisive impact on the decision to allow overseas investment by Taiwanese, South Korean and Japanese companies from 1985 to 1990. This can be seen in the regression analyses presented in Appendix 1.

3. Theoretical Analyses on Multinational Companies

This section theoretically demonstrates that under certain conditions, the

governmental policy of recipient countries is effective in inviting multinational companies. Three policies may be viewed in more detail: (1) currency devaluation, (2) permission given to multinational companies with totally foreign owned capital, and (3) preferential tax treatment. Proposition 1 indicates that it is easier for multinational companies to decide to invest in a country if its government has a devaluation policy. Propositions 2, 3, and 4 make it clear that multinational companies look more favorably on investment if the governments of recipient countries reduce country risk by permitting totally foreign capital. Proposition 5 shows that preferential tax treatment by recipient countries will reduce the country risk for multinational companies.

These policies were implemented in ASEAN countries from 1981 to 1994. They contributed to high economic growth during that period.

(1) Necessary conditions for overseas investment

The variable θ denotes country risk, that is, the level of political and macroeconomic stability in the recipient country. θ affects the level of production in the recipient country $F(k,\ell)$, where k is capital and ℓ labor. t represents the corporate tax rate and e the exchange rate of the investing country with respect to the recipient country (in units of the recipient country's currency). P represents the price of a product in the investor's currency, r the interest rate, and w the wage levels, all evaluated in the currency of the recipient country. The level of profit from overseas production, π_f, can be expressed as follows:

$$\pi_f = \max_{k',l'} (1-t)\{P\,\theta\,F(k',l')-rk'-ewl'\}$$

$$= (1-t)\{P\,\theta\,F(k,l)-rk-ewl\},$$

where k'=k, l'=l.

This can now be contrasted with domestic production, using exactly the same production function. The new variables in an investor's country are θ_d (country risk),

t_d (corporate tax rates) and w_d (wage levels). Without loss of generality, it can be assumed that the country risk of the investor's country is 1. The profit π_d obtained from domestic production is then

$$\pi_d = \max_{k'_d, l'_d} (1-t_d)\{P\theta F(k'_d, l'_d) - rk_d' - ewl_d'\}$$

$$= (1-t_d)\{P\theta F(k_d, l_d) - rk_d - w_d l_d\},$$

where $k'_d = k_d$, $l'_d = l_d$. Here the interest rate r is the same as that in overseas production π_f.

Assume here that the Cobb-Douglas production function for profit from overseas π_f is

$F(k, l) = k^a l^b$ (Without loss of generality, a constant=1 can be assumed.)

Fluctuations in the exchange rate e then affect k and l as expressed in the following formulae:

$$\partial \ell / \partial e = -(\ell / e) \cdot (1-a)/(1-a-b) < 0$$

$$\partial k / \partial e = -(k / e) \cdot b/(1-a-b) < 0$$

where diminishing returns to scale in the form a + b < 1 prevail. This represents an increase in overseas labor input and capital input as the currency of the investor's country appreciates. The reverse can apply for increasing returns to scale.

Contrasting profits earned at home π_d with profits earned overseas π_f, results in

$$\pi_d / \pi_f = \{(1-t_d)/(1-t)\}[(1/\theta)(ew/w_d)^b]^{1/(1-a-b)}$$

A multinational company may invest overseas if $\pi_d / \pi_f < 1$, i.e. $\pi_d < \pi_f$

Relative profit π_d / π_f with respect to the location of production is governed by the following factors:

Country risk, corporate tax rates, overseas wage levels, and exchange rate $(\theta,\ t, w, e)$.

It should be remembered that these four factors act as a group in determining the final outcome. The level of wages in the recipient w is multiplied by the exchange rate e to obtain the level of wages paid out by the investing company. Since the following exchange rate analysis is equally valid for all wage levels w, relatively low wage levels do not constitute the only factor influencing relative profit.

Country risk (θ) and corporate tax rates (t) will be explained briefly.

Country risk θ is governed by:

(1) Political stability and

(2) Macroeconomic stability.

The concept of political stability requires no explanation. Macroeconomic stability refers to consumer prices and the international balance of payments. Both forms of stability are considered pre-conditions for rapid economic growth.

With respect to corporate tax (t), preferential tax treatment via incentives such as tax holidays (zero taxation for a period of several years, i.e., $t = 0$) provides a major incentive for overseas production. The relative profit π_d / π_f is less than 1 if $(1/\theta)$ $(ew / w_d)^b \leq 0$.

The introduction of preferential tax treatment by one East Asian country immediately puts others at a disadvantage. Later developers in Southeast Asia, including Indonesia, the Philippines and Vietnam, have thus been obliged to follow suit.

(2) Dynamic analysis

A dynamic analysis can be more realistic than those previously explained; it shows the importance of the role of the government. The model examines a multinational company operating over two periods. In each period, π_f represents the level of potential profit from an overseas operation when the company does not set up overseas facilities. This is dependent on the exchange rate e which is stochastic, has distributions G, and is identical and independent from one another.

A company searches for countries and regions suitable for expansion. The potential profit earned from overseas operations is given by

$$\pi_f = (1-t)\,(P\theta F - rk - ew\ell)$$

where country risk θ and exchange rate e are considered random variables.

What is the threshold exchange rate e, representing the point at which a "yes" decision to invest abroad is taken? Country risk θ also has a threshold value. Normally, a "yes" decision requires both e and θ to be above their respective threshold values; one without the other is not sufficient. This allows a two-stage analysis as follows:

The first stage includes a dynamic analysis of e with θ constant at $\theta = 1$. This is used to assess the likelihood of a "yes" decision.

The second stage includes a dynamic analysis of θ as a random variable with given e in the event that the offer is accepted.

In the basic model for the first stage, the periods are $T-1$ and T. First, period T is considered and then period $T-1$. If the value function in period T is $V_t(e)$, and the state variable is exchange rate e, then decision-making behavior can be expressed thus:

$$V_T(e) = \max\{\pi_f,\ \pi_d\}$$

The company invests abroad in the case of $\pi_f \geq \pi_d$, that is,

$$(1-t)\,(PF(k,\ell) - rk - ew\ell) \geq \pi_d.$$

Therefore, the value of the exchange rate should be

$$\frac{1}{w\ell}\,(PF(k,\ell) - rk - \frac{\pi_d}{1-t}) \geq e.$$

Or, $\overline{e}_T \geq$e, where $\overline{e}_T = \frac{1}{w\ell}(PF - rk - \frac{\pi_d}{1-t})$, in order that $\pi_f \geq \pi_d$.

This is illustrated in Figure 2.

In period $T-1$, the value function is given by $V_{T-1}(e,s)$, The state variables s indicate either D (domestic production) or S (overseas production). The Bellman

formula (see Sargent, 1987) in this case is

$$V_{T-1}(e,D) = max\{(1+\beta)\pi_t, \pi_d + \beta EV_T(e',D)\},$$

where β denotes a firm's discount factor.

The optimal solution may be found from two possible courses of action: (1) launching overseas production during the current period (T-1) at the given exchange rate e and increasing overseas production in the next period (T), or (2) carrying on with domestic production during the current period (T-1) and postponing the decision until the next period (T). The value function $V_{T-1}(e,D)$ in this case is

$$V_{T-1}(e,D) = \begin{cases} (1+\beta)\pi_f & e \le \overline{e}_{T-1} \\ \pi_d + \beta\ EV_T(e',D) & e \ge \overline{e}_{T-1} \end{cases}$$

where $\overline{e}_{T-1}$ represents the decision threshold at the current period T-1. This satisfies the following expression:

$$(1+\beta)\pi_f = \pi_d + \beta EV_T(e',D).$$

Since

$$EV_T(e',D) = \int_0^{\overline{eo}} \pi_f \, dG(e') + \int_{\overline{eo}}^{\infty} \pi_d \, dG(e'),$$

the threshold value $\overline{e}_{T-1}$ during period $T-1$ is given by

$$\overline{e}_{T-1} = \frac{1}{w\ell}(PF(k,\ell) - rk - \frac{\pi_d}{1-t}) - \frac{\beta}{1+\beta}\int_0^{\overline{e_0}} G(e')de'.$$

Comparing threshold $\overline{e}_T$ in period T with threshold $\overline{e}_{T-1}$ in period $T-1$,

$$\overline{e}_{T-1} - \overline{e}_T = -\frac{\beta}{1+\beta}\int_0^{\overline{e_0}} G(e')de' < 0,$$

Thus

$$\overline{e}_{T-1} < \overline{e}_T \cdot\cdot$$

The critical value of the exchange rate of overseas investment in period T ($\overline{e}_T$) should

be appreciated more than that of investment in period T-1 ($\overline{e}_{T-1}$). That is, the threshold value in any current period T-1 is smaller than that in the next period T. A multinational company will invest abroad in the current period unless its currency is appreciated more than the rate in the next period when it makes decision on the investment. This means that it will decide to invest abroad for two periods T-1 and T if its currency is relatively appreciated. We can continue to iterate this process as follows.

$$\overline{e}_{T-2} < \overline{e}_{T-1}.$$

The condition of the critical values for three periods is

$$\overline{e}_{T-2} < \overline{e}_{T-1} < \overline{e}_{T}.$$

Taking Japanese investment as an example and using the above expression, the following proposition may be argued from a dynamic point of view:

Proposition 1: The longer the investment period of a multinational company, the more its currency must be appreciated.

In the same way, a "yes" decision is possible even under a relatively weak yen if the investment can be recouped in a short term. This explains why relatively short-term Hong Kong investments are more likely to be directed towards China than are Japanese investments.

The mean-preserving spread (Sargent, 1987) may be used to examine overseas expansion with respect to risk of exchange rate. G_1 and G_2 represent distribution functions for the exchange rate e in the periods T-1 and T, and this varies within a limited range, from zero to B.

Assuming a mean-preserving spread,

$$\int_0^y G_1(e)de \leq \int_0^y G_2(e')de', \quad 0 \leq y \leq B.$$

With $\bar{e}^{i}_{T-1}$ as the threshold value corresponding to G_i

$$\bar{e}^{i}_{T-1} = \frac{1}{w\ell}(PF(k,\ell) - rk - \frac{\pi_d}{1-t}) - \frac{\beta}{1+\beta}\int_0^{\bar{e}_0} G_i(e')de',$$

where i is equal to 1 and 2.

Therefore,

$$\bar{e}^{1}_{T-1} - \bar{e}^{2}_{T-1} = -\frac{\beta}{w\ell(1+\beta)}(\int_0^{\bar{e}_0} G_1(e')de' - \int_0^{\bar{e}_0} G_2(e')de')$$

and

$$\bar{e}^{1}_{T-1} < \bar{e}^{2}_{T-1}..$$

From this, the following proposition may be derived:

Proposition 2: The higher the risk of the exchange rate the stronger the currency of the investor's country must be in order to generate a "yes" decision.

In the basic model for the second stage, country risk θ with the exchange rate fixed at e=1 may be considered. As before, two periods, $T-1$ and T, are used. The value function in period T is given as $V_T(\theta)$.

$$V_T(\theta) = max\{\pi_f, \pi_d\},$$

where θ is a state variable with distribution function H.

When overseas production is more profitable than domestic production, $\pi_f \geq \pi_d$,

$(1-t_2)(PF\theta - rk_2 - \bar{e}w\ell_2) \geq \pi_d$.

The decision will be "yes", and the threshold is then

$$\bar{\theta}_T = (1/PF)\{rk_2 + w\ell_2 + \pi_d/(1-t_2)\}.$$

If country risk exceeds this value, the decision will be "yes"; otherwise the company will choose to remain at home. This is illustrated in Figure 3.

The value function for period $T-1$ is $V_{T-1}(\theta, s)$, where $s = D$ (domestic production) or S (overseas production). The Bellman formula in this case is

$$V_{T-1}(\theta, D) = max\left\{(1+\beta)\,\pi_f\,,\ \pi_d + \beta\, EV_T(\theta', D)\right\}.$$

The value function in this case is

$$V_{T-1}(\theta, D) = \begin{cases} (1+\beta)\pi_f, & \theta \geq \bar{\theta}_{T-1} \\ \pi_d + \beta EV_T(\theta', D), & \theta \leq \bar{\theta}_{T-1} \end{cases},$$

where $\bar{\theta}_{T-1}$ represents the decision threshold. This satisfies the following expression:

$$(1+\beta)\,\pi_f = \pi_d + \beta\, V_T(\theta', D).$$

Country risk θ is greater than $\bar{\theta}_{T-1}$. Thus, if country risk is higher than that of domestic production, the decision will be "yes". If it is lower, the company will choose to stay at home, postponing a decision until period T.

Comparing threshold $\bar{\theta}_T$ in period T with threshold $\bar{\theta}_{T-1}$ in period $T-1$,

$$\bar{\theta}_{T-1} - \bar{\theta}_T = \frac{\beta}{1+\beta}\int_{\theta}^{\infty}(\theta' - \bar{\theta})\, dH \geq 0,$$

where H is a distribution function for θ'.

Thus

$$\bar{\theta}_{T-1} > \bar{\theta}_T\,.$$

The following argument can be made:

$$--------> \bar{\theta}_{T-3} > \bar{\theta}_{T-2} > \bar{\theta}_{T-1} > \bar{\theta}_T\ .$$

Proposition 3: The longer the investment period, the higher the country risk level required to generate a yes decision.

The issue of preferential tax treatment may now be examined.

Proposition 4: Preferential tax treatment, i.e., lower rates of corporate tax t_2, generates a "yes" decision in the face of high country risk $\overline{\theta}_{T-1}$ at period T-1.

This can be demonstrated quite readily as follows:

$$\overline{\theta}_{T-1} = \frac{1}{PF}(rk_2 + w\ell_2 + \frac{\pi_d}{1-t_2}) + \{\beta/(1+\beta)\}\int_{\theta}^{\infty}(\theta' - \overline{\theta})\,dH(\theta).$$

And

$$\frac{\partial \overline{\theta}_{T-1}}{\partial t_2} = \frac{\pi_d}{PF(1-t_2)^2} > 0.$$

A company faces two thresholds in its decision to expand overseas, and both must be satisfied to generate a "yes" decision. One is the cost threshold that includes the appreciated exchange rate and the increased wage level of the investing countries. The other is country risk, and this is determined by political stability, public security, and macroeconomic stability. Preferential tax treatment, provided by developing countries, makes a critical contribution to passing the two thresholds.

(3) East Asian Model

A general model may be developed with respect to three considerations.

The first consideration involves the preliminary survey costs associated with overseas investment; this is denoted as C. Costs are burdened by profits in domestic or overseas production. Information has to be obtained from abroad, and investing firms at one time dispatched study missions abroad. These costs have been very high for Japanese companies that tend to take longer times in decisions concerning overseas production.

The second consideration is the possibility that changes in the candidate country may render the planned expansion unfeasible if overseas production has been postponed

until the following period. An example of this is the bottleneck that was caused by rapid economic growth in Thailand and Malaysia in the late 1980's and early 1990's. As inadequacies in the infrastructure of Thailand and labor shortages in Malaysia became evident, companies were forced to abandon earlier plans for expansion. The probability of such circumstances arising is denoted as x. Here it can be assumed that the probability (x) to abandon a plan for overseas production becomes lower as survey costs (C) are increased; that is, $\partial x/\partial C < 0$.

In the last consideration, there is the possibility that a company with overseas operations may be forced to revert to domestic production (or move to a different country) when operations become untenable. This was witnessed in Singapore, Taiwan, South Korea, and other Asian NIEs. For example, a number of foreign companies were attracted to the Julon Industrial Park in Singapore in the late 1970's. They were subsequently obliged to pull out of labor-intensive industries and were unable to maintain production under the three-year wage doubling policy brought in during the early 1980's. The probability of such an outcome is denoted as δ .

The three variables in the model are thus: preliminary survey costs C; the probability x of overseas production being rendered unfeasible sometime between the current period and the next; and the probability δ of overseas operations established during the current period becoming untenable in the next.

The value function for period T is

$V_T(\theta, \theta^c, C, s)$,

where θ represents country risk in the country under consideration (the reciprocal of country risk), θ^C the country risk in a second candidate country, C the preliminary survey costs, and s (which may be either domestic production D or overseas production S).

The Bellman equation in this case is:

$V_T(\theta^c,\theta,C,D) = \max \{\pi_f - C, \pi_d - C\}$.

As before,

$$\bar{\theta}_T = \frac{1}{PF}\left(\frac{\pi_d}{1-t} + w\ell + rk\right).$$

Note that profits from production in the second candidate country at productivity θ^c are assumed to be below profits π_f from the primary country under consideration.

In period $T-1$:

$$V_{T-1}(\theta^c, \theta, C, D) = \max\{A, B\}.$$

Here,

$$A = \pi_f - C + \beta\left[\delta EV_T(\theta', \theta^{c'}, C, D) + (1-\delta)EV_T(\theta', \theta^{c'}, C, F)\right],$$

$$B = \pi_d - C + \beta\left[x(c)EV_T(\theta, \theta^{c'}, C, D) + (1-x(c))EV_T(\theta', \theta^{c'}, C, D)\right],$$

$$\partial x/\partial C < 0 \quad .$$

During period $T-1$, production is carried out at home, and prior survey costs C are incurred. Therefore, $B = \pi_d - C$. With x as the probability that overseas production in period T becomes underside, the total expected value B for period T is obtained by summing expected values $xEV_T(\theta, \theta^{c'}, C, D)$ and $(1-x)EV_T(\theta', \theta^{c'}, C, D)$, and by discounting the total at a factor of β.

Due to overseas production and prior survey costs C during period $T-1$, the value of A is $\pi_f - C$. With δ as the probability that overall operations become untenable during period T, at the point when overseas expansion is considered for the second time, the expected value is

$$\delta EV_T(\theta', \theta^{c'}, C, D) \ .$$

The expected value when overseas production continues and expansion into a second country is also being considered is

$$(1-\delta)\ EV_T(\theta, \theta^{c'}, C, F)\ ,$$

where A is the total sum of the above three expressions. Thus:

$$V_{T-1}(\theta,\theta^{c'},C,D)=\begin{cases} A,\theta\geq\bar{\theta}_{T-1} \\ B,\theta\leq\bar{\theta}_{T-1} \end{cases}.$$

The threshold value at this time is

$$\bar{\theta}_{T-1}=\frac{1}{PF}\left(\frac{\pi_d}{1-t}+w\ell+rk\right)+\frac{\beta(1-x-\delta)}{PF(1-t)}(Z-Z^c),$$

where

$$Z=(1-t)PF(k,\ell)\int_{\bar{\theta}_0}^{\infty}(\theta'-\bar{\theta}_T)dH(\theta'),$$

$$Z^c=(1-t_2)PF(k_2,\ell_2)\int_{\bar{\theta}_0^C}^{\infty}(\theta'-\bar{\theta}_T^c)dH^c(\theta').$$

Since $Z^c\geq 0$ and $Z\geq 0$ at all times, the above may be rewritten as follows:

$$\frac{\partial(\bar{\theta}_{T-1}-\bar{\theta}_T)}{\partial t}=\frac{\beta(1-x(C)-\delta)Z^c}{PF(k,\ell)}\geq 0.$$

Therefore, reduced corporate tax rates provide incentive for multinational companies to set up overseas operations. Preferential treatment is also effective if the following condition holds:

$1-x(C)-\delta>0$.

It was shown earlier that when x(C) becomes smaller, there is a greater chance to satisfy necessary conditions. This is the case where overseas expansion is being investigated during the current period with a view toward implementation in the next period under the same set of conditions. At the same time, efforts must be made to boost survey costs (C) in order to reduce x(C). It is reasonable to conclude that whether or not preferential tax treatment is effective in inviting foreign direct investment depends on value x (C). Preferential tax treatment is effective under a condition of smaller values of x (C).

The case where a second candidate country introduces preferential tax treatment in competition with the first may now be considered. This was witnessed in East Asia

during the 1990's when countries such as Indonesia and the Philippines deregulated in competition with one another. In this case,

$$\frac{\partial \overline{\theta}_{T-1}}{\partial t_2} = \frac{\beta(1-x-\delta)Z}{1-t}.$$

Thus, the introduction of preferential treatment by a second country facilitates overseas expansion. As an example, a multinational company considering operations in Vietnam benefits when Indonesia and the Philippines introduce preferential tax measures. An insufficient infrastructure and legal system (θ) in Vietnam would still not make expansion unviable. In this way, foreign capital is dispersed evenly throughout East Asia. Deregulation and preferential treatment in other regions (namely Southeast Asia) can therefore serve to facilitate the inflow of foreign capital, and this leads to the following proposition:

Proposition 5: Whether or not foreign direct investment by a multinational company in a candidate country will be more unlikely depends on value x (C), when preferential tax treatment is introduced in other countries. The more unlikely a multinational company is to invest in the country, the higher the probability of overseas production being rendered unfeasible sometime between the current period and the next.

This article focused especially on capacity building with respect to a flowchart approach to industrial cluster policy. Among several factors of capacity building, the effectiveness of policies on institutions (such as tax incentives in forming an industrial cluster) was examined.

Kuchiki and Tsuji (2005) show that the implementation of governmental policies has a positive effect on inviting foreign capital and forming industrial clusters in Hanoi, Vietnam and Guadalajara, Mexico. This may be seen in Table 2. Similarly, using "tax incentives for investment" has had a positive effect in China and Vietnam. Table 3

shows that in 17.4% of interviewed companies in China, and 14.1% of those in Vietnam, indicated that they used it as one reason to invest. In Vietnam, 20.0% of the interviewed companies admitted that having “stable political and social conditions” was one of the reasons to invest in that country.

4. Conclusions

In the latter half of the 1980’s, developing countries in East Asia established export-processing zones with sufficient infrastructures to attract multinational companies to invest. They did this by carrying out deregulation geared towards foreign investment, authorizing export-oriented sectors as priority sectors, and by granting preferential tax treatment. However, multinational companies, especially in countries such as South Korea, Japan, and Taiwan, where domestic wages were rising due to their tight labor markets, were forced to invest in other countries to reduce their costs. Their investment was further increased by the appreciated exchange rates which made domestic wages higher. So that export-processing zones in developing countries in East Asia were effective in inviting multinational companies.

This article theoretically showed that policies of both devaluation of the currency exchange rate and preferential tax treatment were effective in inviting foreign direct investment to countries in East Asia in the 1980’s. The static model showed that a multinational company in an industry of diminishing returns to scale would increase production in a developing country if its exchange rates with the developing country were appreciated. The dynamic model also showed that the longer the multinational company’s investment period, the more the exchange rate had to be appreciated in order for that company to continue to invest in the developing country. The dynamic model made clear that the longer the investment period, the less the country risk of the developing country had to be. However, it was also seen that compensation could be made for high country risk by reducing the corporate tax rate of the developing country. A more realistic model of countries in East Asia in the latter half of the 1980’s

confirmed this conclusion. Preferential treatment through tax reductions or exemptions by developing countries was effective in inviting foreign direct investment. These models imply that the roles of central governments in building capacity are crucial for inviting foreign direct investment to form industrial clusters. These roles include depreciating exchange rates, lowering corporate tax rates, and stabilizing macroeconomic conditions.

Appendix 1.

This Appendix contains a discussion of the underlying motivation for direct investment as revealed in questionnaire surveys on direct foreign investment by Japanese companies. When wages in recipient countries were low, the major incentive for multinational companies was cheap labor. Over 70% of companies investing in Thailand (1985) and China (1990) mentioned low wages as the reason for investment. At the same time, the growth in domestic markets in Asian NIE's and ASEAN countries prompted more companies (over 70% in 1993) to set up overseas operations in anticipation of rising demand levels in those countries.

It is clear, then, that direct investment by Japan was motivated by the cost factor in the 1980's. The correlation between Japanese direct investment and wages may be examined. Wage levels and exchange rates are major considerations when comparing costs in terms of labor wages. Fluctuations in the exchange rate played a particularly important role in the direct investment of South Korea, Taiwan, and Japan into other Asian countries during the latter half of the 1980's.

Calculating a regression equation based on the correlation between wage level indices for South Korea, Taiwan and Japan (converted into dollars) and the approved value of foreign direct investment by each country over the period 1981-1991, the following was found:

Direct investment by South Korea = -5.56 + 3.61 (South Korean wages)

(-2.78) (9.11)

Adjusted $R^2 = 0.89$, $D-W = 1.87$

Direct investment by Taiwan = -21.8 + 6.59 (Taiwan wages)

(-4.41) (6.74)

Adjusted $R^2 = 0.82$, $D-W = 1.05$

Direct investment by Japan = -5.09 + 2.98 (Japanese wages)

(-3.00) (8.87)

Adjusted $R^2 = 0.89$, $D-W = 1.30$

Variables were converted into logarithmic form, and manufacturing wages in each country are given in dollar values with the 1980 level equal to 100.

There was a high correlation in all three cases, and t values indicated that all coefficients were statistically significant. Of particular interest is the similarity between wage elasticity in South Korea (3.61) and Japan (2.98). The value for Taiwan (6.59) is almost double that of those two countries. This indicates that reaction to cost is virtually twice as great as in Japan and South Korea.

The value of the South Korean, Taiwanese and Japanese currencies all rose against the dollar following the Plaza Accord in 1986, and wage levels also rose. This led to the threshold mentioned in section 3 and a sharp increase in the level of foreign direct investment from 1987 onwards.

<References>

Devereux, J. and L. L. Chen, "Export Zones and Welfare," *Oxford Economic Papers,* No.47, pp.407-713, 1995.

Hymer, S.H., *The International Operations of National Firms*, Cambridge, MA, MIT Press, 1960.

Kuchiki, A., "Agglomeration of Exporting Firms in Industrial Zones in Northern Vietnam," Kagami, M. and M. Tsuji eds., *Industrial Agglomeration*, Institute of Developing Economies – JETRO, 2003.

Kuchiki, "A Flowchart Approach to Asia's Industrial Cluster Policy," Kuchiki, A. and M. Tsuji, eds., *Industrial Clusters in Asia*, Macmillan, A.,2004.

Kuchiki, A., "Theory of the Flowchart Approach to Industrial Cluster Policy," Kuchiki, A. and M. Tsuji, eds., Flowchart Approach to Indstrial Cluster Policy in Asia, Institute of Developing Economies - JETRO, 2005.

Kuchiki, A. and M. Tsuji, eds., *Flowchart Approach to Industrial Cluster Policy in Asia*, Institute of Developing Economies - JETRO, Tokyo, 2005.

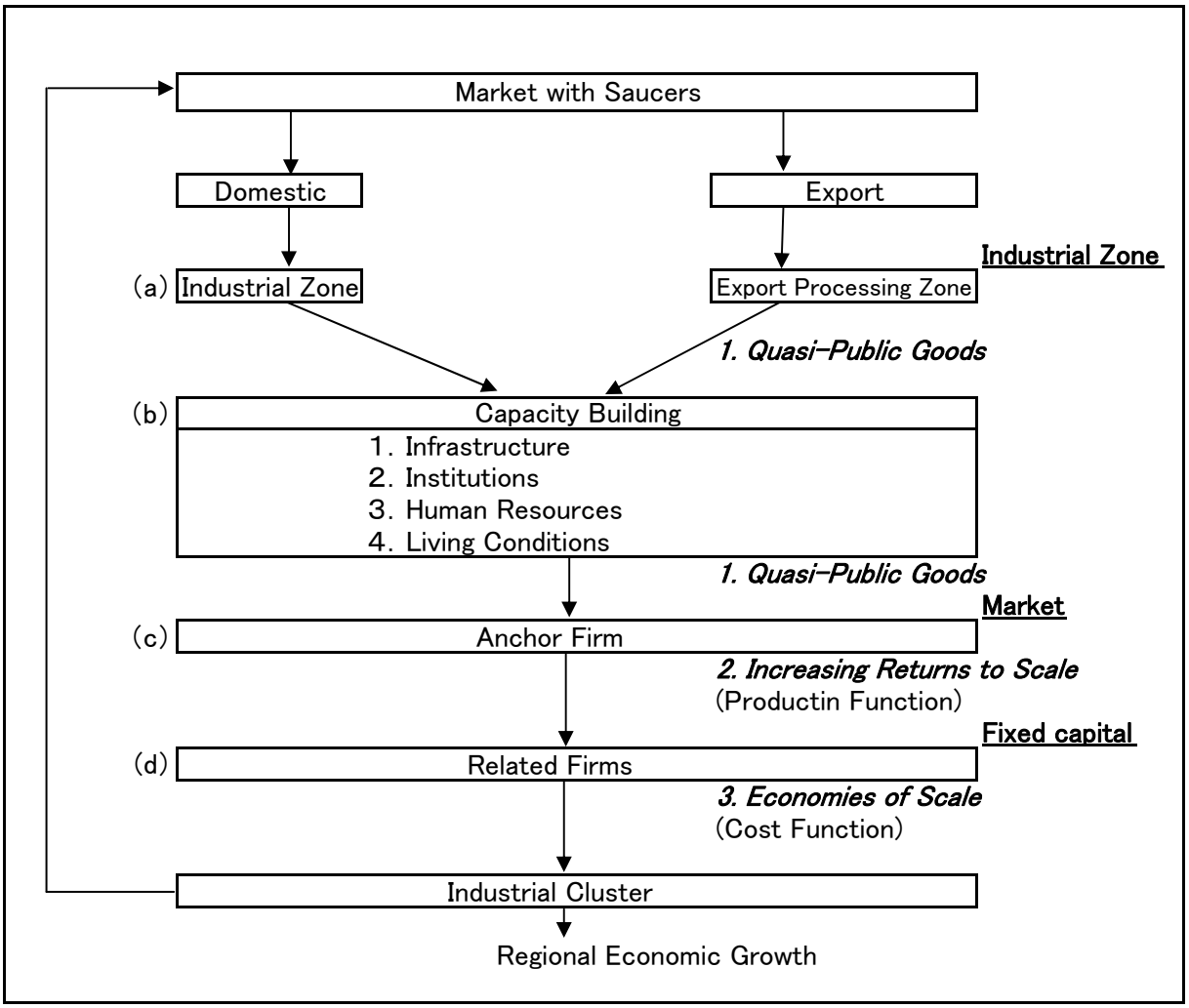
Penrose, E.T., "Foreign Investment and the Growth of the Firm," *Economic Journal*, Vol., June, pp. 220-235, 1956.

Sargent, *Dynamic Macroeconomic Theory,* Cambridge, MA, Harvard University Press, 1987.

Stiglitz J. E. and S. Yusuf eds. 2001, *Rethinking the East Asian Miracle*, New York: Oxford University Press for the World Bank.

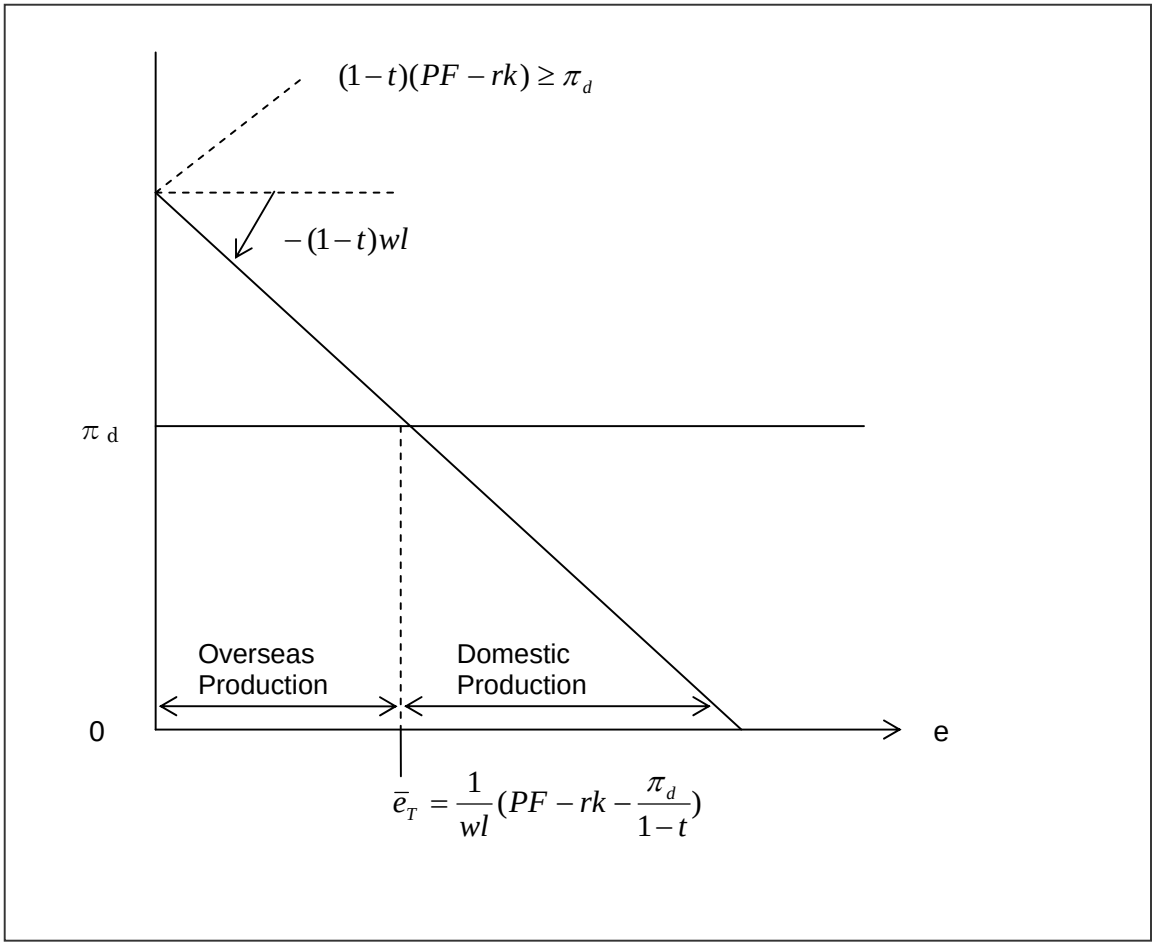
The World Bank, *The East Asian Miracle,* Oxford University Press, 1993.

Figure 1. An Industrial Cluster Formed by an Anchor Firm



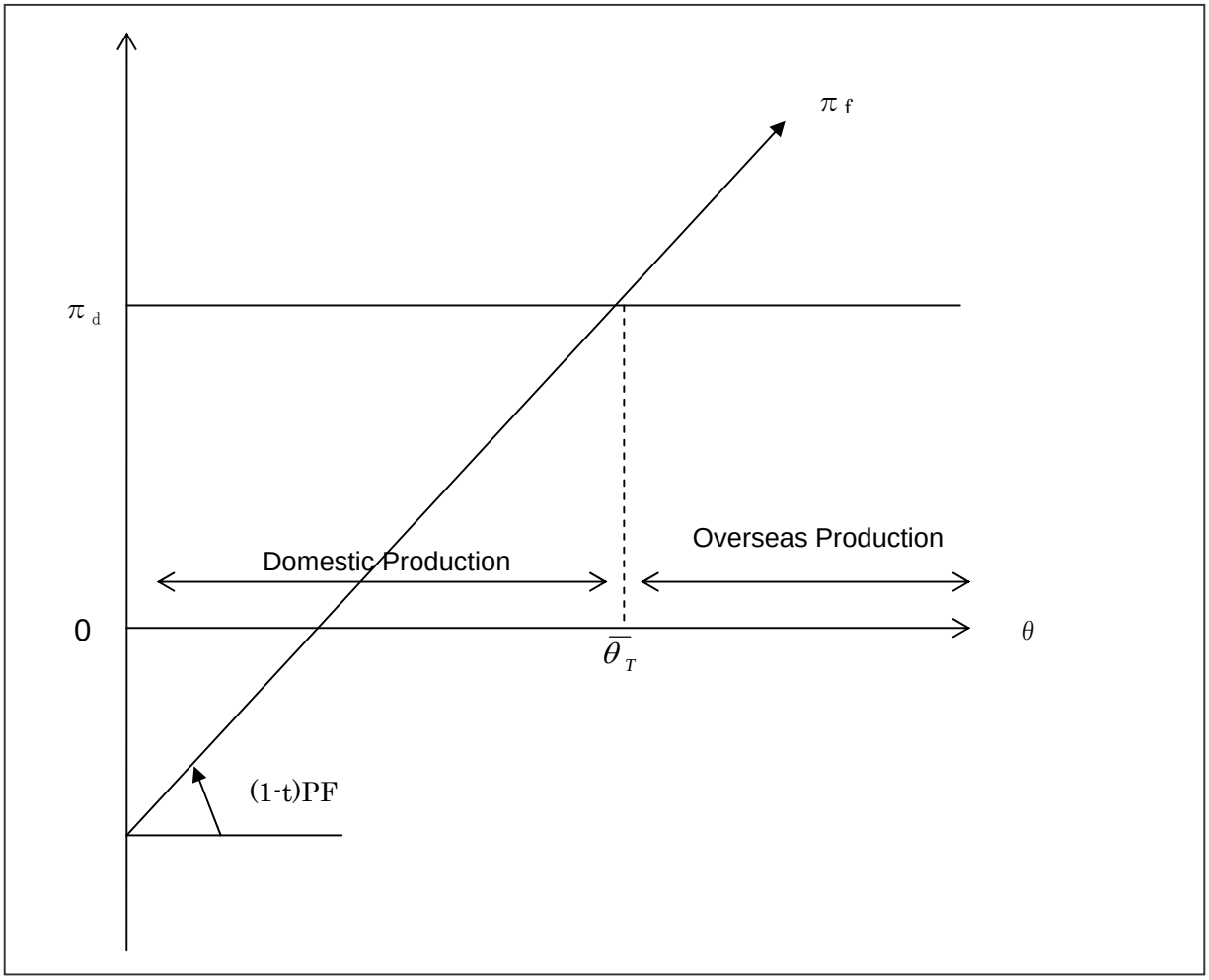
Source: The Author

Figure 2. Threshold of the Exchange Rate



Source: The Author.

Figure 3. Threshold of Country Risk



Source: The Author.

Table 1. Roles of Actors in the Flowchart Approach

			ACTORS				
		Shortage	1	2	3	4	5
Industrial Zone							
Capacity	Infrastructure						
	Institutions						XXX
	Human Resources						
	Living Conditions						
Anchor Company							
Related Companies							

1. Private Companies, 2. Multinational Corporations, 3. Foreign Assistance
4. Local Governments, 5. Central Government (The Flowchart Approach: Ordering and Timing Policies.)

Source: The Author

Table 2. Capacity Building and Industrial Cluster Characterized by Anchor Firms

Country		JAPAN	INDIA	MEXICO	CHINA	CHINA	VIETNAM	Notes
City /Prefecture		Okinawa	Bangalore	Guadalajara	Shanghai	Tianjin	Hanoi	
Type of Industry		Call Center	Software	Electronic	Automobile	Automobile	Printer	
Capacity	(a) Human Resources	* Japanese Speaking HR	* College and Graduate Students		* Metal Industry, Components	* Existence of Daihatsu		Initial Condition
	(b) Infrastructure						* National Roads and Ports Rehabilitation	Positive Policy Effectiveness of the Central Government
	(c) Institution	* Support on Communication System		* Support by the Chamber of Commerce * NAFTA	Governmental Support		* One-Stop Service * Tax System	Positive Policy Effectiveness of the Central Government
	(d) Living Condition	Good Climate	Good Climate					Initial Condition
Anchor Firm					GM, Ford	Toyota	Canon	Automobile / Electronics

Conclusion: 1. Institutional support has a positive effect on industrial cluster formation.
2. There is no need to have anchor firms for industries other than that of the automobile industry, which requires a great number of components.
3. There are cases where the initial condition is decisive.
There are some cases where industrial cluster policy is not effective (not always).

Source: Kuchiki, A. and M. Tsuji eds., *Comparison of Industrial Agglomerations between Asia and the Other Regions*, IDE-JETRO, 2005

Table 3. Top Ten Promising Countries for Overseas Business Operations and Why They are Promising

		China (447 companies)	Thailand (141 companies)	U.S (103 companies)	Vietnam (85 companies)	India (69 companies)
Sales	Potential for growth as a market	82.3%	51.1%	48.5%	41.2%	76.8%
	Present local market size	19.7%	17.0%	61.2%	5.9%	18.8%
	Product development tailored to local needs	7.8%	6.4%	16.5%	1.2%	2.9%
Production	Excellent human resources	24.2%	18.4%	24.3%	35.3%	30.4%
	Inexpensive labor force	74.9%	57.4%	1.9%	74.1%	59.4%
	Low-cost parts and raw materials	34.2%	11.3%	1.0%	12.9%	14.5%
	Supply base for final assembly manufacturers	28.6%	34.0%	26.2%	14.1%	24.6%
	Industrial concentration (concentration of sources, buyers, and partners)	14.3%	21.3%	19.4%	2.4%	2.9%
	For risk diversification	4.5%	12.8%	4.9%	31.8%	4.3%
	Base for exports to Japan	22.4%	19.9%	0.0%	24.7%	10.1%
	Base for export to third world countries	21.9%	29.8%	3.9%	21.2%	17.4%
Infrastructure and Systems	Local infrastructure (electric power, communications, transport, etc.) is well develop	9.4%	23.4%	35.9%	4.7%	2.9%
	Tax incentives for investment	17.4%	24.8%	2.9%	14.1%	4.3%
	Policies to attract foreign capital are stable	4.5%	14.9%	5.8%	7.1%	1.4%
	Progress towards regional integration (reduction of tariffs)	1.3%	9.2%	0.0%	2.4%	1.4%
	Stable political and social conditions	4.0%	34.0%	37.9%	20.0%	1.4%
		Indonesia (62 companies)	Korea (42 companies)	Taiwan (33 companies)	Malaysia (30 companies)	Russia (25 companies)
Sales	Potential for growth as a market	56.5%	66.7%	30.3%	30.0%	92.0%
	Present local market size	17.7%	40.5%	57.6%	6.7%	16.0%
	Product development tailored to local needs	3.2%	9.5%	6.1%	6.7%	0.0%
Production	Excellent human resources	4.8%	21.4%	18.2%	16.7%	4.0%
	Inexpensive labor force	67.7%	7.1%	3.0%	40.0%	8.0%
	Low-cost parts and raw materials	12.9%	7.1%	6.1%	13.3%	4.0%
	Supply base for final assembly manufacturers	27.4%	4.8%	15.2%	23.3%	4.0%
	Industrial concentration (concentration of sources, buyers, and partners)	11.3%	19.0%	24.2%	3.3%	4.0%
	For risk diversification	8.1%	7.1%	6.1%	23.3%	4.0%
	Base for exports to Japan	14.5%	2.4%	3.0%	23.3%	0.0%
	Base for export to third world countries	27.4%	9.5%	18.2%	13.3%	0.0%
Infrastructure and Systems	Local infrastructure (electric power, communications, transport, etc.) is well develop	6.5%	35.7%	18.2%	26.7%	4.0%
	Tax incentives for investment	6.5%	4.8%	6.1%	23.3%	0.0%
	Policies to attract foreign capital are stable	3.2%	7.1%	3.0%	23.3%	0.0%
	Progress towards regional integration (reduction of tariffs)	9.7%	0.0%	0.0%	6.7%	0.0%
	Stable political and social conditions	0.0%	11.9%	18.2%	33.3%	0.0%

Notes: (1) Figures in parentheses under each country name show the number of respondent companies.

(2) The table represents share with respect to the total respondent companies of each country.

Source: *Survey Report on Overseas Business Operations by Japanese Manufacturing Companies*, JBIC Institute, Japan Bank for International Cooperation, 2004