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OPTIMAL FOREIGN STRATEGIES OF THE INTERNATIONAL FIRM*

by

Yōko Wake

I. Preface

Approaches of business firms to foreign markets are realized through the forms of export, direct investment and licensing.[1] If these are called three foreign strategies of the so-called international firm, there must be some mechanism of decision-making for optimal strategies within rational business behavior. The main intention of this paper lies in analyzing such mechanism.

It was R. Aliber that first theorized firm's foreign strategies in connection with market scales, and his conclusion there was that expansion of market scales induces strategic alteration, export → licensing → direct investment. Later on similar arguments have been developed by such theorists as T. Horst [2] who analyzed "optimal behavior under different tariff and tax systems," F. Dei [3] who proved that "in selecting from among the three strategies tariff raising does not always promote direct investment," and further H. Brems [4] who formulated direct investment motivated by profit maximization as a "2-country, 4-firm" model of equlibrium growth. Therefore this paper may be said to go on the same line with these arguments.

Firstly in the next section II we present the basic model and, supposing a case where export and direct investment only are optional, we seek optimal quantities of labor employment and direct investment in both the home and foreign countries, to be born from maximization of statics-view profits. And further statics-view examination is made on how these strategies are affected by changes in managerial environments embodied in parameters. In section III we introduce the process of firm growth and apply to direct investment a behavior hypothesis that may maximimize dynamics-view profits. And in comparing the

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1) See Amano [5] in the annexed References, pp. 256–7; Aliber [1], Japanese version, p. 24.

obtained results with section II we relate them with the growth-theoretical approach that takes the so-called Penrose constraint as the major factor of direct investment. In section IV we take up the third strategy, i.e. licensing and pursue the optimal levels of employment and dicet investment (at home and abroad) as well as of licensing. And then analysis is worked on the effects of environmental changes on the combination of these optimal strategies.

II. Profit Maximization Behavior of the International Firm[2)]

Before entering development of models we shall make a comment on the definition of direct investment. This is because countless views have been extended over its definition and properties,[3)] and still today no unitary conceptional definition is considered to exist. In this paper it is defined as follows. It is "foundation of foreign subsidiary or affiliated firms under control of the home firm,"[4)] and means "set-up of foreign footholds of production and selling with attendant transfer of stocks of management resources[5)] of the home firm." And implicitly "technological superiority of the home firm" is presumed.[6)]

Now let's suppose an international firm allocates its management resources $\bar{K}$ to the home land and the foreign land respectively as K, K^* and combining these with homogeneous labor L, L^*, carries on production Y, Y^*. Supposing even technical levels between the home parent firm and the foreign subsidiary or affiliated firm[7)], we design linear homogeneous production functions:

2) The base models of this paper were owed to and developed on Prof. Ōyama's discussion paper, "Kokusai Kigyō no Senryaku," (Takokuseki Kigyō Kenkyukai Hōkoku, 1979).

3) As an article reviewing theories of direct investment J.H. Dunning [6] is interesting. Therein a voluminous review is exhibited from angles of i) survey approach, ii) trade approach, iii) location approach, iv) international organization and market structure.

4) Kojima, [7], pp. 135–6.

5) In this paper the concept and definition of management resources are based on those stressed by Penrose in his firm growth theory and later applied to direct investment theory by Prof. Komiya (Tokyo University). That is, management resources mean "knowledge and experience on business management; technical and speciality knowledge extensively comprising patent, know-how and marketing methods; positions within markets concerning selling, materials purchasing and capital raising; trade marks or confidence; systems for information collection, and research and development."

6) Analysis of the inductive factors of direct investment has been made by many thorists such as Bandra & White [8], Scaperlanda & Mauer [9] and Richardson [10]. Factors generally mentioned are i) high profit rates, ii) increase in foreign demand, iii) stable acquisition of raw materials and resources, iv) low wages, v) expectation of inflation and exchange rate fluctuation and vi) technical superiority. In particular as for the last-named factor typical theoretical analyses are seen in Aliber [1], Purvis [11] and Seoka [12].

7) This assumption of technical evenness may be unable to escape from a criticism of lack of realistic validity for a reason of limited capability of native labor in absorbing technique. To speak strictly, even when direct investment is defined as

$$Y=F(L, K) \tag{1}$$
$$Y^*=F(L^*, K^*) \tag{2}$$

From these by putting $y=Y/\bar{K}$, $y^*=Y^*/\bar{K}$, $n=L/K$, $n^*=L^*/K^*$, $k=K/\bar{K}$, $k^*=K^*/\bar{K}$ we obtain:

$$y=kf_{(n)} \tag{1}'$$
$$y^*=k^*f_{(n^*)} \tag{2}'$$

where $f'_{n,n^*}>0$, $f''_{n,n^*}<0 \rightarrow$ are assumed. Needless to say by the restrictive conditions of management resources $\bar{K}$ there is a relation:

$$k^*=1-k \tag{3}$$

On the other hand demand for the products in the home and foreign lands, Z, Z^*, can be expressed as the functions of prices in the respective lands, P, P^*, that is:

$$Z=Z(P)$$
$$Z^*=Z^*(P^*)$$

where $Z'_P<0$, $Z^{*\prime}_{P^*}<0$. And since generally firm's expansion of sales share requires additional efforts, the average sale costs per resources unit in the both lands, C, C^*, are presumed to lie in the relation of an incremental function with sales share in respective lands, θ, θ^*, that is:

$$C=C(\theta)$$
$$C^*=C^*(\theta^*)$$

where $C'_\theta>0$, $C^{*\prime}_{\theta^*}>0$.[8]

And we suppose for simplicity that share in the domestic market is stiff and hence the firm cannot change its share.[9] On the contrary its share in the

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establishment of a spot subsidiary wholly controlled by resources T, or technostructure to be distinguished from simple labor power, efficiency of service of T is considered generally to decrease in accompany with international transfer. See Seoka [12], pp. 66–69.

8) Generally the extent of sale cost firm i decides to disburse for sale promotion is determined as the result of business behavior that maximizes profit π_i with respect to production volume q_i and sale cost C_i being defined as:

$$\pi_i=q_ip_i(q_1, \ldots q_n; C_1 \ldots C_n)-N_i(q_i)-C_i \qquad i=1 \ldots n$$

Here N_i is production cost. Therefore the sale cost derived from this depends on conjecture on market structure and other firms' behavior, Imai et al. [13], pp. 174–190.

9) In the theory of direct investment it may be perhaps too bold to take the international firm as a price-maker and the home market as stiff. If we follow the accepted view (represented by Kindleberger and others), "Foreign direct investment originates from monopolistic superiority," and again in view of actual behavior of the multinational firms, it might be said more persuasive to presume some degree of market monopoly at home and abroad. In this paper the writer holds a hypothesis she previously presented, "In the process of transition from innovation to competition firms that have experience of innovation advance abroad in pursuit of new innovational profits" (Wake in [14], Chap. 9). Therefore the inducement to direct investment here is technological superiority, which does not always imply market monopoly.

foreign market is changeable and can be determined within the realm of its optimal foreign strategy. This can be written as:

$$\theta^*=(Y+Y^*-\theta Z)/Z^* \tag{4}$$

That is to say, provided all the products of the subsidiary are demanded in its land and are not directed to other markets, its share in that land can be formulated as the proportion that the sum of home firm's export $Y-\theta Z$ and subsidiary's product Y^* holds to the total demand of the foreign land, Z^*.[10] Here if we put $z=Z/\overline{K}$, $z^*=Z^*/\overline{K}$, equation (4) is rewritten from (1)′ and (2)′ as follows;

$$\theta^*=(kf_{(n)}+k^*f_{(n^*)}-\theta z)/z^* \tag{4}'$$

And if price discrimination and transport cost are not considered, with foreign exchange rate (home-currency base) and import tariff (ad varolem) of the foreign country τ^* being given, home and foreign prices are linked by arbitration terms:

$$P=ep^*/(1+\tau^*) \tag{5}$$

Now let's suppose the international firm, under the above-described basic assumptions, determines optimal combination of overseas strategies so that its statics-view profits may become largest. The home-currency-base profit per resources unit after tax is expressed, letting ω, ω^* denote home and foreign wage rates and t, t^* profit tax rates, as:

$$\begin{aligned}\pi=&(1-t)[\{p-c_{(\theta)}\}\theta z+\{p^*-ec^*_{(\theta^*)}\}\{kf_{(n)}-\theta z\}-\omega nk]\\&+(1-t^*)e[\{p^*-c^*_{(\theta^*)}\}k^*f_{(n^*)}-\omega^*n^*k^*]\end{aligned} \tag{6}$$

Accordingly under the given conditions of product prices p, p^*, wage rates ω, ω^*, exchange rate e, import tariff τ and profit tax rates t, t^*, the firm will determine the input ratios of production factors at home and abroad, n, n^*, as well the ratio of foreign investment k^* that may maximize the average profit π. So by taking the values obtained by partial differentation of (6) with respect to n, n^* and k as zero, we have the following (7), (8), (9):

$$[P-ec^*(1+\epsilon\eta)]f'_{(n)}=\omega \tag{7}$$

$$[p^*-c^*(1+T\epsilon\eta)]f'_{(n^*)}=\omega^* \tag{8}$$

$$(1-t^*)e[\{p^*-c^*(1+T\epsilon\eta)\}f_{(n^*)}-\omega^*n^*]=(1+t)[\{p-ec^*(1+\epsilon\eta)\}f_{(n)}-\omega n] \tag{9}$$

where $T=(1-t)/(1-t^*)$

$\epsilon=(y-\theta z+y^*T^{-1})/(y-\theta z+y^*)$

$\eta=c^{*\prime}_{(\theta^*)}(y-\theta z+y^*)/c^*z^*$

10) To look phenomenally there are many patterns in the behavior of foreign subsidiaries. Besides the inland-market-oriented pattern defined here, there are those oriented to the home land or the third countries (William [15]). In fact in Japan's advancing firms the ratio of exports to sales amounts to a high of 40%—20% to both Japan and the third countries (by an enquete survey of the International Trade and Industry Ministry of 1973). So, if the latter definition is taken the foreign-market share of the parent firm defined in the text is amended as:

$$\theta^*=\{(Y-\theta Z)-(Y^*-\theta_1 Z^*\}/Z^*,$$

where θ_1 denotes spot firm's share, and letting θ_2 represent home firm's share there is a relation of $\theta^*=\theta_1+\theta_2$.

Here η denotes elasticity of the average sale cost in the foreign country which is assumed to be constant. And these three equations respectively can be interpreted as transformation of the marginal conditions.

Thus we can obtain the levels of optimal production and sale at home and abroad by combining the three equations (7), (8), (9) as simultaneous equations. If for simpleness the home and foreign profit tax rates, t, t^*, are assumed to be equal ($T=1$), from (5), (7) (8) we have:

$$e\omega^*/f'_{(n^*)}-\omega/f'_{(n)}=e\tau^*p^*/(1+\tau^*) \tag{10}$$

And from (7), (8), (9):

$$\omega\gamma/f'_{(n)}-e\omega^*\gamma^*/f'_{(n^*)}=0 \tag{11}$$

where $\gamma=f_{(n)}-nf'_{(n)}$

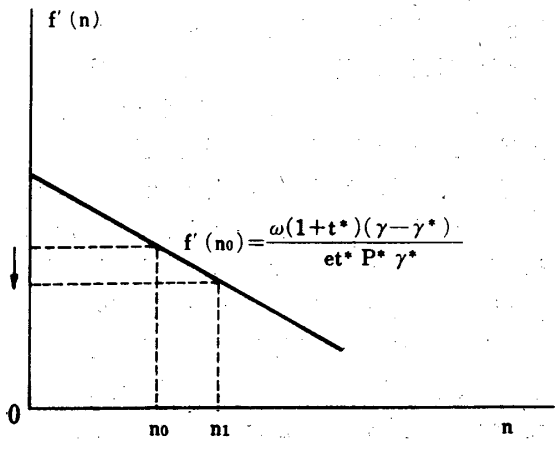
$\gamma^*=f_{(n^*)}-n^*f'_{(n^*)}$

These represent the average productivity of management resources home and foreign. Accordingly from (10), (11) we can seek the factor input ratios home and foreign that can give maximum profits. In other words, n_0, n_0^*, that satisfy the following are the optimal ratios. (See Figure 1).

$$f'_{(n0)}=\frac{\omega(1+\tau^*)(\gamma-\gamma^*)}{e\tau^*p^*\gamma^*} \tag{12}$$

$$f'_{(n0^*)}=\frac{\omega^*(1+\tau^*)(\gamma-\gamma^*)}{\tau^*p^*\gamma} \tag{13}$$

Figure 1



On the other hand as for the share in the foreign market, θ^*, by substituting (12) in (7) we obtain:

$$C^*_{(\theta^{*0})}=\frac{p^*\{\gamma-(1+\tau^*)\gamma^*\}}{(1+\eta)(1+\tau^*)(\gamma-\gamma^*)} \tag{14}$$

That is, θ^*_0 that satisfies (14) is the optimal share for this firm. And again since θ^* is a function of k^* as is shown by (4)′ the optimal foreign investment ratio corresponding to θ_0^* is straightly determined from (14).

By the by, how will these optimal factor input ratios n_0, n_0^* and the direct investment ratio k^* change in response to changes in environments embodied in the parameters? The parameters showing environments comprise foreign exchange rate e, product price in the foreign land p^*, import tariff τ^* and wage rates home and foreign, ω, ω^*. To examine the effects of a rise in tariff, from (12)~(14) the following becomes at once clear. A rise in tariff causes a rise in the factor input ratios n_0, n_0^* ($n_0 \to n_1$ in the Figure) and a decrease in the foreign-market share θ^*. On the contrary as for the effect on the moves of the optimal investment ratio k^* a procedure is necessary as below. By operating partial differentiation on (4)′ with respect to θ^*, n, n^*, k^* we have:

$$\{f_{(n)}-f_{(n^*)}\}dk^*=kf'_{(n)}dn+k^*f'_{(n^*)}dn^*-z^*d\theta^* \tag{4}''$$

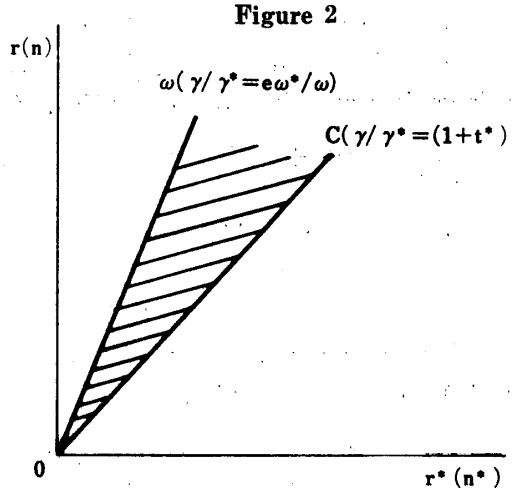
Now while a rise in τ brings about a rise in n, n^* and a decrease in θ^* as above, direct investment k^* rises (or decreases) corresponding to the condition of sigh shown by $n_{(}\gtrless_{)}n^*$. The unequality sign $<$, however, can be theoretically eliminated on account of the positive marginal productivity, $\gamma-\gamma^*>0$, as in (12), (13). And the condition of $n>n^*$ can be rewritten as (15) by (12), (13):

$$\gamma/\gamma^*<e\omega^*/\omega \tag{15}$$

Further the above description may be restated as follows from the angle of two foreign strategies, export and direct investment. Export per resources unit is written as: $E_x=kf_{(n)}-\theta z$. Therefore a rise in import tariff diminishes export and promotes investment.[11] Of course it is under the condition of (15) derived from $n>n^*$ that such a phenomenon of strategic shift theoretically applies. This means in itself that theoretical possibility of optimal strategies greatly rests on the wage levels at home and abroad.

The above-described relations are illustrated in Figure 2. The two axes represent average productivity home and foreign, γ, γ^*, respectively being the functions of n, n^*. Firstly from the condition of positive marginal productivity, it is the region below line W (eqation 15) that shows theoretically applicalble combination of n and n^*. Next, in setting sale costs home and foreign as positive, curve C is drawn, and n, n^* must lie in the region above it. Accordingly the shaded portion exhibits combination of n and n^* that theoretically warrants shift from export to direct investment for the cause of a rise in tariff. And for the presence of n, n^* that satisfy this condition there must be a relation of wages $e\omega^*/(1+\tau^*)>\omega$ between home and foreign wages.

Figure 2



By the by, in decision-making of optimal foreign strategies other environmental factors than tariff must be related. So for the purpose of comparative-statics analysis of the effects on the above results of the firm environments embodied in the parameters, we worked total differentiation on (7)~(9), the result being summarized in (16).

11) This conclusion is derived under the mechanism below:

$$t^*\uparrow \longrightarrow \begin{cases} n\uparrow \\ n^*\uparrow \\ \theta^*\downarrow \end{cases} \longrightarrow \boxed{k^*\uparrow} \longrightarrow k^*f_{(n^*)}\uparrow \longrightarrow \boxed{E_x\downarrow}$$

$$\begin{pmatrix} - & - & (+) \\ a_{11} & a_{12} & a_{13} \\ - & - & (+) \\ a_{21} & a_{22} & a_{23} \\ + & + & (-) \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} dn \\ dn^* \\ dk^* \end{pmatrix} = \begin{pmatrix} - & + & & + & + & + \\ b_{11} & b_{12} & 0 & b_{14} & b_{15} & b_{16} \\ - & & - & + & & \\ b_{21} & 0 & b_{23} & b_{24} & 0 & 0 \\ (+) & - & - & - & - & - \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} & b_{36} \end{pmatrix} \begin{pmatrix} dp^* \\ d\omega \\ d\omega^{*\prime} \\ dt \\ de \\ d\tau^* \end{pmatrix} \tag{16}$$

Here among the plus and minus signs those enclosed in brackets are definite under the condition of $n>n^*$. And if at the initial stage $T=1$ is put, $[A]>0$ holds.[12] So by solving (16) for dn, dn^*, dk^*[13] Table 1 is obtained.

Table 1.

	Changes in firm environmental factors					
	p^*	ω	ω^*	t	e	τ^*
n	(+)	(−)	(+)	(−)	(−)	(−)
n^*	?	−	+	−	−	−
k^*	(−)	+	−	+	+	+

The results shown in this table are considered to be generally in the sphere of common sense, They directly illustrate firm's shift of strategies—from export to direct investment or reverse—corresponding to changes in environments including wage rates ω, ω^*, product price P^*, exchange rate e, and foreign import tariff τ^*.

III. Firm Growth Process and Direct Investment

In this section by introducing growth process of firms we formulate behavioral hypotheses of direct investment in a new style and build them in the framework of analysis explained in the previous section. This is because, in so far as direct investment is materialized generally as establishment of foreign subsidiaries or affiliates, it may be more realistic to presume that optimal strategies are decided taking account of prospective growth in the parent and subsidiary firms.

So first we set a behavioral hypothesis about direct investment as below. The firm is assumed to allocate its management resources $\bar{K}$ to itself and its foreign subsidiary so as to make maximum the present discount value of the

12) When $T=1$, $[A]=e(1+\eta)Z\{P-ec^*(1+\eta)\}\{P^*-C^*(1+\eta)\}\{f_{(n)}-f_{(n^*)}\}^2 f''_{(n)} f''_{(n^*)}>0$

13) $$\begin{pmatrix} dn \\ dn^* \\ dk^* \end{pmatrix} = \frac{1}{[A]} \begin{pmatrix} + & - & - & - & - & - \\ C_{11} & C_{12} & C_{13} & C_{14} & C_{15} & C_{16} \\ ? & - & + & - & - & - \\ C_{21} & C_{22} & C_{23} & C_{24} & C_{25} & C_{26} \\ - & + & - & + & + & + \\ C_{31} & C_{32} & C_{33} & C_{34} & C_{35} & C_{36} \end{pmatrix}$$

In (16) the factor C_{31} of [B] takes a plus sign only when the import tariff τ^* is very low.

sum total of net cash flow which the firm and the subsidiary receive through the process of growth each (NCF in the below). Now if the firm expects that product prices P, P^*, wage rates ω, ω^*, profit tax rates t, t^*, home market share θ and exchange rate e prevalent at the beginning of the plan term will continue in the future, and foresees that capital can be freely raised at interest rates ρ, ρ^* in the competitive capital markets and the current rates are unchanged in the future. Then NCF ν that the firm receives through the future is expressed as:[14]

$$\nu=(1-t)\int_0^\infty e^{-\rho t}[(p-c)\theta z_t+(p-ec^*_t)\{k_t f_{(n)}-\theta z_t\}-\omega n_t k_t -k_t l_{(g)}]dt+e(1-t^*)\int_0^\infty e^{-\rho^* t}[(p^*-c^*_t)k^*_t f_{(n^*)}-\omega^* n_t^* k_t^*-k^* l^*_{(g^*)}]dt \quad (17)$$

where $l_{(g)}$, $l^*_{(g^*)}$ denote average adjustment cost functions per ma-unit of management resources, respectively being incremental functions of the firm growth rates $g(=K/\bar{K})$, $g^*(K^*/\bar{K})$.[15]

And granting that this firm keeps its foreign-market share at the level of the beginning period under the expected rate π of increase in demand for the product z, z^* at home and abroad, under $\dot{\theta}=\dot{\theta}^*=0$ from (4) in the previous section we have:

$$e^{\pi t}(\theta^* z^*+\theta z)=e^{gt}kf_{(n)}+e^{g^* t}k^* f_{(n^*)} \quad (4)''$$

From this, if the growth rate of demand π is given, both at home and abroad the firm growth rates g, g^* must be equal π: $g=g^*=\pi$. On another hand, since the factor input ratios n, n^*, under the given environments such as historical constraints of resource $\bar{K}$ and wage rates ω, ω^*, are determined at levels that satisfy (7) and (8) irrespective of time t, equation (17) can be rewritten:

$$\nu_0=\frac{1-t}{\rho-\pi}\{(p-c)\theta z+(p-ec^*)(kf_{(n)}-\theta z)-\omega nk-kl_{(g)}\} +\frac{e(1-t^*)}{\rho^*-\pi}\{(p^*-c^*)k^* f_{(n^*)}-\omega^* n^* k^*-k^* l^*_{(g^*)}\} \quad (17)'$$

where $0<\rho-\pi<1$, $0<\rho^*-\pi<1$ are necessary for ν_0 to be converged within finite values.

Here by differentiating (17)' with respect to and taking the result as zero,

14) This principle of behavior basically corresponds with the serial relation between capital value, capitalization ratio and income flow in Kindleberger and Aliber.

15) This adjustment cost means the volume of investment necessary for realizing a certain growth rate and this volume, which depends on the existing capital scale of the firm, is shown by $I=\phi(K, \dot{K})$. On presuming linear homogeneity this can be written as $C=C(\dot{K})$ where $C=I/K$, and is often called the Penrose constraint. To add a word, it was the adjustment cost model of Eisner-Strouts [16] that explicitly formulated investment behavior within the profit maximization principle introducing the concept of adjustment cost. And generally in the cost adjustment function

$$C'(\dot{K})\gtrless_{0}\longleftarrow\longrightarrow \dot{K}\gtrless_{0},\ C''(\dot{K})>0$$

is assumed from the stability of optimal capital accumulation process.

we obtain:[16]

$$e[\{p^*-c^*(1+H\sigma\eta)\}f_{(n^*)}-\omega^*n^*-l^*_{(g^*)}]=H[\{p-ec^*(1+\sigma\eta)\}f_{(n)}-\omega n-l_{(g)}] \quad (18)$$

where, $H=\dfrac{(1-t)(\rho^*-\pi)}{(1-t^*)(\rho-\pi)}$

$\sigma=(y-\theta z+y^*H^{-1})/(y-\theta z+y^*)$

$\eta=c'^*_{(\theta^*)}(y-\theta z+y^*)/c^*z^*$

On putting $t=t^*$, $\rho=\rho^*$, for simplicity, by substituting (7), (8) derived in the previous section in (18) and combining them as simultaneous equations with (10) we get:

$$f'_{(n0)}=\frac{\omega(1+\tau^*)(\gamma-\gamma^*)}{e\tau^*p^*\gamma^*+(1+\tau^*)l_{(g)}-el_{(g^*)}} \quad (19)$$

$$f'_{(n0^*)}=\frac{e\omega^*(1+\tau^*)(\gamma-\gamma^*)}{\tau^*p^*\gamma-(1+\tau^*)\{l_{(g)}-el^*_{(g^*)}\}} \quad (20)$$

From this, the optimal factor input ratios home and foreign, n_0, n_0^* are directly determined on the presupposition of investment behavior that maximizes NCF. On the other hand as for the foreign-market share θ^* and direct investment ratio k^*, we can find these from (21) which is obtained by substituting (19) in (7):

$$C^*_{(\theta^*)}=\frac{ep^*\{\gamma-(1+\pi^*)\gamma^*\}-(1+\tau^*)(l_{(g)}-el^*_{(g^*)})}{e(1+\tau^*)(\gamma-\gamma^*)} \quad (21)$$

By comparing the values of (19)~(21) thus obtained with the values of (12~(14) shown in the previous section, we shall examine what meanings are implied respectively in the results got through the statics behavior principle of profit maximization and the results through the dynamics principle. First it is obvious that, under the state of equal profit tax rates and equal interest rates, the different-behavior hypothesis is reduced to the difference of the adjustment cost between two lands measured by home-land currency. And this difference depends on the technical restriction of the adjustment cost function and the exchange rate. True it is not an easy task to make theoretically convincible explanation of the technical shape of the adjustment function. So tentatively let's suppose that the firm lies in a buyer-monopoly position in the capital-goods market at home, and prices of capital goods tend to rise relatively to foreign market prices in accompany with the volume of purchase of such goods. And we assume that such a market environment at home is generating a situation of

16) If it is presumed, contrary to this paper, that the growth of the firm and that of the subsidiary are not interdependent but have respectively independent investment functions, in other words if the constraint of (3) is removed, the conditional equation (18) is of course replaced by the following two conditions. That is, the optimal capital accumulation process, g, g^* and the optimal capital quantity k, k^* for both firms are independently determined under the marginal conditions:

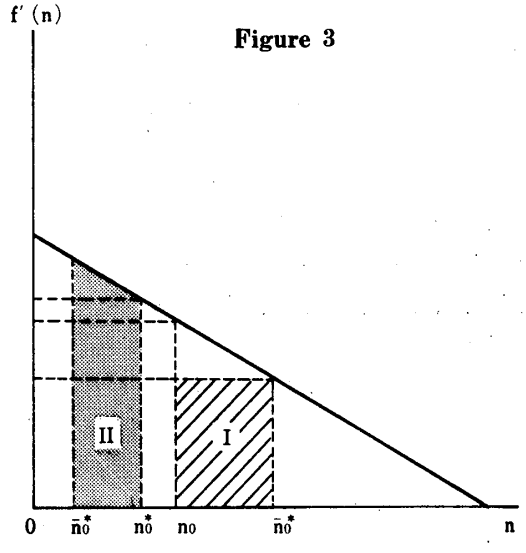
$$l'(g)=\frac{(P-ec^*)f_n-wn-l_{(g)}}{\rho-g}>0$$

$$l'(g^*)=\frac{(P^*-c^*f_{(n^*)}-w^*n^*-l_{(g^*)}}{\rho-g^*}>0$$

$l_{(g)} > el^*_{(g^*)}$.[17] Here to compare the values of (12) and (19), the optimal factor-input ratio in the case of introducing growth, $\bar{n}_0$ and that in the case of non-introduction n_0 hold a relation of $\bar{n}_0 > n_0$ as shown in Figure 3, That is to say, other things being equal, the relatively high adjustment cost at home relatively raises the optimal volume of labor employment through substitution between capital and labor. And it is clear that as for the factor-input ratio in the foreign land there is a reverse relation $n_0 < n_0^*$ from (13) and (20).

On another hand as to the foreign market share there is a relation of $\theta^* < \theta$ from comparison between (14) and (21). A relatively high adjustment cost at home works rather to lower the optimal sales share in the foreign market. Here it is impossible to confirm what responses are seen in the direct investment ratio. Yet by putting differences of optimal values brought out by the different behavior principles respectively as Δn_0, Δn^*_0, $\Delta\theta^*_0$, Δk^*_0 we obtain $\Delta\theta^*_0 = \Delta k^*_0\{f_{(\Delta n0)} - f_{(\Delta n^*0)}\}$ from (4)'. Therefore when in Figure 3 area II exceeds area I the effect of a relatively high adjustment cost at home will tend to push up the optimal investment ratio k^*_0. and at the same time will suppress down the optimal export level defined by $k_0 f_{(n0)} - \theta z$ Of course this conclusion rests on the technical restraints of the production function. Yet if such production technique as strongly implies decrease in marginal productivity is assumed, as for firms taking behavior of maximizing dynamics-view profits an adjustment cost increasing in the growth process has an effect of promoting direct investment. This conclusion is conformable with the growth-theoretical approach that takes the Penrose constraint as the major factor of direct investment.

Figure 3



Next let's go on to examine what effects environmental changes will work on foreign strategies. Following the same procedure as described in the previous section, total differentiation was worked on equations (7), (8), (18), the result being summarized as:

17) If we follow a view pointed out by Aliber, "If diversion by countries of the investment capitalization rate makes the major inducement of foreign investment it tends to be actively advanced in capital-intensive industries" (Kindleberger, ed., [1] p. 32), this assumption of the buyer-monopoly state in the home capital-goods market can have theoretical validity to some extent. And if we take explicitly in our model the growth-theoretical approach that places the motive of direct investment on the Pemrose constraint it may be realized by $l_{(g)} > el_{(g^*)}$.

$$\begin{pmatrix} \underset{a_{11}}{-} & \underset{a_{12}}{-} & \underset{a_{13}}{(+)} \\ \underset{a_{21}}{-} & \underset{a_{22}}{-} & \underset{a_{23}}{(+)} \\ \underset{a_{31}}{+} & \underset{a_{32}}{+} & \underset{a_{33}}{(-)} \end{pmatrix} \begin{pmatrix} dn \\ dn^* \\ dk^* \end{pmatrix} = \begin{pmatrix} \underset{b_{11}}{-} & \underset{b_{12}}{+} & 0 & \underset{b_{14}}{+} & \underset{b_{15}}{+} & \underset{b_{16}}{+} & 0 & 0 & 0 \\ \underset{b_{21}}{-} & 0 & \underset{b_{23}}{-} & \underset{b_{24}}{+} & 0 & 0 & 0 & 0 & 0 \\ \underset{b_{31}^*}{(+)} & \underset{b_{32}^*}{-} & \underset{b_{33}^*}{-} & \underset{b_{34}^*}{-} & \underset{b_{35}^*}{-} & \underset{b_{36}^*}{-} & \underset{b_{37}^*}{-} & \underset{b_{38}^*}{-} & \underset{b_{39}^*}{?} \end{pmatrix} \begin{pmatrix} dp^* \\ d\omega \\ d\omega^* \\ dt \\ de \\ d\tau^* \\ d\rho \\ dl \\ d\pi \end{pmatrix} \tag{22}$$

By solving (22) for dn, dn^*, dk^* we get Table 2.

Table 2.

	Changes in firm environmental factors								
	p^*	ω	ω^*	t	e	τ^*	ρ	l	π
n	(+)	(−)	(+)	(−)	(−)	(−)	(−)	(−)	?
n^*	?	−	+	−	−	−	−	−	?
k^*	(−)	+	−	+	+	+	+	+	?

Here by putting $H=1$ at the beginning period, among the factors of (22) those with no stellar mark * are the same with the factors of (16) in the previous section. And also $[A]>0$.[18] The plus-minus signs in the brackets are definite under the condition of $n>n^*$.

Thus as regards the effects of product prices p, p^*, wage rates ω, ω^*, profit tax rate t, import tariff rate τ^* and exchange rate e their respective effects on the endogeneous variables similar results have been known as in the previous section. Yet as to direct investment on firm growth process additionally other environmental factors should come into consideration. One of these is the moves of interest rates in the capital market. Since usually firms use market interest rates as discount rates it is obvious that changes in interest rates exert not a few effects on firm's foreign strategies. Financial stringency at home fosters direct investment, and at the same time induces contraction of home production scales and attendant decrease in export. And in accompany with this rise in the direct investment, that is, increase in management resources in the subsidiary, k^*, labor employment n^* per resources unit declines. Of course as to changes in interest rates abroad also similar relations of responses (with inverse effects) can be found.[19]

18) See Footnote 11.

19) These responses between interest rates and foreign strategies back up Aliber's theory of "capitalization ratio diversion." By his theory, "Provided risk premiums against indefinite flow incomes (incl. foreign exchange rate risk) are standardized among countries, differences by countries of the ratio of capitalization to total capital reflect differences of the capitalization rates of fixed credit, i.e. differences of interest rates." This means in itself that a major inducement in foreign strategies lines in the moves of interest rates home and foreign. Aliber [1], p. 29.

A second environmental factor is the adjustment costs home and foreign, $l_{(g)}, l^*_{(g^*)}$ which increase on the process of firm growth, as mentioned already. These are costs emerging from diseconomies of big-scale business, in which are included those from managerial constraints attendant to growth process and those from exogeneous factors such as changes in market situations and legal regulations, the former making the Penrose constraint. As may be evident from Table 2, if for some reasons the home adjustment cost function $l^*_{(g^*)}$ has shifted upward (or downward) the firm copes with it in a direction of contraction of home production and decrease (increase) of export as well as raising (lowering) of the direct investment ratio. Again as to the adjustment cost in the foreign land there is similar mechanism, though in an opposite direction.

A third environmental factor added by consideration of firm growth process is the growth rate π of demand, at home and abroad, for the product the firm produces and sells. In our theoretical framework, however, the effects of changes in the demand growth rate on export and direct investment cannot be explicitly drawn out. For this π has an offsetting effect on the discount rate similarly for both the aspecs of NCF, one received from domestic production-sale and another from export and direct investment.

IV. Three Foreign Strategies and Business Management

It is a fact not to be overlooked that licensing is involved in the foreign strategies of the international firm along with export and direct investment so far discussed. It may not always be an easy matter to grasp this licensing compactly within firm's foreign strategies. By an opinion stepwise shift from export to licensing and licensing to direct investment makes the development pattern of the international firm.[20] From this viewpoint licensing is a prestage for founding subsidiaries or affiliates abroad and its main motive is not gains such as royalty charges but rather should be regarded as a chain link of direct investment.[21] Again it is possible to conceive licensing as "sale of technology as a commodity" and here it may be compiled in export strategy.

Anyhow, detailed discussion about definition of strategies is not our aim here. So we will defer it to another occasion, and define that licensing is a foreign

20) As is represented by R. Vernon's words "direct investment is a successor of export," as regards the pattern of stepwise foreign advance theoretical and positive study has been continued up to date by many theorists. For example, G. Gruber [18], H. Horst [19] and R. Z. Aliber [1] are noteworthy in their theoretical fruits.

21) In this paper licensing is defined for convenience as "to raise productivity of the license-receiver firm at some certain rates and to receive royalties as compensation, yet it must be noted that actually there are other motives in the background, as J. Branson points out, such as mutual interests through cross-licensing, ii) evasion of competitive technical innovation, iii) too small a market scale, or lack of resources and experiences for direct investment, iv) rigid legal control on direct investment, and other numerous uncertainty factors.

strategy independent of export or direct investment. In other words, we take that the foreign subsidiary and the license-receiver firm are different business bodies. And licensing means that a firm admits use of its techniques to foreign firms (admission of rights) and receives royalties at a certain rate of profits gained through sale. Now, since the production technique of the license-giver firm can be expressed by linear homogeneous function F, used in the foregoing sections, the output volume $\tilde{Y}$ of the foreign license-receiver firm is assumed to be written, variable λ denoting the level of licensing, as:

$$\tilde{Y}=\lambda F(\tilde{L}, \tilde{K}) \tag{23}$$

where $0\leq\lambda\leq1$.[22] And from this expression, by putting $\tilde{y}=\tilde{Y}/\bar{K}$, $\tilde{k}=\tilde{K}/\bar{K}$, $\tilde{n}=\tilde{L}/\bar{K}$ we get:

$$\tilde{y}=\lambda f(\tilde{n})\tilde{k} \tag{23}'$$

On the other hand, to let $\tilde{\theta}$ show the sales share of the foreign firm in its land, there is relation:

$$\theta^*+\tilde{\theta}=1 \tag{24}$$

And the average sale cost of this firm per resorces unit, C, is an incremental function of θ, $\tilde{c}=\tilde{c}(\tilde{\theta})$. Under these situations the royalty returns the international firm receives through licensing, are assumed to be written, the royalty rate $\mu(0<\mu<1)$ being given, as:[23]

$$R=\mu(p^*-\tilde{c}(\tilde{\theta}))\lambda f(\tilde{n})\tilde{k}.$$

Thus the profits the international firm obtains through foreign activities (export, direct investment, licensing) per resources unit, after tax and on the home-currency base, π', can be expressed by adding up (6) in the previous section and the said R as:

$$\begin{aligned}\pi'=&(1-t)\{(p-c)\theta z+(p-ec^*)(kf_{(n)}-\theta z)-\omega nk\}\\&+(1-t^*)e\{(p^*-c^*)k^*f_{(n^*)}-\omega^*n^*k^*+\mu(p^*-\tilde{c})\lambda f_{(\tilde{n})}\tilde{k}\}\end{aligned} \tag{25}$$

Now we presume that the firm, with given resources at home and abroad, determines employment at home and abroad, n, n^*, and the level of licensing λ so that the average profit π' becomes largest. Therefore by putting as zero the values of partial differention of (25) with respect to n, n^*, λ we obtain the following (26)~(28).

22) Our assumption about transfer of techniques to the foreign subsidiary in this paper is only tentative one. For more exact theorization analysis of dynamics mechanism of transfer will be necessary. On this point R. Findley's recent article [22] is suggestive. He explains relation of technical gaps and capital formation in developing the Veblen-Gershenkron hypothesis.

23) Usually in discussion about the determination of royalties they are defined as charges per unit of output [13], p. 311. In this paper, in order to introduce the mutual-collision nature in the sales share between the license-giving and license-receiving firms we assumed royalties on the base of profits after deducting sale costs. This point resembles Idei's model [3].

$$\{P-ec^*(1+\epsilon\eta)+e\mu\tilde{c}\epsilon\tilde{\eta}\}f'_{(n)}=\omega \tag{26}$$

$$\{P^*-c^*(1+T\epsilon\eta)+\mu\tilde{c}T\epsilon\tilde{\eta}\}f'_{(n^*)}=\omega^* \tag{27}$$

$$\mu(p^*-\tilde{c})=(\mu\tilde{c}\epsilon\tilde{\eta}-c^*\epsilon\eta)T \tag{28}$$

where $T=(1-t)/(1-t^*)$

$\epsilon=(y-\theta z+y^*T^{-1})/(y-\theta z+y^*)$

$\eta=C^{*\prime}(y-\theta z+y^*)/c^*z^*$

$\tilde{\epsilon}=\tilde{y}T^{-1}/\tilde{y}$

$\tilde{\eta}=\tilde{c}'_{(\tilde{\theta})}\tilde{y}/\tilde{c}z^*$

Here η represents elasticity of the average sale cost in the foreign firm receiving license and is taken to be constant. Expressions (26) and (27) are of course the conditions on which the marginal productivity value becomes equal to the wage rate respectively at home and abroad, and (28) is nothing but the condition of equalization between the royalty return per output unit and the marginal cost of licensing.

Now, while the optimal employment volume and optimal licensing level that satisfy (26)~(28) being decided for each time point, direct investment k^* is presumed to be settled at a level that maximizes NCF this firm receives in the future. Here NCF ν' is expressed as:

$$\nu'=(1-t)\int_0^\infty[(p-c)\theta z_t+(p-ec^*_t)\{k_tf_{(n)}-\theta z\}-\omega n_tk_t-k_tl_{(g)}]e^{-pt}dt$$
$$+e(1-t^*)\int_0^\infty[(p^*-c^*_t)k^*_tf_{(n^*)}-\omega^*n^*_tk^*_t-k^*_tl^*_{(g^*)}+\mu(p^*-\tilde{c}_t)\lambda_t\tilde{k}_tf_{(\tilde{n})}]e^{-p^*t}dt \tag{29}$$

Now, by the similar procedure as in the previous section, if we assume $\dot{\theta}=\dot{\theta}^*=\tilde{\theta}=0$ under given product prices p, p^*, wage rates ω, ω^*, royalty rate μ and growth rate π, $k_t=e^{\pi t}k$, $k^*_t=e^{\pi t}k^*$, $\tilde{k}_t=e^{\pi t}\tilde{k}$ and so (29) can be developed as follows;

$$\nu'_0=\frac{1-t}{\rho-\pi}\{(p-c)\theta z+(p-ec^*)\}kf_{(n)}-\theta z\{-\omega nk-kl_{(g)}\}$$
$$+\frac{e(1-t^*)}{\rho^*-\pi}\{(p^*-c^*)k^*f_{(n^*)}-\omega^*n^*k^*-k^*l^*_{(g^*)}+\mu(p^*-\tilde{c})\lambda\tilde{k}f_{(\tilde{n})}\} \tag{29}'$$

And by putting as zero the value of partial differentiation of (29)' with respect to k^* we obtain:

$$e[\{p^*-c^*(1+H\sigma\eta)+\mu\tilde{c}\tilde{\eta}\}f_{(n^*)}-\omega^*n^*-l^*_{(g^*)}]$$
$$=H[\{p-ec^*(1+\sigma\eta)+\mu\tilde{c}\tilde{\eta}H^{-1}\}f_{(n)}-\omega n-l_{(g)}] \tag{30}$$

where $H=\dfrac{(1+t)(\rho^*-\pi)}{(1-t^*)(\rho-\pi)}$

$\sigma=(y-\theta z+y^*H^{-1})/(y-\theta z+y^*)$

Thus from (26)~(28) and (30) endonegeous variables n, n^*, λ, k^* can be sought. For simplicity let's suppose that interest rates and profit tax rates home and foreign are respecively the same. The optimal factor input ratios n_0, n_0^*, which are obtained by combining the product price arbitration terms (5) and (26), (27), (30) into simultaneous equations, take the similar values

$$f'_{(n0)}=\frac{\omega(1+\tau^*)(\gamma-\gamma^*)}{e\tau^*p^*\gamma^*+(1+\tau^*)(l_g-el^*_{(g^*)})} \tag{20}$$

$$f'_{(n0^*)}=\frac{\omega^*(1+\tau^*)(\gamma-\gamma^*)}{\tau^*p^*\gamma-(1+\tau^*)(l_g-el^*_{(g)})} \tag{21}$$

as in the previous section. And here the optimal employment volumes at home and abroad are determined independently of the licensing level, while from the condition of the plus value of the marginal productivity in (20), (21), $\gamma-\gamma^*>\nu\rightarrow n>n^*$ holds whichever the sign of $[l-el^*]$ may be.

On another hand the optimal licensing level λ_0 can be sought from the average sale cost of the foreign firm, $\tilde{C}$:

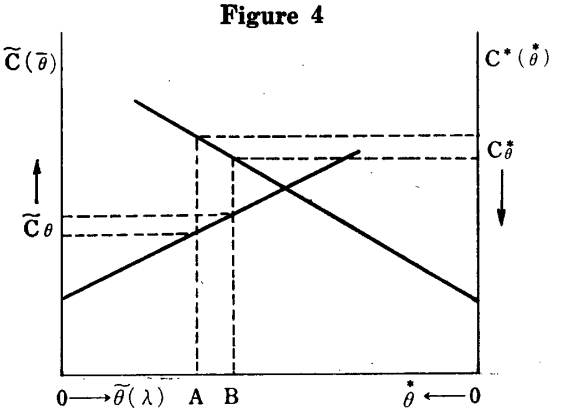
$$\tilde{C}=\frac{e[\{\alpha\mu\gamma^*+(1+\tau^*)\eta p^*\gamma^*\}-\eta l^*]-[e(\alpha\mu\gamma+\eta p^*\gamma\}-\eta l]}{e\mu\eta\tilde{\eta}(1+\tau^*)(\gamma-\gamma^*)} \tag{31}$$

where $\alpha=(1+\tau^*)(1+\eta)\{p^*-(1+\tilde{\eta})\eta\tilde{\eta}\}$

which is derived in sunstituting (26) and (20) in the above conditional equation (28). This is because, since $\tilde{C}$ is the incremental function of the foreign firm's foreign-market share $\tilde{\theta}$ and $\tilde{\theta}=\lambda kf_{(\tilde{n})}/z^*$ is defined, if $\tilde{\theta}$ is determined under given foreign demand, foreign firm's resources, etc., the optimal licensing level λ_0 also is straightly settled.

In investingating effects of environmental changes on international strategies, let's suppose there has been raising of foreign import tariff τ^*. From the value to be calculated by differentiating (31) with respect to τ^*[24] it is known that a rise in τ^* pushes upward the average sale cost $\tilde{C}$ and the foreign-market share θ of the license-receiver firm. This rise of $\tilde{\theta}$ is of course means a rise in the licensing level λ, and at the same time is nothing but a decline in the international firm's foreign-market share θ^* by (24). This relation is shown in Figure 4. A rise in the tariff causes a rise in $\tilde{\theta}$ and a decline in θ^* corresponding to | A—B |. And, from (20), (21) its rise pushes up the production factor input ratio n at home and lowers n^* in the foreign land.

Figure 4



How direct investment changes here can be sought from:

$$\{f_{(n)}-f_{(n^*)}\}dk^*=kf'_{(n)}dn+k^*f'_{(n^*)}dn^*-z^*d\theta^* \tag{4)''}$$

Yet if the above results are correlated with $dn, dn^*, d\theta^*$, it leads to the result that the effects of tariff on direct investment cannot be confirmed. That is to say, in response to a rise in tariff direct investment may increase, decrease or remain unchanged in future according to cases. If, as Aliber has pointed out,[25]

24) $d\tilde{c}/dt^*=e\eta\{(p^*\gamma-l)+l^*\}/(1+\tau^*)^2e\mu\eta\tilde{\eta}(1+\tau^*)(\gamma-\gamma^*)>0$

25) Aliber [1] pp. 23–24.

generally customs do not work so much influence on decision-making of firms intending foreign investment, a rise in tariff pushes down international firm's foreign-market share by accelerating licensing and oppressing export.

On the other hand a rise in the royalty rate pushes down the optimal licensing level from (31). This is because, since in this paper royalty is defined as compensation of a certain rate to the profit of the license-receiver firm gains, and again the receiver-and the giver are presumed to be in collision on the foreign market, by a rise in royalty raises the marginal cost of licensing from (28) and as the result lowers the receiver's sales share as well as the optimal licensing ratio. Of course because the factor input ratios home and foreign, n, n^* are decided independently of μ, by the relation of (4)″ a decrease in direct investment and an increase in export are directly derived.

As for changes in the exchange rate and the home adjustment cost also similar discussion can be developed. All these effects have been examined with respect to export, licensing, direct investment and the foreign-market share of the international firm, as shown in Table 3.

Table 3.

	Firm environmental factors					
	p^*[26]	τ^*	e	l	ω	μ
Export	$\overset{?}{(-)}$	?	?	?	−	+
Licensing	$\overset{-}{(+)}$	+	−	+	0	−
Foreign-Direct Investment	$\overset{?}{(+)}$	?	?	?	+	−
Foreign Market-Share of Int. Firm	$\overset{+}{(-)}$	−	+	−	0	+

V. Conclusion

Needless to say, arguments adapting immediately the results of abstract theoretical analyses as they are to the reality are accompanied by a great danger. So taking some angles on correspondence with the reality we shall make some re-consideration on this paper.

Firstly when the international firm can select only export and direct investment as foreign strategies, either under a behavior principle aiming at maximum statics-view profits or one for maximum dynamics-view profits[27], export and

26) $d\bar{c}/dp^* = [-e\mu(1+t^*)(1+\eta)(\gamma-\gamma^*) - e\eta\{\gamma-(1+\tau^*)\gamma^*+\eta(l-el^*)\}]/[+] \lesseqgtr 0$
where $\gamma-\gamma^*>0$ from (20), (21), and hence if τ^* is sufficiently low and $l-el$ is negative or sufficiently small the unequality sigh $<$ holds.

27) This paper presuppose that in making decisions about direct investment the firm forecasts that business environments existing at that time are unchanged in future. Actually, however, some mechanism for formation of rational expectations under future uncertainty must be working. For by decision-making on

direct investment responding to changes in business environments are always alternative.

In international firms oriented to optimal foreign strategies, the labor/capital ratio of the foreign subsidiaries is always smaller than that of the home parent firm. This theoretically backs up the labor-saving pattern of direct investment.

On the other hand, when the three foreign strategies including licensing are being developed, and especially when the international firm and the foreign license-receiver firm are in collision on the foreign market, firstly, a rise in foreign country's tariff or the Penrose constraint promotes licensing but not always fosters direct investment.[28] Secondly, expectation of reduction of the exchange rate and of inflation in the foreign land generally induces shift of strategy from licensing to export or direct investment and raises international firm's foreign-market share. However, when the adjustment cost in the home parent firm is sufficiently high, or when the foreign tariff is sufficently high, expectation of inflation has an effect of fostering licensing and direct investment complementarily and diminishing export. Thirdly, the labor-market situation at home and abroad works no influence on international firm's licensing strategy. Fourth, an increase in the royalty rate does not always promote licensing.

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shortsighted prospects a realized investment level might be different from optimal one. In this sense this paper must be amended and expanded to a direct investment model that explicitly introduces expectation-formation under uncertainty as seen in Long [23].

28) This conclusion retains possibility of a direct investment increase by tariff raising to compare with Idei's words, "Tariff raising promotes licensing but never direct investment." [3], p. 62.

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