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Internalization and internationalization under competing real options

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Abstract

The theories of internalization and internationalization provide general factors of international market entry but are not precise about its timing. The theory of real options may complement these approaches as it centers the impact of uncertainty on the timing and dimensioning of investment. A panel study of 5379 German entries to 22 countries suggests that, under the moderating influence of competition, the economic uncertainty in a host country has a U-shaped influence on the moment of entry. The results further reveal that uncertainty has a negative effect on the amount of capital at entry. Uncertainty shows no impact on the share in capital at entry, which challenges the view of international joint ventures as real options.

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1. Timing and dimensioning foreign direct investment

Firms that consider investing abroad need to decide about the time and mode of market entry. Choosing the right moment and volume of international entry is important, as its success is affected by uncertainty. In particular, such investment decisions have to respect the environmental uncertainty that is exogenous to the investor's actions (Adner and Levinthal, 2004). On the one hand, a high degree of environmental volatility suggests to wait and postpone the entry, even though cash flows will be lost. On the other hand, it may offer a chance to prevail over competitors and therefore suggests entering as soon as possible. If so it will be advisable to keep the capital at entry limited since, depending on the current level of uncertainty, there might be better opportunities for large investments. In effect, uncertainty seems to play an ambiguous role in the entry decision. This research sheds some light on its influence on the timing and dimensioning of an initial foreign direct investment.

There is a large body of literature on international market entry but a shortage of studies on its timing. Various studies of international entry treat the timing of investment by relative terms such as early and late (Delios and Makino, 2003; Luo, 1998; Ursacki and Vertinsky, 1992) or first and second (Chang and Rosenzweig, 2001). Only a few studies consider the absolute point in time, i.e., the year of entry. Tan and Vertinsky (1996) draw on the theory of internalization (Buckley and Casson, 1976) and investigate the time by which 262 Japanese electronics companies enter Canada and the US. The

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study investigates entries by joint ventures vs. wholly-owned subsidiaries and uses numerous independent variables including the current market growth in the host country but does not incorporate the influence of uncertainty. [Delios and Henisz \(2003\)](#) build on the theory of internationalization ([Johanson and Vahlne, 1977](#)) and consider the impact of political hazards in the host countries on 3867 international expansions by Japanese firms. The results do not distinguish between different extents of entry but suggest that the influence of political hazards is negative and moderated by the investor's experience. Political hazards, however, may not be as relevant to foreign direct investment decisions as economic turbulences are ([Hule, 2000](#)). According to time series collected by the World Bank ([Kaufmann et al., 2004](#)), the industrialized countries, which account for a major share of foreign direct investment, show a high and rather constant level of political stability. More importantly, political hazards represent a downside risk whereas uncertainty may comprise both up- and downturns. Empirical evidence on the impact of the host country's environmental volatility on the timing of entry is weak so far.

The existing studies on the timing of foreign direct investment use the established theories of internalization and internationalization as a background but synthesize the models of entry by arguments from other origins. It seems that the traditional approaches to international entry need to be enriched for a dynamic analysis. [Buckley and Casson \(1998\)](#) state that early models of the multinational enterprise did not foresee the rising importance of uncertainty in today's foreign direct investment decisions. Therefore, Buckley and Casson propose a new approach, the theory of real options. [Rivoli and Salorio \(1996\)](#) argue that the theory of real options incorporates the question of "when" a foreign direct investment takes place after a location has been selected for entry.

Through an option lens, the time of entry is the moment by which the internationalizing firm exercises the waiting option to enter by an initial investment. At the same time, the firm acquires a growth option to be exercised by a subsequent investment. The values of both options rise with uncertainty. Their trade-off is supposed to guide the timing of entry: The option model tells the investor to enter now or later. If it advises not yet to invest, the investor may repeat the option valuation later and notice that entering has become preferable. Once the entry decision has been made, the value of the growth option is supposed to influence the dimensioning of entry. This paper seeks to develop and empirically test an option model of international entry by equity. It combines conceptual work on international real options ([Rivoli and Salorio, 1996](#); [Buckley et al., 2002](#)) with insights from option models that include the effect of competition ([Folta and O'Brien, 2004](#)). Theoretically, the interaction of uncertainty and competition complements existing approaches as to explain the timing of international entry. Practically, it may help managers realize that entering under high uncertainty creates valuable growth options when competitors threaten to enter the field. Considering uncertainty as an influencing factor can further contribute to explaining the dimensioning of investment at international entry. Managers may react to uncertainty by limiting the capital invested but not necessarily sharing it with a joint venture partner.

The remainder of the paper is structured as follows. The next section takes an option view to the known perspectives of internalization and internationalization and raises the question of compatibility. The third section employs a model of competing real options to explain the timing and dimensioning of entry to a foreign market provided that the general decision of entry has been made. The data from the German central bank, the measures and the econometric model are explained in the fourth section. Section 5 presents the results about the timing of entry and its volume as measured by the share and amount of capital. The final section discusses the results, reflects the limitations and derives implications for management and future research.

2. An option view to international entry

2.1. Internalization

According to the "Long-run Theory of the Multinational Enterprise" by [Buckley and Casson \(1976\)](#), firms circumvent the imperfections of international markets by internalizing business processes concerning tacit knowledge, perishable goods, intermediate products and raw materials. However, internalizing markets may lead to reduced economies of scale, problems of cross-border communication and discrimination by host governments. [Calvet \(1981\)](#) tries to reconcile the theory of internalization with the transaction cost view of markets and hierarchies ([Williamson, 1975](#)). The theory of transaction costs suggests internalizing transactions that feature a high rate of repetition, are surrounded by uncertainty and require specific investment. [Casson \(1985\)](#) points out that transaction costs are not exactly the same as the costs of internalization but overlap with respect to communication and control. Similar approaches to internalization were presented

by Rugman (1980), Teece (1981), and Hennart (1982). Later contributions consider international joint ventures as an alternative type of coordination (Buckley and Casson, 1996; Hennart, 1993). Facing the costs of internalization, firms enter a foreign market by exporting, joint venturing or establishing a fully-owned subsidiary. The mode of market entry is characterized by the degree of control over the foreign affiliate and varies from market over shared to hierarchical coordination.

The notion of transaction costs to determine the degree of control at market entry receives support from several empirical studies (Gatignon and Anderson, 1988; Hennart, 1991; Pak and Park, 2004) but leaves aside the issue of timing. Buckley (1988) recognizes a dynamic deficit of the internalization concept and proposes to integrate ideas from strategic management. However, even studies that enhance the approach by variables of corporate strategy leave the timing of entry unattended (Bradley and Gannon, 2000; Hennart and Park, 1994; Madhok, 1998). The same criticism applies to Dunning's (1981) eclectic paradigm that adds factors of ownership (Hymer, 1976) and location (Johnson, 1968) advantages but, in spite of further development (Dunning, 2000) and recent support (Mudambi and Mudambi, 2002; Tsai and Cheng, 2002; Tse et al., 1997), stays a static approach (Kutschker and Schmid, 2005; Macharzina and Engelhard, 1991).

Buckley et al. (2002) show that the choice of exporting, joint venturing and establishing a fully-owned subsidiary can indeed be a dynamic one. A firm contemplating entry to a foreign market and facing high uncertainty will seek to stay flexible. To this end, it may completely or partly defer an entry by equity. Exporting preserves full flexibility but impedes gathering local information. Sharing the control of foreign operations with a joint venture partner improves the access to local information and helps reduce uncertainty while it requires committing resources only to a limited extent. Thus a joint venture can be a useful intermediate step to full ownership.

Buckley, Casson, and Gulamhussen develop a two-phase decision tree model to explain the choice of market entry by maximizing the expected profit. If a success is very unlikely, the expected returns are negative. The firm will refrain from entering by equity to avoid losses. However, it thereby cuts the opportunity to benefit from a rising probability of success in the second phase. When the probability of success is intermediate in the first phase, the firm will choose a joint venture and thereby create an option on full ownership in the second phase, which turns out valuable when the probability happens to increase. If not, the loss is still limited. Under a high probability of success, the expected returns will be greatest when entering right away by a fully-owned subsidiary.

The decision tree model of the market entry mode has the potential to compensate for the dynamic weaknesses of the internalization concept. However, as a decision tree model, it does not exploit all benefits of real options theory. Some authors assign decision tree models to the category of net present value techniques (Hommel and Lehmann, 2001; Trigeorgis, 1996). It will be worthwhile to examine different real option models for their ability to reproduce foreign direct investment decisions. Furthermore, this option view of internalization does not capture the uncertainty caused by the joint venture partner's behavior. Another problem refers to the quality of international joint ventures as real options. Options theory is directed towards investing capital while choosing an institutional arrangement involves sharing capital with a partner. Control will only rise by an additional investment if the joint venture partner agrees to a partial or full buy-out. Buckley, Casson, and Gulamhussen believe that transaction costs are lower between joint venture partners than between ordinary firms, making a deal with equity less difficult. Their second argument is that one partner may be better informed than the other, which is an advantage in negotiations about the purchase of equity. Empirical evidence on the use of joint ventures as real options on international market entry points to the inclusion of buy-out clauses in joint venture contracts. Reuer (2002) reports that a minority of foreign investors use buy-out clauses to ensure the right of takeover. The study by Tong et al. (in press) suggests that only minority and diversifying joint ventures contribute to the growth options that a foreign investor possesses. Evidence about domestic joint ventures serving as real options is mixed. In the study by Vassolo et al. (2004), the impact of uncertainty on takeover is insignificant even if controlling for buy-out clauses. Kogut (1991) observes the probability of a takeover to rise when positive market signals arrive, though unexpected events may not indicate a decline in uncertainty. Folta and Miller (2002) find that uncertainty exerts a negative influence on takeover but makes no significant contribution to its explanation.

2.2. Internationalization

Johanson and Wiedersheim-Paul (1975) describe the internationalization processes of four Swedish firms and presume that, in general, firms enter a foreign market by an incremental "establishment chain". International business starts by exporting occasionally. Later, firms contract intermediaries to sell their products abroad and gain first insights about the

foreign market. Then they allocate resources for sales subsidiaries and collect more specific information. The chain is completed by establishing production sites abroad.

Empirical studies show that not only Swedish but also US (Davidson, 1980), Japanese (Johansson and Nonaka, 1983), Turkish (Karafakioglu, 1986) and Spanish companies (Camino and Cazorla, 1998) use an incremental pattern of market entry. The Uppsala model explains this pattern by a self-reinforcing process of learning and investing in the foreign market (Johanson and Vahlne, 1977). Several Finnish firms, however, seem to ignore this rule (Björkman and Eklund, 1996). Neither do empirical studies of internalization or recent findings about “born global” firms support the prevalence of an establishment chain (Bürgel and Murray, 2000; McNaughton, 2000; Moen and Servais, 2002). In this regard, Johanson and Vahlne (1977) mention that a low level of market risk may require less experience and allow to leapfrog stages of the establishment chain.

In a view of real options, uncertainty is central to the timing and dimensioning of investment at market entry. To stay with the model by Buckley et al. (2002), the investor has the choice between a deferred, a partial, and a full investment. A partial investment creates a real option on up-sizing since it improves the ability to meanwhile gather information and run the investment more successfully than if it was deferred. At a low probability of success, the investor will defer the entry as long as the expected returns are negative. When the probability is intermediate, a partial investment is preferable. It carries the option but not the obligation to invest more at a later stage, depending on how conditions will evolve. At a high probability of success, a full investment promises the highest expected returns.

Apparently, the options view is not only able to mirror the perspective of internalization but also the perspective of internationalization. Exporting corresponds to an omitted investment abroad, joint venturing to a partial investment and establishing a fully-owned subsidiary to a full investment. However, the analogy may depend on buy-out clauses that couple the issues of ownership and investment. The decision tree model considers the size of investment by three steps (no, partial and full investment). Considering steps is in line with the internalization perspective of market entry by exporting, joint venturing or establishing fully-owned subsidiaries but appears unnecessary in the internationalization perspective of foreign direct investment, as an internationalizing firm is mostly free to choose the amount of investment. Similarly, the firm may continuously change the degree of control by adjusting the share in capital. For an option analysis, discrete modes of international entry are dispensable.

The following option models abandon probabilities of success as an expression of uncertainty. They conceptualize uncertainty as a continuous variable reflecting environmental volatility, which can be resolved by a wait-and-see approach. The models help overcome the deficit that entry modes address the timing and dimensioning of entry by relative terms, i.e., they say that a *partial* investment may *precede* a full investment. Decomposing the entry decision into the issues of timing and dimensioning allows for applying specific option models to explain the absolute timing and dimensioning of entry, i.e., *when* does the firm trigger an initial investment of *what size*.

3. Models of international real options

3.1. Creating a growth option by killing the waiting option to invest

McDonald and Siegel (1986) devise a model to determine the optimal timing of a real investment under uncertainty. It was further developed by Pindyck (1991). The investor triggers an investment if the discounted cash flows are greater than a threshold which rises with uncertainty. Simulations make clear that even under moderate levels of uncertainty this threshold can be twice the amount of the investment. Under higher uncertainty, the threshold rises to ten or even more times the amount to be invested, indicating a high opportunity cost of giving up the flexibility to invest later.

Managers do not seem to use quantitative option models for foreign direct investment decisions (Becker, 2005) but may implicitly account for the value of flexibility (Howell and Jägle, 1997; Miller and Shapira, 2004). To mirror real options reasoning (McGrath and Nerkar, 2004), a simple model of option values will be sufficient. Investors are likely to enter a foreign market as soon as the net present value of immediate market entry C exceeds the value of the option to defer entry D :

$$C > D.$$

The net present value C is a function of the tendency of the expected profits, which rise by economic growth. Firms that are contemplating entry to a host country may take the opportunity of economic growth and decide to invest now.

Hypothesis 1. The economic trend in the host country has a positive impact on the number of entries by foreign firms.

As entry by equity is costly and at least partly irreversible, uncertainty makes the option to defer valuable; the waiting option value D rises with uncertainty. Therefore, we expect a negative effect of uncertainty on the timing of entry. Under high uncertainty, firms that consider entering a foreign country by equity will tend to postpone the investment.

Hypothesis 2a. The economic uncertainty in the host country has a negative impact on the number of entries by foreign firms.

The effect of uncertainty on the entry by equity may be moderated by the level of competition in the host country and become nonlinear. Entering a foreign market does not only mean exercising a waiting option D but can also imply creating a growth option G , i.e., the option to enlarge the foreign affiliate at a later point in time (Li, 2007). Therefore, a growth option value should be added to both sides of the inequation:

$$C + G_i > D + G_d$$

Including the growth option value on both sides would not affect the entry decision if it was the same for immediate and delayed entry. However, when competitors threaten to enter the field, holding the opportunity to grow will be worth the more the sooner it is available (Folta and O'Brien, 2004). Having invested improves the ability to preempt competition (Li, 2007), react to competitors' moves (Trigeorgis, 1996) or force them to "make room" (Kulatilaka and Perotti, 1998). Consequently, competition causes a difference between the growth option value of immediate entry G_i and deferred entry G_d . The growth option value of immediate entry increases with the level of competition $\alpha \geq 1$ by realizing an early mover advantage ($G_i = \alpha G$). When the investor defers entry, the early mover advantage may be gone; the growth option holds its basic value ($G_d = G$).

$$C + \alpha G > D + G$$

$$\Leftrightarrow V = C - D + (\alpha - 1)G > 0.$$

The investment rule that includes the effect of competition states that the investor will trigger the investment if the net value of immediate entry V as the difference of the net present value C and the value of the waiting option D plus the advantage of having an early growth option $(\alpha - 1)G$ is positive. The investor will defer entry if V is negative. Fig. 1 displays the value functions under different levels of competition.

The net present value C decreases with uncertainty since the expected profits are discounted by a risk premium. The reaction of C to uncertainty is modest as compared to the option values, which can be massive under uncertainty. The irreversibility of investment creates a waiting option value D that increases with uncertainty and, at low levels of uncertainty, rises faster than the growth option value (Dixit and Pindyck, 1994). However, the waiting option value is limited to the capital that might be lost in the case of failure.

In the absence of competition (Fig. 1a), acquiring a growth option now or later makes no difference to the investment decision. The net value of immediate entry V is governed by the waiting option D only. Under moderate levels of competition (Fig. 1b), the value of having an early growth option $(\alpha - 1)G$ starts low and will hardly catch up with the waiting option value D as uncertainty rises. The net value of immediate entry V is only positive when uncertainty is low. As stated by Hypothesis 2a, uncertainty continues to have a negative influence the timing of entry. However, when competition is strong (Fig. 1c), the value of having an early growth option $(\alpha - 1)G$ may rise at higher rates than the waiting option value D (Kulatilaka and Perotti, 1998) and finally exceed it, since the value of having a growth option early is theoretically unlimited. In effect, the net value function V is U-shaped: When uncertainty is low, the influence of the waiting option prevails; rising uncertainty keeps the foreign investor from entry. Strong competition, though, allows the influence of the growth option outweigh the waiting option's effect. When uncertainty is high, competition leads to a positive impact of uncertainty on the decision to enter.

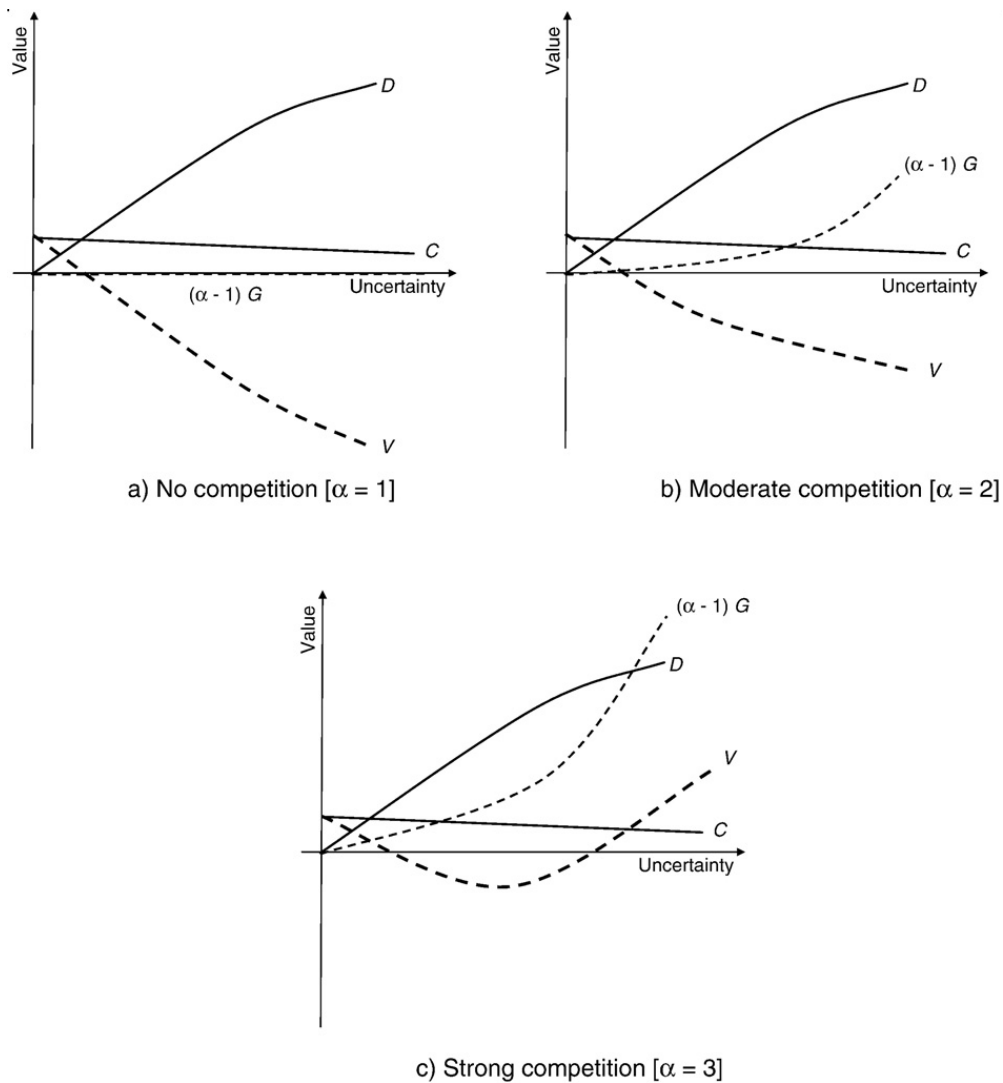


Fig. 1. Value functions of international entry.

Hypothesis 2b. Under the moderating influence of competition, the effect of uncertainty on the timing of investment becomes nonlinear: When uncertainty increases from a low to moderate level, uncertainty has a negative impact on number of entries, while uncertainty has a positive impact on number of entries when uncertainty increases from a moderate to high level.

3.2. Dimensioning the growth option by the share and amount of capital

Pindyck (1988) devises a model of incremental investment to calculate the optimal stock of capital for an investment project under uncertain demand. The total value of the project W is maximized by considering two components. One is the net present value C of the capital already invested and the other is the value of the growth option G to invest more capital:

$$W = C + G.$$

In Pindyck's model, the optimal stock of capital increases moderately by a rising demand and decreases sharply by the uncertainty of demand. The mechanism of optimizing the stock of capital can be transferred to dimensioning a new foreign affiliate: When an internationalizing firm has decided to enter a foreign market it may restrict the initial stock of capital and preserve a growth option on a subsequent investment. The higher the profits the firm expects, the higher the

investment at entry (net present value effect). The higher the uncertainty the firm faces, the lower the investment to start with (growth option effect). Fig. 2 displays curves of the optimal dimensioning of entry as a function of uncertainty and expected profits. The curves to the upper left indicate higher initial investments than those to the lower right area. When uncertainty is high, changes in the expected profits influence the optimal stock of capital only to a limited extent.

According to the previous discussion on the option view to international entry, the initial investment can be analyzed from the perspectives of internalization and internationalization. Internalization decisions address the share in capital that is chosen for entry, i.e., entry by a minority or majority joint venture or a fully-owned subsidiary. Internationalization decisions relate to investing a certain amount of capital at entry, i.e., entering by a smaller or larger subsidiary. Looking at the whole of new investment in a host country, we consider the average share and average amount of capital which were used by the foreign investors for entry.

In the perspective of internalization, the entry mode is described by the extent to which the investor exerts control over foreign operations. Market growth allows for greater profits. Looking at the whole of initial foreign direct investment into a country, we expect that

Hypothesis 3a. The economic trend in the host country has a positive impact on the average share in capital at entry.

In the perspective of internationalization, the extent of entry is characterized by the size of investment. Foreign firms will dimension their investments according to the economic prospects.

Hypothesis 3b. The economic trend in the host country has a positive impact on the average amount of capital at entry.

Pindyck's (1988) model of incremental investment suggests that the value of the option to grow increase by uncertainty. In the face of uncertainty, the investor will limit the capital at entry. In terms of internalization, uncertainty will have a negative influence on the degree of control. Tong et al. (in press) show that choosing a minority share in a joint venture provides the foreign investor with a higher potential to grow than a majority share. The investor may upgrade the engagement as soon as uncertainty lessens.

Hypothesis 4a. The economic volatility in the host country has a negative impact on the average share in capital at entry.

With respect to internationalization, uncertainty suggests to limit the size of investment at entry and hold the option of enlarging it as soon as uncertainty abates.

Hypothesis 4b. The economic volatility in the host country has a negative impact on the average amount of capital at entry.

Differently from the timing of entry, we do not hypothesize an influence of competition on the dimensioning of entry. Competition creates a value of holding a growth option now instead of acquiring it later, which is an issue of timing. The

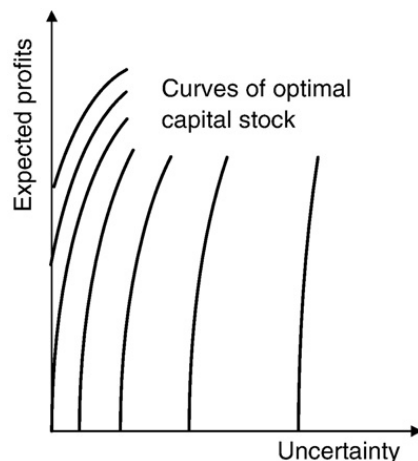


Fig. 2. Optimal capital stock at international entry.

dimensioning of entry refers to the basic growth option value and will be less affected by the level of competition since a small investment to start with may suffice to react to competitors' moves and, if necessary, exercise the growth option.

4. Panel study of foreign direct investment in the OECD 23 countries

4.1. Deutsche Bundesbank FDI statistics

For the purpose of official statistics on foreign direct investment, German investors are legally obligated to report their investment objects to the Deutsche Bundesbank (Central Bank of Germany). The reports include simplified balance sheets, figures of revenue and employees as well as local and sectoral information. The Bundesbank Economic Research Center stores these data in the MiDi database. In principle, public access is denied but, under strict confidentiality, provided to visiting researchers. The data are organized in a way that allows for tracking chains of indirect investment. Thereby not only direct subsidiaries, but also subsidiaries of subsidiaries etc. are assigned to the German investors. The project uses final figures of the years 1996 to 2000 and preliminary data of 2001.

In order to gain a set of comparable investment objects, the study was restricted to certain countries and industries. The industrialized OECD 23 (–1, which is Germany) countries accounted for 87% of the stock of German foreign direct investment in the last year of observation, which is 2001 (Deutsche Bundesbank, 2003). Manufacturing is the most important German industry sector and was chosen for the study, since more than 50% of foreign direct investment is related to these industries. Reports of precedent years served as references to distinguish new entrants from former objects. Because data series start in 1996, new entrants could be identified from 1997 on. As suggested by the Bundesbank researchers, investment objects with a balance sheet total below € 5 million were cut off in order to prevent artifacts of entry near the exemption limit (changing from year to year, most recently € 3 million). The resulting data comprise 5379 entries in the manufacturing sector by 2282 German investors in 22 countries over a period of 5 years.

4.2. Measures and econometric model

The timing of international entry may be tracked by observing a panel of potential investors. The MiDi database, however, reports only on those firms that have actually entered a foreign country. To avoid a selection bias, we examine a panel of host countries that receive entries from an unknown set of potential investors. We assume that the total number of German firms contemplating entry for more or less static reasons, e.g., ownership, location, and internalization advantages (Dunning, 1981) were the same during the period of observation. Considering a panel of countries instead of investors requires aggregating data on the country level. Under these circumstances it is difficult to take into account company characteristics such as experiences from previous entries. Though, the MiDi database comprises mostly small and medium-sized enterprises. Only a minority of these firms feature prior entries, and only very few, even large firms, have entered the same country before. Therefore, the experience bias should be limited.

The first dependent variable, *entry*, indicates the timing of entry and was measured by the count of German entries within a country and year. The other two dependent variables refer to the dimensioning of entry according to the concurrent perspectives of internalization and internationalization. The *share* in capital (internalization) was measured by the German investors' average interest in their new foreign affiliates per host country and year. The *amount* of capital (internationalization) was measured by the average foreign direct investment spent for entries within a particular country and year. The log of investment was used since most investments were small as opposed to very few large investments. The Bundesbank calculates foreign direct investment as the total of attributable shares in the registered capital minus owing contributions, capital and surplus reserves, profit or loss brought forward, net profit or loss minus deficits uncovered by equity, loans from the investor and those from associated companies.

Investors strike and create real options depending on the uncertainty they perceive in their individual business environments. As the MiDi database is anonymous, volatility could not be measured in a questionnaire survey but had to be estimated by a correlative that captures a broad scope of the uncertainties related to the host country. Every month, the OECD publishes the 6-month rate of change (6mC) of the composite leading indicator (CLI) in the member countries. By considering multiple factors, the CLI forecasts the direction and intensity of cyclical differences of the economic development from the long-term trend. An alternative would be using stock indices. However, the CLI is more country-specific. Stock indices are usually calculated from large companies that operate internationally and

Table 1
German entries by equity to the OECD 23 countries

Host country	1997	1998	1999	2000	2001
Australia	13	22	22	31	15
Austria	84	77	91	91	56
Belgium	27	40	41	28	28
Canada	16	22	25	29	21
Denmark	24	23	16	21	17
Finland	8	10	10	14	10
France	128	196	145	166	131
Greece	7	12	11	6	4
Ireland	6	17	14	10	11
Italy	73	112	108	88	68
Japan	19	22	28	26	12
Luxembourg	12	10	3	8	8
Mexico	31	33	34	34	27
Netherlands	55	66	56	54	39
Norway	6	14	18	16	12
Portugal	23	30	37	14	13
Spain	72	78	86	70	57
Sweden	23	26	27	43	22
Switzerland	72	74	74	76	50
Turkey	22	21	17	27	22
United Kingdom	95	98	119	89	85
USA	157	173	243	204	152
Total	973	1176	1225	1145	860

thereby refer to the whole range of countries entered by these companies rather than exclusively to their home countries. The study uses the standard deviation of the monthly CLI 6mC within a country and year as a proxy of economic volatility (*vola*). For robustness, environmental uncertainty could also be measured in different respects such as political instability. We experimented with a measure of political instability drawn from World Bank data but observed that it was correlated to the CLI measure and produced an unacceptable degree of multicollinearity. Calculating the mean of the 6mC delivers a related CLI measure for the variable *trend*, which is to indicate the economic prospects of the host country.

The level of competition in a host country is hypothesized to moderate the influence of uncertainty on the timing of entry. On the country level, it is hardly feasible to identify the competitors of entering firms. However, there may be general indicators of competition as perceived by foreign investors. The stronger the competition, the more important it is to preserve one's own competitive advantage. In order to have their technologies protected, manufacturing firms need a patent in each country in which they wish to sell their products. Thus the number of patents will be associated with the level of competition (McGrath and Nerkar, 2004). The level of competition (*comp*) in a host country and year was measured by the number of patents claimed in this country according to the World Development Indicators CD-ROM 2005 (World Bank).

Other time-dependent factors are likely to reflect a country's overall attractiveness to foreign direct investment. The country's buying power was included by yearly data on the GDP per capita (*gdppc*). The technological position of a host country was measured by its average R&D intensity in the year of observation (*rnd*). Both time series were taken from the World Development Indicators CD-ROM. Time dummies control for overall influences that vary with time.

The dynamic variables under investigation are supposed to influence the timing and dimensioning of international entry based on the general decision to enter a host country. The factors found by previous studies to influence international market entry such as market size, industry structure, location or culture, are nearly constant within a limited period of observation. A panel technique allows for studying the effects of dynamic variables while constant variables do not have to be explicit in the model. Constant properties of the panel objects are extracted from the time series. Various studies employ cross-sectional time-series analysis to investigate investment behavior in the light of real options (Bloom et al., 2003; Kalckreuth, 2003; Ogawa and Suzuki, 2000). The standard methods are fixed and random effects models using "within" estimation. To capture constant influences on the object level, fixed effects models introduce a constant whereas random effects models include a random variable for each object.

Table 2
Descriptive statistics and correlation matrix

Variable	Mean	S.D.	Min.	Max.	Trend	vola	comp	gdppc	rnd	VIF	VIF'
Entry	48.900	48.614	3.000	243.000							
Share	0.835	0.098	0.445	1.000							
Amount	9.142	1.056	5.426	11.688							
Trend	2.895	5.247	-11.170	21.402	1.000					1.11	1.11
vola	2.784	2.247	0.263	12.449	0.055	1.000				1.03	1.02
comp	126552	54108	27985	230729	-0.303	0.064	1.000			1.23	1.21
gdppc	26885	12508	2873	56381	-0.039	-0.089	0.274	1.000		1.87	1.10
rnd	0.018	0.009	0.003	0.043	-0.080	-0.017	0.286	0.670	1.000	1.86	

The estimators of these methods, however, are inefficient if the data are heteroscedastic. Heteroscedasticity occurs if the variances of the error terms are not the same for all objects. Feasible generalized least squares (FGLS) models are able to estimate the heteroscedasticity function (Wooldridge, 2003). A modified Wald test examines the null hypothesis that all variances are equal. For the data at hand, the null hypothesis had to be rejected, which suggests estimating the regression coefficients using an FGLS model.

5. German entries between 1997 and 2001

Table 1 shows a country breakdown of the 5379 German entries filed in the MiDi database between 1997 and 2001. The panel models consider 22 countries × 5 years = 110 observations.

Descriptive statistics are given in the left part of Table 2. The dependent variables are listed above the independent and control variables. The correlation matrix in the middle of Table 2 shows that most variables are fairly independent of each other but *rnd* is correlated to *gdppc*. Furthermore, the variance inflation factors (VIF, right part of Table 2) are far higher than 1.0 and indicate multicollinearity. Dropping *rnd* results in much more acceptable variance inflation factors (VIF'); obviously the multicollinearity is mainly caused by the pair-wise correlation between *gdppc* and *rnd*. As these variables are just controls, both were included in the panel estimations. Eliminating one or the other does not change the results to a remarkable extent.

5.1. Number of entries

The results about the timing of international entry are presented in Table 3. Model 1 is the base model and comprises the control variables and time dummies (concealed) only. Model 2 includes the economic *trend* in the host country. Contrary to Hypothesis 1, its influence on the number of entries is not significant. A log likelihood test shows that *trend* does not significantly contribute to explaining *entry*. Foreign investors seem to choose the time of entry regardless of the contemporary economic prospects in the host country. Net present values appear to play a minor role in the decision to enter a foreign country now instead of entering it later.

Table 3
FGLS panel models of the number of entries to a host country

Hyp. Exp. sign	Entry	Model 1	Model 2	Model 3	Model 4
2b	comp × vola ²				2.02E-6** (9.52E-7)
+					
2a	vola			-5.1684*** (0.9594)	-7.8853*** (1.6709)
-					
1	trend		-0.3883 (0.6746)		0.1135 (0.5729)
+	gdppc	-5.80E-4* (2.99E-4)	-5.67E-4* (3.00E-4)	-7.95E-4*** (1.77E-4)	-8.50E-4*** (1.69E-4)
	rnd	1983.3*** (0532.1)	1950.6*** (0535.8)	1761.1*** (0416.0)	1764.8*** (0405.4)
	log likelh.	-527.64	-527.50	-521.50***	-519.69***

Estimation with time dummies; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$, std. errors in parentheses.

Table 4
FGLS panel models of the average share in capital at entry

Hyp. Exp. sign	Share	Model 5	Model 6	Model 7	Model 8
4a	<i>vola</i>			–0.0022 (0.0035)	–0.0022 (0.0033)
-					
3a	<i>trend</i>		0.0056*** (0.0017)		0.0056*** (0.0018)
+					
	<i>gdppc</i>	–1.53E-6** (6.68E-7)	–1.61E-6** (7.27E-7)	–1.54E-6** (6.87E-7)	–1.63E-6** (7.47E-7)
	<i>rnd</i>	4.0160*** (0.8076)	4.0901*** (0.9030)	4.0412*** (0.8178)	4.1391*** (0.9270)
	Log likelh.	148.27	148.27	148.24	147.69

Estimation with time dummies; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$, std. errors in parentheses.

Model 3 reveals that *vola* exerts a significantly negative influence on the number of entries and causes a significant jump in log likelihood, which gives support to Hypothesis 2a. The main effect of uncertainty on the timing of investment appears to be negative. This result suggests that, on balance, the waiting option has a stronger impact on the decision to enter than the growth option.

Model 4 introduces the interaction of competition and the square of uncertainty. The coefficient of $comp \times vola^2$ is significantly positive; the linear term of *vola* remains significantly negative. This finding indicates a right-hand shifted parabola (as in Fig. 1c) and supports the view of a U-shaped influence of uncertainty under the moderating effect of competition on the number of entries, as was presumed by Hypothesis 2b. Furthermore, we observe a significant jump in log likelihood. In the range of low uncertainty, foreign investors seem to refrain from entry as uncertainty increases. On the other hand, under strong competition, they tend to enter the host country at rising uncertainty as the value of the growth option overrides the value of the waiting option.

5.2. Capital at entry

The growth option model states that the smaller the investment at international entry, the larger is the option to grow by a later investment. We examine the influence of the economic trend and uncertainty on the dimensioning of entry with respect to both the perspectives of internalization and internationalization. Table 4 reports the results concerning the share, Table 5 regarding the amount of capital at entry. Models 5 and 9 are the base models, respectively.

Model 6 in Table 4 tests the impact of the economic trend on the *share* in capital at entry. Supporting Hypothesis 3a, *trend* exerts a significantly positive influence on the degree of control over the new foreign subsidiaries and significantly increases the log likelihood as compared to the base model. The impact of *trend* is also significant in the complete Model 8.

Model 10 in Table 5 examines the influence of the economic trend on the *amount* of capital at entry. In contrast to Hypothesis 3b, the related coefficient is only insignificantly different from 0. The log likelihood test indicates that *trend* makes no explanatory contribution. It seems that foreign investors expecting high returns at the moment of entry use a strong governance mode (internalization) but not necessarily a large investment (internationalization) to establish a new subsidiary abroad.

Table 5
FGLS panel models of the average amount of capital at entry

Hyp. Exp. sign	Amount	Model 9	Model 10	Model 11	Model 12
4b	<i>vola</i>			–0.0722** (0.0332)	–0.0724** (0.0336)
-					
3b	<i>trend</i>		0.0086 (0.0140)		0.0151 (0.0153)
+					
	<i>gdppc</i>	–1.36E-5* (8.29E-6)	–1.33E-5 (8.31E-6)	–1.34E-5* (7.96E-6)	–1.33E-5* (8.00E-6)
	<i>rnd</i>	48.9061*** (10.6205)	48.6071*** (10.5782)	48.4053*** (10.5916)	47.5327*** (10.4815)
	Log likelh.	–128.73	–129.11	–126.80**	–126.97

Estimation with time dummies; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$, std. errors in parentheses.

Table 6
FGLS panel models of the proportion of joint ventures at entry

Exp. Sign	propjv	Model 13	Model 14	Model 15	Model 16
+	vola			0.0091 (0.0060)	0.0057 (0.0055)
–	trend		–0.0121*** (0.0029)		–0.0115*** (0.0030)
	gdppc	3.29E-6*** (1.14E-6)	4.49E-6*** (9.60E-7)	3.52E-6*** (1.21E-6)	4.62E-6*** (1.09E-6)
	rnd	–7.9484*** (1.4374)	–9.5920*** (1.3948)	–8.3369*** (1.4703)	–9.8207*** (1.5111)
	Log likelh.	83.39	88.26***	84.46	87.54**

Estimation with time dummies; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$, std. errors in parentheses.

The growth option model expects uncertainty to discourage the binding of capital. Therefore, Hypothesis 4a predicts a negative influence of uncertainty on the *share* in capital at entry. The findings of Model 7 and Model 8 in Table 4, however, contradict this proposition. In both models, *vola* shows no significant impact and does not improve the log likelihood.

Model 11 in Table 5 examines the influence of uncertainty on the *amount* of capital at entry. The coefficient of *vola* is negatively signed and significant. There is also a significant increase in log likelihood, adding support to Hypothesis 4b. The same finding is brought forward in the complete Model 12. Apparently, uncertainty does not prevent foreign investors from choosing a high mode of control (internalization) but it does keep them from spending a large investment (internationalization) to start a foreign affiliate.

5.3. Proportion of joint ventures

As uncertainty does not seem to matter to the share in capital at entry, the findings of Table 4 contradict the common notion of joint ventures as real options. However, previous studies treated the mode of market entry rather as a nominal (joint venture vs. fully-owned subsidiary) than a continuous variable (share in capital). Classifying subsidiaries with a capital share of less than 95% as joint ventures, we calculated the ratio of joint ventures and all new investments *propjv* per host country and year. Table 6 presents the results.

Just as it did to the *share* in capital at entry, the economic trend in the host country makes a contribution to explaining the proportion of joint ventures. There is a significantly negative influence of *trend* on *propjv* (Models 14 and 16). To put it in other words, the higher the expected returns, the more investors choose a fully-owned subsidiary as their mode of market entry.

To preserve the growth option of taking over the joint venture at a later point in time, high uncertainty should be associated with a high proportion of joint ventures at entry. However, the coefficient of *vola* is insignificant. Investigating the mode of market entry delivers the same result as considering the continuous share in capital: The governance mode that investors choose to enter a foreign market does not seem to be affected by the economic volatility surrounding the investment object.

6. Discussion

The real options view complements the perspectives of internalization and internationalization as it introduces the dynamic influence of uncertainty on the timing and dimensioning of international market entry. Traditional theories of foreign direct investment conceive uncertainty as a downside risk that suggests being careful at international entry. The theory of real options recognizes uncertainty as a chance as well as a risk, since the returns of an investment can be greater than expected, too. “Wait and see” may be worthwhile as it carries the possibility of uncertainty to resolve. However, “having a foot” in the foreign market improves the ability to react to competitors’ moves. Investing to a limited extent provides this advantage but preserves the flexibility to invest the major part at a later point in time. Enforced by competition, the value of the option to grow may be greater than the value of the option to defer and plead for entering soon.

Our study of German investment in the OECD 23 countries suggests that the uncertainty of a host country have a nonlinear effect on the number of entries under the moderating influence of competition. When uncertainty is low,

rising uncertainty seems to prevent entry, which is in line with previous findings on the timing of foreign direct investment (Delios and Henisz, 2003) and conceptual work on international real options (Rivoli and Salorio, 1996). When uncertainty is high and competitors threaten to enter the field, however, rising uncertainty appears to attract entry. This observation of investment behavior is new in the context of foreign direct investment and consistent with the findings that Folta and O'Brien (2004) produce in the context of US American domestic investment. Extending the work of Folta and O'Brien, we empirically examine the moderating effect of competition as competition is supposed to boost the value of the option to grow after an early market entry. Pioneering in competitive markets may provide first-mover advantages to the German investors under study. A similar finding should be reproducible in other country settings since German investors do not perceive first-mover advantages higher or significantly different from managers from other Western countries (Song et al., 1999).

The model of waiting and growth options does not claim to explain why firms consider entering a particular country, as the theories of internalization and internationalization do. Neither does it include preceding activities to explore the foreign market such as exporting or licensing. It starts from the premise that firms have decided to enter by equity and are now waiting for the appropriate moment. For the empirical analysis, we assume that the number of firms generally contemplating entry to the OECD 23 countries stays the same during the 5-year period of observation. Given the intention to place an investment in that country, the option model provides an explanation for the ambivalent role of uncertainty on its timing.

As an implication for management, the real options model asserts that entering a foreign market in the face of high uncertainty can be rational even though traditional theories of market entry and the net present value rule advise not to invest. Our study of 5379 German entries suggests that foreign investors do not regard textbook advice but enter under high uncertainty. Examples of entry under high uncertainty have been presented by previous studies. Li (2007) demonstrates that Volkswagen acquired a growth option by entering China in the 1980s, knowing that the economic and political development of China was difficult to predict. In the subsequent years, Volkswagen became the most successful foreign investor in the Chinese car market. Buckley and Tse (1996) point to U.S. and European companies that entered the Eastern part of Germany in the early 1990s, right after the German re-union. Investing early in a highly uncertain environment provided them with powerful growth options. Other examples are the pioneering investments by Mercedes-Benz to build buses and coaches in Brazil (1950s) and Turkey (1960s) as well as Nestlé's investments in the developing countries (1970s) and the ongoing investments by Messer Griesheim to build up chemical plants in Cuba. Decision-makers in international management seem to abandon the negative view of investment risk and recognize the strategic value of investing under high uncertainty. The results of our study support this view. Future work is to bring forward empirical evidence of the success of applying real options reasoning to the timing of entry.

The assumption that the economic trend in a host country would impact the timing of investment was not confirmed by the data. In fact, this lack of support strengthens the option perspective to international market entry: Quantitative option models show that the waiting and growth option values of an investment object may by far exceed its net present value (McDonald and Siegel, 1986; Pindyck, 1988). In practical terms, the finding that the economic trend does not seem to guide the timing of entry can be interpreted in a way that foreign investors consider the short-term return on market entry less relevant than the value of preserving flexibility. Ironically, managers may create shareholder value by disregarding the discounted cash flow method and applying real options reasoning instead.

The influence of a host country's uncertainty on the dimensioning of foreign direct investment can be studied both by the perspectives of internalization and internationalization. Interpreting international entry as creating an option to grow, uncertainty is supposed to have a negative impact on investment either way. The empirical results are contradictory though. Economic uncertainty has a negative influence on the amount of capital (internationalization) whilst it has no influence on the share in capital (internalization). The economic trend, by contrast, exerts no influence on the amount whereas it has a positive influence on the share. Since the value of growth options is driven by uncertainty, this observation suggests that investors use rather the amount than the share of capital in a new foreign affiliate as a growth option. There is no support for the notion of Buckley et al. (2002) that reduced transaction costs and asymmetric information are sufficient to provide the investor with the option to take over a joint venture. Using the CLI measure of uncertainty and considering the average dimensioning of international entries, it seems that international joint ventures may be less treated as growth options than foreign subsidiaries in general. Joint ventures seem to serve as regular investments as the capital share is mostly influenced by the economic trend, i.e., the expected cash flow. This finding challenges the view of joint ventures as real options (Kogut, 1991; Folta, 1998; Chi and McGuire, 1996). An implication for future studies of international real options may be focusing on the investment perspective of internationalization. However, considering the average share of investment

through all investments does not exclude the possibility that a minority of the joint ventures under observation are treated as real options. The findings of Tong et al. (in press) stress that the growth option value of joint ventures may depend on certain characteristics, e.g., their contribution to produce diversification, which our study does not account for.

Managers appear to be aware of the problem of maintaining investment flexibility in international joint ventures. Reuer (2002) reports on foreign investors' efforts to negotiate buy-out clauses with their joint venture partners and thereby ensure the right to exercise growth options on additional investment. The challenge of synchronizing investment decisions with foreign partners seems to be prevalent in many industries. TUI, the German market leader in vacation travel and package tours, use tight management contracts, quality standards, and their market power to control partner hotels and resorts at foreign destinations. When contracts and other means fail to guarantee investment flexibility, TUI takes full ownership. Our study suggests that foreign investors facing environmental uncertainty rather limit their stake than engage in a joint venture.

Further research is also needed to empirically validate the findings since the study is subject to a number of limitations. Surveys and laboratory experiments suggest that economists abandon traditional net present value rules to stay flexible for future investment decisions. For the time being, though, it is no more than an assumption that foreign investors apply real options reasoning to their decisions. The model of waiting and growth options tries to reproduce basic reasoning and might be a quasi theory rather than a true theory of decision behavior. Nevertheless, it provides an explanation why German investors choose the timing and dimensioning of international entry synchronized to uncertainty.

The empirical findings could be affected by methodological shortcomings, too. The Deutsche Bundesbank database is anonymous and does not allow for studying a panel of *potential* investors. In an aggregate figure, we do not know whether the unobserved influences at the firm level even out or produce artifacts. Factors at the industry level such as industry size or age are not considered either. Constant factors on the country level are controlled for by the FGLS model but are not regarded by the theoretical model. Therefore, the claim of the study is only that it makes a contribution to explaining the influence of uncertainty on the timing and dimensioning of entry as a supplement to previous work. It is not able to explain the international entry decision as a whole.

The measurement of uncertainty relies on the presumption that the investors' expectations are correlated to the economic forecasts collected by the OECD. The study should be followed by a survey that might provide a smaller coverage but will enable investigating the decision makers' intentions about using real options. The survey should also make sure that the investors under investigation hold a waiting option of international entry (consciously or unconsciously, Bowman and Hurry, 1993). Our study can merely presume that, on the aggregate level, a constant share of German firms will contemplate entry. Within a limited period this assumption appears reasonable since taking a country into consideration for entry is a long-term issue.

Theoretical work will be necessary to integrate real option models with explanations of choosing particular countries for market entry, since the present study merely respects such factors in an econometric way. Future research should also clarify the impact of uncertainty on choosing other modes of market entry than entering by equity. The concept of internationalization seems to be more compatible with real options than the theory of internalization. The combination of internationalization and real options theory may contribute to explaining the evolution of individual subsidiaries, international networks of firms, and multinational corporations.

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References

- Adner, R., Levinthal, D.A., 2004. What is not a real option: considering boundaries for the application of real options to business strategy. *Academy of Management Review* 29, 74–85.
- Becker, M., 2005. Controlling von Internationalisierungsprozessen. Katholische Universität Eichstätt-Ingolstadt, Diss.
- Björkman, I., Eklund, M., 1996. The sequence of operational modes used by Finnish investors in Germany. *Journal of International Marketing* 4 (1), 33–55.
- Bloom, N., Bond, S.R., van Reenen, J., 2003. Uncertainty and company investment dynamics: empirical evidence for UK firms. Working Paper 4025, Center for Economic Policy Research, London.
- Bowman, E.H., Hurry, D., 1993. Strategy through the option lens: an integrated view of resource investments and the incremental-choice process. *Academy of Management Review* 18, 760–782.

- Bradley, F., Gannon, M., 2000. Does the firm's technology and marketing profile affect foreign market entry? *Journal of International Marketing* 8 (4), 12–36.
- Buckley, P.J., 1988. The limits of explanation: testing the internalization theory of the multinational enterprise. *Journal of International Business Studies* 19, 181–193.
- Buckley, A., Tse, K., 1996. Real operating options and foreign direct investment: a synthetic approach. *European Management Journal* 14, 304–314.
- Buckley, P.J., Casson, M.C., 1976. *The Future of the Multinational Enterprise*. Macmillan, London.
- Buckley, P.J., Casson, M.C., 1996. An economic model of international joint venture strategy. *Journal of International Business Studies* 27, 849–876 (Special Issue).
- Buckley, P.J., Casson, M.C., 1998. Models of the multinational enterprise. *Journal of International Business Studies* 29, 21–44.
- Buckley, P.J., Casson, M.C., Gulamhussen, M.A., 2002. Internationalisation—real options, knowledge management and the Uppsala approach. In: Havila, V., Forsgren, M., Hakansson, H. (Eds.), *Critical Perspectives on Internationalization*. Pergamon, Oxford, pp. 229–261.
- Bürgele, O., Murray, G.C., 2000. The international market entry choices of start-up companies in high-technology industries. *Journal of International Marketing* 8 (2), 33–62.
- Calvet, A.L., 1981. A synthesis of foreign direct investment theories and theories of the multinational firm. *Journal of International Business Studies* 12, 43–59.
- Camino, D., Cazorla, L., 1998. Foreign market entry decisions by small and medium-sized enterprises: an evolutionary approach. *International Journal of Management* 15, 123–130.
- Casson, M.C., 1985. Transaction costs and the theory of the multinational enterprise. In: Buckley, P.J., Casson, M.C. (Eds.), *The Economic Theory of the Multinational Enterprise*. Macmillan, London, pp. 20–38.
- Chang, S.J., Rosenzweig, P.M., 2001. The choice of entry mode in sequential foreign direct investment. *Strategic Management Journal* 22, 747–776.
- Chi, T., McGuire, D.J., 1996. Collaborative ventures and value of learning: integrating the transaction cost and strategic option perspectives on the choice of market entry modes. *Journal of International Business Studies* 27, 285–307.
- Davidson, W.H., 1980. The location of foreign direct investment activity: country characteristics and experience effects. *Journal of International Business Studies* 11, 9–22.
- Delios, A., Henisz, W.J., 2003. Political hazards, experience, and sequential entry strategies: the international expansion of Japanese firms, 1980–1988. *Strategic Management Journal* 24, 1153–1164.
- Delios, A., Makino, S., 2003. Timing of entry and the foreign subsidiary performance of Japanese firms. *Journal of International Marketing* 11 (3), 83–105.
- Deutsche Bundesbank, 2003. Kapitalverflechtung mit dem Ausland—Statistische Sonderveröffentlichung 10. Deutsche Bundesbank (central bank of Germany), Frankfurt am Main.
- Dixit, A.K., Pindyck, R.S., 1994. *Investment under Uncertainty*. Princeton University Press, Princeton, NJ, Chichester.
- Dunning, J.H., 1981. Explaining the international direct investment position of countries: towards a dynamic or development approach. *Weltwirtschaftliches Archiv/Review of World Economics* 117, 30–64.
- Dunning, J.H., 2000. The eclectic paradigm as an envelope for economic and business theories of MNE activity. *International Business Review* 9, 163–190.
- Folta, T.B., 1998. Governance and uncertainty: the trade-off between administrative control and commitment. *Strategic Management Journal* 19, 1007–1028.
- Folta, T.B., Miller, K.D., 2002. Real options in equity partnerships. *Strategic Management Journal* 23, 77–88.
- Folta, T.B., O'Brien, J.P., 2004. Entry in the presence of dueling options. *Strategic Management Journal* 25, 121–138.
- Gatignon, H., Anderson, E., 1988. The multinational corporation's degree of control over foreign subsidiaries: an empirical test of a transaction cost explanation. *Journal of Law, Economics, and Organization* 4, 305–336.
- Hennart, J.-F., 1982. *A Theory of Multinational Enterprise*. University of Michigan Press, Ann Arbor, MI.
- Hennart, J.-F., 1991. The transaction costs theory of joint ventures: an empirical study of Japanese subsidiaries in the United States. *Management Science* 37, 483–497.
- Hennart, J.-F., 1993. Explaining the swollen middle: why most transactions are a mix of “market” and “hierarchy”. *Organization Science* 4, 529–547.
- Hennart, J.-F., Park, Y.-R., 1994. Location, governance, and strategic determinants of Japanese manufacturing investment in the United States. *Strategic Management Journal* 15, 419–436.
- Hommel, U., Lehmann, H., 2001. Die Bewertung von Investitionsprojekten mit dem Realloptionsansatz—Ein Methodenüberblick. In: Hommel, U., Scholich, M., Vollrath, R. (Eds.), *Realloptionen in der Unternehmenspraxis: Wert schaffen durch Flexibilität*. Springer, Berlin, pp. 113–129.
- Howell, S.D., Jägle, A.J., 1997. Laboratory evidence on how managers intuitively value real growth options. *Journal of Business Finance & Accounting* 24, 915–935.
- Hule, R., 2000. Information, risk and timing of foreign direct investment: a real options perspective. In: Chen, J.-R. (Eds.), *Foreign Direct Investment*. Macmillan, London, pp. 75–95.
- Hyer, S., 1976. *The International Operations of National Firms*. MIT Press, Cambridge, MA.
- Johanson, J., Vahlne, J.-E., 1977. The internationalization process of the firm—a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies* 8, 23–32.
- Johanson, J., Wiedersheim-Paul, F., 1975. The internationalization of the firm—four Swedish cases. *Journal of Management Studies* 12, 305–322.
- Johansson, J.U., Nonaka, I., 1983. Japanese export marketing: structures, strategies, counterstrategies. *International Marketing Review* 1, 12–25.
- Johnson, H.G., 1968. *Comparative Cost and Commercial Policy for a Developing World Economy*. Almqvist and Wicksell, Stockholm.
- Kalckreuth, U.v., 2003. Exploring the role of uncertainty for corporate investment decisions in Germany. *Swiss Journal of Economics and Statistics* 139, 173–206.
- Karafakioglu, M., 1986. Export activities of Turkish manufacturers. *International Marketing Review* 3, 34–43.
- Kaufmann, D., Kraay, A., Mastruzzi, M., 2004. Governance matters III: governance indicators for 1996–2002. *World Bank Economic Review* 18, 253–287.
- Kogut, B., 1991. Joint ventures and the option to expand and acquire. *Management Science* 37, 19–33.
- Kulatilaka, N., Perotti, E.C., 1998. Strategic growth options. *Management Science* 44, 1021–1032.
- Kutschker, M., Schmid, S., 2005. *Internationales Management*, fourth ed. Oldenbourg, München, Wien.
- Li, J., 2007. Real options theory and international strategy: a critical review. *Advances in Strategic Management* 24, 71–105.
- Luo, Y., 1998. Timing of investment and international expansion performance in China. *Journal of International Business Studies* 29, 391–407.
- Macharzina, K., Engelhard, J., 1991. Paradigm shift in international business research: from partist and eclectic approaches to the GAINS paradigm. *Management International Review* 31, 23–43 (Special Issue).

- Madhok, A., 1998. The nature of multinational firm boundaries: transaction costs, firm capabilities and foreign market entry mode. *International Business Review* 7, 259–290.
- McDonald, R.L., Siegel, D.R., 1986. The value of waiting to invest. *Quarterly Journal of Economics* 101, 707–727.
- McGrath, R.G., Nerkar, A., 2004. Real options reasoning and a new look at the R&D investment strategies of pharmaceutical firms. *Strategic Management Journal* 25, 1–21.
- McNaughton, R.B., 2000. Determinants of time-span to foreign market entry. *Journal of Euromarketing* 9 (2), 99–112.
- Miller, K.D., Shapira, Z., 2004. An empirical test of heuristics and biases affecting real option valuation. *Strategic Management Journal* 25, 269–284.
- Moen, O., Servais, P., 2002. Born global or gradual global? Examining the export behavior of small and medium-sized enterprises. *Journal of International Marketing* 10 (3), 49–72.
- Mudambi, R., Mudambi, S.M., 2002. Diversification and market entry choices in the context of foreign direct investment. *International Business Review* 11, 35–55.
- Ogawa, K., Suzuki, K., 2000. Uncertainty and investment: some evidence from the panel data of Japanese manufacturing firms. *Japanese Economic Review* 51, 170–192.
- Pak, Y.S., Park, Y.-R., 2004. Global ownership strategy of Japanese multinational enterprises: a test of internalization theory. *Management International Review* 44, 3–21.
- Pindyck, R.S., 1988. Irreversible investment, capacity choice and the value of the firm. *American Economic Review* 78, 969–985.
- Pindyck, R.S., 1991. Irreversibility, uncertainty, and investment. *Journal of Economic Literature* 29, 1110–1148.
- Reuer, J., 2002. How real are real options? The case of international joint ventures. In: Hitt, M., et al. (Eds.), *Creating Value—Winners in the New Business Environment*. Blackwell, Oxford, pp. 61–84.
- Rivoli, P., Salorio, E., 1996. Foreign direct investment and investment under uncertainty. *Journal of International Business Studies* 27, 335–357.
- Rugman, A.M., 1980. A new theory of the multinational enterprise: internationalization vs. internalization. *Columbia Journal of World Business* 15, 23–29.
- Song, X.M., di Benedetto, C.A., Zhao, Y.L., 1999. Pioneering advantages in manufacturing and service industries: empirical evidence from nine countries. *Strategic Management Journal* 20, 811–836.
- Tan, B., Vertinsky, I., 1996. Foreign direct investment by Japanese electronics firms in the United States and Canada: modelling the timing of entry. *Journal of International Business Studies* 27, 655–681.
- Teece, D.J., 1981. The multinational enterprise: market failure and market power considerations. *Sloan Management Review* 22 (3), 3–17.
- Tong, T.W., Reuer, J., Peng, M.W., in press. International joint ventures and the value of growth options. *Academy of Management Journal*, 50.
- Trigeorgis, L., 1996. *Real Options: Managerial Flexibility and Strategy in Resource Allocation*. MIT Press, Cambridge, MA.
- Tsai, M.-T., Cheng, Y.-M., 2002. The decision criteria for the ownership control entry mode for Taiwanese manufacturing firms in the United States: an application of the logit model and AHP. *International Journal of Commerce and Management* 12 (2), 45–71.
- Tse, D.K., Pan, Y., Au, K.Y., 1997. How MNCs choose entry modes and form alliances: the China experience. *Journal of International Business Studies* 28, 779–805.
- Ursacki, T., Vertinsky, I., 1992. Choice of entry timing and scale by foreign banks in Japan and Korea. *Journal of Banking & Finance* 16, 405–421.
- Vassolo, R.S., Anand, J., Folta, T.B., 2004. Non-additivity in portfolios of exploration activities: a real options-based analysis of equity alliances in biotechnology. *Strategic Management Journal* 25, 1045–1061.
- Williamson, O.E., 1975. *Markets and Hierarchies—Analysis and Antitrust Implications*. Free Press, New York.
- Wooldridge, J.M., 2003. *Introductory Econometrics: A Modern Approach*, second ed. Thomson South-Western, Mason, OH.