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Locational power of the
corporation tax and the interest rate
in highly globalized economy

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Abstract

As firms' activities are expanded to cover the whole world, new mechanism begins to work in a firm's production activity, and some economic elements which were not taken into consideration as a location factor become to influence factory's location selections. The typical examples are a function of the transfer price of intermediate goods in movements between a firm's factories that are located in different countries, and locational effects of the corporation tax and the interest rate which are manipulated by the government and the central bank. This paper analyzes the effects of the corporation tax rates and the interest rates of countries on the location decision of a firm through a transfer price function. This analysis shows that the corporation tax rate and the interest rate direct the spatial area in which location of a factory is prospective and the transfer price level. It will be shown in the analysis that the corporation tax rate and the interest rate intervene into the selection of the country by a manufacturer, furthermore, they play an important role in determination of the location site in the selected country. The analysis will offer a significant suggestion to policy makers in a country that the corporation tax and the interest rate are important location factor when the administration induces firms from foreign countries to vitalize the certain regions.

JEL: R30

Keywords: Corporation tax rate, Interest rate, Transfer price, Firm's location,
Location prospective area, Chaotic phenomenon

Locational effect of corporation tax and interest rate through transfer price

1 Introduction

It would not take a long time for firm to determine its factory's location when firm's production activity is confined in a country. While, in the highly globalized world firm takes a series of processes to decide factory's location since its production activity is conducted in a large geographical area where several countries are contained. In this situation, as firm plans to establish a new factory, it faces the issues of country selection and then site selection within the selected country. To decide factory's location the firm proceeds carefully location determination processes deliberating various location factors in which the corporation tax and the interest rates of the countries are included that were not picked up as the location factor in the pro-globalization.

In these days firm fragments its production process into several blocs and scatters fragmented blocs across countries¹. The intermediate goods produced at a factory are moved to another factory by using the transfer price². There are two primary reasons why the transfer price is used by firm: One is that since firm measures the factory's profit by utilizing this price, the firm can estimate the factor's profit contribution to the firm's total profits. The other is that the country in which factory locates charges the corporation tax on the factory's profit that is determined by using the transfer price.

In the globalized economy, a manufacturing firm, which makes final goods from the intermediate goods produced by its factories, usually selects a country and chooses a place within the selected country as it establishes new factory. In location determination processes the transportation costs, wage rates, agglomeration economies are considered as the fundamental location factor. The firm pays attention these factors. In addition, the firm considers the corporation tax and the interest rates of countries because these rates influence not only the country selection but also the determination of the location site within the selected country. The main purpose of the present paper is to analyze the locational power of the corporation tax and the interest rate through the function of the transfer price.

This paper is organized as follows: In the next section the assumptions and framework are introduced. And the profit function of a firm will be derived. And then, explains that the first stage of the location determination processes is to set up a location prospective area. In order to define the location prospective area chaotic phenomenon is used. In section 3 the locational power of the corporation tax and interest rate are analyzed in a certain transportation costs of the intermediate goods. Section 4 concludes the analysis.

¹ Shi-Yan(1995)analyses the reasons and the mechanism of fragmentation and spatial departure of production activity.

² The transfer price has been extensively studied by Hirshleifer (1956), Eden (1985) and Dobbs (2000).

2. Location decision-making and optimal transfer price

2.1 Derivation of the profit function of a firm

The following assumptions are placed and the framework for the analysis is constructed. A firm produces goods by using two production processes, the first process and the second process. The first process is conducted by factory 1 which manufactures intermediate goods, m_q , in the home country. The intermediate goods are transported the factory1 to factory 2 by the transfer price m_p . The factory 2 locates at a market place in a foreign country. The factory 2 uses one unit of the intermediate goods to produce one unit of the final goods. And the factory 2 sells the finished goods by the price p to the market and it determines the quantity of the final goods in order to maximize the profits of the factory 2. While, the factory 1 decides the transfer price in order to maximize the total profits of the firm. The tax rates of the home and the foreign country are represented by t and t^* , respectively. In addition, the interest rates of the home and the foreign country are indicated by r and r^* . At the first stage of the analysis the interest rates are not incorporated into the consideration for the simplification. Their effects will be examined at the second stage of the analysis.

Now, the profit of the factory 1 is given by equation (1)

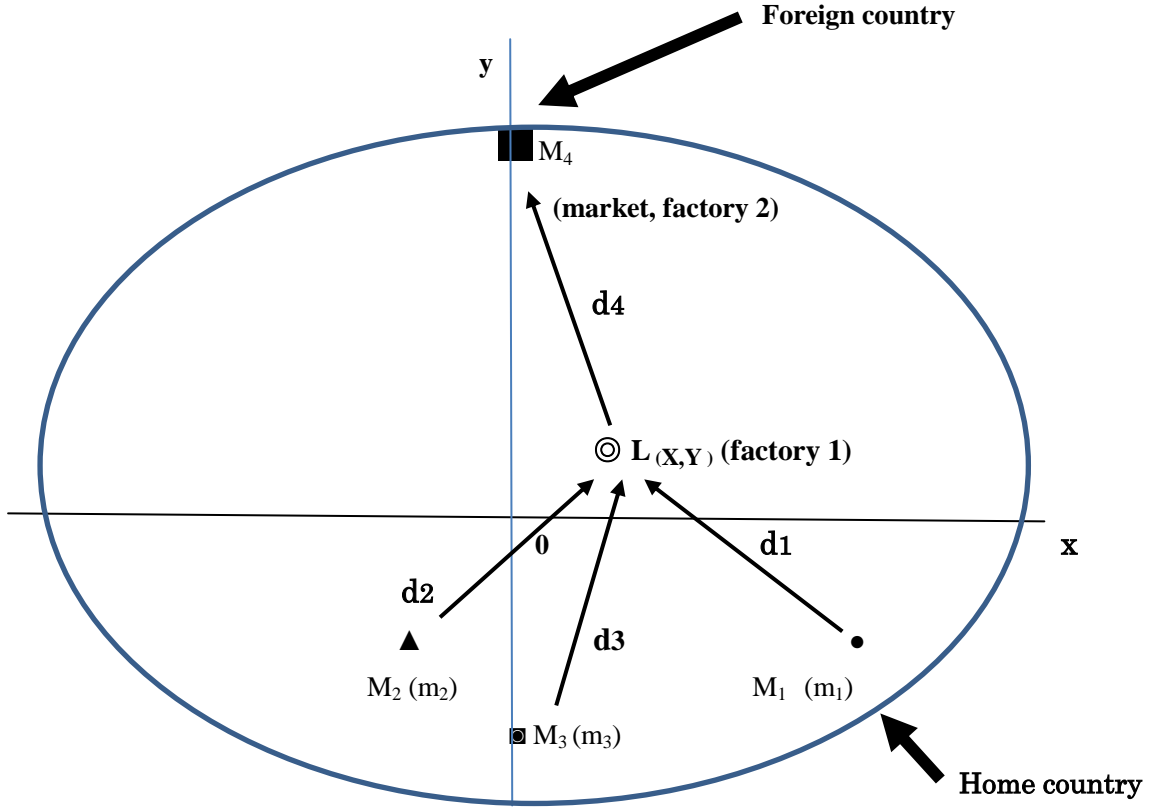
$$Y_1 = (1 - t)[m_p * m_q - C(m_q) - F_1] \quad (1)$$

where m_q is quantity of the intermediate goods, $C(m_q)$ is the cost function and F_1 is fixed costs.

The

cost function $C(m_q)$ of the factory 1 is derived on the basis of the following assumptions: The factory 1 uses two different kinds of materials m_1 , m_2 to produce the intermediate goods m_q . And the factory 1 uses lubricating oil m_3 to operate machines. The materials m_1 , m_2 and oil m_3 are produced at points M_1, M_2 and M_3 which are identified by coordinates (x_1, y_1) , (x_2, y_2) , (x_3, y_3) , respectively, on a large plain space. These materials are transported to the factory 1 at point L which is indicated by (x, y) . Freight rates of the materials m_1 , m_2 are denoted by t_m , and the rate of the oil m_3 is given by t_e . Mill prices of these are shown by p_1 , p_2 , and p_3 , and these prices are given. The intermediate goods are transported from the factory 1 to the factory 2 which locates at the market at point M_4 (x_4, y_4) . The freight rate of the intermediate goods m_q is t_g . Figure 1 illustrates the geographical relationship between the factory 1, the factory 2, the market and the points of the three materials. The territory of the home country is indicated by oval curve, and that of the foreign country is given by the square.

Figure 1 Location figure of factories



The production function of the factory1 is represented by equation (2):

$$mq = Am_1^\alpha m_2^\beta \quad (2)$$

where A, α and β are parameters and they are defined as $A > 0, 0 < (\alpha + \beta) < 1$. The distances between the material places, $M_i (i=1, 2, 3)$ and the factory1, $L(x, y)$ are represented by d_1, d_2, d_3 , respectively:

$$d_1 = ((x - x_1)^2 + (y + y_1)^2)^{0.5} \quad (3a)$$

$$d_2 = ((x + x_2)^2 + (y + y_2)^2)^{0.5} \quad (3b)$$

$$d_3 = (x^2 + (y + y_3)^2)^{0.5} \quad (3c)$$

The distance between the factory1 and the factory 2 which locates at the market M_4 is given by d_4 :

$$d_4 = (x^2 + (y - y_4)^2)^{0.5} \quad (3d)$$

If the profit of the factory 1, Y_1 , is given by equation (4),

$$Y_1 = (1-t)[mq((mp - t_g d_4) - (p_3 + t_e d_3)) - (p_1 + t_m d_1)m_1 - (p_2 + t_m d_2)m_2 - F_1] \quad (4)$$

Making use of the law of equi-marginal productivity, that is, the ratio between the productivities of the two intermediate goods should be equal to the ratio between the delivered prices of them, quantities of these goods are derived as equations (5a) and (5b): (For simplicity, α and β are assumed $\alpha = \beta = 0.4$):

$$m_1 = A^{-1.25} mq^{1.25} ((p_2 + t_m d_2) / (p_1 + t_m d_1))^{0.5} \quad (5a)$$

$$m_2 = A^{-1.25} mq^{1.25} ((p_1 + t_m d_1) / (p_2 + t_m d_2))^{0.5} \quad (5b)$$

Since quantity of oil m_3 is a linear function of amount of the final goods, it is simply given by (5c),

$$m_3 = mq \quad (5c)$$

From the above equations, the cost $C(qm)$ of the factory 1 is obtained as equation (6),

$$C(mq) = 2A^{-1.25} mq^{1.25} (p_1 + t_m d_1)^{0.5} (p_2 + t_m d_2)^{0.5} + mq(p_3 + t_e d_3) + F_1 \quad (6)$$

Finally, the profit function of the factory 1 is shown as equation (7):

$$Y_1 = (1-t)[mq((mp - t_g d_4) - (p_3 + t_e d_3)) - 2mq^{1.25} A^{-1.25} (p_1 + t_m d_1)^{0.5} (p_2 + t_m d_2)^{0.5} - F_1] \quad (7)$$

The factory 1 determines the transfer price and its location to maximize the firm's total profits by using equation (7).

Let us derive the profit of the factory 2, Y_2 . The profits are obtained under the following assumptions: Since the factory 2 uses one unite of intermediate goods to produce one final goods, the quantity of the final goods Q is equal to the intermediate goods m_q . The market price of the finished goods is shown by p which is determined by the market demand function (8).

$$p = a - vQ \quad (8)$$

where v is parameter, it is assumed as 1. The profit of the factory 2, Y_2 , is shown by equation (9)

$$Y_2 = (1 - t^*)[(p - mp)Q - C(Q) - F_2] \quad (9)$$

where F_2 is the fixed cost, and $C(Q)$ is the costs of assembling the intermediate goods to the finished goods, $C(Q)$ is given by equation (10). Parameter a is assumed 600 for simplicity of calculation.

$$C(Q) = b Q(g + Q)^2/h \quad (10)$$

where parameter b , g and h are assumed 1.5, 2, and 200 for simplicity of calculation, respectively. Since the factory 2 determines the quantity supplied at the market to maximize its own profits, the quantity is derived by using equation (8), (9), and (10), it is shown by equation (11),

$$Q = 0.22(-206 + (582409 - 900mp)^{0.5}) \quad (11)$$

Since the supply quantity Q is a function of the transfer price mp , the total profits of the firm Y can be rewritten as a function of the transfer price as equation (12),

$$\begin{aligned} Y = (1 - t)[(0.22(-206 + (582409 - 900mp)^{0.5}))(mp - t_g d_4) - (p_3 + t_e d_3) - \\ - 2(0.22(-206 + (582409 - 900mp)^{0.5}))^{1.25} A^{-1.25} (p_1 + t_m d_1)^{0.5} (p_2 + t_m d_2)^{0.5} - F_1] \\ + (1 - t^*) [(600 - (0.22(-206 + (582409 - 900mp)^{0.5})) - mp)(0.22(-206 + \\ (582409 - 900mp)^{0.5})) - F_2]. \end{aligned} \quad (12)$$

2-2 Derivation of the optimal transfer price and a location prospective area

Let us derive the optimal transfer price mp_4 and the location (X, Y) of the factory 1 from equation (12). To derive the optimal transfer price and the location of the factory 1, the Gradient dynamics is used. The essence of this method is that first, an initial value set is given to x_n , y_n , and mp_n in the following equations (13a, b, and c) as a temporal solution, and obtain the values of x_{n+1} , y_{n+1} , and mp_{n+1} by calculations indicated by the three equations (13a, b, and c). And then, the same calculation is iterated until a given tentative solution can be approximately judged as the solution. If the values of $(x_{n+1}, y_{n+1}, mp_{n+1})$ in equations (13a, b, and c) become approximately the same as those of (x_n, y_n, mp_n) , the values can be admitted as the solution.

$$x_{n+1} = x_n + j^* \partial Y / \partial x, \quad (13a)$$

$$y_{n+1} = y_n + j * \partial Y / \partial y, \quad (13b)$$

$$mp_{n+1} = mp_n + j * \partial Y / \partial mp, \quad (13c)$$

where j is the width of a step and n shows the number of the calculation. And $\partial Y / \partial x$, $\partial Y / \partial y$, and $\partial Y / \partial mp$ are given by equations (14a, b, and c). In addition, the tax rates are assumed to be the same in home and foreign country, $t = t^* = 0.82$. Other parameters' value are assumed as follows: $(x_1=3, y_1=-0.5)$, $(x_2=-3^{0.5}, y_2=-0.5)$, $(x_3=0, y_3=-1.5)$, $(x_4=0, y_4=1)$, $A=1$, $p_1=0.25$, $p_2=2$, $p_3=0.2$, $t_m=0.11$, $t_e=0.01$, $t_g=0.225$, $F_1=5000$, $F_2=2500$.

$$\begin{aligned} \partial Y / \partial x = & 0.18[-t_g x (299.4 - 0.5mp) / d_4 + (299.4 - 0.5mp) (-t_g(x/d_4) - t_e(x/d_3)) - \\ & - A^{-1.25} (299.4 - 0.5mp)^{1.25} t_m [\{ (p_2 + t_m d_2)^{0.5} / (p_1 + t_m d_1)^{0.5} \} (x - x_1) / d_1 + \\ & + \{ (p_1 + t_m d_1)^{0.5} / (p_2 + t_m d_2)^{0.5} \} (x + x_2) / d_2] = 0 \end{aligned} \quad (14a)$$

$$\begin{aligned} \partial Y / \partial y = & 0.18[-t_g(y-1)(299.4 - 0.5mp) / d_4 + (299.4 - 0.5mp) (-t_g((y - y_4) / d_4) - t_e((y - y_3) / d_3)) - \\ & - A^{-1.25} (299.4 - 0.5mp)^{1.25} t_m [\{ (p_2 + t_m d_2)^{0.5} / (p_1 + t_m d_1)^{0.5} \} (y + y_1) / d_1 + \\ & + \{ (p_1 + t_m d_1)^{0.5} / (p_2 + t_m d_2)^{0.5} \} (y + y_2) / d_2] = 0 \end{aligned} \quad (14b)$$

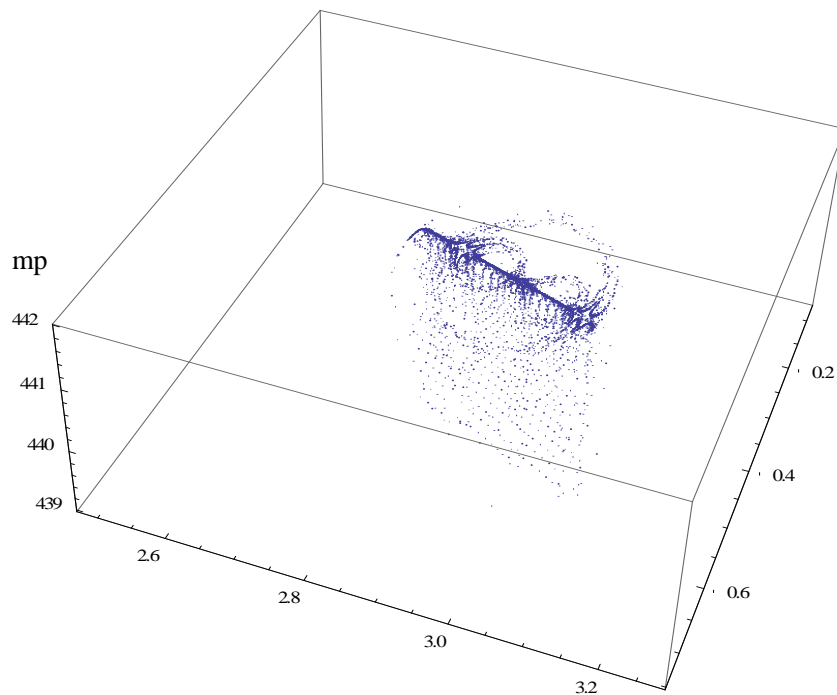
$$\begin{aligned} \partial Y / \partial mp = & 0.18[-(0.5 * mp - 299.4)] + 0.22[299.4 - 2 * 0.5mp + 0.5 t_g d_4 + 0.5(p_3 + t_e d_3) + \\ & + 2.5 A^{-1.25} (p_2 + t_m d_2)^{0.5} (p_1 + t_m d_1)^{0.5} (299.4 - 0.5mp)^{0.25}] = 0. \end{aligned} \quad (14c)$$

The calculation result derived from the Gradient dynamics (Puu, 1998, Ishikawa 2009) using equation (14a, b, and c) shows the figure illustrated in Figure 2. Figure 2 indicates that the optimal transfer price is approximately 442, and although the optimal location of the factory 1 is not clearly specified, the best location is can be found in the area where a chaotic phenomenon appears.

The graph shows that chaotic phenomenon appears along the area of M_1 , the source of raw materials. It can be established that the optimal transfer price is at 442. However, it is difficult to determine the optimal location of factory 1. Nevertheless, the optimal location is within the area around point M_1 where chaotic phenomenon appears. If the factory 1 chooses to locate within that particular area, the profit will be almost at the same level. Firm's total profits will be $Y=3307^3$.

³ The phenomenon shown in Figure 2 is a *chaos* or a *chaotic* phenomenon generated from the

Figur2 Appearance of a chaotic phenomenon and a location prospective area



2-3 Formation of location prospective area

As figure 2 shows, the optimal price can be fixed at 442. On the other hand, the optimal factory locational site can't be settled because of emergence of chaotic phenomenon. Indeed, firm can't specify the optimal locational site because of emergence of chaotic phenomenon. The firm can, however, set up a kind of location prospective area by referring the chaotic phenomenon: Because chaotic phenomenon generates around the optimal site. Then, if the manufacturer locates its factory within the range of the chaotic phenomenon, profit of firm is not far reduced from the optimal level. It could be, thus, that the firm achieves so-called target level of profit. Hence, the area where this chaotic phenomenon appears is considered as a location prospective area (LPA, hereafter).

In addition, even when the optimal locational site is particularized, the firm may be unable to lay a factory at the site because there are various reasons such as weak ground, high land values, protracted bargaining, surrounding production circumstance or living environment in real life. In these cases, firms need to explore the second-best locational spot around the area which has the optimal site and they set up a locational prospective area. It could be said, therefore, that the first step of the location determination process is to set up a Location Prospective Area, LPA⁴.

Cauchy Convergence in the derivation of optimal location and price. To identify this phenomenon we need further analysis but this will not be discussed in this study. In the context of the analysis this problem does make no obstacle to logical development.

⁴ An example of the application of the concept of the LPA is shown by Dumayas-Ishikawa (2013).

2-4 Firm's profits and revenues of countries in different corporation tax rates

In the situation as shown in Figure 2, profit of the firm and revenues of the two countries are shown in the first row of Table 1. The second row of Table 2 shows the transfer price, size of LPA, firm's profit and country's tax revenue when the corporation tax rates of the two countries are reduce to 0.27. If the tax rates are the same, reduction of tax rates does not change the transfer price. The reduction widens of the size of LPA. This implies that the firm becomes to have wider options in the determination of factory's location. The third row of Table 2 shows the results of calculation when tax rates of the two countries are $t=0.7$, $t^*=0.82$. It is interesting that the reduction of tax rate of the home country increases the transfer price and increases the tax revenues of the foreign country.

Table 1 Variation of transfer price and firm's profits due to change of tax rates

tax rates	$t=t^*=0.82$	$t=t^*=0.27$	$t=0.70, t^*=0.82$
transfer price	442	442	417
LPA	small area around M1	large area round M1	small area around M1
Price of final goods	551	551	545
sale amount	49	49	55
firm's total profits	3307	13417	5869
Y_1	2968	12040	5293
Y_2	339	1377	576
tax revenue, home	13525	4453	12350
tax revenue, foreign	1544	509	2624

3 Locational power of the corporation tax and interest rate

3-1 Effect of the corporation tax rates on the factory's location

Let us analyze the effect of the corporation tax rate on the factory's location. This analysis is conducted in the following assumptions: the freight rate of intermediate goods, t_g , is 0.725. The corporate tax rate of the foreign country is fixed at 0.82, while the tax rate of the home country will be reduced in the order from 0.7 which means relatively high tax rate, and 0.614 medium tax rate, and then 0.6 which implies relatively low tax rate. The factory's location will be derived for the three different tax rate combinations ($t=0.7$, $t^*=0.82$), ($t=0.614$, $t^*=0.82$) and ($t=0.6$, $t^*=0.82$). This analysis will shows the locational power of the corporation tax rate.

3-1 Location of factory when the corporation tax rate is relatively high

Figure 3A shows the LPA when the corporation tax rate of the home country is

relatively high, that is, tax rates combination ($t=0.7$, $t^*=0.82$). The LPA is formed near point M_1 , and the transfer price is determined at 417.9. As the LPA is a liner which leads to the market place, the firm locates the factory 1 on this line and it can obtain targeted profit which can be estimated 5811.

Figure 3A LPA near the material M_1 when the tax rate is relatively high

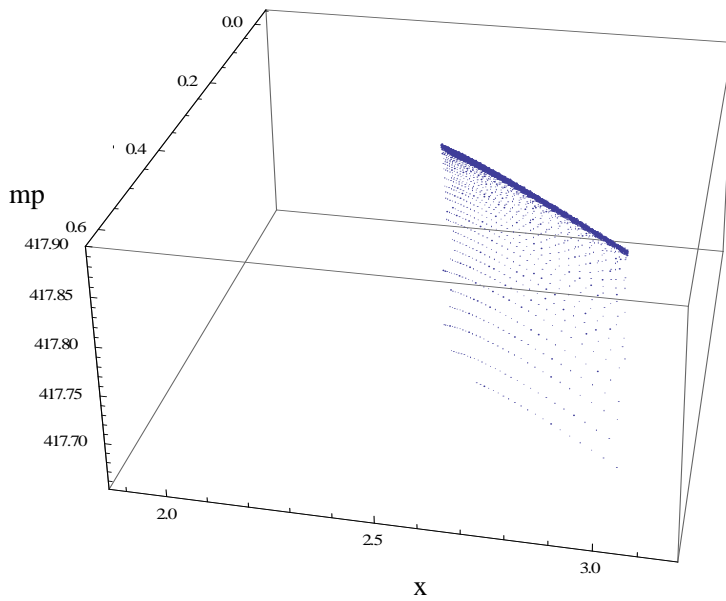


Table 2 LPA, transfer price, and profits for the three combination of tax rates

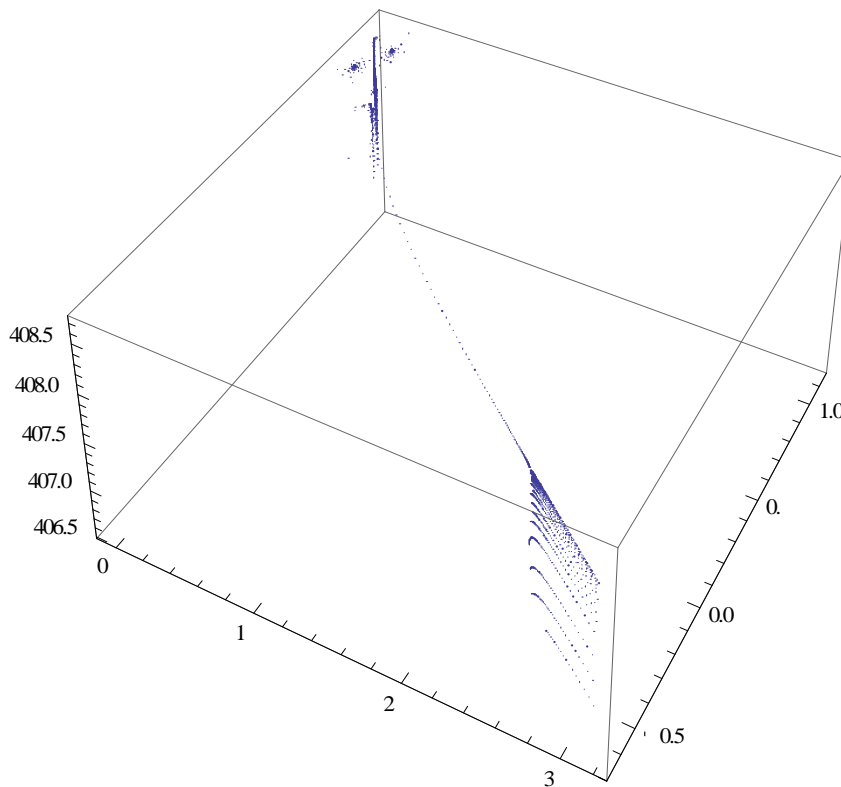
tax rates	$t=0.7, t^*=0.82$	$t=0.614, t^*=0.82$	$t=0.6, t=0.82$
LPA	near M_1	from M_1 to M_4	near M_4
transfer price	418	408	407
profits	5811	7536	7789

3-2 Change of position of LPA due to reduction of the corporation tax rate

When the tax rate of the home country decreases from 0.7 to 0.614 remaining that of the foreign country at 0.82, a large LPA is formed in the range from point M_1 to the market M_4 . Figure 4B depicts the large LPA. As shown in the second row of Table 2, if the firm locates the factory point M_1 and set the transfer price at 408, the firm obtains profit of 7536. While, the firm set the factory at the place next to the market place M_4 , the firm's profit is 7526. Needless to say, the firm does not locate the factory at the market place to avoid high tax rate.

Although the difference in firm's profits is generated by locating the factory different places which are included in the LPA, the difference between the profits is only 10 which is 0.15 percent against the firm's profit of 7526. This implies that if the firm locates factory within the LPA, firm can drive almost same profits; the firm can obtain the wider option range in the determination of factory's location.

Figure 3B Expansion of LPA due to reduction of the corporation tax rate



3-3 Position of LPA when the corporation tax rate is relatively low

The LPA is formed near the market place M_4 when the tax rate of the home country becomes relatively low, 0.6, remaining that of the foreign country at 0.82. The transfer price of the intermediate goods is determined at 407. Figure 3C depicts the result of the calculation. Factory 1 and 2 may co-exist across border, and the firm's total profits are 7789 as shown in the third row of Table 2.

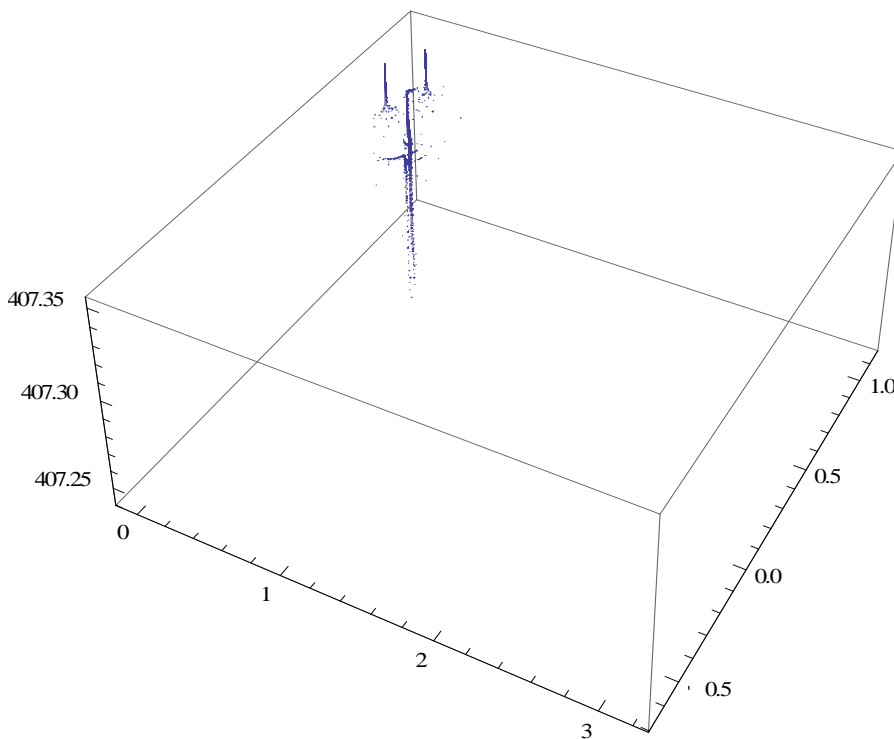
It can be said that the reduction of the corporation tax rate of the home country alters the factory's location pattern. Incorporating the results when the freight rate is 0.225 into consideration, the locational power of the corporation tax rate is summarized as follows:

- 1) The reduction of the corporation tax rate expands LPA at the same position near point M_1 when

the transportation cost of the intermediate goods is relatively low. The expansion of the LPA gives the firm wider option in the determination of factory's location:

- 2) When the transportation cost of the intermediate goods is relatively high in a certain range, the reduction of the corporation tax rate moves the position of the LPA toward the market place M_4 , consequently, the change of the corporation tax rate works to direct that the factory's location is a place near market place M_4 .

Figure 3C LPA near the market place M_4 when the tax rate is relatively low



4 Location power of the interest rate

4-1 Derivation of firm's profit function as the interest rate is incorporated into consideration

In those days firm's production activity was confined within a country, and the interest rate did not directly influence factor's location. In these days, however, the production activity is organized across borders, and the interest rate affects firm's country selections and location site selections within selected country; it works as location factor in the location determination process.

In this section the interest rate is incorporated into the analysis conducted in the previous section. The interest rate of the home country and the foreign country are given by r and r^* , respectively. In

addition, the period of the firm's production activity in question is indicated by T. If the firm obtains the profits derived by equation (12) at every unit time, the firm's total profits in the period of T, TY, is given by equation (15)⁵.

$$TY = \int_0^T Y_1 e^{rt} dt + \int_0^T Y_2 e^{r^*t} dt \quad (15)$$

The equation (15) is rewritten as equation (16),

$$\begin{aligned} TY = & (-1/r + (1/r) \text{Exp}(rT)) (1-t) [(0.22(-206 + (582409 - 900mp)^{0.5})) (mp_4 - t_g d_4) - (p_3 + t_e d_3)] - \\ & - 2(0.22(-206 + (582409 - 900mp)^{0.5}))^{1.25} A^{-1.25} (p_1 + t_m d_1)^{0.5} (p_2 + t_m d_2)^{0.5} - F_1] \\ & + (-1/r^* + (1/r^*) \text{Exp}(r^*T)) (1-t^*) [(600 - (0.22(-206 + (582409 - 900mp)^{0.5})) - mp) (0.22(-206 + \\ & (582409 - 900mp)^{0.5})) - F_2]. \end{aligned} \quad (16)$$

Based on the equation (16), locational power of the interest rate is examined in the next subsection.

4-2 Shift of factory's location due to change of the interest rate

The optimal transfer price and factory's location in this situation is derived by the same method used in the previous section. And the transportation costs of intermediate goods, t_g , is 0.625, the corporation tax rates of the home and foreign country are fixed at 0.7 and 0.82, respectively. Others are assumed as those used in pervious analysis. The period of the firm's production activity in question is 1.55. Suppose that the interest rate of the foreign country is fixed at 0.1, and that of the home country is initially 0.11 and later 0.35.

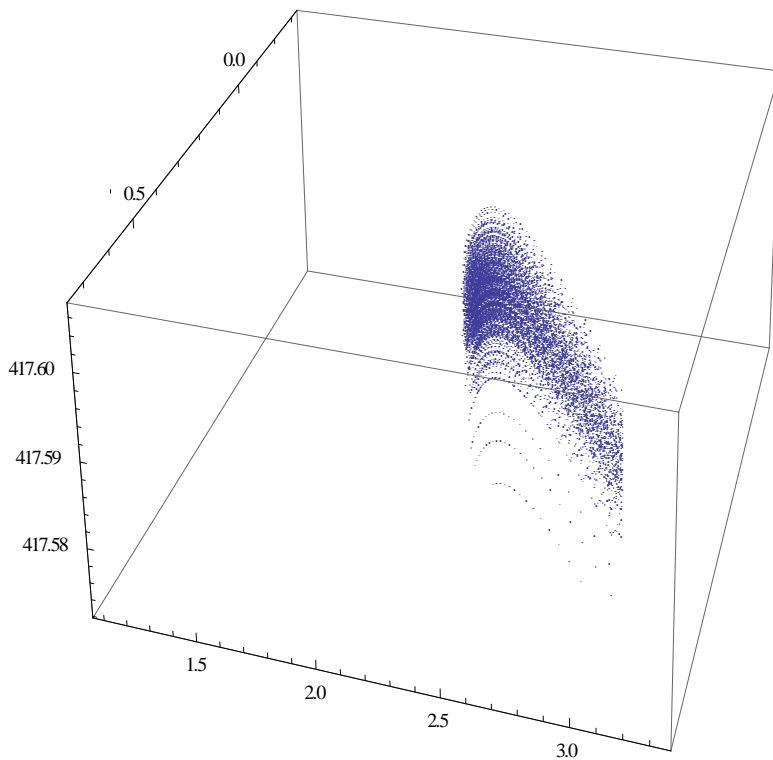
When the interest rate of the home country is 0.11, the optimal transfer price and LPA are obtained by the applying the same method in the previous for equation (16). The calculation results are shown in Figure 4A. The LPA is formed near point M_1 and the transfer price is determined at 417.6. Hence, when the interest rate of the home country is 0.11, the firm locates the factory at a point which belongs to the LPA and set the transfer price 417.6 to achieve the targeted profit.

Let us derive the LPA and the transfer price when the interest rate of the home country is raised to 0.35. The optimal location site of factory and transfer price is derived in the same way. The calculation result is depicted in Figure 4B. The LPA is formed near the market place M_4 and the

⁵ Incorporating another factors which are related to the interest rate such as construction costs of factory into consideration, the analysis will provide more comprehensive insights. Since the primary aim of this section is to show that the interest rate has a location power, the analysis is conducted in the simplest framework.

transfer price is set at 410.4. In this case, the firm locates the factory at a point near the market place.

Figure 4A Formation location prospective area near point M_1

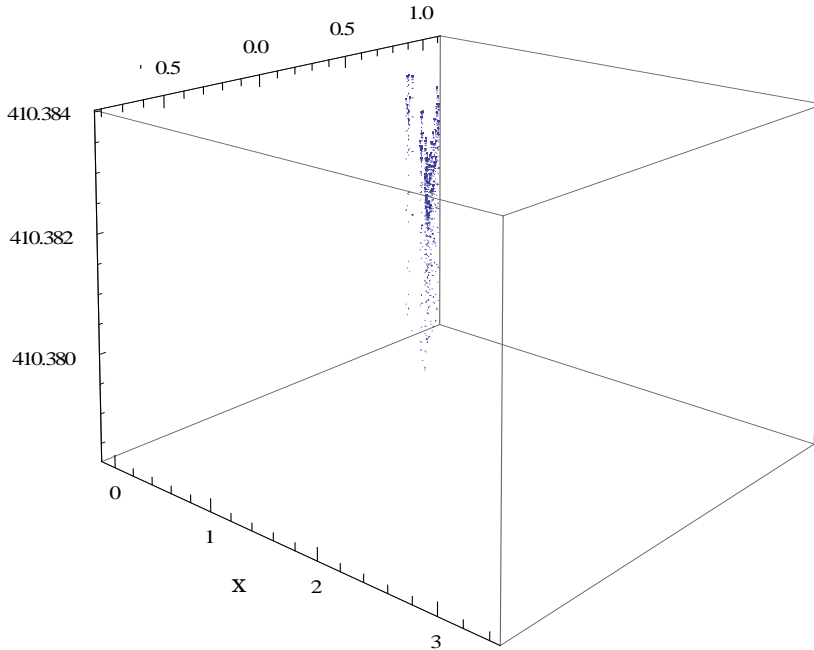


Comparison of Figure 4A and 4B indicates that when the interest rate of the home country is changed from 0.11 to 0.35, the factory's location shifts from point near M_1 to point near M_4 . It can be said that the interest rate works to move the location of the factory and change transfer price: the interest rate clearly has a locational power.

It is noteworthy that since the interest rates are different between the two countries, the factory 1 does not locate at the market place to agglomerate with the factory2. They just co-exist across border between the countries. Although this location pattern seems an agglomeration, they do not agglomerate at the market place⁶.

⁶ The location pattern that manufacturing factories co-exist across border can be identified at the border between Marisa and Singapore. Some Japanese manufacturing firms locates their factories across border. The intermediate goods are moved between them by using the tariff price of which concept is similar to the transfer price.

Figure 4B Shift of locational prospective area due to change of interest rate



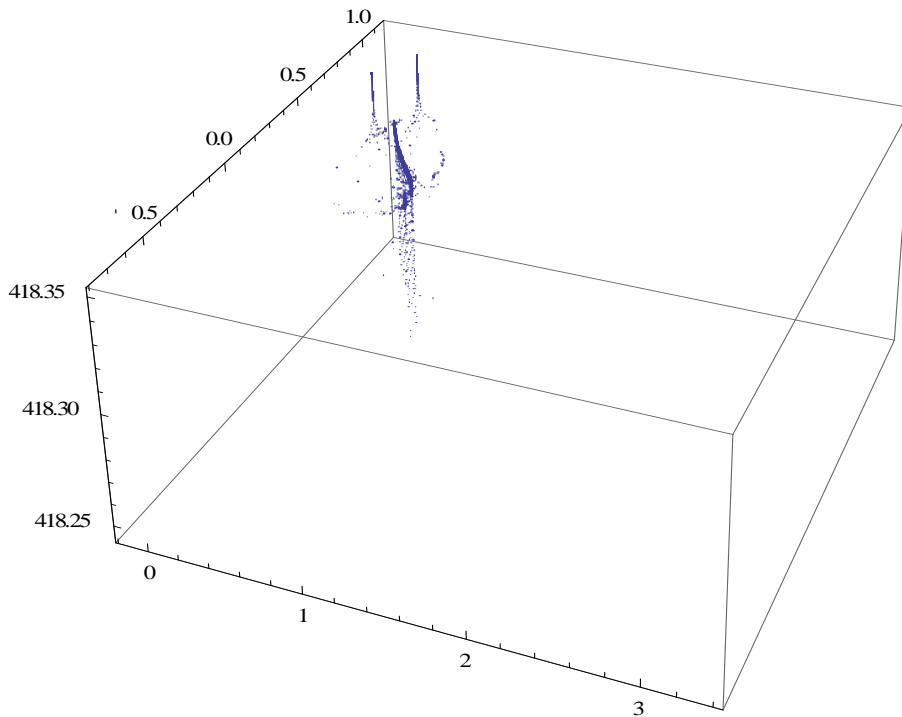
4-3 Shift of factory’s location by expansion of period of production activity

Let us analyze the factory’s location when the period of the production activity expanded from 1.55 to 1.75. In this analysis, the interest rate of the home country is reassumed to 0.11 from 0.35.

The results of the analysis is shown in Figure 5. Comparing Figure 5 with Figure 4A, it is shown that by the expansion of the period of the production activity the position of LPA is shifted from the place near M_1 to that near the market place M_4 , and the transfer price is slightly raised from 417.6 to 418.4. That is, when the period of production activity in question is relatively short, the firm locates the factory at a place near point M_1 : While, when the period is long, the factory is located at a place near the market M_4 . It can be said that the location of the factory is different according to the production activity period.

The fact that the factory’s location is dependent on the period of production activity is very important for the firm: The firm should deliberate the three major issues when it plans to establish the factory, location site of the factory, transfer price of the intermediate goods, and the period of production activity in question. Especially the judgment of the activity period is a troublesome issue for the firm’s management. Because the construction costs of factory and the costs of the shifting factory’s location, which are omitted in this analysis, are influenced by the interest rate, and these costs affect substantially the period of production activity.

Figure 5 Shift of locational production area by expansion of activity period



5 Concluding remarks

In the time which the economic activity has expanded on a global scale, the function which did not attract attention so much begins to act with importance in firm's management and some economic factors also starts to influence firm's location selections: For instances, the function of the transfer price is used when firm moves intermediate goods between a firm's factories; and the corporation tax rate and the interest rates play an important role in firm's country selections and the location selections within the selected country.

The paper analyzed the locational effects of the corporation tax and the interest rate on the factory's location incorporating the function of the transfer price of intermediate goods into consideration. The results of the analysis are summarized as follows: 1) The corporation tax and the interest rate clearly influence factory's location. 2) The reduction of the corporation tax rate of the home country widens the LPA when the freight rate of intermediate goods is low. A large LPA gives firm the wider options in the determination of factory's location. 3) When the freight rate of intermediate goods is raised to a certain level, reducing the tax rate of the home country moves the position of the LPA from one of sources of material points to the site near the market place. This means that the lowering the tax rate directly changes the factory's location. 4) The increase of the interest rate of the home country and the expansion of the period of production activity attract the

position of the LPA toward the market place when the freight rate of intermediate goods is relatively high.

It is safe to say from the results of the analysis that in highly globalized economy some economic factors which were not paid attention so much before begin to play a significant role in the firm's location determination process.

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