

Agglomeration Mechanism of Horizontally Integrated Multinationals under D-S Model of Limited-Number Enterprises

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By pointing out the limitation of a classical model of new economic geography –the Krugman model -- by loosening the assumption of the number of enterprises, we present a more general model under the circumstances of labor force relatively overmuch to investigate agglomeration mechanism of horizontally integrated multinationals in host country. The results of the model show that agglomeration of horizontally FDI is the outcome which includes accumulating and increasing the process of supply and consumption. Market equilibrium is attained by market jams and market enlarges the two kinds of contrary strength.

Keywords: Multinationals, Horizontally integrated multinationals, D-S model, Agglomeration mechanism.

1 Introduction

An enterprise mainly has two very different reasons to go abroad. One is to take market as the orientation, the business enterprise engages in the production of the same or the same kind of product at the same time in several nations including the mother country, and sell towards the host country to satisfy the demands of the local market. Another is for making good use of international factor endowments difference. The business enterprise carries on corresponding allocations in different region according to the different attribute of each link of the product-value chain and combines market management of the subsidiaries organically together. The former is for the sake of serving the local market well, which is generally called “*horizontally*” FDI; another is for acquiring lower price devotion factors, which is called “*vertically*” FDI^[1].

Documents on FDI are extremely abundant, but many are at the aspect of positive study. On the theoretical side Chinese scholars mostly just studied FDI in very general terms, not having subdivided FDI into types. Since 80s’ Markusen & Venables subdivided FDI into vertically and horizontally types, and brought them into the general

equilibrium-analysis frame which is held in esteem in the international trade-theory circles. The works of Helpman and Markusen have made the theory of multinationals and essential international trade theory blend day by day. This paper follows the demarcation of FDI by Markusen to investigate the agglomeration mechanism from the angle of host country.

2 Basic models

The classic model of Dixit & Stiglitz (1977) built an abstract analytical frame of monopolistic competition and product diversification; Krugman, Paul. (1991b) led the space factor into the D-S model to construct a so-called “The core-periphery model”. Krugman’s model supposes that the number of firms is sufficient that a firm’s influence on the price index is too small to be estimated. On the other hand the labor-force resources are supposed to be limited in Krugman’s model. However, labor force resources are relatively overmuch for a developing country (such as China) in general. Yang Xiao-kai (1993) corrected the limitation of the D-S model by loosening the assumption of “sufficient enough firms”. On this foundation and under the assumption of labor force resources being in excess, this paper investigates agglomeration mechanism of horizontal FDI in the host country.

2.1 Basic assumptions

Suppose existing agriculture and industry are the two sectors in the host country. The industrial sector has a production technique of increasing returns to scale. The agricultural sector depends upon the production technique of constant returns to scale. The utility of each consumer in the host country adopts Cobb-Douglas utility function as follows:

$$U = M^\mu A^{1-\mu} \quad (2.1)$$

In Eq. (2.1) M and A respectively measure the consumption of industrial goods aggregation and agricultural goods by a consumer of host country. Suppose any two kinds of industrial goods have the same elasticity of substitution. Thus the subutility that the consumer gets to consume industrial goods aggregation can take the CES function as:

$$M = \left(\sum_{i=1}^n C_i^{(\delta-1)/\delta} \right)^{\delta/(\delta-1)} \quad (2.2)$$

In Eq. (2.2) C_i is for the consumption of industrial good “ i ” by a consumer of the host country and n is for numbers of kinds of industrial goods consumed in the host country.

2.2 Consumption decision of the consumer

The first stage: the consumer chooses the combination of industrial goods and agricultural goods consumed under income constraint to make his utility maximized.

$$\max M^\mu A^{1-\mu} \quad (2.3)$$

$$s.t. \quad A + IM = Y \quad (2.4)$$

Take the price of agricultural goods as 1 and the price of industrial goods aggregation as I . Then get the budget constraint Eq. (2.4). Construct the Lagrangian function to get the following:

$$IM = \mu Y \quad (2.5)$$

$$A = (1 - \mu)Y \quad (2.6)$$

μ and $1 - \mu$ reflect the consumer's expenditure proportion on industrial goods and on agricultural goods. μ also represents a level of national industrialization to some extent.

At the second stage: the consumer makes the subutility maximized by choosing C_i under the budget constraint of Eq. (2.8), p_i is the price of industrial goods

$$\text{"}i\text{" in the host country.} \quad \max \left(\sum_{i=1}^n C_i^{(\delta-1)/\delta} \right)^{\frac{\delta}{\delta-1}} \quad (2.7)$$

$$s.t. \quad \sum_{i=1}^n p_i C_i = \mu Y \quad (2.8)$$

We can know from the consumer's maximizing utility behaviors that the demand function of a representative consumer to industrial good "i" in host country is as (2.9).

$$C_i = p_i^{-\delta} (I^{\delta-1} \mu Y) \quad (2.9)$$

In Eq. (2.9) I is the price index of industrial goods of host country. It is as follows:

$$I = \left(\sum_{i=1}^n p_i^{(1-\delta)} \right)^{\frac{1}{1-\delta}} \quad (2.10)$$

Suppose L is the total population of host country. Then the demand function of the host country to industrial good "i" is Eq. (2.11).

$$x_i = L C_i = L p_i^{-\delta} (I^{\delta-1} \mu Y) \quad (2.11)$$

2.3 Production decision of the manufacturer

Suppose each firm produces a kind of product only and suppose only nonskilled labor. The kind of production factor which is used in the course of production, regardless multinationals or native enterprises, has the same production function as follows:

$$l_i = \alpha + \beta x_i \quad (2.12)$$

l_i is the number of workers that the enterprise produces product "i" to use, x_i is the output of product "i", α is the fixed cost of the factory measured by the number of workers and β is the marginal cost measured by the number of workers. If the wage of the host country is w , then the profit function that an enterprise produces product "i" is (2.13).

$$\pi_i = p_i x_i - w(\alpha + \beta x_i) \quad (2.13)$$

Take (2.10) and (2.11) into Eq. (2.12), and then into the profit function (2.13) to get

profits that a horizontally integrated multinational wins in the host country:

$$\begin{aligned}\pi_i &= p_i x_i - w(\alpha + \beta x_i) = (p_i - w\beta) \cdot LI^{\delta-1} \mu Y p_i^{-\delta} - w\alpha \\ &= \frac{p_i^{1-\delta}}{\sum_{i=1}^n p_i^{1-\delta}} \cdot L\mu Y - \frac{p_i^{-\delta}}{\sum_{i=1}^n p_i^{1-\delta}} \cdot L\mu Y w\beta - w\alpha\end{aligned}\quad (2.14)$$

From the first line conditions of the profit function one gets the equilibrium price:

$$p_i = \frac{(\delta n - \delta + 1) w\beta}{(\delta - 1)(n - 1)} \quad (2.15)$$

The reform of both the Chinese land system in the countryside and the state-owned business enterprise in the city, which make China appear a flood of rural surplus labors and urban unemployed workers, lower considerably the wages level of Chinese manufacturing workers, increase the supply elasticity of the labor force and make Chinese labor force resources greatly in excess. So the main factor that decides the extent of agglomeration of enterprises is not the amount of labor force, but is mainly because of the competition between firms which causes the price index to decrease, the demand for a firm's product decrease and profits of the firm to decrease. When the long-term equilibrium is attained, $\pi_i = 0$. Take (2.10), (2.11) and (2.15) into the enterprise's profit function (2.14) to get:

$$\begin{aligned}\pi_i &= (p_i - w\beta) \cdot L\mu Y \cdot \frac{p_i^{-\delta}}{\sum_{i=1}^n p_i^{1-\delta}} - w\alpha \\ &= \left(1 - \frac{w\beta}{p_i}\right) \cdot \frac{1}{n} L\mu Y - w\alpha = \frac{1}{\delta n - \delta + 1} \cdot L\mu Y - w\alpha\end{aligned}\quad (2.16)$$

Make $\pi_i = 0$ and get (2.17).

$$\pi_i = \frac{1}{\delta n - \delta + 1} \cdot L\mu Y - w\alpha = 0 \quad (2.17)$$

Find the solution of Eq. (2.17):

$$n^* = \frac{L\mu Y}{\delta w\alpha} + 1 - \frac{1}{\delta} \quad (2.18)$$

(2.18) is the long-term equilibrium number of firms. Suppose that the number of native enterprises in the host country is n_m . Then one finds that horizontal FDI enterprise numbers in the host country is (2.19).

$$n_f = n^* - n_m = \frac{L\mu Y}{\delta w\alpha} + 1 - \frac{1}{\delta} - n_m \quad (2.19)$$

3 Model analyzing on agglomeration mechanism of horizontal FDI

3.1 Comprehensive agglomeration effect

We can see from Eq. (2.19) in a certain period the number of horizontal FDI enterprises in the host country is positively interrelated to the level of industrialization

μ of the host country. μ represents the degree of agglomeration effect. This shows the advantages of material factors and their spatial scale of concentration, such as human resources, infrastructure and related industries etc., constitute the regional foundation of FDI in-draft ability. The connected effect between both front and back industries being caused by industrial agglomeration lowers the cost of conveyance for FDI enterprises agglomerating in the region, and can help FDI enterprises form a connection having strategic meaning, help them strengthen ability to compete and establish competitive advantage. The industrial agglomeration also attracts and causes a well-trained labor force and technical personnel of related professions to agglomerate, which raises the productivity of labor.

3.2 Local market enlarges effect

We can also see from Eq. (2.19) that the number of horizontal FDI enterprises in the host country is also positively interrelated to the population L and average income level y of the host country. Along with exaltation of population and average income level of the host country horizontal FDI also increases. Along with the entering of multinationals, the location cost brought by agglomeration of FDI increases not much in the early years. At the same time people's income level quickly increases along with the industrial agglomeration. Industrial agglomeration still promotes the agglomeration of urban population. A huge urban population provides high consumption ability, produces various needs and makes the market continuously expand. It is thus clear that local market's enlarges effect is the motivation that causes the FDI's spatial agglomeration.

3.3 Economic effect of cultural contacts

Suppose that the original endowments of factors are the same, at this time hobbies of decision maker and economic culture contacts degree between FDI enterprises and host country have a dominant function to the location choice of the beginning FDI enterprises.

The host country environment is the total of each kind of factors which influence behavior and decision of enterprises directly or indirectly in the process of their carrying out the management of internationalization; these factors create "thrust" or "resistance" to the enterprise. Though the managerial environment of the host country is complicated and changeable, if enterprise decision makers contact the environment closely over a long period of time, they are familiar with the alterational regulation of related environment factors, then they can well foresee, accept and do reaction in time to the environmental variations. Therefore FDI enterprises incline to choose more familiar environment. FDI location decision is directly to be influenced a great extent by geographical and traditional economic cultural contacts. However, because of some common characteristics of FDI enterprises from the same country, the demonstrated effect is also more outstanding to them, which make the consequent FDI agglomeration usually present an obvious "home-country agglomeration effect".

3.4 Policy encourages effect

Suppose the original endowments of regions A and B are the same. The first ingoing foreign enterprise will invest in a certain region according to accidental affairs such as canvassing business activity or specially encouraging policy of the government. Once the multinationals entered a region (such as region A), the originally symmetric state is changed. On one hand the entering of the multinationals enhances the market enlargement effect; Enterprises entering lead to an increment of employment, increase of income level, and increment to the demand for products; the agglomeration effect brings about the external economy and strengthens the conglomerating power of the region. On the other hand its successfully entering becomes a signal indicating regional characteristics and strengthens confidence of the multinationals prepared to enter later. The subsequent multinationals invest in region A constantly but not in region B. When industries in region A develop firstly, the environmental infrastructure and various corresponding systems contributing to the enterprises in it start to be constructed. This accelerates FDI further agglomeration in region A, promotes mutuality between the environment and the industries, which form circulating accumulation causality, whereas, in region B, backwardness of industries and environment interact on each other, which forms a vicious cycle and makes the regional gap between A and B increasingly bigger. It is thus clear that, if a certain region has attracted a great deal of FDI enterprises because of the special policy or the opportunity, so this region is placed in a very beneficial position in the competition of attracting FDI enterprises in the future, the existence of the agglomeration effect makes new investors to be continuously attracted to this region.

3.5 Market competition effect

It can be found in Eq. (2.19) that the number of horizontally FDI enterprises is negatively interrelated to the wage level of the host country, namely the cost of the labor force runs high more quickly and other factors endow changes in the host country, which is not beneficial to import horizontal FDI. However, the regional in-draft ability to FDI is also limited. When FDI agglomeration effect develops to a certain degree, the external cost of FDI rises, the price of immobile factors (such as land) starts to rise, the agglomeration effect gradually decreases, which make multinationals evade region A while choosing locations. Therefore location choice of the enterprise is decided by contrast of the external economy brought by agglomerating and external uneconomy brought by congestion. When enterprises gather together so excessively that competition between enterprises is more vigorous, housing cost, transportation cost, production cost and management cost increase along with population and industries concentrating, inside and outside operating circumstance of the multinationals is worse. The more manufacturers there are, higher prices of immobile factors are, more vigorous product competition is, the stronger the price competition effect caused by the ascension of the cost of congestion is, more difficult manufacturers earn profits, all these produce regional

dispersing power. At this time the region loses its attraction to FDI, brings exclusive function to the multinationals that would soon enter and crowding-out effect to the weak multinationals. The former four kinds are the strengths that help FDI to agglomerate; the final kind is the strength that helps FDI to spread. Market equilibrium is attained by market congestion and market enlarges the two kinds of contrary strength.

4 Conclusions

Agglomeration of Horizontally Integrated Multinationals in the host country is led by comprehensive agglomeration effect, the local market enlarges effect, the economic culture contacts effect, policy encouragement effect and market competition effect. Agglomeration of Horizontally FDI is the outcome that includes accumulating and increasing process of supply and consumption, market potential is the important constitutive part of accumulating cause and effect relations; but price competition and land exploitation are the dispersion strength of the production and consumption. Market equilibrium is attained by market congestion and market exacerbates the two kinds of contrary strength.

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