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THE SEQUENTIAL-INVESTMENT STRATEGY VS. THE SINGLE-INVESTMENT STRATEGY: LESSONS FROM KOREAN FIRMS' FDIS TO CHINA

Abstract. *The paper focuses on an eye-catching FDI pattern prevailing among Korean firms, so-called sequential FDIs. Between a single-investment strategy and a sequential-investment strategy, we scrutinise the reasons why the sequential-investment strategy is pursued by Korean parents taking time value into consideration. Fundamentally, Korean parents are inclined to establish Chinese subsidiaries sequentially because they can enjoy more flexible production effects, which enable them to lead markets in quantity competition. Three important theoretic predictions are drawn from a quantity competition model. First, the net discount payoff under the sequential-investment strategy is payoff dominant to the single-investment strategy's as long as the market bargaining power of Korean parents can be enhanced. Second, those parents withholding higher discount factors are more likely to pursue the sequential-investment strategy. Third, the longer the Korean parents can stay in China, the more likely that they are to invest sequentially. Pooling LSDV (least squares dummy variable) regressions support these theoretic predictions. It is evident that sequential investments significantly increase the Korean parents' production capabilities because the production portfolios constructed by the sequential investment strategy can organise internal production networks. As more subsidiaries are networked, the longer the new subsidiaries established by follow-up investments can be sustained owing to tie-in effects. The duration since after the first subsidiary foundation is positively associated with the frequency of sequential investments. It is evident that Korean firms' sequential investment strategy, combined with their geographical proximity to China, contributes to overcoming market uncertainty and foreignness in China.*

Keywords*: Sequentiality, FDI, quantity competition, production effect, performance, and duration*

JEL Classification: L23, L26, M21, M1

1. Introduction

Since its open door policy in 1979, China has been experiencing the huge influx of foreign investment. Korea established a diplomatic tie with China in 1992 and China has currently become the largest trade partner of Korea. There is no doubt

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that Korea enjoys a geographical advantage as the closest neighbor country of China. Consequently, the export-led Korean economy becomes largely affected by China's economic fluctuations. In fact, Korean firms' Chinese FDIs are highly dependent on trade paths to trade volumes between the two countries (Duanmu, 2014).

Some early papers study the rush-to-China phenomenon from the perspective of resource-based view (Luo, 2001; Pan and Tse, 2000; Sun, 1999; Zhao and Zhu, 1998; Jeon, 1992). This view mainly points out that foreign investors penetrate into China to access abundant production resources, which is plausible to some degree. Nevertheless, throughout the rapid growth of China, a non-deniable global norm exists: China is the world's factory. Not only to meet global market demand, but also to preoccupy the rapidly growing Chinese domestic market, China is currently considered a target country for constructing efficient production bases. Fewer labor disputes secured by the Chinese government's labor policy and factor intensity are the fundamental foundations for Korean firms' aggressive FDIs to China (Hyun, 2010; Zhan, 2005) and they can concentrate on improving production capabilities, which can ultimately reinforce market governance.

This proposes a non-deniable business norm: achieving market leadership in China is the shortcut to maximise production capability. An intriguing question for business entrepreneurs is how to achieve this business norm. Interestingly, an eye-catching pattern prevails in Korean firms' FDIs to China. Several Korean firms have attempted to construct efficient production portfolios through sequential investments. In the paper, sequential investments are defined as a series of follow-up FDIs to establish new subsidiaries subsequent to the first FDI for establishing an initial subsidiary.

Korean parents' FDI behavior provides a clue to understand why a sequential investment strategy is preferred. According to Park and Lee (2003), Korean firms prefer tight subsidiary controls and, therefore, as a foreign entry mode, they prefer FDI to joint venture. Guillen (2003) also exhibits that Korean parents tend to mimic other Korean affiliates when they penetrate into foreign markets, and this trend is more evident in high-tech industries. In practice, Korean parents are intended to establish internal production networks, and a majority of their subsidiaries are established by manufacturers indeed (Park and Kim, 2010). In relation to this, sequentiality reinforces Korean parents' competitiveness because they can adapt themselves to volatile business environments more quickly, taking advantage of internal capital markets. Kim (2010) suggests that Korean firms began to invest sequentially in order to mitigate FDI failures.

Actually, the sequential investment strategy has several strategic advantages. First, sequential investments are designed to create production portfolios and parents can acquire market know-how through sequential FDI processes. This brings stronger bargaining powers against competitors (Ogasavara and Hoshino, 2009). For instance, parents can circumvent market uncertainties through inter-subsidiary networks (Song, 2002). Second, subsidiary-wise, internal capital markets enable parents to coordinate flexible manufacturing (Wong, 2006). In the market

characterised by a short product life cycle (PLC), this advantage provides a shortcut for late entrants to leapfrog early entrants. Third, firms can overcome newness and foreignness by timely acquiring experience and familiarity (Chang and Rosenzweig, 2001).

As parents launch additional subsidiaries, their market bargaining powers will be stronger later. For instance, parents can expedite subsidiary-specific advantages for tightening their internal capital markets, which strengthen the competitiveness of the group as a whole (Kimura et al., 2008; Rugmand and Verbeke, 2001). Actually, Korean small- and medium-sized enterprises (SMEs) pursue internationalisation through sequential investments in China. For instance, Lee et al. (2013) and Kim (2004) demonstrate that Korean firms proceed to a market-based division of labor by networking sequentially established local subsidiaries, which expands their market bargaining powers through specialisation.

Henceforth, it is not too much to say that pursuing the sequential investment strategy is helpful in strengthening Korean parents' market bargaining powers in China. But, unfortunately, no previous related literature directly tackles this issue. So far, the sequential-investment strategy itself is approached merely from an investment stochastic decision perspective along with stage-by-stage termination and suspension. In terms of a real option, the sequential investment strategy is a way of diversification or concentration (Smith and Thompson, 2009; Bar-Ilan and Strange, 1998; Kelle, 1987). Differently from the previous works, the objectives of this paper are set to explore why Korean parents pursue sequential investments in China, what are the determinants of such sequential investments, and how the sequential investments contribute to the performance of Korean parents.

For scrutinising these objectives, a quantity competition model that highlights four points is constructed. First, Korean parents attempt sequential investments to achieve economies of scale. This suggests that the Chinese market is characterised by quantity competition. Second, sequentiality is accompanied by a time interval, and thus a finitely repeated game rather than a simultaneous move game is more appropriate to model Korean parents' sequential FDIs. Third, due to internal capital markets, sequential investments can effectively alleviate numerous shocks originating from market uncertainties. In location choice, Korean firms aggressively seek out the presence of other Korean firms for taking advantage of backward and forward linkage effects (Debaere et al., 2008). Fourth, within the framework of quantity competition, Korean parents can enjoy cost-side advantages and this makes them pursue the sequential-investment strategy. This means that those parents pursing the sequential-investment strategy are in a better position to lead markets. In the model, market competition structure can change from Cournot type to Stackelberg type.

The model produces some empirically testable predictions. A critical problem is that Korean parents' Chinese subsidiary-wise panel data is not available. Thus, pooling LSDV (least squares dummy variable) regressions are attempted with a cross-sectional data earned from KOTRA (Korea Trade-Investment Promotion

Agency). Empirical frameworks are designed to test how Korean parents' sequential investments to China contribute to their performances, how patience can affect the sustainability of the sequential-investments, and how the frequency of the sequential investments is determined.

The paper is organised as follows. In Section 2, a finitely repeated sequential investment model is constructed. Pooling LSDV estimation equations are introduced in section 3 and section 4 discusses some estimation results. Section 5 summarises the main findings of the paper along to conclusion remarks.

2. Model Framework

2.1. Entry Options

A is a foreign entrant and *B* is an incumbent with a first-mover advantage in China. They are competitors in market *Z*, which is characterised by Cournot type quantity competition. *Z* is assumed to be a rapidly growing market. *B* preoccupies *Z* owing to cost competitiveness. The inverse demand curve for the market is given to $p = 1 - q_A - q_B$ where the market size is fixed to be one. Initially, the marginal cost of *A* is c_A and the marginal cost of *B* is c where $c_A \geq c$. Thus, *A* is inferior to *B* in Cournot competition structure. *A* penetrates into China for obtaining cost competitiveness.

China can play as a production base for *A*, which lowers production cost significantly *ex post* its first FDI. *A* is able to achieve cost competitiveness on the same level of *B* through the first FDI. In that, *A* can produce at $c_A = c$ once it establishes the first subsidiary.[1]

A has two strategic options when it penetrates into China: a single-investment strategy vs. a sequential-investment strategy. Denote R_A as *A*'s revenue in China and *F* is its total investment to China. Under the condition of $R_A \geq F$, the expected payoff of *A*'s single-investment strategy is[2]

$$w_A = xR_A - F \tag{1}$$

where x is the probability that *A* controls its subsidiary successfully.

If *A* wants to establish its own internal capital market, it must make an additional investment, *i.e.* hF, for coordinating sequentially established subsidiaries where $0 < h < 1$. With the probability of x, *A* can recover hF while constructing a production network across all the subsidiaries. In this case, A's investment decreases to $(1 - h)F$. This is the cost-side gain earned from a successful internal capital market. The expected payoff of *A*'s sequential-investment strategy is

$$\tilde{w}_A = x[R_A - (1 - h)F] + (1 - x)(R_A - F) - hF \tag{2}$$

[1] This assumption is based on as Zhan (2005) who firmly conclude that the low-cost advantage is the primary reason for Korean parents' FDIs to China.

[2] If $R_A < F$, *A* will not consider FDI at all. Thus, $R_A \geq F$ is *A*'s FDI participant criterion. Note that *A* can still earn negative payoff due to x.

The advantage of *A*'s internal capital market is straightforward because $\widetilde{w}_A - w_A = (1-x)(R_A - hF) > 0$. Therefore, constructing an internal capital market is always a pay-off dominant strategy. This suggests that *A* is generically inclined to implement a sequential investment strategy. Two interesting implications are derived from this result. First, the higher the profit of the sequential investment strategy is, the more likely *A* is to follow the $\widetilde{w}_A$ path. Second, *A* is generically inclined to choose the w_A path if x increases given that $\frac{\partial w_A}{\partial x} > \frac{\partial \widetilde{w}_A}{\partial x}$. This result reveals that *A* is intended to implement a select-and-focus strategy in a simultaneous move game.

2.2. Productions

A plans to stay in China for $0 \leq t \leq n-1$ where $n \geq 2$; *A* establishes its first subsidiary at $t = 0$ and then it launches a series of subsidiaries through follow-up investments during $1 \leq t \leq n-1$. In contrast to *A*'s aggressive move, the incumbent *B* does not establish any subsidiary because it preoccupies production, networking, and distribution.[3] At $t = 0$, firm i solves the following profit maximisation problem

$$\pi_i^0 = \max_{q_i^0}(p-c)q_i^0 \tag{3}$$

The equilibrium quantities at $t = 0$ are $q_A^{0*} = q_B^{0*} = \frac{(1-c)}{3}$ and the equilibrium profits of both firms are $\pi_A^{0*} = \pi_B^{0*} = \frac{(1-c)^2}{9}$. Evidently, the lower the marginal production cost is, the higher the production quantity is. This effectively explains why the rush-to-China phenomenon is popular among global manufacturers.

A decides whether to establish a new subsidiary in each t. The number of subsidiaries founded by the follow-up investments is $m-1$ for $1 \leq t \leq n-1$ where $m \leq n$. Alternatively stated, *A* establishes total m subsidiaries in China including the first subsidiary. Owing to its internal capital market, all the subsidiaries founded by *A*'s follow-up investments can produce at the marginal production cost of c.

For $1 \leq t \leq n-1$, $q_{A,i}^t$ is the production quantity of *A*'s individual subsidiary at t. Then, $Q_A^t = \sum_{i=1}^m q_{A,i}^t$ is the total production quantity of *A*'s whole subsidiaries at t. *B*'s total production quantity at t is given to $Q_B^t = q_B^t$ because it does not have any subsidiary.

Unlike their European and North American rivals, Korean large corporations are strongly motivated to internalise all investment decisions.[4] This is evident from the Korean firms' noticeable Chinese FDI attitude to achieve the economies of

[3] The first mover can lead late entrants by improving allocations of resources (Etro, 2008).
[4] When it is necessary, they do not even hesitate to delay FDIs (Christopher & Fausten, 2002).

scale.[5] By this, *A*'s production portfolio provides a strategic advantage of flexible manufacturing, and its business model can create market governance. For instance, an old saying, '*don't put all your eggs in one basket*', applies to this strategy exactly. Compared to *B*, *A* can allocate Q_A^t to its subsidiaries.[6] Hence, *A* can adapt faster than *B* when new production life cycles begin, while accommodating technological transitions. This enhances *A*'s market governance, which formulates an ordered market structure against *B* in *Z*. Revoking China's rapid economic growth, this leadership must be able to explain the rapid expansion of *Z*.

Huck et al. (2001) and Okuguchi(1999) provide good explanations on this issue; Stackelberg competition makes markets more efficient, which yields higher production outputs than Cournot competition. According to Mitraille and Moreaux (2013), such market expansion is still valid in exhaustible resource industries; even between n identical firms in Cournot equilibrium, a leadership can be exerted over rivals when a firm stores to accumulate outputs, which enables the firm to control market share. The sequential investment strategy of A incurs this type of production control effect. Hence, the market competition structure is considered to be changing from Cournot type to Stackelberg type when $t \geq 1$. During $1 \leq t \leq n-1$, *A* solves (4) and *B* solves (5).

$$\pi_A^t = \max_{Q_A^t}(p-c)Q_A^t \tag{4}$$

$$\pi_B^t = \max_{Q_B^t}(p-c)Q_B^t \tag{5}$$

In Stackelberg competition, *A*'s equilibrium production quantity per subsidiary in each t ($t \geq 1$) is determined by $q_A^{t*} = \frac{(1-c)}{m}$ and its equilibrium profit is $\pi_A^{t*} = (1-c)^2$. *B*'s equilibrium production quantity is determined by $q_B^{t*} = \frac{(1-c)}{2}$ while $\pi_B^{t*} = \frac{(1-c)^2}{4}$. From these equilibrium outputs, one can derive $Q_A^{t*} \geq Q_B^{t*}$; the total production quantity of the foreign investor pursuing the sequential-investment strategy is greater than the incumbent's; hence, *A* can outperform *B* independently from market demand condition. If *Z* expand rapidly, *A*'s market governance will be enforced accordingly.

2.3. The Sequential-Investment Strategy and Its Strategic Advantages

The total production quantity of *A* throughout the whole period of $0 \leq t \leq n-1$ is defined as $Q_A = q_A^{0*} + \sum_{t=1}^{n-1}\delta^t Q_A^t$ and the total production quantity of *B* is defined as $Q_B = q_B^{0*} + \sum_{t=1}^{n-1}\delta^t Q_B^t$. The discounted net payoff of *A*'s sequential-investment strategy for $0 \leq t \leq n-1$ is given to (6) and the discounted net payoff

[5] The minimum efficient scale of *B* can outweigh that of *A* because it produces in a single production facility. But, total production scale can be entirely different.

[6] Cournot reaction is still required within *A*'s internal capital market, which means that *A* determines the production quantities of its individual subsidiaries simultaneously (Miller *et al*, 1999).

of *B* for the same period is given to (7). Note that a discount factor, *i.e.* $\delta = 1/(1 + r)$, determines present values where r is a discount rate ($r > 0$).

$$\tilde{\pi}_A^{0|t} = \frac{(1-c)^2}{9} + \frac{(\delta-\delta^n)(1-c)^2}{1-\delta} \quad (6)$$

$$\tilde{\pi}_B^{0|t} = \frac{(1-c)^2}{9} + \frac{\delta-\delta^n}{1-\delta}\frac{(1-c)^2}{4} \quad (7)$$

A naturally intriguing question is what if *A* does not implement the sequential-investment strategy; if so, both *A* and *B* can share *Z* equally. It is worthwhile testing whether making follow-up investments is strategically better off to the forward looking *A*. In terms of opportunity cost, the gain from the sequential-investment strategy must outweigh the gain from the single-investment strategy. Proposition 1 demonstrates that pursing a series of follow-up investments is always pay-off dominant to *A*. This reveals that constructing production portfolios in China is a best responding strategic behavior of Korean cohorts. In particular, multinational corporations (MNCs) can fully extract the gains from the follow-up investments throughout regional production networks. Therefore, they are more likely to choose the sequential investment strategy rather than the single investment strategy according to Proposition 1.

Proposition 1. *If the market bargaining power of Korean parents can be enhanced by sequential FDIs,* they *prefer the sequential-investment strategy to the single-investment strategy.*

Proof. *A*'s discounted net payoff without any follow-up investment is defined as $\pi_A^{0|t} = \frac{1-\delta^n}{1-\delta}\frac{(1-c)^2}{9}$. Then, $\tilde{\pi}_A^{0|t} - \pi_A^{0|t} = \frac{8}{9}\frac{\delta-\delta^n}{1-\delta}(1-c)^2 > 0$, thus $\tilde{\pi}_A^{0|t}$ is always payoff dominant to $\pi_A^{0|t}$.
Q.E.D.

Proposition 2 exhibits how the discount factor affects *A*'s sequential-investment strategy. Generically, a patient *A* can bear a lower $\tilde{\pi}_A^{0|t}$ and vice versa. Therefore, if δ is high enough, *A* becomes to have a long-term investment plan, which makes *A* commit to the sequential-investment strategy. In real business, a variety of factors such as internal capital withholdings, previous foreign market experiences, and capital intensity can affect a firm specific patience level. In this regard, Korean multinationals are expected to have more Chinese subsidiaries compared to small and medium sized firms. Actually, they are; KOSPI listed firms, KOSDAQ firms, and audited firms have 2.93, 1.58, and 1.74 Chinese subsidiaries, respectively.

Proposition 2. *The higher the discount factors are, the higher the discounted net payoffs of Korean parents are.*

Proof. Given that $\tilde{\pi}_A^{0|t} = \frac{(1-c)^2}{9} + \frac{\delta-\delta^n(1-c)^2}{1-\delta}$, $\frac{\partial\tilde{\pi}_A^{0|t}}{\partial\delta} \geq 0$ if and only if $\frac{\delta-\delta^n}{1-\delta} \geq 0$. Because $\frac{\delta-\delta^n}{1-\delta} = 1 + \delta + \cdots + \delta^{n-1}$, it is always $\frac{\partial\tilde{\pi}_A^{0|t}}{\partial\delta} \geq 0$. *Q.E.D.*

According to Proposition 3, *A* is more likely to earn from the follow-up investments as longer it can stay in China. Because Korea established a diplomatic tie with China in 1992, the maximum length of Korean firms' duration is limited to twenty-four years. Because China has been growing very rapidly since the early 1990s, those Korean firms that penetrated earlier could accumulate market know-how's if they are patient enough as shown in Proposition 2. Because no Korean parents have yet retreated from China in our sample, Proposition 3 suggests that early entrants are able to outperform late entrants.

Proposition 3. *The gains from Korean parents' sequential investment strategy are positively associated with their duration in China as long as they can lead markets.*

Proof. If *A*' leaves China at t ($t < n$), its discounted net payoff is given to $\tilde{\pi}_A^{0|t}$. Then, $\tilde{\pi}_A^{0|n} - \tilde{\pi}_A^{0|t} = \frac{(1-c)^2}{1-\delta}\delta^t(1-\delta^{n-t}) > 0$ and $\tilde{\pi}_A^{0|n+1} - \tilde{\pi}_A^{0|n} = \delta^n(1-c)^2 > 0$. Therefore, the longer *A* competes in China, the more it can earn. *Q.E.D.*

3. Empirical Test

3.1. Data Description

In the paper, we use '*Foreign Operating Korean Firms Directory 2011/12*' that is published semiannually by KOTRA (Korea Trade-Investment Promotion Agency). The directory reports Korean firms' FDI information along with their subsidiary information in China. Unfortunately, the directory provides very limited cross-sectional information such as address, total investment, foundation year, and total employees.

To collect detailed subsidiary information, the following steps are used. In the first step, those parents that recorded FDIs in China are selected from the directory. In the second step, we count only those FDIs for establishing new subsidiaries and the FDI information is double-checked through parents' homepages. In the third step, the whole Chinese subsidiaries of each parent are collected from the directory. In the fourth step, we identify whether they are the first subsidiaries or not. However, there are some practical problems. First, subsidiary information is limitedly available because the directory does not provide the detailed information of individual subsidiaries. In fact, only very few subsidiaries have fully usable information; hence, averaging across subsidiaries is not technically available to

characterise parent-wise follow-up investments. To circumvent this problem, I focus on the first subsidiaries of our Korean parents. Because follow-up investments are conditional events on successful initial investments, parental commitments to first subsidiaries can be used as proxyes to project the sustainability of sequential investments.

As a result, 135 Korean parents are collected and seventy-four firms (56.8%) are found to have pursued the sequential-investment strategy. Classifying by firm size, KOSPI listed firms are sixty-two firms, KOSDAQ listed firms are twenty-eight firms, and externally audited firms are forty-five firms. It is straightforward to see that the ratios of first subsidiary investment over total assets are 11.4%, 9.7%, and 3.3% by the order of KOSDAQ listed firms, externally audited firms, and KOSPI listed firms. This exhibits that small- and medium-sized firms put higher weights on their Chinese first subsidiaries compared to KOSPI listed firms, which exhibit size effects in FDI.

Total working years measured by initial subsidiary's age is not significantly different across three groups and their standard deviations are not that different, too. It is because they could invest in China since 1992. However, it is interesting to note that total working years are different across industry groups. For instance, the average total working years of consumer goods industries like paper, apparel, and food is 12.6 years and that of traditional manufacturing industries like electrics, electronics, machinery, and chemical is 11.6 years. This shows that Korean firms' early FDIs to China was led by cost-sensitive light industries. Heavy industries penetrated into China to obtain scale economies later on, and Korean electronics also started to move their factories to China as the PPP of China increases. The relatively short total working years of the automobile and transport industries is due to Hyundai Motor Company(HMC)'s late FDIs to China. It was not until 2003 that HMC launched a joint venture with Beijing Automotive Group (BAG). The subcontractors of HMC have started to invest to China afterward.

Table 1. Korean Parents' FDIs to China

Definitions	KOSPI Listed Firms (62 Firms)	KOSDAQ Listed Firms (28 Firms)	Audited Firms (45)
First Subsidiary Investment / Total Assets	3.3%	11.4%	9.7%
Total Number of Subsidiaries	2.9 (2.9)	1.6 (1.3)	1.7 (1.1)
The Ratio of First Subsidiaries that are located in Special Economic Zone	28 (45.1%)	16 (67.9%)	19 (35.5%)
Total Working Years	11.9 years (4.6)	11.3 years (4.7)	1 years (5.7)

3.2. Empirical Frameworks

Empirical frameworks are designed to test the theoretical predictions of the game model. For this purpose, three different equations are prepared. Equation (8) tests how the sequential-investment strategy affects the production capability of parent firms, which can verify Proposition 1. y_i represents total sales and productivity. KS is a KOSPI listed firm dummy and KD is a KOSDAQ listed firm dummy. By the architecture of the equation, both KS and KD dummies measure how they earn more y_i compared to externally audited firms.

The number of Chinese subsidiaries (sn_i) is used as a proxy for measuring Korean parents' sequential-investment strategy. For robustness, the subsidiary commitment (sc_i) that is defined as the ratio of first subsidiary investment over i's total assets is also tested. lr_i is the labor equipment ratio that represents per labor productivity and ci_i is the capital intensity that represents per labor capital investment. One thing that must be discussed is the size effect. In (8), two group dummies cannot fully adjust endogenous size effects, and thus the natural log of i's total employees and its squared values are used as well. This treatment has two technical advantages. One can circumvent multicollinearity, and it can be tested if diminishing returns to scale works.

$$y_i = c + KS + KD + sn_i(+sc_i) + lr_i + ci_i + \ln em_i + +\ln em_i^2 + \varepsilon_i \quad (8)$$

Proposition 2 suggests that Korean parents are more likely to pursue the sequential-investment strategy as lower their discount factors are. Equation (9) is designed to test Proposition 2. The natural log of total working years (lnT_i) is a proxy to measure the sustainability of i' sequential FDIs in China. Because the firm-specific discount factor is not measurable, one needs to project it through the longevity of the first subsidiary. A clue for understanding this is 'tied-in' effect; Korean parents' commitments to follow-up investments tend to be dependent on the investment scale on their first subsidiaries. As they add up new subsidiaries, they are more deeply tied in Chinese production facilities, which can enhance the sustainability of their Chinese subsidiaries.

$$lnT_i = c + KS + KD + sc_i(+sn_i) + lr_i + c_i + \ln em_i + \varepsilon_i \quad (9)$$

Among 135 parents, none have retreated from China yet.[7] Thus, two groups of parents are compared in equation (10) where $sc^{h(l)}$ is a dummy that gives the value of one to those parents with the higher(lower)-than-average subsidiary commitments. Thus, the group of $sc^{h(l)} * sn_i$ represents the total number of subsidiaries of those parents with the higher(lower)-than-average subsidiary commitments. Hence, one can verify how the sustainability of Korean parents' sequential investments is affected by their first subsidiary commitments.

[7] Thus, the total working years of i is identical to the age of its first subsidiary.

$$lnT_i = c + KS + KD + sc^h * sn_i\left(+sc^l * sn_i\right) + lr_i + c_i + \ln em_i + \varepsilon_i \quad (10)$$

According to Proposition 3, the timing of initial penetration is positively associated with the frequency of the follow-up investments. Equation (11) tests Proposition 3. The dependent variable (ni_i) is total number of subsidiaries and lnT_i is a proxy for gauging i's duration in China. As a proxy for measuring the production effect by the sequential-investment strategy, the natural log of total sales ($lnsa_i$) is used.[8] For correcting endogeneity associated with the frequency of sequential investments, the ratio of i's first subsidiary employees over i's total employees (sr_i) is used.

$$ni_i = c + KS + KD + lnT_i + lnsa_i + lr_i + sr_i + \varepsilon_i \quad (11)$$

Because 135 parents have different industry backgrounds, heteroscadasticity can occur. Hence, all the equations are estimated by the White standard error that can correct heteroscadasticity. The financial information of the explanatory variables is collected from *KIS-Value*.

4. Empirical Results

A noticeable feature in Table 2 is that the productivity of the audited firms is higher than that of both the KOSPI listed firms and the KOSDAQ listed firms. This is due to the size effect. Because the firms size of audited firms is comparatively smaller, their subsidiary commitment tends to be higher than two other groups, which results in higher productivity. It is interesting to see that the total number of subsidiaries is positively associated with total sales and productivity, which is broadly consistent to Fukunari et al. (2008), Tomiura (2007), Kimura and Kiyota (2006), and Antras and Helpman (2004). Subsidiary commitment also increases both dependent variables; this result coincides with Raff and Ryan (2008) who demonstrate that Japanese parents make follow-up investments as higher the gains they can earn from the first investments. These results support Proposition 1. The positive and significant labor equipment ratio along with capital intensity implies that capital goods and intermediate goods are being invested as traditional manufacturers move to China. The size effect controlled by total employees exactly reveals that diminishing returns to scale exits; this outcome is consistent with the fact that Korean parents' Chinese FDIs are mainly focused on manufacturing sectors.

[8] Although subsidiary-level total sales is more desirable, parent-level total sales is used due to data available. Because the production effect of sequential investment would be co-integrated into parents' total sales, the coefficient of $lnsa_i$ in (9) will be estimated bigger than the real coefficient where subsidiary-level total sales is used.

Table 2. The Contributions of Sequential FDIs on Korean Parents' Production Capacities

	Dependent Variable: The National Log of Total Sales		Dependent Variable: Productivity	
Constant (c)	-5.4233*** (.9097)	-6.2601*** (.9893)	-2.5210** (.8202)	-3.2599*** (1.0381)
KOSPI Dummy (KS)	-.1134 (.1376)	-.1057 (.1404)	-.2816** (.1191)	-.2751** (.1232)
KOSDAQ Dummy (KD)	.2623 (.1592)	-.3091* (.1662)	-.2629* (.1076)	-.3031*** (.1148)
Total Number of Subsidiaries (sn_i)	.2037** (.0912)	-	.1697*** (.0889)	-
Initial Subsidiary Commitment (sc_i)	-	.8520* (.4539)	-	.7661* (.4012)
Labor Equipment Ratio (lr_i)	.1739*** (.0287)	.1925*** (.0301)	.2569*** (.0682)	.2730*** (.0721)
Capital Intensity (ci_i)	.0236*** (.0062)	.0329*** (.0055)	.0286*** (.0053)	.0365*** (.0051)
The Natural Log of Parent's Employees ($\ln em_i$)	.1662*** (.0279)	.1878*** (.0293)	.0850*** (.0237)	.1041*** (.0287)
The Squared Natural Log of Parent's Employees ($\ln em_i^2$)	-.4602*** (.2060)	-.5828*** (.2135)	-.5898*** (.1764)	-.6983*** (.2026)
R^2	0.8943	0.8920	0.4574	0.4499
Observations	130	130	130	130

1. *, **, *** are significant at 10%, 5%, and 1%.

2. The numbers in the parentheses are White standard errors.

Table 3 summarises the estimation results of (9) and (10). First, early entrants to China show significantly higher initial subsidiary commitments. Second, they are more likely to establish additional subsidiaries as they stay longer in China. These groups can be considered to have relatively lower discount factors. It is also true that those parents with the higher-than-average first subsidiary commitments have more subsidiaries than those with the lower-than-average ones. Thus, one can say that the lower the Korean parents' discount factors are, the earlier they penetrate into China and the greater the scale of their sequential investments will be. Henceforth, Proposition 2 is supported.

Table 3. The Sustainability of Korean Firms' Sequential FDI to China

	Dependent Variable: The Natural Log of Total Working Years Since after First Subsidiary Foundation		
Constant (c)	2.0823*** (0.2125)	2.2122*** (0.1908)	2.3781*** (0.1995)
KOSPI Dummy (KS)	0.1533 (0.0932)	0.1482 (0.0976)	0.1498 (0.0956)
KOSDAQ Dummy (KD)	0.0602 (0.1082)	0.1000 (0.1099)	0.0644 (0.1102)
Initial Subsidiary Commitment (sc_i)	0.9354** (0.4472)	-	-
Total Number of Subsidiaries (sn_i)	0.0446*** (0.0150)	-	-
The Number of Subsidiaries for Those parents with Higher-than-Average sc_i ($sc^h * sn_i$)	-	0.1116* (0.0612)	-
The Number of Subsidiaries for Those parents with Lower-than-Average sc_i ($sc^l * sn_i$)	-	-	0.0359** (0.0162)
Labor Equipment Ratio (lr_i)	-0.0349* (0.0182)	-0.0351* (0.0183)	-0.0414** (0.0186)
Capital Intensity (ci_i)	-0.0536* (0.0295)	0.0017 (0.0187)	-0.0607* (0.0309)
The Natural Log of Parent's Employees ($\ln em_i$)	0.0140 (0.0333)	0.0147 (0.0315)	-0.0102 (0.0330)
R^2	0.1186	0.0597	0.0594
Observations	130	130	130

1. *, **, *** are significant at 10%, 5%, and 1%.

2. The numbers in the parentheses are White standard errors.

According to Table 4, the total working years increase the frequency of sequential investments. In other words, the earlier the Korean parents establish their first subsidiaries in China, the more subsidiaries they have. This supports Proposition 3. The labor equipment ratio and capital intensity are insignificant, while the parent's size is significant. This implies that it is not an organisational characteristic but a firm size that determines the speed of constructing production portfolios.

Table 4. The Determinants on the Frequency of Sequential FDIs

	Dependent Variable: Total Numbers of Chinese Subsidiaries		
Constant (c)	-1.3709 (0.9724)	-0.4131 (0.4146)	-2.0899* (1.1119)
KOSPI Dummy (KS)	0.5795 (0.3557)	0.2214 (0.3664)	0909 (.3721)
KOSDAQ Dummy (KD)	-0.2342 (0.3063)	-0.0542 (0.2853)	-.1097 (.2909)
The Natural Log of Total Working Years ($\ln T_i$)	0.8340* (0.4275)	-	.7521* (.3929)
The Natural Log of Parent's Total Sales ($\ln sa_i$)	-	0.4311** (0.1736)	.4140** (.1665)
Labor Equipment Ratio (lr_i)	0.1165 (0.1296)	1.0287 1.1991	.1412 (.1207)
Capital Intensity (ci_i)	0.2918 (0.4168)	-0.3271 (0.4572)	-.3342 (.4444)
The Natural Log of Parent's Employees ($\ln em_i$)	-0.0496* (0.0270)	0.0277 (0.0334)	.0138 (.0318)
R^2	0.1343	0.1769	0.2030
Observations	126	126	130

1. *, **, *** are significant at 10%, 5%, and 1%.

2. The numbers in the parentheses are White standard errors.

5. Conclusions

Korean firms' Chinese FDIs have important business implications because two countries are intimately tied to each other both politically and economically. Owing to its geographical proximity to China, Korea is one of top FDI investors in China.

A peculiar FDI pattern observed among Korean firms is that they invest sequentially. The quantity competition model of the paper is constructed based on a noteworthy implication drawn from this pattern. Their market bargaining powers become stronger as they can achieve economies of scale faster than other incumbents. From a long-term perspective, net present value becomes a crucial factor for the sequential FDI decision to Korean parents.

Reflecting this, a finitely repeated quantity competition model was built, and three meaningful predictions were derived. First, compared to those parents that stopped with single-shot investments only, those parents implementing the

sequential investment strategy can have greater net payoffs. This is the strategic motivation of the sequential investment strategy. Second, if parents are patient enough, they are more likely to build local production portfolios in the long run. Combined with the resource-based view, this implies that large corporations are in a better position to allocate resources across Chinese subsidiaries with time intervals. This prediction is exactly parallel to the fact that KOSPI listed firms have more subsidiaries than both KOSDAQ listed firms and externally audited firms. Third, the age of the first subsidiary plays an important role in the sustainability of sequential investments. Intuitively, parents can adapt to local business environments and acquire valuable embedded knowledge more easily if they can stay longer in China.

However, the sequential investment strategy cannot be solely viewed as a firm-side internal decision process. In fact, Chinese government's led infrastructure investments have created synergy effects to both Chinese government and Korean parents, *i.e.* Chinese government's national wealth accumulation and Korean firms' economic rents accumulation, respectively (Kang and Lee, 2007). Not only physical infrastructures, but also foreign investor friendly legal and institutional systems should be regarded as the gateway to remarkable FDI influx to China, too.

The model of the paper considers the case where market demand does not expand. In reality, China has recorded 8-15% GDP growth rate since 1992, and thus Korean parents could enjoy rapid market expansion while reinforcing their competitive advantages. Therefore, the theoretical predictions of the model can have more powerful implications. Empirical evidence estimated by pooling LSDV supports the predictions. Korean parents' production portfolios in China contribute to their performances, indeed. In particular, follow-up investments occur more frequently as their first subsidiary commitments are stronger. Also, the longer the presence of Korean parents in China is, the more sustainable their sequential investments are.

The most salient feature of the paper is that it adopts the production-networking effect as the key decision factor for Korean parents' sequential FDIs to China. This is the difference from previous works that mostly concentrated on either real option theory or resource-based theory. Unfortunately, a cross-sectional dataset is used in the paper, but a panel dataset would be useful to trace the performance of Korean parents dynamically.

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