The New Agenda for FDI: Evidence from South Korea and Germany

Gilroy, Bernard Michael and Lukas, Elmar

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Bernard Michael Gilroy[1] and Elmar Lukas[2]

Abstract

The purpose of this study is to find reasonable explanations why cross-border acquisitions of foreign firms are often the preferred strategy to enter new markets. Furthermore, we formalize the choice of market entry strategy for an individual multinational enterprise (MNE) from a dynamic perspective. It is argued that, incorporating a suitable treatment of irreversibility, uncertainty and flexibility related to an MNEs investment decision will show, that future investment opportunities play an important role when it comes to deciding whether to enter the new market via greenfield or acquisition. We also briefly discuss stylized facts given evidence from South Korea and Germany.

***JEL*-classification numbers**: D43, F23, L13, P31.

Keywords: Foreign direct investment, multinational enterprise, sequential investments, entry mode, greenfield investment, cross-border acquisition.

1 Introduction

In 1999, as Figure (1) illustrates, global cross-border acquisitions reached $1.1 trillion in 2000, up by 49 percent from $738 billion in 1999. These numbers are based upon UNCTAD (2000) who has registered all transactions in which a foreign purchaser acquired more than a 10 percent share.[3] Among developing countries, Latin America has been the largest target region of cross-border merger and acquisitions (M&As), most of which have been through privatization programs. However, though smaller in M&A size, East

[1]Prof. Dr. B.M. Gilroy, University of Paderborn, Chair of International Economics, Faculty of Business Administration, Economics and Business Computing, Warburger Str. 100, D-33098 Paderborn, email: mikegilroy@notes.upb.de

[2]Dipl.-Wirt. Ing. / Dipl.-Phys. Ing. E. Lukas, University of Paderborn, Chair of International Economics, Faculty of Business Administration, Economics and Business Computing, Warburger Str. 100, D-33098 Paderborn, email: ELukas@notes.upb.de

[3]See [37]

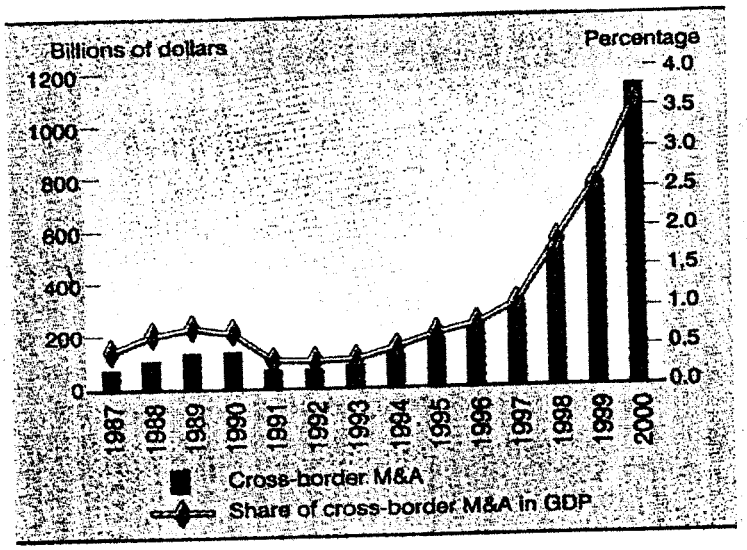

figure.1

Figure 1: World Cross-Border Mergers and Acquisitions, 1991-1999,Source: [38, p. 53]

Asia has been the fastest growing target region, growing at an annual average rate of 106 percent.[4] Unlike in Latin America, cross-border M&A activity in East Asia has been largely through sales of private firms.[5]

As Figure (2) depicts, Cross-border mergers and acquisitions in East Asia's crisis countries (Indonesia, Korea, Malaysia, and Thailand) increased enormously in value from $3 billion in 1996 to $22 billion in 1999, before decreasing to some $18 billion in 2000. Korea was the main impetus of these activities, where M&A value reached $13 billion in 1999. Consequently, cross-border mergers and acquisitions have accounted for an increasing share of foreign direct investment (FDI) flows to East Asia. As Mody and Negishi (2001) have recently observed empirically: *"The share of M&A in East Asia's FDI rose from 6 percent in 1995 to 13 percent in 1997 and increased further, to 30 percent, in 1999. Thus, the much-talked-about resilience of FDI during the crisis was due entirely to the rapid increase in M&A rather than to traditional foreign investment in "greenfield" projects (those designed to build new means of production). "*[6]

[4]See e.g. [28, p. 5]

[5]See e.g. [24].

[6][29, p. 2]

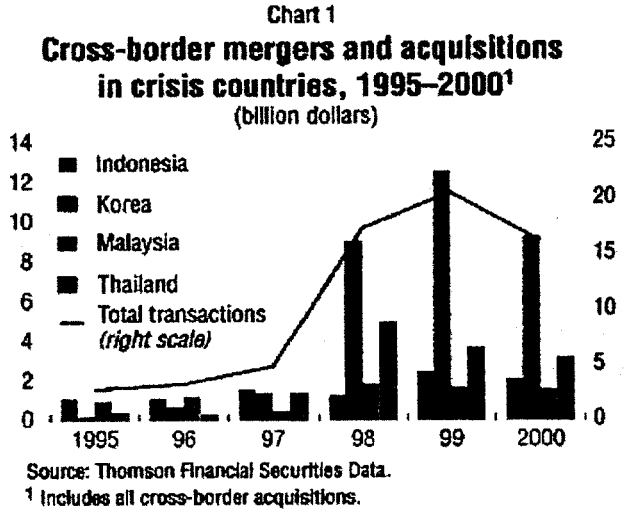

Figure 2: Cross-border mergers and acquisitions in crisis countries, 1997-1999, Source: [29]

Until recently, Korea's M&A market was one of the most inactive and closed among industrialized countries. This was to a large extent due to prohibitive legal restrictions which discouraged M&A activities. Important post-crisis policy reforms[7] have triggered the new wave of M&A activity in Korea.

A second stylized fact one observes is the recent M&A activities of foreign-based enterprises' entry into services (nontradable) sectors, whereas greenfield FDI traditionally was principally focused on manufacturing of goods for export or as substitutes for imports.[8] Figure (3) indicates that wholesale and retail trade, real estate, and financial services sectors were being intensively targeted by the new patterns of M&A activity in East Asia.

[7]e.g. on February 14, 1998, the National Assembly passed 18 economic reform bills, many of them designed to induce foreign capital through M&As ; the revaluation and adjustment of capital and foreign exchange losses (August 1999); the introduction of the Foreign Investment Promotion Act (November 1998); restrictions on cross-debt guarantees (April 1998); enhancing institutional voter rights (June 1998); the introduction of international accounting standards (August 1999); and lowering the minimum equity holding requirement to exercise shareholder's rights (1999).

[8]See [29].

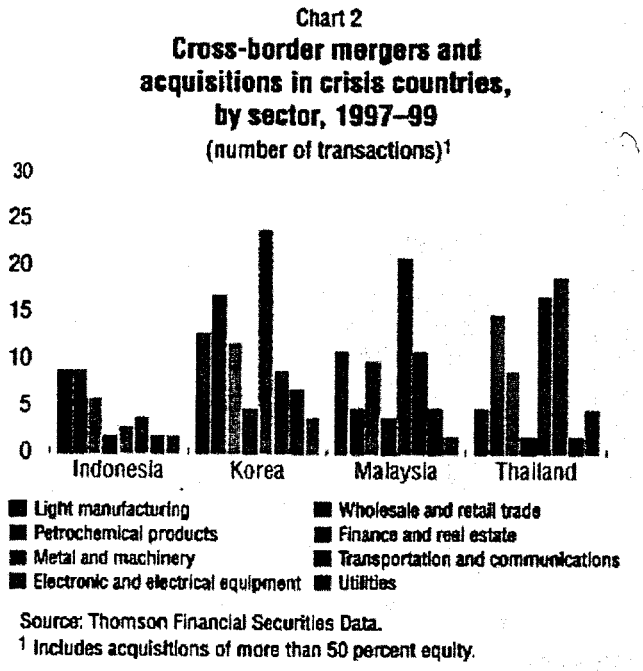

Figure 3: Cross-border mergers and acquisitions in crisis countries, by sector, 1997-1999, Source: [29]

2 Review of the Literature

In todays fast moving rapidly changing business and technological environment, the form of market entry has become a crucial decision to most MNEs. Several empirical studies have shown that since the late 1980s, most of the market entry into industrialized countries is done by acquiring host companies whereas greenfield, i.e. the construction of new foreign production sites, is preferred for less developed countries (LDCs).[9] However, so far, there exists a lack of in-depth research in the literature on dynamic aspects of why MNEs prefer one market entry alternative against the other.

In the last decade, however, researchers have started to highlight the importance of a more dynamic perspective in foreign direct investment (FDI) theory, in order to incorporate irreversibility, flexibility, and uncertainty features associated with foreign direct investment decisions.[10] Buckley and Casson (1998) stressed the need for a dynamic perspective

[9]See e.g. [3, 19, 37, 38, 20].

[10]See e.g. [8, 22, 23, 21, 6].

in FDI theory in order to overcome the static nature of past models. Furthermore, they argue that the existing models do value FDI decisions only *"...in terms of its immediate effects rather than in terms of the new opportunities to which it may ultimately lead."*[11] That is future growth options are not considered.

Given such a context, the interdependence of subsequent investment decisions and the asymmetry within the decisions, e.g. whether to wait, continue or defer an investment have been successfully modelled with financial options methodology.[12]

We model a two-phase market entry situation where each phase is connected to some sort of sunk cost and the flexibility to decide whether to initiate the phase or not. The first phase represents the building phase, e.g. the establishment of a physical presence by either acquiring assets already in place or by building a production plant. This phase serves as a platform, i.e. an important prerequisite to further expand an MNEs presence in the new market. Thus, the second phase may represent the construction of a regional technology platform. We assume that the attributes of the foreign location are connected to the second phase by introducing a variable θ which is linked to MNEs profits.

3 The Model

For simplicity, as is commonly asserted in the real options literature, the following assumptions are postulated: i) the costs for a foreign direct investment strategy represent sunk costs and ii) the choice of which entry strategy an enterprise chooses has no influence upon the profit rates of other enterprises in the foreign market, iii) the corresponding level of profits π per period due to FDI are unknown ex ante and follow a geometric Brownian motion with a drift μ and a volatility σ, iv) there exists a traded commodity whose fluctuations are perfectly correlated with π and v) the rate of drift of π is smaller than that of the riskless interest rate r.

It is assumed that the enterprise wants to serve the market with a single product and that the returns connected with it are uncertain, that is they follow a Brownian motion. Under the assumption that the rate of profit per period is not influenced by the choice of entry strategy itself and that a projects returns per period last infinitely, it may be

[11] See [7, p. 22]

[12] See e.g. [8, 6, 14, 15, 27, 33].

formulated that

$$d\pi = \alpha\pi dt + \sigma\pi dz \tag{1}$$

where α is the rate of drift, σ represents the volatility and dz is an increment of the Wiener Process. Consequently, the value of an investment project is:

$$V(\pi, t) = E\left(\int_{s=t}^{\infty} \pi_s e^{-\rho s} ds\right) \tag{2}$$

Assuming that profit flows are not limited over time and constant per period, equation (2) simplifies to:

$$V(\pi) = \frac{\pi}{\rho - \alpha} \tag{3}$$

whereby ρ is the risk adjusted discount rate. Since V is a multiple of π, the value of the investment project V is also characterized by a geometric Brownian motion with a drift α and volatility σ. In the theoretical considerations following, the value of investment project V is thus also an uncertain, i.e. stochastic variable.

3.1 Foreign Direct Investment

It is assumed that market entry through foreign direct investment follows a two stage process. To simplify the analysis, we furthermore assume that throughout the durations of each separate stage the option rights are exclusive and furthermore that there are no problems of forfeiture or expiration limits with regard to exercising the respective investment option.

During the first stage of setting up an operation physical presence costs of the order of I_1^{FDI} emerge. Counterbalancing these costs an enterprise obtains the value V given it exercises the investment possibility. Exercising this option an enterprise generates a second option which gives the enterprise an exclusive right to realization of the second stage, putting it in a position to accrue further potential growth. I_2^{FDI} designates the corresponding costs of exercising the second stage option. By exercising the second stage option an enterprise obtains a project with a value $(1+\theta)V$, whereby $\theta \in \mathbb{R}$ is interpreted as a location specific parameter reflecting the attractiveness of the foreign market location.[13] It is assumed that θ is a proportional to the *Inward FDI Index* as recently implemented by UNCTAD.[14]

Formalizing the optimization problem in this manner is similar to the finance analytics of a

[13]For a detailed discussion of the relevance of locational factors for FDI see [31].

[14]The Inward FDI Index of a country is defined by UNCTAD [38, p. 39 con't] as the ratio of the region's share of world FDI inflows to world GDP, the ratio of the region's share of world FDI inflows

perpetual compound option, whereby exercising the option in stage one generates a second option in stage two. The methodological foundations and solution of this optimization problem were first analyzed by Geske (1979) and McDonald and Siegel (1986).[15] It may be demonstrated that for each stage there exists a threshold or trigger value at which it is optimal for an enterprise to exercise the investment option.[16]

The following section briefly summaries the trigger values V^* and V^{**} which illustrate when it is optimal for an enterprise to trigger the first and second stages.

4 Results of the Two Stage Optimization Problem

This section presents a summarization of a comparative-static analysis of the derived individual stage trigger points. The comparative-static results for the trigger value V^{**} are well-known from the standard literature.[17] The threshold value V^{**} becomes larger, the higher the costs of production in the second stage are and the smaller β_1 is. Given that $\partial\beta_1/\partial\sigma < 1$, it follows that an increase in involved investment uncertainty leads to an increase in V^{**}. Similar results are also obtained for the first stage trigger values of V^*. However, of interest economically is the ratio between the two trigger points. It permits inferences on the manner in which an enterprise enters a new market based upon the potential locational characteristics θ and the market entry costs. Given the situation in which the second stage trigger value of V^{**} is smaller than the first stage trigger value V^*, an enterprise will immediately enter the market through cross-border acquisition once the threshold value V^* is reached. Under such circumstances the second stage of investment will not be postponed.

Proposition 4.1 ***One shot market penetration:*** *An enterprise will not implement greenfield foreign direct investment given that*

$$\frac{I_1^{FDI}}{I_2^{FDI}} > \frac{1}{(1+\theta)}. \tag{4}$$

An acquisition in the new market thus serves as the preferred entry strategy. The investing enterprise internalizes the potential locational advantages θ in the second stage. We call

to world employment, the ratio of the region's share of world FDI inflows to the region's share of world exports of foods and non-factor services.

[15] See [15] and [27].

[16] The derivation of the trigger values are given in the appendix.

[17] Compare [14].

this threshold the "one shot" strategy and designate it with V^*_{os}. The trigger point value for which it is optimal for the enterprise to exercise the first stage investment V^*_{os} is derived as:

$$V^*_{os} = \frac{\beta_1}{\beta_1 - 1} \frac{I_1^{FDI} + I_2^{FDI}}{(2+\theta)}. \tag{5}$$

The trigger point value for the second stage is obtained as:

$$V^{**} = \frac{\beta_1}{\beta_1 - 1} \frac{I_2^{FDI}}{(1+\theta)}. \tag{6}$$

An increasing θ has the tendency ceteris paribus to enhance the amount of foreign acquisitions and take-overs occurring. Consequently, foreign direct investment in countries characterized by a high value of θ follow the now quite common route of mergers and acquisitions in entering new foreign markets. On the other hand, increasing market entry cost I_2^{FDI} enhances the tendency to avoid a mergers and acquisitions entry strategy.
Under the circumstances that the value of the second stage trigger point V^{**} is greater than the first stage value V^*, an enterprise will not immediately desire to access the potential entry locational advantages. In such a situation the enterprise will enter the market in an exploratory manner. An explicit market entry will occur when the threshold value V^*_{og} is obtained. Under such conditions the second stage is deferred.

Proposition 4.2 ***Organic market penetration:*** *An enterprise will implement foreign direct investment sequentially in the form of greenfield investment given that:*

$$\frac{I_1^{FDI}}{I_2^{FDI}} < \frac{1}{(1+\theta)}. \tag{7}$$

Under such circumstances a greenfield foreign subsidiary is set up during stage one and expanded upon during stage two in order to harvest the potential locational advantages θ. We call this threshold the "organic expansion" strategy and designate it with V^*_{og}. The trigger point at which it is optimal for an enterprise to exercise the first stage greenfield investment is determined as:

$$V^*_{og} = \frac{\beta_1}{\beta_1 - 1} I_1^{FDI}. \tag{8}$$

The trigger point value for the second stage is obtained as:

$$V^{**} = \frac{\beta_1}{\beta_1 - 1} \frac{I_2^{FDI}}{(1+\theta)}. \tag{9}$$

Thus there exists a tendency ceteris paribus given a decreasing θ for an increase in exploratory market entry. Consequently, countries exhibiting a small θ are more likely to be

characterized by greenfield investment activities of multinational enterprises. Such a strategy is additionally supported by the element of increasing market entry costs I_2^{FDI}. Figure (4) below illustrates graphically the preferred market entry strategies (a) greenfield investment and (b) cross-border merger and acquisitions for I_1^{FDI}/I_2^{FDI} given $I_1^{FDI}/I_2^{FDI} = 0.95$.

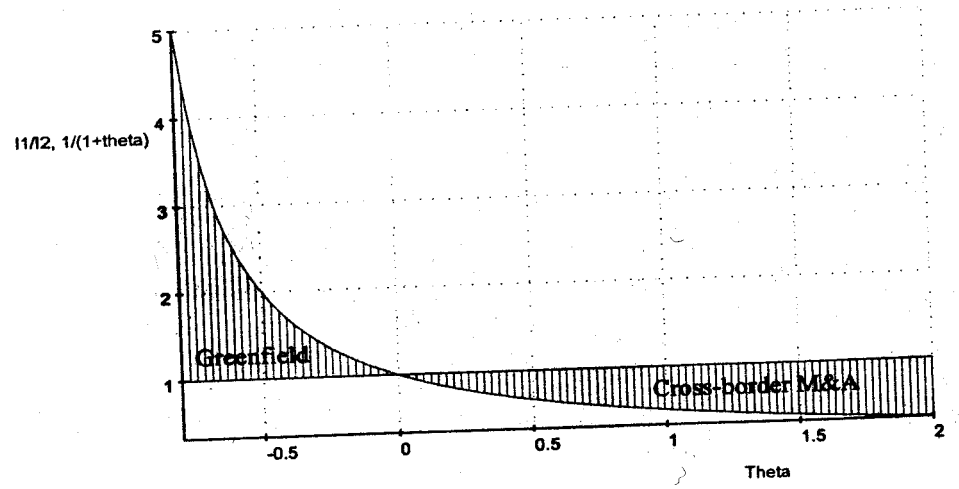

Figure 4: Regions of preferred strategies, a) Greenfield and b) cross-border M&A.

The above postulated theoretical propositions are in accordance with recently observed stylized facts of observable market entry strategies. Table (1) below illustrates the UNCTAD *Inward FDI Index* by region for the time periods 1988-1990 and 1998-2000. Observing Table (1) confirms the existing phenomena that developing countries commonly possess a smaller *Inward FDI Index* than industrialized or developed countries. For example, between the years 1998 to 2000 the *Inward FDI Index* for the European Union obtained a magnitude of 3.0 compared to an index of only 0.6 for the Asian and Pacific regions. At the same time the industry nations exhibit a markedly higher level of cross-border merger and acquisitions as an entry strategy to new foreign markets.[18] These observations are compatible to the theoretical structure presented here. As Figure (4) depicts the threshold, i.e. trigger point, separates the regions between the two possible strategies. The results show, that for a higher θ the multinational enterprise would favor the acquisition of a foreign company over a greenfield investment.

The limitations of the poor data situation at hand makes it difficult, however, not im-

[18] See [38, p.11]

Region	1988-1990 FDI share/ GDP share [a]	FDI share/ employment share [b]	FDI share/ export share [c]	FDI inward index	1998-2000 FDI share/ GDP share [a]	FDI share/ employment share [b]	FDI share/ export share [c]	FDI inward index
World	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Developed economies	1.0	4.0	1.1	2.0	1.0	4.4	1.1	2.2
Western Europe	1.3	4.9	0.9	2.4	1.6	6.3	1.1	3.0
European Union	1.3	4.8	1.0	2.4	1.6	6.4	1.1	3.0
Other Western Europe	1.1	5.7	0.6	2.5	1.1	5.5	0.6	2.4
North America	1.1	4.7	2.0	2.6	0.9	4.4	1.6	2.3
Other developed economies	0.3	1.1	0.5	0.6	0.1	0.5	0.2	0.3
Developing economies	1.0	0.2	0.7	0.6	1.0	0.3	0.7	0.7
Africa	1.0	0.2	0.7	0.6	0.7	0.1	0.6	0.4
North Africa	0.6	0.4	0.7	0.6	0.4	0.2	0.4	0.3
Other Africa	1.2	0.2	0.8	0.7	1.0	0.1	0.7	0.6
Latin America and the Caribbean	0.8	0.6	1.0	0.8	1.1	1.0	1.6	1.2
South America	0.7	0.5	1.0	0.7	1.2	1.1	2.6	1.8
Other Latin America and the Caribbean	1.2	0.8	1.1	1.0	0.9	0.7	0.6	0.7
Asia and the Pacific	1.1	0.2	0.6	0.6	0.9	0.2	0.6	0.6
Asia	1.1	0.2	0.6	0.6	0.9	0.2	0.6	0.6
West Asia	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.2
Central Asia	..	..	..	..	1.7	0.3	1.3	1.1
South, East and South-East Asia	1.3	0.2	0.7	0.7	1.1	0.2	0.6	0.6
South Asia	0.1	-	0.3	0.1	0.2	-	0.3	0.2
Pacific	4.5	1.6	1.9	2.7	1.2	0.3	0.5	0.7
Developing Europe	2.2	3.4	0.5	2.1	1.2	1.5	0.6	1.1
Central and Eastern Europe	0.2	0.1	0.2	0.1	0.9	0.4	0.6	0.6
Memorandum: least developed countries [d]								
LDCs: total	0.3	-	0.6	0.3	0.6	0.1	1.0	0.6
African LDCs	0.5	0.1	0.0	0.4	1.6	0.1	1.7	1.1
Latin America and the Caribbean LDCs	0.3	-	0.4	0.3	0.1	-	0.2	0.1
Asian and Pacific LDCs	0.1	-	0.5	0.2	0.1	-	0.2	0.1
Asian LDCs	0.1	-	0.5	0.2	0.1	-	0.2	0.1
West Asian LDCs	..	..	..	..	-1.3	-0.2	-0.9	-0.8
South and South-East Asian LDCs	0.1	-	0.5	0.2	0.2	-	0.5	0.2
Pacific LDCs	..	..	..	..	..	..	..	..

Source: UNCTAD.

[a] The ratio of the region's share of world FDI inflows to the region's share of world GDP.
[b] The ratio of the region's share of world FDI inflows to the region's share of world employment. The data are from the ILO's LABSTA database and the World Bank's *World Development Indicators*, 2001.
[c] The ratio of the region's share of world FDI inflows to the region's share of world exports of foods and non-factor services.
[d] LDCs as defined by the United Nations.

Note: The indexes for some regions are based on incomplete coverage of countries in the region, due to lack of data on one or more variables. Also, the indexes for Central Asia, Developing Europe and Central and Eastern Europe are not strictly comparable between the two periods because the number of countries included in each differed substantially between the two periods. The increase in the number of countries covered by the index for developing economies in the second period (from 86 to 100) can cause a moderate upward bias in that grouping's index in the second period.

Table 1: Regional Inward FDI Index by region, 1988-1990 and 1998-200, [38, p.11] .

possible to derive certain insights. During the period 1989-2000, Germany and Europe in general exhibited a high *Inward FDI Index* mainly driven by liberalization and deregulation processes and the German reunification, opening up growth opportunities (i.e. high values of θ) for foreign investors. Consequently, the appropriate market entry strategy for a Korean enterprise would thus be, in accordance to our model, the acquisition of a German counterpart as reflected e.g. by Samsungs' purchase of the German TV-tube manufacturer "Fernsehglas Tschenitz" in 1994.

On the other hand, South Korea has historically exhibited an *Inward FDI Index* lower that one. Consequently German investors should prefer market entry through greenfield investment. According to Mi-hui (2002) greenfield investment made up 68.4 percent of

Home Company	Host Company	Value (US$-mil)	Stake (%)	Year
Commerzbank AG	Korea Exchange Bank	-	31	1999
BASF AG	Daesang Group (Lysin Business)	600	100	-
Allianz AG	First Life Insurance Co, Ltd	-	100	
DaimlerChrysler AG	Hyundai Motors	428	10	2000

Table 2: Cross-border M&A Entry into Korea by German Enterprises

total FDI into South Korea in 2000.[19] German companies such as BASF (vitamine B2 production), Bosch (diesel injection), and Osram (flourescent lamps) invested into new production subsidiaries in Korea.

However, recently, South Korea has lowered their FDI restrictions enhancing the M&A activities of German enterprises (See Table (2) for some examples).

Given the fact that cross-border M&A activity in East Asia is still in an early stage of development and momentarily of relatively small magnitudes, a conclusive answer as to potential short- and long-term benefits (e.g. asset- augmenting foreign direct investment) and costs (e.g. potential enhanced global concentraton levels or predatory "fire sale" pricing effects) of the new M&A wave in Korea can not be sufficiently discussed here. However, recently, Mody and Negishi (2001) have argued that: *"The limited evidence available goes against the hypothesis that significant amounts of assets were sold at fire-sale prices. Cross-border mergers and acquisitions were highest in Korea, which suffered least from the crisis and recovered fastest. Cross-border M&A transactions not only shot up to $9 billion in 1998-five times higher than in 1997-but also continued to rise (by 38 percent) in 1999 despite a 15 percent appreciation of the won beginning in 1998. This suggests, therefore, that foreign firms' acquisitions of assets have been driven more by new opportunities created by policy changes that encouraged M&A than by firms' greater liquidity resulting from foreign exchange depreciations. The widely differing prices at which distressed assets were sold-which ranged from 25 percent to about 80 percent of their book values-suggest that these prices reflect differences in the assets' quality rather than fire sales."*[20]

These stylized facts are in accordance with our theoretical line of argumentation pre-

[19] See [32].

[20] [29, p. 5]

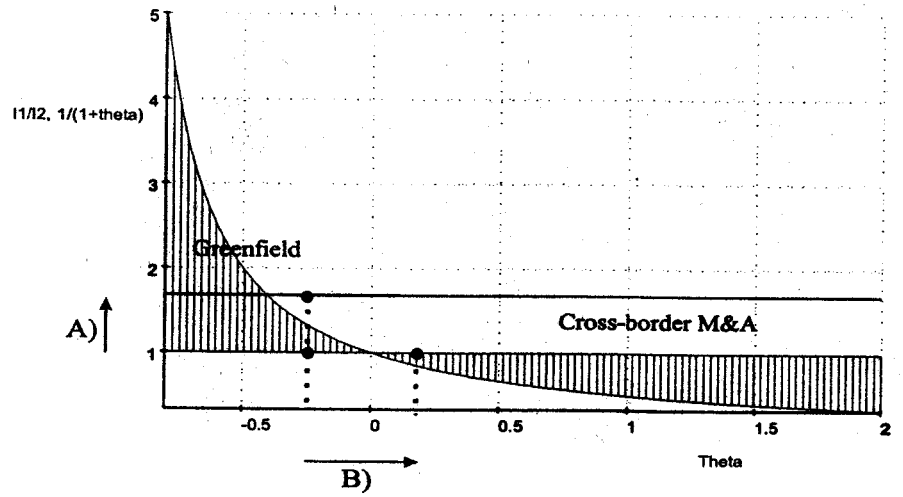

Figure 5: Influences of Policy Reforms

sented above. If one interprets that potential real locational advantages may be internalized through M&A an increasing θ (See Figure (5) effect B)) ceteris paribus should result in increasing levels of mergers and acquisitions as has been observed in e.g. in Korea. Furthermore, it is conceivable that the policy changes, such as the encouraging of investment in R&D, affect the cost I_2^{FDI} in phase two as illustrated in Figure (5) effect A).

5 Conclusion

In this paper, we briefly review the recent evidence of the growth in M&A activities in the global entry market process of multinational enterprises. We present a real options model approach based on a two-phase market entry situation.

The theoretical discussion presented exemplifies the strategy options of a "one shot" market penetration (i.e. market entry by M&A) and "organic market penetration" (i.e. market entry in the form of greenfield investment).

The theoretical and empirical evidence from South Korean and German multinational enterprises analyzed here is consistent with the perceived dominant trend observed to-

day for companies to enter markets of countries characterized by low location-specific attractiveness via greenfield set-ups while cross-border mergers and acquisitions are the preferred mode of entry given high levels of location-specific attractiveness.

6 Appendix

Within the "Investment under uncertainty" a perpetual compound option may be valued applying either Contingent Claims Analysis or Dynamic Programming. The model presented here applies the Dynamic Programming Method.[21] The initial point of analytical departure is the Bellman Equation:

$$\rho F_{(i)} dt = \mathcal{E}(dF_{(i)}) \tag{10}$$

whereby F denotes the option value of V, $\mathcal{E}(\ldots)$ represents the expectations operator and the index i designates the corresponding stage. With the aid of Itôs lemma one obtains for the differential of $F(V)_{(i)}$ the following:

$$dF_{(i)} = \frac{\partial F_{(i)}}{\partial V} dV + \frac{1}{2} \frac{\partial^2 F_{(i)}}{\partial V^2} (dV)^2. \tag{11}$$

Substituting equation (3) für dV in (11) regarding that $\mathcal{E}(dz) = 0$, one obtains the following partial differential equation from equation (10) of the form:[22]

$$\frac{1}{2}\sigma^2 V^2 \frac{\partial^2 F_{(i)}}{\partial V^2} + \alpha V \frac{\partial F_{(i)}}{\partial V} - \rho F = 0 \tag{12}$$

with $\alpha = \rho - \delta$. The general solution to the above stated differential equation has the form:[23]

$$F(V)_{(i)} = A_1 V^{\beta_1} + A_2 V^{\beta_2} \tag{13}$$

with

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left[\frac{\alpha}{\sigma^2} - \frac{1}{2}\right]^2 + \frac{2\rho}{\sigma^2}} \tag{14}$$

The values of the investment possibilities $F_1(V)$ and $F_2(V)$, as well as the optimal trigger points V^* and V^{**} (representing the actual timing of the respective investment) may now be solved for recursively. First the values of the second stage investment possibility $F_2(V)$, along with the corresponding trigger point V^{**} are derived. Then the values of the first stage investment possibilities $F_1(V)$ along with the corresponding trigger point V^* are derived.

[21] Compare [14, pp. 147 cont´t.] for a solution along the lines of Contingent Claims methodology.

[22] Since the right to exercise an option is not limited by time it follows that $\frac{\partial F_{(i)}}{\partial t} = 0$.

[23] Compare [14, pp.143 cont´t.].

6.1 Threshold Value of Stage Two

Under consideration of the following restrictions:

$$F_2(0) = 0 \tag{15}$$

$$F_2(V^{**}) = (1+\theta)V^{**} - I_2^{FDI} \tag{16}$$

$$\frac{dF_2}{dV}(V^{**}) = (1+\theta) \tag{17}$$

the value of the investment possibility $F(V)$ from equation (12) is obtained as:

$$F_2(V) = \begin{cases} A_2 V^{\beta_1} & if \quad V < V^{**} \\ (1+\theta)V - I_2^{FDI} & if \quad V \geq V^{**} \end{cases} \tag{18}$$

with:

$$V^{**} = \frac{\beta_1}{\beta_1 - 1}\frac{I_2^{FDI}}{(1+\theta)} \tag{19}$$

$$A_2 = (1+\theta)\frac{1}{\beta_1}V^{**(1-\beta_1)} \tag{20}$$

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left[\frac{\alpha}{\sigma^2} - \frac{1}{2}\right]^2 + \frac{2\rho}{\sigma^2}} \tag{21}$$

6.2 Threshold Value of Stage One

The derivation of the stage one trigger point is analogous to Section 5.1. The Bellmann Equation (10) is applied to obtain the differential equation (12), which has the general solution form:

$$F_1(V) = A_1 V^{\beta_1} + A_2 V^{\beta_2} \tag{22}$$

However, now one must examine whether the case a) $V^{**} > V^{*}$ (greenfield investment case) or the case b) $V^{*} > V^{**}$ (acquisition or merger case) is given. The implication hereof is that the boundary conditions according to which case one is examining change given that option $F_2(V)$ is exercised or not. Thus:

$$F_1(0) = 0 \tag{23}$$

$$F_1(V^{*}) = F_2(V^{*}) + V^{*} - I_1^{FDI} \tag{24}$$

$$\frac{dF_1}{dV}(V^{*}) = \frac{dF_2}{dV}(V^{*}) + 1 \tag{25}$$

6.2.1 Greenfield Investment

The following restrictions are valid:

$$F_1(0) = 0 \tag{26}$$

$$F_1(V^*) = A_2 V^{*\beta_1} + V^* - I_1^{FDI} \tag{27}$$

$$\frac{F_1}{dV}(V^*) = A_2 \beta_1 V^{*(\beta_1 - 1)} + 1. \tag{28}$$

Consequently the value of the investment possibility $F_1^{og}(V)$ from equation (12) may be derived. Then:

$$F_1^{og}(V) = \begin{cases} A_{og} V^{\beta_1} & if \quad V < V_{os}^* \\ F_2(V) + V - I_1^{FDI} & if \quad V > V_{os}^* \end{cases} \tag{29}$$

with:

$$V_{og}^* = \frac{\beta_1}{\beta_1 - 1} I_1^{FDI} \tag{30}$$

$$A_{og} = A_2 + \frac{V^* - I_1^{FDI}}{V^{*\beta_1}} \tag{31}$$

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left[\frac{\alpha}{\sigma^2} - \frac{1}{2}\right]^2 + \frac{2\rho}{\sigma^2}} \tag{32}$$

6.2.2 Acquisitions and Mergers

The value of the investment possibility $F_1^{os}(V)$ from equation (12) can now be determined given the following restrictions:

$$F_1(0) = 0 \tag{33}$$

$$F_1(V^*) = (1+\theta)V^* - I_2^{FDI} + V^* - I_1^{FDI} \tag{34}$$

$$\frac{F_1}{dV}(V^*) = (2+\theta). \tag{35}$$

It follows that:

$$F_1^{os}(V) = \begin{cases} A_{os} V^{\beta_1} & if \quad V < V_{os}^* \\ (2+\theta)V - I_2^{FDI} - I_1^{FDI} & if \quad V > V_{os}^* \end{cases} \tag{36}$$

with:

$$V_{os}^* = \frac{\beta_1}{\beta_1 - 1} \frac{I_1^{FDI} + I_2^{FDI}}{(2+\theta)} \tag{37}$$

$$A_{os} = \frac{(2+\theta)}{\beta_1} V^{*1-\beta_1} \tag{38}$$

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left[\frac{\alpha}{\sigma^2} - \frac{1}{2}\right]^2 + \frac{2\rho}{\sigma^2}} \tag{39}$$

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