FDI Motive and Gains under Asymmetric Information

Yiwei Huang[1, a], Anmin Zhang[2]

[1]Guangdong Institute of Mechanical and Electrical Technology, Guangzhou, China

[2]Guangdong Rural Credit Cooperatives Union, Guangzhou, China

[a]huangyiwei08@126.com

Abstract: This paper presents a model to analyze the shaping mechanism and allocation of the investment gains by multinational enterprise (MNE) when it enters the host market through cross-border merger. The results show that, with advanced micro-management techniques as a wide range of application of computer technology, the MNE can be more accurate in predicting changes in the productivity of a corporation of the host country after merging with it, and therefore more effective in allocating resources, and consequently will gain a greater profit than that of the host country's corporation. This paper also infers that by choosing some proper FDI policies, the host country could share the profit with MNE.

1. Introduction

Recently, scholars began to pay more attention to the role of information asymmetry in firm heterogeneity, and their effects on FDI incentives. Firms with proprietary experience accumulated through long-term specialized production are more capable of accurately detecting the host country's local market demand, investment costs, and the trend of changing productivity before making an investment decision, and thus are more effective in allocating resources and adjusting their investment strategies. It is only when the multinationals carry out FDI, will they make full use of this information superiority for their own firms in order to avoid the resulting interest being shared by other local shareholders (Hart, 2000) [1]. As a result, the possession and efficient use of information superiority have become another important motive for multinationals to carry out FDI. The study of Rivoli and Salorio (1996) [2] showed how the decision-making time of FDI can be affected. Market imperfections theory implies that FDI will occur when its net present value (NPV) is positive and greater than those of the alternatives. However, when environmental uncertainty is high and exogenous information sets in, this rule can be compromised if FDI is partially irreversible, or if it can be delayed. So they concluded that the ownership-location-internalization (OLI) advantage of MNE would, in return, inhibits or delays the occurrence of FDI under uncertainty. Goldstein and Razin (2006) [3] developed.

An model to describe an information-based trade-off between direct investments (FDI) and portfolio investments (FPI). In the model, the authors examined separately situations of complete information and asymmetric information. The authors explained the reason why the ratio of FDI tends to be higher than that of FPI in developing countries. Ying and Yang (2007) [4] analyzed how MNEs make use of heir full information superiority to influence the host country's policies of attracting foreign investment under circumstances of asymmetric information. In the study of FDI-related issues, Razin and Sadka (2003) [5] held that some MNEs have the advanced super-micro-management techniques by virtue of high specialization in an industry and a wide range of computer technology application, which their local counterparts do not possess, and thus they gain complete information superiority. Due to this kind of information superiority, multinational companies can carry out cross-border merger and acquisitions (M&A) under the conditions that MNEs have the same capacity as the firms of host country in terms of technology, capital, etc. By building a model of incomplete information, Razin and Sadka demonstrated how

MNEs generate FDI revenue under the condition of perfect competition, and they concluded that all investment profit goes to the host country completely.

Inspired by the idea of Razin and Sadka (2003), we establish a oligopoly game model in this paper under the condition of incomplete information to illustrate the occurrence of the two-way investment among developed countries and the one-way investment between developed and developing countries. Then we arrive at a new conclusion that the fine-tuning gains of FDI is shared by foreign investors and the host countries or is entirely captured by FDI in most situations. Compared with the conclusion that the host countries obtain the investment profit exclusively (Razin and Sadka, 2003), our result can give a more reasonable explanation to the real motives of not only the multinationals in conducing FDI, but also the host countries in attracting them.

This paper is structured as follows. Section 2 introduces and analyses the domestic oligopoly equilibrium model based on incomplete information and no inflow of FDI. Section 3 discusses the oligopoly equilibrium model with incomplete information and FDI inflow. Section 4 looks into the allocation of gains from FDI trade. And finally in Section 5, we conclude the paper.

2. The equilibrium in the domestic market with no inflow of FDI

We only consider the situation of two periods in a product market. Assuming that FDI did not enter the domestic market in the first period, and there are only 2 firms in product supply-side, called A and B, whose behavior are rational. We assume that A and B are identical domestic firms, and so their products' prices are. In a constant level of technology, both of the firms employ capital input (K) and labor input (L), where the number of labor input is fixed and the only variable input is capital. For simplicity, let the form of their production function is $F_1(k) = k$. However, the domestic production technology is instable, and productivity vary with the environment changes, which may be because there is no good use of computer systems in the domestic production and can not monitor it in real time. Therefore, the actual production function should be $F_2(k) = (1+\varepsilon)*k$, where ε is a random productivity factor, whose value fluctuate with the changes of economic environment as well as the internal related factors of firms. The ε has zero mean and is independent across the two firms. Furthermore, we assume that ε varies from -1(so their output is non-negative) to 1 for ease; and ε is subject to uniform distribution. As the lower management level of domestic firms lead to incomplete information, they can not accurately grasp the specific value of ε, so the domestic firms make their production decision according to the rule of $\varepsilon = E(\varepsilon) = 0$. That is to say the domestic firms' expected function is $F(k) = k$.

Suppose that capital depreciates at the rate δ (<1) and r is the exogenously given price of capital. The inverse demand function in the market of the host country is $p = a - Q$. Each firm's initial stock of capital is zero. At the starting point of the decision process of agents in the first period, both of the two firms make the investment decision that choosing the optimal k_1^i ($i = A, B$; k_1^i stands for the capital stock of firm i in the first period) enable them to maximize their present value of the assets at the end of the period 1. According to the basic assumptions of Razin and Sadka (2003), the objective function of firm i is.

$$V_1^i = \frac{p_1 k_1^i + (1-\delta)k_1^i}{1+r} - k_1^i, \ (i = A, B) \tag{1}$$

Where V_1^i stands for the present value of the assets of firm i at the end of period 1; and p_1 is the product price in the first period. In accordance with the first-order condition of equation (1), we can get the firm i's investment reaction curve is.

$$k_1^i = \frac{a - (\delta + r) - k_1^j}{2}, (i = A, B; j = B, A). \tag{2}$$

Now, from formula (2), we can yield the two firms' investment solution of Cournot competition equilibrium in the first period is.

$$k_1^i = \frac{a - (\delta + r)}{3}, (i = A, B).$$ (3)

By the end of the first period, firms A and B will continue to make the decision of the investment in the second period. The decision-making rules is to choose the optimal k_2^i ($i = A, B$; k_2^i stands for the capital stock of firm i in the second period) in order to make their net present value of the assets come to maximum at the end of the period 2. Their objective function will be.

$$V_2^i = \frac{p_2 k_2^i + (1 - \delta)k_2^i}{1 + r} - (k_2^i - (1 - \delta)k_1^i + c), (i = A, B).$$ (4)

Where V_2^i stands for the present value of the assets of firm i at the end of period 2; p_2 is the market price in period 2; and c denote the extra cost of firm i's additional investment. By the same reason, we can get the best capital stock in the second period as equation (5) according to the first-order condition.

$$k_2^i = \frac{a - (\delta + r)}{3}, (i = A, B).$$ (5)

For the sake of convenience, we let $k_1^i = k_2^i = \frac{a - (\delta + r)}{3} = k^*$, and substituting k^* into equation (4) can give us the both firms' maximized net present value of the assets as.

$$V^* = V_2^i(k^*) = \frac{1}{9}\frac{[a - (\delta + r)]^2}{1 + r} + (1 - \delta)k^* - c$$ (6)

3. The equilibrium analysis after FDI entering into the domestic market

Assume that, at the beginning of period 2, firm B decides to sell its own business, and at the same time, firm A and foreign-funded enterprises (called "firm F"), desire to bid for firm B. According to the equation (6), we can know the reservation price of firm B about its own assets is: $R^B = V^*$.

The FDI is viewed as having a unique characteristic with respect to the quality of management. They can then apply hands-on management standards that enable them to get information of changing economic environment earlier and react accordingly in real time to changing economic environments. They can obtain the full benefits of their actions of monitoring the firm for themselves after they gain control over the firm. This feature may stem from a specialization by the foreign direct investors in a certain niche, a wide range of application of computer technology as well as monitoring the entire production by computer system.

As the firm F has superior micro-management skills exclusively, specifically, we suppose that the firm F, once acquiring and managing the firm B, can better monitor the productivity of it (before investment in physical capital is carried out) than its domestic counterpart. So we can think safely that the FDI investor (firm F) can actually elicit the true ε of the firm B, after it acquires control of the firm, but before it has to carry out the investment plan. And firm F will dynamically adjust the level of capital stock based on the value of ε, that is to say F will carry out an ε-dependent schedule. If firm F wins the bid and decides to make new investment for a given value of the productivity factor ε, it will change the capital stock to $k^*(\varepsilon)$ defined implicitly by.

$$k^*(\varepsilon) = \arg : \max_{k(\varepsilon)} V_F(\varepsilon)$$ (7)

Where $V_F(k(\varepsilon)) = \dfrac{k(\varepsilon)(1+\varepsilon)(a - k^* - k(\varepsilon)) + (1-\delta)k(\varepsilon)}{1+r}$. From the first-order condition of equation
$- (k(\varepsilon) - (1-\delta)k^* + c\}$

(7), we can yield

$$k^*(\varepsilon) = k^* + \frac{(\delta + r)\varepsilon}{2(1+\varepsilon)} \tag{8}$$

Substituting $k^*(\varepsilon)$ into equation (6) can give us the corresponding value of $V_F^*(\varepsilon)$.

If the firm F will make no new investment and operate with its initial capital stock $(1-\delta)k^*$, The corresponding expectations for the present value of the assets could be denoted by.

$$V_F^0 = \frac{(a - k^* - (1-\delta)k^*)(1-\delta)k^* + (1-\delta)^2 k^*}{1+r} \tag{9}$$

(The firm A 's investment-decision is to make an additional investment to augment its capital stock to k^* constantly). Let $V_F^*(\varepsilon) = V_F^0$, we can obtain the threshold level $\varepsilon = \varepsilon_0$ that whether firm F make additional investment or not. Therefore, the firm will indeed augment its capital stock to $k^*(\varepsilon)$, if its productivity factor is above this threshold; otherwise the firm will operate with its initial capital stock $(1-\delta)k^*$.

Lemma. There must be a unique ε_0 in $\varepsilon \in (-1,1)$ that satisfy $V_F^*(\varepsilon_0) = V_F^0$.

Anticipating the dynamic adjustment of investment schedule, if F want to bid for firm B, the value to the FDI investor of the firm B at the time of purchase (namely, before ε is revealed), denoted by R^F, is given by.

$$R^F = \int_{-1}^{1} \{ \frac{P(\varepsilon) \cdot k^*(\varepsilon)(1+\varepsilon) + (1-\delta)k^*(\varepsilon)}{1+r} \tag{10}$$
$$- [k^*(\varepsilon) - (1-\delta)k^* + \alpha(\varepsilon) \cdot c]\} f(\varepsilon)d\varepsilon$$

where $\alpha(\varepsilon) = \begin{cases} 0 & if\ \varepsilon < \varepsilon_0 \\ 1 & if\ \varepsilon \geq \varepsilon_0 \end{cases}$, $k^*(\varepsilon) = \begin{cases} (1-\delta)k^* & if\ \varepsilon < \varepsilon_0 \\ k^* + {(\delta+r)\varepsilon} \big/ {2(1+\varepsilon)} & if\ \varepsilon \geq \varepsilon_0 \end{cases}$, $P(\varepsilon) = a - k^* - k^*(\varepsilon)$, $f(\varepsilon) = \dfrac{1}{2}$,

Although can enter the domestic market by the form of Greenfield investment under the condition of failing to bid for firm , this will generate additional cost, which is related to clearing the relationship with the government and the efficiency of the administrative examination and approval, and it can be denoted by c_h .

We assume that, in the case of asymmetric information, FDI has the accurate information of its own additional investment cost, and know exactly c_h is greater than the profit generated by setting up a plant in the host country. Therefore, the firm F will not invest in the host country if it fails to bid. However, firm A only knows that the scope of distribution of firm F 's additional cost, c_h ,is $(0,\overline{c}]$, and the cumulative distribution function of c_h and the corresponding density function are given by $F(c_h)$ and $f(c_h) = F'(c_h)$ respectively. Firm A thinks that if F establish directly a plant in the host country, firm A and F would create a Cournot oligopoly equilibrium in the domestic market, moreover, FDI would choose the optimal investment k^*. Therefore, from the view of firm A, the present value of firm F's profit will be.

$$\Pi_F^* = \frac{Pk^* + (1-\delta)k^*}{1+r} - k^* = \frac{a^2 - 5a(\delta+r) + 4(\delta+r)^2}{9(1+r)} \tag{11}$$

where Π_F^* needs to meet the condition of $\Pi_F^* < \overline{c}$.

It is evidently that, for firm A, firm F will set up directly a plant in the host country when the condition of $c_h \leq \Pi_F^*$ is satisfied, thus from the view of firm A, once failing to bid for firm B, the probability that firm F enters the host market by Greenfield investment is.

$$\pi = P(c_h \leq \Pi_F^*) = \int_0^{\Pi_F^*} f(c_h)dc_h = F(\Pi_F^*) \tag{12}$$

Thus, firm A also knows that it will monopolize the whole market with the probability of $1-\pi$ if it can succeed in bidding for firm B. At this point, the objective function of the firm A is given by.

$$V_M^A = \frac{P_M \cdot k_M + (1-\delta)k_M}{1+r} - (k_M - k + c) \tag{13}$$

where V_M^A stands for the present value of the assets of firm A when it monopolizes the whole market at the end of period 2; $P_M = a - k_M$ is the price of monopolized market; k_M denotes the capital stock of firm A in corresponding market.

According to the first-order condition of equation (13), we can yield the optimal k_M is.

$k_M = \dfrac{a-(\delta+r)}{2}$. However, the solution of $k_M = \dfrac{a-(\delta+r)}{2}$ should meet the precondition of $k_M > k$,

that is to say , meet $\dfrac{a-(\delta+r)}{2} > 2(1-\delta)\dfrac{a-(\delta+r)}{3}$, and thus $\delta > \dfrac{1}{4}$ is the equivalent expression of that condition. It is apparently that firm A will not make additional investment, and rent out the excess capital to hedge against inflation if $\delta \leq \dfrac{1}{4}$.

Synthesizing the above analysis, we can get the firm A's present value of assets when it outbid F and monopolize the whole market is.

$$V_M^A = [\frac{P_M \cdot k_M + (1-\delta)k_M}{1+r} - (k_M - k + \beta(\delta)c)] = \frac{[a-(\delta+r)]^2}{4(1+r)} + 2(1-\delta)k^* - \beta(\delta)c \tag{14}$$

Where $k = 2(1-\delta)k^* = 2(1-\delta)\dfrac{a-(\delta+r)}{3}$, $k_M = \dfrac{a-(\delta+r)}{2}$, $P_M = a - k_M$, $\beta(\delta) = \begin{cases} 0 & if\ \delta \leq \dfrac{1}{4} \\ 1 & if\ \delta > \dfrac{1}{4} \end{cases}$.

However, this situation analyzed above only occurs with the probability of $1-\pi$. If the F firm has access to the host market in the form of setting up branch directly (occurs with the probability of π), then the firm A and F will form a duopoly in the domestic market too. In this case, the present value of the firm A's assets is given by.

$$V_D^A = \frac{(a-2k^*) \cdot k^* + (1-\delta)k^*}{1+r} - (k^* - 2((1-\delta)k^*)) = \frac{[a-(\delta+r)]^2}{9(1+r)} + 2(1-\delta)k^* \tag{15}$$

There is no the additional cost c appearing in equation (15), this is because we know that the rate of depreciation can not be too big, in other words, $\delta \leq \dfrac{1}{2}$ holds. At this time, A firm will be able to achieve the best output without needing additional investment after buying B's assets, and can still rent out the excess capital to preserve its value.

Now, by synthesizing the results of equations (14) and (15), we can yield the expectation of the present value of the firm A's assets when it bid the firm B as follows.

$$EV_{AB}^A = (1-\pi)V_M^A + \pi V_D^A \tag{16}$$

If the firm B is bidden by F, the present value of the firm A's assets will be given by.

$$V_{FB}^A = \frac{1}{9}\frac{[a-(\delta+r)]^2}{1+r} + (1-\delta)k^* - c \tag{17}$$

Therefore, we can know the reservation price of the assets of firm B to the firm A at the time of purchase, according to equations (16) and (17), is.

$$R^A(\pi) = EV_{AB}^A - V_{FB}^A = (1-\pi)V_M^A + \pi V_D^A - V_{FB}^A = (1-\pi)\frac{5}{36}\frac{[a-(\delta+r)]^2}{1+r} + (1-\delta)k^* + c - (1-\pi)\beta(\delta)c \tag{18}$$

It is obviously that R^A is a function on the π, and its value is inversely proportional to π.

4. The allocation of investment gains when FDI enters the host country

From formulas (6) and (10), we will gain a important result.

$$R^F - R^B = \int_{-1}^1 \frac{\frac{[(a-k^*-k^*(\varepsilon))k^*(\varepsilon)-(a-2k^*)k^*]}{1+r}}{(1+\varepsilon)-(r+\delta)[k^*(\varepsilon)-k^*]f(\varepsilon)d\varepsilon} + \int_{-1}^1 c(1-\alpha(\varepsilon))f(\varepsilon)d\varepsilon = \int_{-1}^1 \frac{\frac{[(a-k^*-k^*(\varepsilon))k^*(\varepsilon)-(a-2k^*)k^*]}{1+r}}{(1+\varepsilon)-(r+\delta)[k^*(\varepsilon)-k^*]f(\varepsilon)d\varepsilon + \frac{(1+\varepsilon_0)}{2}c} \tag{19}$$

(we have known that ε is subject to uniform distribution, thus $f(\varepsilon) = \frac{1}{2}$).

$R^F - R^B > 0$ holds because of (i) the first term on the right side of the equation (19) is the gains generated from the FDI investor's adjusting promptly the capital stock to $k^*(\varepsilon)$ according to the real value of productivity factor ε, which is more reasonable than the local firm's choice of a uniform capital stock, k^*, and (ii) the second term on the right side of the equation (19) is the saving of the 'sunk' cost c in all the low-productivity firms, whose ε's are less than ε_0. Moreover, it is evident that the value of the left side of equation (19) is proportional to the size of the host market (a), which means that the FDI investor's gain from its information advantage are increase in the size of the host market.

Proposition 1. With information advantage due to their superior micro-management skill, a foreign direct investor can fine tune the capital stock to the true productivity of a domestic firm after acquiring the firm. Therefore, it can gain higher return from the firm than its domestic counterparts.

Therefore, firm F will certainly participate in the bid for B. $R^F - R^B$ is the intrinsic gains associated with the superior micro-management by firm F. It is obviously that the greater the change in productivity ε is, the greater the revenue of cross-border merge will be.

About equation (18), we have known that R^A is a monotone decreasing function of π, thus $R^A(\pi=0) > R^B$ and $R^A(\pi=1) < R^B$ hold. So there is a right value π_1 in the collection of π, which enable $R^A(\pi=\pi_1) = R^B$ to be established when $\pi = \pi_1$. That is to say, firm A will be involved in the bid for firm B only if $\pi \leq \pi_1$ holds.

As a result, when $\pi \in (\pi_1, 1]$, that means, from the view of firm A, the firm F's cost of Greenfield investment is too low so that the probability that firm F enters the host market by the form of Greenfield investment after failing to bid is greater than π_1, firm A will give up the bid for B. In this case, the FDI investor (firm F) obtains all of the gains from bid for B. It can be said that firm F get all of the merge revenue with the probability of $(1-\pi_1)$.

Now we turn to the discussion about the situation of $\pi \in [0, \pi_1]$. Let $R^F = R^A(\pi)$, we get the corresponding probability value π_2, and $\pi_2 < \pi_1$. Case 1: if $\pi \in (\pi_2, \pi_1]$, the firm F will obtain firm B at the cost of the reservation price of firm A, and the fine-tuning gains is shared by firm F and B. The gains belongs to firm F is $R^F - R^A(\pi) = R^A(\pi_2) - R^A(\pi)$, and that accrue to the firm B is $R^A(\pi) - R^B = R^A(\pi) - R^A(\pi_1)$. Case 2: if $\pi \in [0, \pi_2]$, the firm A will obtain the firm B at the cost of the

reservation price of firm F. In this case, the firm F can not merge B, and have no way to make the best use of its complete information advantages for carrying out effective micro-management to firm B, thus the revenue should have been generated from that does not exist. In fact, however, the gains generated by firm A's merging B is the monopoly profit, which is obtained by firm A and B in common, and firm A and B enjoy $R^A(\pi) - R^F = R^A(\pi) - R^A(\pi_2)$ and $R^F - R^B = R^A(\pi_2) - R^A(\pi_1)$ respectively.

Proposition 2. i) If the costs of Greenfield investment are very high ($\pi \in [0, \pi_2]$), the MNC will not enter the host country and the gain from MNC's information advantage dose not exist. ii) If the costs of Greenfield investment are moderate ($\pi \in (\pi_2, \pi_1]$), the MNC will get firm B at the cost of the reservation price of firm A, and share the fine-tuning gains with domestic economy; iii) If the costs of Greenfield investment are very low ($\pi \in (\pi_1, 1]$), the MNC will get firm B at the cost of the reservation price of firm B and obtains all of the gain from its information advantage.

Proposition 2 shows that, by setting a proper entering cost to satisfy $\pi \in (\pi_2, \pi_1]$, domestic government can share with FDI investor the fine-tuning gains generated from FDI's complete information advantage.

5. Concluding remark and policy implication

Based on the idea of Razin and Sadka (2003), we establish a oligopoly game model in this paper under the condition of incomplete information to analyze the investment gains from the cross-border M&A of MNE and the allocation of the gain. Foreign direct investor have a cutting-edge advantage over domestic investors in extracting information about the true value of the firm after it acquires and gains control of the firm. It can apply its superior micro-management skills to elicit the true value of the productivity factor ε. The results show that the greater the uncertainty existing in the host country's firm is, the more obvious the complete information advantage of MNE is, and the greater the investment return invented by MNE through cross-border merge will be also. Loungangi and Razin (2001) [6] conducted a empirical analysis in that aspect, and their finding is consistent with the results of our model.

Differing with the conclusion by Razin and Sadka (2003), our analysis indicates that as long as the situation of cross-border merge occurs, the fine-tuning gains of FDI tends to be shared by foreign multinational corporations and the host country together (its share proportion depending on the size of additional cost generated from multinationals' investing in the host country), or is entirely captured by the multinational companies. By contrast, our conclusion has a more reasonable explanation for the motive that the MNE makes the decision of FDI in reality as well as the host country attracts foreign investment.

A country's authorities must be very careful to make the FDI policy in order to not only attract foreign investment but also share the fine-tuning gains of it. To achieve this goal, the policy-makers can consider setting the cost of Greenfield FDI in a reasonable scope, neither too high nor too low. Furthermore, those countries who have larger size of the market can set a relatively higher cost of entry. That is to say those countries with larger markets could provide less incentive to attract FDI. Of course, in the long term, to improve the productive capacity of domestic enterprises and to reduce information gaps caused by delaying computer-related technology applications, policy-makers should consider a certain degree of policy support to enterprises.

References

[1] O. Hart, Financial Contracting, Nancy L. Schwartz Lecture, Kellogg Graduate School of Management, Northwestern University, 2000.

[2] Rivoli and Salorio, "Foreign direct investment and investment under uncertainty," Journal of International Business Studies, Vol. 27, No. 2, 1996, pp. 335-357.

[3] Goldstein and Razin, "An information-based trade off between foreign direct investment and foreign portfolio investment," Journal of International Economics,70, 2006, pp. 271–295.

[4] Ying and Yang, "The role of information in the competition for FDI under uncertainty," Research in Economics,61, 2007, pp.62–70.

[5] Razin and Sadka, "Gains from FDI inflows with incomplete information," Economics Letters,78, 2003, pp.71–77.

[6] P. Loungangi, A. Razin, "Foreign direct investment: a critical view," Financial and Development, 38 (2),2001, pp.6–10.

[7] Pavida Pananond, "Motives for foreign direct investment: a view from emerging market multinationals," Multinational Business Review, 23 (1), 2015, pp.2-14.

[8] Chiara Franco, "Exports and FDI motivations: Empirical evidence from U.S. foreign subsidiaries," International Business Review, Vol. 22 (1), 2013, pp 47-62.