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The Optimal Foreign Entry Mode Choice: The Role of Firm Heterogeneous Capability

Chen Lili, Zhou Mao, Shen Ting
(Southwest University of Finance and Economics, Chengdu, China)

Abstract: By developing a general equilibrium model with firm heterogeneity in capability, this study attempts to explore specifically how a firm's technology and management mobile capabilities with other immobile capabilities affect its optimal entry mode choice. We highlight that a firm with relatively stronger management capability prefers M&A in management intensive industry, while a firm with the strongest technology capability prefers newly-built operation in technology intensive industry. Our theoretical results are consistent with the findings in the empirical work of Andersson and Svensson (1994).

Keywords: foreign direct investment; greenfield FDI; mergers and acquisitions; technology capability; management capability

JEL codes: F1, L2

1. Introduction

This paper examines how a firm's heterogeneous capability in technology and management affect its optimal entry mode choice with a general equilibrium model. Our results show, in equilibrium, a firm's capabilities play a key role in determining its optimal international entry mode choice. Our paper is closest in spirit to two strands of literature examining the choice of foreign entry mode. One strand, the Management literature, relying on "resource-based view of the firm", emphasizes a firm's capabilities as the determinants of the international organization of production. According to the "resource-based view of the firm", a firm's endowment of "capabilities" or intangible assets is key to superior firm performance (Wernerfelt, 1984). The Management literature discovers that the level of technology and management capability endowed by a firm plays a significant role on its performance. Anderson and Svensson (1994) argue that a distinction should be made at the firm level between technology skill and organization/management skills. "Technology skill" is related to invention and the ability to innovate with respect to investment in own R&D, and "Organization/Management capability" is associated with the ability to absorb and utilize existing knowledge. Using Swedish data, their empirical paper shows that a greater propensity to undertake M&A when a firm owns higher organization/management capability,

Chen Lili, Professor, School of International Business, Southwestern University of Finance and Economics; research areas/interests: international trade and investment. E-mail: llchen@swfue.edu.cn.
Zhou Mao, Ph.D. Student, School of International Business, Southwestern University of Finance and Economics; research areas/interests: international trade and investment. E-mail: 603970224@qq.com.
Shen Ting, Postgraduate Student, School of International Business, Southwestern University of Finance and Economics; research areas/interests: international trade theory and policy. E-mail: 782607126@qq.com.

and a greater propensity to undertake greenfield FDI when a firm owns higher technology capability. The other strand, the "new" Trade literature, based on a general equilibrium analysis, analyzes the endogenous selection of heterogeneous firms into models of foreign entry (Melitz, 2003; Bernard et al., 2003; Helpman et al., 2004). Few studies combine these two strands in an integrated framework with the exception of Nocke and Yeaple (2007). An important feature we share with Nocke and Yeaple (2007) is that we incorporate the "resource-based view of the firm" into a general equilibrium model of international trade and investment. The key difference between our paper and that of Nocke and Yeaple (2007) is that we explore specifically how the technology and management mobile capability a firm possesses affects the optimal choice of international entry modes. In contrast to our paper, Nocke and Yeaple (2007) have mainly discussed how the degree of international mobility of different capabilities affects a firm's optimal entry mode choice.

The management strategy literature posits that some capabilities, such as marketing, distribution, and country specific institutional competency are imperfect mobile across countries (Anand & Delios, 2002). Through merge and acquisition, the acquiring firm can exploit complementarities between local firms' country specific capabilities and its own technological advantages. The more the acquiring firm can learn about the market of host country, the greater the benefit of M&A. However, the acquired activities involve risky exposure of technology which may lead to a reduction of the acquirer's core competitiveness, especially for acquirers with advanced technologies. By contrast, by engaging in greenfield FDI, firms can protect its proprietary technology and maintain its market power as illustrated by Hennart et al. (1993, 1997). But one key disadvantage through greenfield FDI is that firms cannot access local firms' specific resource quickly. Therefore, there is a trade-off between these two FDI options in various industries.

In this paper, we highlight that greenfield FDI can be the optimal choice for a firm with low management capability in management intensive industry if the firm is endowed with the strong mobile capability in technology. This is in contrast to the findings of Nocke and Yeaple (2007) that a firm with high mobile capability only prefers M&A access in all types of mobile intensive industry. Our theoretical results are consistent with the findings in the empirical work of Andersson and Svensson (1994).

2. The Model

2.1 Demand

We begin with a model based on Nocke and Yeaple (2007) with two identical countries, A and B, indexed by *k*. Each country is endowed with Y units of labor, whose price is normalized to 1. For each country, the representative consumer has two-tier preferences: Cobb-Douglas preferences over two types of industries and the CES preferences over a continuum of varieties in each industry. The sub-utility in the industry *i* can be written as,

$$U_i = [\int_{\omega\in\Omega_i} q(\omega)^{1-\rho_i} x(\omega)^{\rho_i} d\omega]^{\frac{1}{\rho_i}}, \rho_i = \frac{\sigma_i - 1}{\sigma_i}, \sigma_i > 1 \quad (1)$$

Where $x(\omega)$ is the level of consumption, $q(\omega)$ is the perceived quality of variety ω, σ_i is the elasticity of substitution across varieties and Ω_i is the set of varieties available to consumers.

These preferences generate a demand function for individual varieties in each industry of country *k*

$$x^k(\omega) = \beta_i Y (P_i^k)^{\sigma_i - 1} q^k(\omega) p^k(\omega)^{-\sigma_i} \quad (2)$$

Where β_i is the income share of the expenditure spent on the goods of industry i ($\sum \beta_i = 1$) $p^k(\omega)$ denotes

the price of variety ω, P_i^k is the aggregate price index for the industry i, $P_i^k = \left[\int_{\omega\in\Omega_i} q^k(\omega)\ p^k(\omega)^{1-\sigma_i} d\omega\right]^{\frac{1}{1-\sigma_i}}$. Since nations are symmetric, the price indices in the two nations are the same: $P_i^k = P_i$.

2.2 Firms' Types and Product Quality

Nocke and Yeaple (2007) suggest that firms' endowments can be distinguished into two types according to their mobility: "mobile" and "non-mobile" capability. "Mobile" capability can travel easily across borders. In contrast to "mobile" capability, "non-mobile" capability is usually country specific, such as knowledge of local market condition, consumer tastes, or the relationships between local supplies and buyers. Therefore, it is more costly to travel across countries. The empirical findings of Anderson and Svensson (1994) suggest that the nature and composition of skills exert a major influence on the entry mode. We investigate technology capability, management capability and other "non-mobile" capabilities denoted by t, z and n, respectively. Therefore, a firm's type is indexed by (*t, z, n*).

The defining feature of "non-mobile" capability according to Nocke and Yeaple (2007), is that "non-mobile" capability can be more effective in its country of origin than abroad. For example, "marketing expertise" is usually country-specific. The better a firm's marketing expertise is, the more possibility its product is accepted by local consumers. Henceforth, when a firm utilizes country A's "non-mobile" capability to serve country A which is denoted by n^A, its perceived quality in country A is $q^A = n^A$. But provided that it uses this capability to serve the other nation B, its perceived quality in nation B is only $q^B = \delta n^A$, where $\delta\in(0,1)$. The parameter δ reflects the disadvantage of using a "non-mobile" capability originated from a different country.

2.3 Production

2.3.1 Marginal Cost

The efficiency of a firm's productivity hinges on its own technology level directly. There is an inverse relationship between a firm's technology and its marginal cost: $c(t)=1/t$, where $t > 0$. Goods that are exported across border are subjected to the melting-iceberg transport cost $\tau_i > 1$. Let $\hat{c}^k(\omega)$ denote the marginal cost of a firm selling variety ω in country k. The profit maximization price must then satisfy $p^k(\omega) = \hat{c}^k(\omega)/\rho$, i.e., each firm charges a fixed markup.

2.3.2 Cost Function When Engaging in Greenfield FDI

Under the mode of greenfield FDI, a firm owns its proprietary technology and can minimize the risk of losing control over the technology. A firm with proprietary technology usually has better bargaining power in the factor market. The higher a multinational company's technology level, the more significant monopoly advantage in production it gets and the lower the marginal cost it incurs. We assume that a firm's marginal cost of producing in the foreign country when it enters the market through greenfield FDI is $c(t) = \frac{1}{t} f(t)$, where $f(t)\in(0,1)$ [1]. We define *f(t)* as a cost reduction factor caused by its monopoly advantages in production from its proprietary technology. Firm's "non-mobile" capability, however, still keeps its initial value *n* via greenfield FDI.

2.3.3 Cost Function When Engaging M&A

Firms with higher management capability have stronger capability to exploit complementarities from the acquired companies when engaging M&A. According to the Management strategy literature, this synergy effects improve firm productivity. We assume, after the firm of type (*t, z, n*) accomplishes its acquisitions, its technology

[1] $f(t)$ has the following properties of function $f'(t)<0$, $\lim_{t\to 0} f(t) = 1$, $\lim_{t\to\infty} f(t) = 0$

level changes to $tg(z)$, where $g(z)$ is characterized as a technology absorptive factor[2]. The foreign production unit of the firm who enters the market through M&A is $c=\frac{1}{tg(z)}$. Moreover, a firm can make use of the acquired firm's "non-mobile" capability in recipient nations n' which is often better than n.

2.4 Stages of Firm Decision

For simplicity, we exclude the situation of export-platform FDI, and all activities have to be undertaken with the firm because of contracting problems.

Besides production at home market, a firm can sell its product abroad by 3 distinct ways: exporting with the transport cost; setting up newly-built operations or executing M&A. Entrants' decision proceeds in two stages:

Stage 1: An entrant decides to be acquired in M&A market or to how to serve international market most profitably as a firm.

Stage 2: A firm competes in the market as price setters and achieves profit.

We refer to a player "entrant" or "firm". The distinction between "entrant" and "firm" is useful as an entrant may acquire or be acquired by other entrant at stage 1.

3. Equilibrium

In this section, we discuss the equilibrium of our model and determine the equilibrium pattern of exporting, greenfield FDI or M&A. We assume a perfectly competitive M&A market, $V_i(t, z, n)$ represents the stock price of an entrant with type (t, z, n) in the M&A market in industry i. For the entrant of type (t, z, n), it can sell itself to achieve the value $V_i(t, z, n)$, or buy another entrant of type (t', z', n') at price $V_i(t', z', n')$. Since the acquired firms are always not well developed and characterized by lacking technology or management advantages but still possess valuable local resources. We henceforth assume, under market clearing condition, the value of an acquired entrant in the M&A markets is $V(0, 0, n)$, which only depends on its advantages originating from its "non-mobile" capability.

3.1 The Gross Profit

We begin by deriving the gross profits of firms at the second stage. The gross profit of a firm selling variety ω in country k is given by

$$S_i q^k(\omega)(\hat{c}^k(\omega))^{1-\sigma_i} \quad (3)$$

Where the markup-adjusted demand level S_i is given by

$$S_i=\frac{\beta_i Y}{\sigma_i(\rho_i P_i)^{1-\sigma_i}} \quad (4)$$

Now, the firm's gross profit in country k depends on firm's technology level, firm's management capability, firm's perceived quality in country k (which depends on the "non-mobile" capability used for serving country k) and its entry mode. We define the post-M&A type of a firm as (t, z, n_1, n_2), wheren_1 is its own "non-mobile" capability, and n_2 is the "non-mobile" capability obtained in a foreign country. The gross profit that this firm in country B achieves from selling in country A is given by

[2] $g(z)$'s characteristics are as follows: $g(z)>1$, $g'(z)>0$, $\lim_{z\to\infty} g(z)=\infty$

$$\text{Exporting: } S_i T_i \delta_i n_1 (\frac{1}{t})^{1-\sigma_i}$$

$$\text{greenfield FDI: } S_i \delta_i n_1 [\frac{1}{t} f(t)]^{1-\sigma_i}$$

$$\text{M\&A: } S_i n_2 \left[\frac{1}{tg(z)}\right]^{1-\sigma_i}$$

For notational simplicity, let $T_i = \tau_i^{-(\sigma_i - 1)}$ ($T_i = \tau_i^{1-\sigma_i} < 1$), the advantage of this transformation is that a firm's profit is linear in the redefined variables. It is worthy of noting that there is a negative correlation between $T_i < 1$ and τ_i.

We now yield this firm's total profits generated from domestic and the foreign country

$$\text{Exporting: } \pi_x = (1 + T_i \delta_i) S_i n_1 \left(\frac{1}{t}\right)^{1-\sigma_i} \tag{5}$$

$$\text{greenfield FDI: } \pi_g = \left[1 + \delta_i f(t)^{1-\sigma_i}\right] S_i n_1 \left(\frac{1}{t}\right)^{1-\sigma_i} - F_c \tag{6}$$

Where F_c is the fixed cost under the mode of greenfield FDI.

$$\text{M\&A: } \pi_a = S_i (n_1 + n_2) g(z)^{\sigma_i - 1} \left(\frac{1}{t}\right)^{1-\sigma_i} - V(t', z', n_2) \tag{7}$$

Where $V_i(t', z', n_2)$ denotes the stock price of the acquired entrant.

We then turn to the first stage. For the firm of type (t, z, n), the value from selling itself or serving the foreign market is $V(t, z, n) = \max\left\{V(0, 0, n\ ), \pi_x, \pi_g, \pi_a\right\}$.

3.2 Industry

In this subsection, we first consider technology intensive industry M. For simplicity, we suppose all firms in the industry M are only different in technology level, each firm's management ability is 1, and "non-mobile" capability is also 1. For the entrant of type (t, 1, 1), its value is $V(t, 1, 1)$

$$V(t, 1, 1) = \max\left\{V(0, 0, 1), \pi_x(t), \pi_g(t), \pi_a(t)\right\} \tag{8}$$

Where

$\pi_x(t) = (1 + T\delta) S t^{\sigma - 1}$

$\pi_g(t) = \left[1 + \delta f(t)^{1-\sigma}\right] S t^{\sigma - 1} - F_c$

$\pi_a(t) = 2Sg(1)^{\sigma - 1} t^{\sigma - 1} - V(0, 0, 1)$

Since $(1 + T\delta)S < 2S < 2g(1)^{\sigma - 1} S$ and $\lim_{t \to \infty}\left[1 + \delta f(t)^{1-\sigma}\right] S > 2g(1)^{\sigma - 1} S$. These profit functions are depicted in Figure 1. It is evident immediately to get three thresholds,

$$t_0 = \left[\frac{V(0,0,1)}{(1+T\delta)S}\right]^{\frac{1}{\sigma-1}}, \quad t_1 = \left\{\frac{V(0,0,1)}{[2g(1)^{\sigma-1} - 1 - T\delta]S}\right\}^{\frac{1}{\sigma-1}}, \quad t_2 = \left\{\frac{V(0,0,1) - F_c}{\left[2g(1)^{\sigma-1} - 1 - \delta f(t)^{1-\sigma}\right]S}\right\}^{\frac{1}{\sigma-1}}.$$

Proposition 1. There exist three thresholds $0 \le t_0 \le t_1 \le t_2$. Firms with a technology level between $(0, t_0)$ sell themselves in the M&A market, firms with a technology level between (t_0, t_1) supply the foreign market through exporting, firms with a technology level between (t_1, t_2) serve the foreign market via acquiring foreign entrants. When $t \in (t_2, \infty)$, firms selects greenfield FDI (see Figure 1).

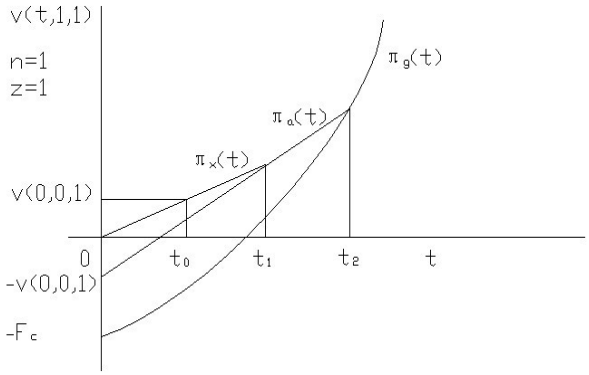

Figure 1 Technology's Capability Impact on Firms' Selection of Internationalization Path[3]

We now move on to industry N, which is management intensive. In this industry, we assume all firms in this industry only differ in management ability, each firm's technology is 1, and "non-mobile" capability is also 1. For the entrant of type (1, z, 1), its value is $V(1, z, 1)$

$$V(1,z,1)=\max\left\{V(0,0,1),\pi_x(1),\pi_g(1),\pi_a(z)\right\} \tag{9}$$

Where

$\pi_x(1)=(1+T\delta)S$

$\pi_g(1)=\left[1+\delta f(1)^{1-\sigma}\right]S-F_c$

$\pi_a(z)=2g(z)^{\sigma-1}S-V(0,0,1)$.

Since $V(0, 0, 1)$, $\pi_x(1)$, $\pi_g(1)$ are unrelated to z, we just need to compare the two entry modes: greenfield FDI and M&A or exporting and M&A. As$y = g(z)$is monotonic increasing function, it has inverse function. When $\pi_g(1) = \pi_a(z)$ or $\pi_x(1) = \pi_a(z)$, we can derive the thresholds, respectively

$$\overline{z_1}=g^{-1}\left\{\left[\frac{S+\delta f(1)^{1-\sigma}S+V(0,0,1)-F_c}{2S}\right]^{\frac{1}{\sigma-1}}\right\} \text{ or } \overline{z}_2=g^{-1}\left\{\left[\frac{(1+T\delta)S+V(0,0,1)}{2S}\right]^{\frac{1}{\sigma-1}}\right\}.$$

Proposition 2. There exists a threshold $\overline{z_1}>0$ or $\overline{z_2}>0$, when$z\in(0,\overline{z_1})$ or $z\in(0,\overline{z_2})$, the firm is more inclined to select greenfield FDI or exporting, respectively. When $z\in(\overline{z_1},\infty)$ or $z\in(\overline{z_2},\infty)$, the firm is more inclined to select M&A (see Figure 2).

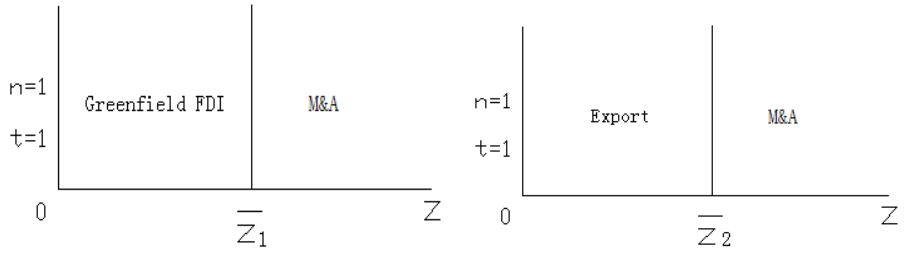

Figure 2 Management Capability's Impact on Firms' Selection of Internationalization Path

[3] When $F_c<V(0,0,1)$, there are two intersections, but it does not affect a firm' interval of decision making.

4. Conclusion

In this paper, we develop a general equilibrium with firm's heterogeneity in technology and management capability to address two sets of questions: (1) Does a firm's different mobile capability affect firm's entry mode choice differently? (2) What is the optimal international organization of production among exporting, greenfield FDI and cross-border M&A for a firm which possesses different heterogeneous technology and management mobile capabilities in different industry? There are three predictions derived from our model. First, the source of firm's different mobile capabilities plays an important role for the optimal entry mode choice. Second, in the industry where all firms differ in management capability, firms with relatively stronger management ability prefer to M&A, while firms with relatively less management ability prefer to newly-built operations. On the contrary, in the industry where all firms differ in technology capability, the lowest efficient firms choose to sell itself in M&A market, less efficient firms opt to export, higher efficient firm chooses M&A, while the highest efficient firm chooses greenfield FDI. Third, our paper also contributes to the management strategy literature based on "resource-based view of the firm" by providing a theoretical explanation on the best entry mode choice.

Our research has some policy implications. As explored by our analysis, the optimal entry mode is different for a firm with different mobile capabilities. Hence, the government should exert policy tailored for the particular type of FDI in order to obtain the optimal social welfare.

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Appendix

Proof of the gross profit of a firm selling one variety in country A (Equation 3)

A firm's gross profit selling one variety in country A,

$$\pi = \left[p^A(\omega) - \hat{c}^A(\omega) \right] \beta_i Y \left(P_i^A \right)^{\sigma_i - 1} q^A(\omega) p^A(\omega)^{-\sigma_i}$$

We calculate the partial derivative of π with respect to $p^A(\omega)$,

$$\frac{\partial \pi}{\partial p^A(\omega)} = \beta_i Y (P_i)^{\sigma_i - 1} q^A(\omega) \left\{ p^A(\omega)^{-\sigma_i} + \left[p^A(\omega) - \hat{c}^A(\omega) \right] \left(-\sigma_i \right) p^A(\omega)^{-\sigma_i - 1} \right\} = 0$$

So we have $p^A(\omega) = \frac{\sigma_i}{\sigma_i - 1} \hat{c}^A(\omega) = \frac{1}{\rho_i} \hat{c}^A(\omega)$.

Using the optimal pricing we can express the firm's gross profit selling one variety in country A

$$\pi = S_i q^A(\omega) \left[\hat{c}^A(\omega) \right]^{1-\sigma_i}$$

where the markup-adjusted residual demand level

$$S_i = \frac{\beta_i Y}{\sigma_i (\rho_i P_i)^{1-\sigma_i}}$$