A THEORY OF ALLIANCE GOVERNANCE:
A STRATEGIC OPTION ALTERNATIVE TO TRANSACTION COST THEORY

DISSERTATION

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* * * * *

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ABSTRACT

This study uses real option theory to explain and predict why and when different types of inter-firm exchange governance are chosen under different levels of uncertainty. While transaction cost theory successfully addresses a firm's exchange governance choices, it has also received criticism regarding some of its major assumptions and predictions. In this dissertation, real option view is introduced as an alternative to transaction cost theory to explain and predict a firm's governance choice while responding to the criticisms to the transaction cost theory of firm. The first step to build real option theory of governance is to recognize the fact that a market contract can be designed as a real option which is written on the partner's uncertain strategic capability. Based on this premise, uncertainty and asset specificity - the two central variables in transaction cost theory - play different roles in the real option view of governance. First of all, it can be expected that under high levels of capability uncertainty, firms will choose market governance because of its high real option value. Hierarchical governance such as acquisition will be considered only when the uncertainty surrounding the partner's capability is low. Also, transaction-specific investment or asset specificity can be considered positively because it
generates real option value for the investing firm. Moreover, learning-by-doing type asset specificity is even better because it can provide the firm with an exclusive right to exercise the real option. However, since both market governance and joint venture can be designed as real option, a general framework that influences the initial governance form under real option view is presented. Specifically, types of learning required to identify the value of real asset, and the concern for securing underlying property are suggested as two major factors that influence the choice between market contract, and more hierarchical governance such as joint venture. The empirical study, which used alliance samples from biotechnology industry, supported the major hypothesis regarding capability uncertainty, learning and property rights. Finally, it is suggested that a firm can be conceptualized as a collection of real assets rather than a nexus of contract.
Dedicated to my parents
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CHAPTER 1
INTRODUCTION

A firm’s decision regarding the choice of exchange governance mode with other external organizations is perhaps one of the most important issues in the field of strategic management (Rumelt, Schendel, & Teece, 1991). Traditionally, inter-firm governance (or alliance) mode decisions about whether a firm should choose a market contract mode, hierarchical governance mode or hybrid form of governance (such as joint venture) have been mainly discussed in the transaction cost theory (Coase, 1937; Williamson, 1975, 1985, 1991; Hennart, 1988, 1993). According to transaction cost theory, exchange governance choices are made on the basis of the comparative cost of alternative modes. It has been argued by both transaction cost theorists (Williamson, 1975, 1985) and those who criticized this theory (Hill, 1990; Kogut & Zander, 1992, 1993; Ghoshal & Moran, 1996), that opportunism is the central concept in the transaction cost theory which causes the transaction costs to rise. Hierarchical governance substitutes market governance when markets fail due to high transaction cost. More hierarchical governance is supposed to reduce transaction cost by its ability to control the opportunism inherent in a market transaction.
Since transaction cost theory postulates that firm organizations exist due to a set of market failures, this theory is frequently referred to as the theory of the firm among business and economics scholars. Indeed, the influence of transaction cost theory on management literature and related business disciplines is truly impressive. Besides addressing strategic issues such as make-or-buy decisions (Monteverde & Teece, 1982; Walker & Weber, 1984), vertical merger (Spiller, 1985; Weiss, 1992, 1994), and diversification (Teece, 1980), the theory has also been applied to other business phenomena such as technology and R&D management (Pisano, 1990; Teece, 1988), international business (Hennart, 1982, 1986; Buckley & Casson, 1976), finance (Williamson, 1988a), marketing (Anderson, 1985; Dwyer & Oh, 1988) and public administration (Moe, 1991). Among all of these applications of transaction cost theory, the successful explanation and prediction of the vertical integration decision from the transaction cost theory best represent the characteristics of the theory of the firm because exploring the rationale behind vertical integration is considered tantamount to asking why a firm-type governance exists, instead of the alternative of market contracting (Conner & Prahalad, 1996).

This dissertation directly challenges the transaction cost approach in a firm’s boundary choice with a very different theoretical perspective. Specifically, ‘real option’ (or sometimes referred to as ‘strategic option’) theory is adopted here to explain and predict when and why firms choose a certain governance mode in forming an alliance (or exchange) relationship with other firms. The most
fundamental insight using the real option view in this dissertation may be the recognition that a firm's exchange governance choice, whatever it might be, requires some degree of investment in resources and that this investment can create real option value for the investing firm under high uncertainty. It will be suggested that a firm's governance decision will be influenced by this real option value in its investment. Especially, this study recognizes the real option value embedded in the investment involved in the market transaction as an important determinant of horizontal and vertical integration. Thus, unlike the transaction cost theory, the real option view of the governance choice focuses its attention on the possible option value in the transaction rather than on the potential cost and opportunism in the transaction.

It should be noted however, that the real option perspective was previously adopted by some researchers to explain some equity-based alliance governance choices such as joint venture (e.g., Kogut, 1991; Folta & Leiblein, 1994; Chi & McGuire, 1996) and minority investment (e.g., Hurry, Miller, & Bowman, 1992). Although the real option approach has been used in equity-based alliances, there are two major contributions of this dissertation to real option application literature which have yet to be addressed.

First of all, this study explicitly recognizes that all governance choices involve resource investments which confer real option value to the firm. Especially, this dissertation is the first to recognize that market governance (i.e., non-hierarchical governance) itself can be considered as a real option, which
brings further expansion opportunities for the firm. As mentioned above, although previous researches had identified real option value in equity-based governance such as joint ventures and minority investments, no studies have identified that there exist real option values in market transactions (i.e., non-hierarchical governance). Focusing on the market contract as having real option value will enable this study to build a theory of general alliance governance parallel to the transaction cost theory.

Second, although a few previous researchers have recognized the fact that the real option view can substitute for transaction cost theory in equity-based governance choices (e.g., Folta & Leiblein, 1994; Chi & McGuire, 1996), all of them treated these two views as complementary rather than contradictory. Although this study recognizes this complementary nature, it will be emphasized that the real option view on governance decision can sometimes be contradictory to the major assumptions and predictions of transaction cost theory. Especially, this dissertation argues theoretically how uncertainty and asset specificity - two of the most important concepts in transaction cost theory - have contradictory implications in the real option theory of governance. As it will turn out, the roles of uncertainty and asset specificity in the real option view of governance will be exactly the opposite of those in transaction cost theory. This is perhaps the most interesting and exciting part in the real option theory of governance.

Thirdly, this dissertation emphasizes and elaborates on the concept of learning and property rights in real option analysis. As mentioned earlier, real
option view per se, is still under development in terms of its theoretical sophistication. This dissertation will refine the real option logic by introducing two concepts - learning and property rights. This study argues that these two concepts represent important, but neglected aspects of the real option theory in general. These two concepts are unique characteristics of real option theory, which cannot be found in financial option. This dissertation intends to make contributions to real option theory literature by examining these two concepts in depth, and to the real option theory of governance choice by suggesting specific influences of learning and property rights on the choice between contract-based alliance vs. more equity-based alliance governance.
CHAPTER 2

TRANSACTION COST THEORY: REVIEW AND CRITIQUE

2.1. Transaction Cost Theory

In his seminal article, "The nature of the firm", Coase (1937) first posed the question: why do firms exist? He asked why there are organizations when the same production activity could be regulated by the price mechanism in the market. Central to this question was the notion that markets and organizations are alternatives for carrying out the same productive activity. He reasoned that firm organizations exist when the cost of managing economic exchange across markets is greater than the cost of managing economic exchange within the boundaries of an organization.

Coase's focus on transaction cost as a foundation of firm organization was further developed by Williamson (1975, 1985). As Williamson (1975, 1988b) put it, the transaction cost logic of economic organization had its origins in a tautology, which Coase (1988) defines as "a proposition that is clearly right". In order to avoid being a tautology, the concept of transaction cost had been operationalized by Williamson according to the attributes of a transaction.
However, the operationalization of the transaction cost and the emphasis in the operationalization has been changed a bit as the theory progressed.

In his earlier work, Williamson (1975) suggested that a set of human factors (such as bounded rationality and opportunism), together with a related set of environmental factors (such as uncertainty and small-numbers exchange condition), explain the circumstances under which complex contingent claims contract will be costly to write. The two environmental factors - uncertainty and small-numbers condition - are joined by a related set of human factors such as bounded rationality and opportunism to lead to market failure. Specifically, bounded rationality was paired with uncertainty while opportunism was paired with small-number condition. In both cases, the transaction was adopted as the basic unit of analysis, following John R. Commons’ (1934) proposition. The rationale behind these two pairings are as follows.

First, the reasoning behind the pairing bounded rationality with uncertainty is that it is very costly or impossible to identify, due to bounded rationality, future uncertain contingencies and specify, *ex ante*, appropriate adaptations in the market contract. Therefore, transaction cost increases as the level of uncertainty increases given the bounded rationality of human beings. In such circumstances, long-term contracts may be supplanted by internal organization since internal organization "permits adaptations to uncertainty to be accomplished by administrative processes in a sequential fashion" (Williamson, 1975: 9). As a matter of fact, this operationalization is quite consistent with Coase’s original
notion of transaction cost theory. The central factor that causes the difficulty of transaction is human being's inability to anticipate future environmental uncertainties and specify appropriate adaptations in the market contract. Thus, environmental uncertainty was a critical external variable that causes transaction cost to rise, given the assumption of bounded rationality.

Second, according to Williamson (1975), opportunism coupled with small numbers condition increases transaction cost. Opportunism is defined here as "self-interest seeking with guile", and implies that economic agents can be guided by strategic behavior (Williamson, 1975). Opportunistic behavior in a transaction involves both selective or distorted information disclosure or self-disbelieved promises regarding future conduct. However, opportunism alone does not cause the market transaction to fail, according to Williamson. It is further necessary that a small-numbers condition prevail. Absent this, the existence of a large number of potential exchange partners will render an exchange partner’s opportunistic inclination ineffectual. Only when the small-numbers condition prevail, do parties involved in a transaction have a strong incentive to behave opportunistically. Although there exist a large number of bidders for a specific market exchange in the beginning, when the winning bidder accumulates idiosyncratic experience during the contract execution, it is transformed into a small-numbers exchange condition afterwards. As a result of this ‘fundamental transformation’ to the small-numbers condition, bilateral monopoly emerges with the typical problems associated with this form of
exchange. The transaction problem at this bilateral monopoly stage is that each party seeks exchange terms most favorable to it, which often leads to opportunistic representations and haggling. In this context, transaction cost can be defined as the costs of negotiating, monitoring, and enforcing a contingent claims contract to ensure against these possibilities. However, there has been slight changes in emphasis in transaction cost theory in Williamson’s later work.

In his later work, between the two possible causes of transaction cost, Williamson began to emphasize the latter — opportunism under small number condition (Williamson, 1979, 1985). He also emphasized the role of asset specificity — a term used for idiosyncratic investment and experience — as a determinant of small number condition (Williamson, 1985, 1989; Riordan & Williamson, 1985). Asset specificity refers to the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value. Asset specificities are, thus, transaction specific investments which are only valuable in a specific transaction, and have little or no value in any other transaction. They are also, by their nature, sunk costs (Williamson, 1985, 1989). The reason why asset specificity is emphasized by Williamson may be that the conditions of high asset specificity (i.e., high transaction specific investment) accompanied in the transaction ‘locks in’ the exchange relationship to a bilateral monopoly situation, as stated earlier. In short, Williamson suggested asset specificity as an ultimate reason for the ‘fundamental transformation’ to the small-numbers condition.
Of course, if the asset specificity would cause the transaction cost to rise, it should be assumed that exchange partners can behave opportunistically. If all exchange partners keep all the transaction provisions with trust and honesty, and do not take advantage of the bilateral monopoly situation, then the presence of asset specificity would not affect transaction cost at all. Therefore, the assumption of opportunism is essential in Williamson’s later version of transaction cost theory.

The most notable and concrete work which examines the role of transaction-specific investment in transactional failure and vertical integration may be that of Klein, Crawford, and Alchian (1978). Their specific examples of exchange difficulties shows that when a supplier makes a transaction-specific investment, a buyer through post contractual opportunistic behavior can exploit the supplier by, for example, insisting on a lower price for the supplies than what had been agreed to in the original supply contract. The opportunistic buyer can potentially exploit all the value of the supplier’s transaction-specific investment over its salvage value. In short, the opportunistic buyer can effectively ‘hold-up’ the supplier who had made a investment unique to the buyer. The amount that the buyer can exploit out of the supplier’s transaction-specific investment is termed an ‘appropriable quasi rent’ (Klein, Crawford, & Alchian, 1978). However, not only the supplier but also the buyer is locked in this bilateral monopoly created by transaction-specific investment. The supplier can also have an incentive to behave opportunistically and raise the price of the supply or degrade
the quality of supply. Or the supplier can also ask for higher price for the supplies to the buyer in order to safeguard against the buyer's opportunistic behavior. Eventually, these transactional difficulties will lead to common ownership through vertical integration.

According to Williamson, there exist at least four types of asset specificity (Williamson, 1985). Physical asset specificity is a specialized investment on such physical assets as equipment and machines. Human asset specificity arises by learning-by-doing as the transaction evolves over time. Site asset specificity refers to successive stations that are located in a cheek-by-jowl relation to each other so as to economize on inventory and transportation expenses. Lastly, dedicated assets refers to an investment in generalized production capacity at the request of a particular customer. (This type of investment is explained in detail in Williamson's hostage model (Williamson, 1983)). All of these forms of asset specificity lock in the exchange relationship for both exchange partners, and coupled with the behavioral assumption of opportunism, creates incentives for appropriating quasi-rents from the other partner.

Even though Williamson's later version of transaction cost theory focused on asset specificity and opportunism, he also mentions the role of uncertainty in his later version of the theory (Williamson, 1985, 1989). As was mentioned, the presence of uncertainty was a major cause for transaction cost theory for both Coase (1937) and early Williamson (1975). However, in his later work, the definition of uncertainty has been changed. In short, the role of uncertainty in
transaction cost theory was only emphasized in connection with opportunism (Williamson, 1985, 1989). Citing Koopmans (1957), who distinguished primary vs. secondary uncertainty, Williamson introduced the notion of ‘behavioral uncertainty’, extending his earlier work on uncertainty:

Primary uncertainty is of a state-contingent kind, while secondary uncertainty arises “from lack of communication, that is from one decision maker having no way of finding out the concurrent decisions and plans made by others.” Which Koopmans judges to be “quantitatively at least as important as the primary uncertainty arising from random acts of nature and unpredictable changes in consumer’s preferences” (1957, pp. 162-63) (Williamson, 1985: 57).

Williamson noted that some uncertainties have behavioral origins, and propose another type called ‘behavioral uncertainty’. According to him, the secondary uncertainty that Koopmans identified seemed rather innocent and nonstrategic. Unlike these type of uncertainties, behavioral uncertainty refers to the exchange partner’s strategic nondisclosure, disguise, or distortion of information. As its definition indicates, behavioral uncertainty is closely related to opportunism. This may be why opportunism is considered the central behavioral assumption in the transaction cost theory today. It can be noticed that the Coase’s definition of uncertainty as well as Williamson’s earlier version of uncertainty corresponds to the primary uncertainty according to Koopman’s classification.
Although Williamson's contribution to the transaction cost theory builds upon Coase's initial insight, Williamson's later version of transaction cost theory differs from Coase's in the following ways. Most of all, the assumption of opportunism and the emphasis on asset specificity is not the central concern for Coase. As a matter of fact, Coase argued that Williamson's (1975, 1985) and Klein, Crawford, and Alchian (1978)'s works do not represent an extension of his earlier work, but rather to be an alternative, incorrect explanation for vertical integration (Coase, 1988). Coase rejects the notion of opportunism and the threat of hold-up on the grounds that opportunistic behavior is usually effectively handled in the marketplace.

Added to this confusion in transaction cost theory is the existence of another line of thought in the theory, termed as the 'measurement branch' by Williamson (1985, 1989). According to Williamson (1985, 1989), the measurement branch is best represented by Alchian and Demsetz (1972), and Barzel (1982). Unlike the Williamson's emphasis on the asset specificity, this branch focuses on the difficulty of the measurement of the opportunistic exchange partner's output performance. However, the contribution of Alchian and Demsetz (1972) can be found in explaining the internal organizational structure rather than inter-organizational transaction relationships. Specifically, they based their argument on the team production and address the potential measurement problem due to a team member's incentive to shirk. They suggest that internal organizational structures such as management and shareholder
exists in order to manage this shirking problem. On the other hand, Hennart’s application of transaction cost theory to the multinational enterprises and joint ventures do focus on the inter-organizational transaction relationship on the basis of measurement problems arising from exchange partner’s cheating (Hennart, 1982, 1986, 1993).

Despite slightly different emphases among authors, transaction cost theory has had a tremendous impact on management and organization theory (Barney & Ouchi, 1986; Barney & Hesterly, 1996). Most of all, Williamson’s operationalization of transaction cost theory is widely used across different disciplines of the management. Accordingly, a great deal of empirical work has followed Williamson’s framework. While most of this empirical work supports the transaction cost theory, some of the results have not been consistent with it. This empirical work, and some of the contradictory findings, will be discussed below.


The most frequent test of the transaction cost theory has been what is called the ‘make-or-buy’ decision, which has been treated as synonymous to the vertical integration decision. In the past, researcher found supporting evidence for transaction cost theory when transaction-specific investment is involved in the transaction (Barney & Hesterly, 1996). In other words, when there existed high level of transaction-specific investment (or asset specificity), then the transaction
will occur within a single ownership, whether it is greenfield investment or a vertical merger. The results have been found whether the transaction-specific investment is measured in terms of human asset specificity (Armour & Teece, 1980; Masten, Meehan, & Snyder, 1991; Anderson & Schmittelein, 1984), capital intensity (MacDonald, 1985; Caves & Bradburd, 1988), or site specificity (Joskow, 1985; Stuckey, 1983). Studies which particularly focused on vertical merger with regard to the asset specificity also supported transaction cost theory (Spiller, 1985; Weiss, 1992,1994).

However, with regard to uncertainty, the results are mixed and sometimes contradictory to transaction cost theory. While there are some empirical studies which support the assertion that a high level of uncertainty encourages vertical integration (Helfat & Teece, 1987), there are other studies which report mixed or contradictory results to the transaction cost theory (Walker & Weber, 1984, 1987; Harrigan, 1985; Balakrishnan & Wernerfelt, 1986). For example, Walker and Weber (1984, 1987) examined two types of uncertainty - volume and technological uncertainty - in their study of make-or-buy decisions in the automobile component industry. According to their definition, volume uncertainty depends on the assessment of fluctuations in the demand for a component and the confidence placed in estimates of that demand. Technological uncertainty was defined in terms of changes in component specification and design. In both of their studies, the effects of these uncertainties on the vertical integration were mixed. Especially, in both cases, the increase in the technological uncertainty did
not lead to vertical integration. On the contrary, the influence of technological uncertainty was opposite to the transaction cost prediction in one of their studies (Walker & Weber, 1984), i.e., higher technological uncertainty was associated with less vertical integration.

Similarly, Balakrishnan and Wernerfeit (1986) reported that in the presence of technological uncertainty, the vertical integration decision is opposite to the prediction of the transaction cost theory. When there is a strong possibility of technological obsolescence, firms rely on market contracts and retain flexibility rather than vertical integration. On the other hand, Harrigan (1985) found that the strategic business units (SBUs) she studied made fewer products and services in-house and firms were engaged in fewer stages of processing when demand was highly uncertain than they did when demand was more certain.

Although the major logic and predictions of transaction cost theory is intuitively appealing, the lack of empirical support regarding different types of uncertainty - both technological uncertainty and demand uncertainty - indicates that there may be an alternative explanation for empirical results. Also, given the earlier distinction between primary uncertainty and behavioral uncertainty in the previous section (2.1), it is questionable whether the above contradictory (and also supporting) empirical findings of transaction cost theory correctly used right measurement for uncertainty. This issue will be discussed more in the following section along with other critiques of transaction cost theory.
2.3. Critiques of Transaction Cost Theory

Even though the contributions of the transaction cost theory to the management and related areas are tremendous, there also have been some criticisms of this theory. In this study, three major problems with transaction cost theory in predicting vertical integration are identified. The problems to be discussed are:

1) The ambiguous role of uncertainty in determining exchange governance, which has been mentioned in the previous section.

2) The under-emphasized role of capability differences between the exchange partners in governance choice.

3) Excessive emphasis on the negative side of the transaction such as opportunism, asset specificity, and cost.

1) The ambiguous role of uncertainty in governance choice.

As was mentioned earlier, the transaction-cost-based study of the impact of uncertainty on exchange governance has had mixed and contradictory empirical results (e.g., Walker & Weber, 1984, 1987; Harrigan, 1985; Balakrishnan & Wernerfelt, 1986). These contradictory findings were reported for both technological uncertainty (Walker & Weber, 1984; Balakrishnan & Wernerfelt, 1986) and demand uncertainty (Harrigan, 1985). In short, under high levels of technological or demand uncertainty, firms tend to rely on market governance instead of more hierarchical governance.
However, it is questionable whether the empirical studies which tested the influence of uncertainty on governance used correct measurements for Williamson's later definition of uncertainty - i.e., behavioral uncertainty. As was discussed in earlier section, Williamson's later version of transaction cost theory emphasizes 'behavioral uncertainty' rather than 'primary' or 'external environmental' uncertainty. On the other hand, Coase's notion of uncertainty and Williamson's initial notion of uncertainty was primary (or external) uncertainty. Behavioral uncertainty was uncertainty regarding partner's opportunistic behavior. However, technological uncertainty (Walker & Weber, 1984; Balakrishnan & Wernerfelt, 1986) and demand uncertainty (Harrigan, 1985) or volume uncertainty (Walker & Weber, 1984, 1987) do not seem to measure behavioral uncertainty. Rather, it can be presumed that technology and demand related uncertainty measures primary (or external environmental) uncertainty. Similar type of measurement can be found in empirical studies which tested Williamson's theory. For example, Helfat and Teece (1987) measured stock beta as the uncertainty in transaction cost theory and get a supporting results. However, it is not very convincing how stock beta can measure behavioral uncertainty. Rather, it could be a measure of environmental uncertainty. This seems to be an irony given the fact that the authors of these studies claimed to test Williamson's later version of transaction cost theory in their empirical study. Recently, Sutcliffe and Zaheer (1998) recognized that the contradictory empirical findings may be due to different operationalization of uncertainty.
Therefore, in their empirical study, they distinguished three types of uncertainty - primary, behavioral, and competitive uncertainty - and tested their influence on governance choice. The result shows that primary uncertainty was associated with market governance, while behavioral uncertainty was associated with hierarchical governance. This result shows that while the effect of behavioral uncertainty is consistent with Williamson's later version of transaction cost theory, the effect of primary uncertainty was not consistent with Coase's original theory and Williamson's initial version of transaction cost theory.

Although the prediction on behavioral uncertainty was supported, the prediction on primary uncertainty was not, and may need an alternative theoretical explanation. An intuitive explanation for it may be that when primary (or external) uncertainty is high - whether it is technological or demand uncertainty - firms may want to retain strategic flexibility by avoiding costly vertical integration and maintaining market exchange relationship. The explanation of these findings presumes that vertical integration costs more in terms of resource commitment than an outsourcing contract. Especially when there exists a possibility of technological obsolescence, firms may want to avoid investing in a vertically integrated way in a specific technology and production process. Thus, it is reasonable to assume that when a specific business activity involves a high degree of external uncertainty, firms will have incentives to use market forms of governance to manage these activities instead of internalizing them through vertical integration. This type of rationale can be easily understood.
in light of the current business practices which encourages outsourcing for a
lean, nimble or ‘virtual’ organizational structure in a highly uncertain and
competitive environment (Chesbrough & Teece, 1996; Tully, 1993).

These empirical findings and current business practices in outsourcing
suggest that Coasian transaction cost theory may not be adequate in explaining
some of the exchange governance choices under high levels of primary or
external uncertainty. A new theory which can explain the role that strategic
flexibility plays under uncertainty may be needed.

2) The under-emphasized role of capability differences between the exchange
partners

The transaction cost theory based prediction about market contracts and
vertical integration largely ignores the capability differences that may exist
between the two parties in exchange in carrying out specific business activities
(Demsetz, 1988; Kogut & Zander, 1992). A firm may outsource a particular
production activity to a supplier firm not because the transaction cost is low, but
simply because the supplier has better capability and can produce at a lower
cost. Conversely, a firm may decide to vertically integrate an activity not because
the possible transaction cost with a supplier is high but because no other firms
are as capable and qualified as the firm itself in performing an activity. Superior
capability in performing a certain business activity may include production cost
advantage, experience in marketing skills, and so forth.
For example, Demsetz (1988: 146-147) explicitly recognized the importance of production cost differentials when he criticized transaction cost theory:

Firms purchase inputs when they can secure them more cheaply than by producing them. The cost of transacting is one element of the cost of purchasing from others, but only one. There are variety of others, including what we ordinarily call production costs ... The emphasis that has been given to transaction cost (or that has been claimed to be given) dims our view of the full picture by implicitly assuming that all firms can produce goods or services equally well.

As a matter of fact, transaction cost theory does acknowledge that there exist production cost advantage for the supplier in the market contract (Williamson, 1985). However, it assumes that the production cost differences arise primarily due to economies of scale. Williamson (1985) suggested that if the supplier can produce a product by pooling the demand in the market and by using general purpose technology, it will naturally enjoy low production cost due to the economies of scale vis-à-vis in-house production of the buyer. However, if there exists asset specificity problems between the buyer and the seller, the bilateral monopoly situation emerges because of the ‘fundamental transformation’. Since the seller cannot sell to other buyers due to the specificity of its productive assets, the production cost advantage because of economies of scale cannot be achieved. When asset specificity is low, the outside supplier could produce to the needs of wide variety of buyers using the same production technology, thereby achieving economies of scale. Therefore, the problem of
asset specificity is necessary and sufficient condition for vertical integration in transaction cost theory (Williamson, 1985; Riordan and Williamson, 1985).

Therefore, from a transaction cost theory perspective, if a market contract persists between two organizations, it can be interpreted that the market transaction between the two does not pose serious transactional hazards and is probably less costly than internal organization. However, although transaction cost theory may have already taken account of the production cost differences arising from scale economies, it still ignores the production cost differences between a supplier and buyer which is independent of scale economies. Current literature in the strategic management abounds with theoretical arguments and examples of firm-specific resources and capabilities which are heterogeneously distributed among firms and imperfectly mobile across firms (Barney, 1991; Peteraf, 1993; Nelson and Winter, 1982). For example, the resource-based view may explain the sustained capability differentials between the buyer and the supplier by suggesting that the superior resources that a firm controls remain limited in supply (Ricardo, 1966), and inimitable due to causal ambiguity (Reed and DeFillippi, 1990; Lippman and Rumelt, 1982), unique history (David, 1985), social complexity (Barney, 1986a), and etc. Production cost differences may arise from unique firm-specific capabilities rather than from scale economies.

One theory which explicitly considers innate capability differences between firms in predicting whether firm will adopt a market contract or vertically integrate, is the capability based view (Argyres, 1996; Kogut & Zander, 1992,
1993, 1996). Based on the evolutionary economics proposed by Nelson and Winter (1982), Kogut and Zander (1992, 1993, 1996) emphasized internally accumulated knowledge, capabilities and organizational routines as a basis for a firm's expansion and growth. Thus, Kogut and Zander propose that the growth of the firm is built upon the recombining current capabilities and existing knowledge. This notion generates a rather tautological proposition such as "what a firm has done before tends to predict what it can do in the future" (Kogut and Zander, 1992: 383) because this view explains a firm's investment behavior from observing what the firm has done. The extreme internal focus of this view is probably due to the fact that while transaction cost theory focuses on the exchange, evolutionary theory is mainly concerned on the internal production (Winter, 1988).

Applied to the firm's make-or-buy decision, these authors suggest that firms grow by vertical integration (i.e. greenfield investment) because they are capable of performing a particular activity better than anybody else (Kogut and Zander, 1992). However, they also extend their view on the exchange possibility by suggesting that if a more qualified supplier exists, then outsourcing will be chosen. Kogut and Zander (1992), to support this argument, cited empirical tests of the transaction cost theory by Walker and Weber (1984) and Monteverde and Teece (1982). Although evidence that support transaction cost theory was found in both studies, in Walker and Weber (1984), the most important variable to explain make-or-buy decision was differential firm capabilities (measured as
production cost). Also, in Monteverde and Teece (1982) study, the most significant variable was the dummy variable for the firm itself. Additional supporting arguments and empirical evidence indicating the importance of the capability difference in governance choices are suggested by other authors as well (e.g. Demsetz, 1988; Langlois, 1992; Langlois & Robertson, 1989; Argyres, 1996). For example, Argyres (1996) recently examined vertical integration and outsourcing decision in an in-depth case study and found strong support for the capability perspective. Consistent with Kogut and Zander (1992), he found that firms vertically integrated activities for which they possess capabilities that are superior to potential suppliers', and outsourced when suppliers possess superior capabilities. These theoretical arguments and empirical results support the assertion that the consideration of comparative firm capability is an important factor in make-or-buy decisions.

The capability view of outsourcing is also consistent with what has been referred to as the 'virtual organization' or 'modular organization' (Chesbrough & Teece, 1996; Tully, 1993). In order to become lean and retain strategic flexibility in the face of uncertain business environment, firms are outsourcing many business activities while only keeping core strategic activities in which firms have advantages. The fact that firms keep internally the activities that they are most capable of doing and outsource those at which they don't excel suggests that current business practice in highly competitive environments is consistent with the capability-based view. The lack of attention on the innate capability
differences between the exchange partners in transaction cost theory may be a natural result of the theory’s parsimonious emphasis on the specific attributes of a transaction such as asset specificity. However, as empirical research and current business practices suggest, consideration of the capability differentials is a critical factor in explaining and predicting governance choice.

On the other hand, the capability-based view on exchange governance choice also suffers from its weakness. The theory seems to possess an element of tautology because it virtually says that firms do what they can do best and outsource what they are not good at. This line of logic definitely needs some type of specific operationalization in order to avoid being a tautology. Furthermore, although the capability-based view explains and predicts the choice between make-or-buy, it is silent about another important governance alternative, i.e., acquisition. Perhaps one of the most critical weakness of the capability-based view is that it cannot clearly predict the choice between outsourcing and acquisition. For example, when the partner’s capability is superior to the internal capability of the focal firm, the capability based view predicts outsourcing. However, instead of having an outsourcing contract, the focal firm can also acquire the partner firm and can have the same transactional benefit internally. In both cases, the focal firm can take advantage of the partner’s superior capability. However, the capability-based view cannot distinguish under which circumstances outsourcing will be chosen instead of acquisition, and vice versa. Considering the fact that transaction cost theory has been successful in
explaining the choice of vertical mergers and acquisitions over market
transaction (Spiller, 1985; Weiss, 1992, 1994), this is a serious drawback in the
capability-based theory. Therefore, a theory which addresses the innate
capability differentials between exchange partners and at the same time, predicts
mergers and acquisitions over outsourcing decision is needed.

It is expected that the real option view can supplement the capability-
based view and can explain why firms acquire other firms, while paying attention
to the capability differences between the two organizations. A detailed
discussion will be presented in the major theory development in Chapter 4.

3) Excessive emphasis on the negative side of the transaction such as
opportunism, asset specificity, and cost.

Another line of criticism of transaction cost theory centers on the theory's
excessive emphasis on the negative side of a transaction. This type of criticism
can be broadly classified into three types according to their emphasis. The first
type of criticism centers on the assumption of opportunism. Recently, a growing
number of researchers criticized the assumption of opportunism in the market
transaction as overemphasized and unnecessary (Granovetter, 1985;
Donaldson, 1990; Hill, 1990; Ghoshal & Moran, 1996). For example, Donaldson
(1990) argued that the assumption of opportunism is too narrow in modeling
human motivation and carries a negative connotation in our society. Also,
Granovetter (1985) treated the assumption of opportunism as 'undersocialized',

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and suggested that it can be attenuated depending on the social context in which economic transactions are embedded. He has argued that since exchange partners are deeply embedded in social relationships, they are prevented from behaving opportunistically in order not to put their social network relationships in danger. Similarly, Hill (1990) argued that in the long run, the invisible hand of the market deletes actors and punishes those whose behaviors are habitually opportunistic. As an illustration, Hill (1995) stated that Japanese transactors are believed to incur lower transaction cost than U.S. transactors because they have developed an institutional environment which fosters relational trust. In addition, some authors suggest that opportunism can be treated as a variable instead of a fixed attitude among exchange partners (Ghoshal & Moran, 1996). It is possible that the firm may perceive low level of opportunism in a transaction depending on the firm’s philosophy in interorganizational relationship (Lee, 1995), perception (Buckley & Chapman, 1995), risk preference and trust between the partners (Chiles & McMackin, 1996; Ring & Van de Van, 1992), and skills in governing exchanges (Barney & Hansen, 1994). All of these criticisms on the assumption of the opportunism boil down to the fact that the threat of opportunism, and thus transaction cost in the real transaction may not be as high as what Williamson (1975, 1985) had been concerned about. Recently, some authors went beyond criticizing the assumptions of opportunism in the transaction cost theory and made attempts to build a theory of the firm which does not rely on the assumption of opportunism (e.g., Conner & Prahalad, 1996;
Kogut & Zander, 1992, 1993, 1996; Liebeskind, 1996; Grant, 1996). All of the criticisms on opportunism and new attempts to build a theory of the firm without opportunism may imply that a firm's governance choice may depend on factors other than the threat of opportunism.

Second, while a transaction cost theory treats a transaction-specific investment (or asset specificity) as a main source of transaction cost and therefore, something to be avoided, some researchers have pointed out the fact that this can in fact, be a source of sustainable competitive advantage because when the specialized and idiosyncratic investment becomes valuable, it will be rare and costly to imitate by other competitors. This assertion was primarily made by resource-based view scholars such as Conner (1991), Mahoney and Pandian (1992), and Peteraf (1993) because they recognized that much of the source of abnormal firm performance comes from unique and specialized investment. For example, Conner (1991) explicitly stated the resource-based interpretation of specialized investment, and its implication for the resource-based theory of the firm interpretations that are quite different from the transaction cost perspective:

A striking characteristic of much of the resource-based literature is (a) acknowledgment of the importance of asset specificity (and attendant small numbers) but (b) little discussion of avoidance of opportunist potential as the central activity or purpose of the firm. Put differently, instead of viewing the firm as an "avoider of a negative," the resource-based literature tends to see the firm as the "creator of a positive," as creator of unique productive value ... it is argued that the firm has advantage over a collection of market transactions in those situations where redeployment inside the firm is more efficient and, perhaps more important, qualitatively more
productive because of the opportunity to benefit from asset interdependencies within the firm (Conner, 1991: 139-140).

Thus, according to this view, asset specificity can be considered as something that generates economic rents rather than something to be avoided. This view was also supported by an empirical study by Dyer (1996) recently. Dyer reported that there exists a positive relationship between supplier-automaker specialization and performance. In particular, there was a positive correlation between interfirm human asset cospecialization and improvements in both quality and new model cycle time. The fact that transaction specific investment can have positive effect on firm performance may have implications for the firm's governance choices. Again, a new perspective may be needed to accommodate this possibility.

In the third, some authors recently have been aware of the fact that excessive emphasis on the transaction cost unduly obscures the attention to the 'transaction value' (Zajac & Olson, 1993; Madhok, 1997). For example, Zajac and Olson (1993) propose a transactional value framework for analyzing interorganizational strategies that addresses joint value maximization, and the processes by which exchange partners create and claim value. Also, Madhok (1997) related the concept of value to the capability that the organization possess. However, although the concept of the transaction value itself seems new and promising, the task of defining and operationalizing has not been accomplished yet in the literature.
Based on the three criticisms on the transaction cost theory stated above -
1) the ambiguous role of uncertainty, 2) the neglected role of capability
difference between the exchange partners, and 3) excessive emphasis on the
negative side of the transaction such as opportunism, asset specificity, and cost -
the present study proposes a new theory which may substitute for transaction
cost theory in predicting and explaining alliance. It is expected that the real
option view can be extended to explaining governance choices while addressing
all three of the criticism. The next chapter will review how the real option
perspective has been applied in the management literature.
CHAPTER 3

REVIEW OF REAL OPTION THEORY AND APPLICATIONS

3.1. Basic Concepts of Financial Option

Before the introduction of real option theory and its possible applications to the current topic, it is worthwhile to review the original concepts and valuation models of economic options. The concept of economic options and their valuation methods have been well developed in the financial economics literature (e.g., Black & Scholes, 1973; Merton, 1973; Cox, Ross, & Rubinstein, 1979). While the first option pricing model proposed by Black and Scholes has received some criticism (Black, 1989), it is still widely used. Although simplistic in its assumptions, it parsimoniously identifies major variables which have considerable influence on the value of the financial options. The Black-Scholes formula for the pricing of a stock call option is the following:

\footnotesize
\begin{align*}
\text{Value of Call Option} &= P \cdot N(d_1) - EX \cdot e^{-r \cdot t} \cdot N(d_2) \\
\text{where} \\
\quad d_1 &= \frac{\log (P / EX) + r \cdot t + \sigma^2 \cdot t / 2}{\sigma \cdot \sqrt{t}} \\
\quad d_2 &= \frac{\log (P / EX) + r \cdot t - \sigma^2 \cdot t / 2}{\sigma \cdot \sqrt{t}}
\end{align*}
\normalsize
N(d) = cumulative normal probability density function
EX = exercise price of option
P = current price of stock
\sigma^2 = variance per period of rate of return on the stock
t = time to maturity
r = risk-free interest rate

This formula presents a set of important variables which influence the value of a call option. These variables are exercise price of option (EX), current stock price (P), variance of the rate of return on the stock (\sigma^2), time to maturity (t), and risk-free interest rate (r). Each of these variables has either positive or negative influence on the option value.

First, the exercise price (EX) has a negative effect on the value of the option. This is not difficult to understand because the owner of the option gains the difference between the stock price at maturity and the exercise price when the stock price exceeds the exercise price. Therefore, the lower the exercise price, the higher the option value, other things being equal.

Second, the current stock price has a positive correlation with the option value. This is obvious because the owners of call options will hope for the stock price to rise. The higher the stock price, the higher the probability that the option will eventually be exercised. If the stock price is high enough, exercise becomes a virtual certainty.
Third, the variance on the rate of return on the stock has a positive correlation with the value of the option. If the current share price equals the exercise price, the call option written against this stock has 50 percent chance of ending up worthless (if the share price falls) and a 50 percent chance of ending up "in the money" (if the share price rises). It is important to note that the downside risk of the stock price does not affect the option holder because the option holder's pay off is fixed regardless of how much the stock price goes down. All the option holder loses will be the price of option he or she paid initially, no matter how much the stock price falls. When the stock price falls below the exercise price, the option holder will just let the option go unexercised.

Therefore, the downside risk of the stock price decrease is hedged. On the contrary, however, when the stock price exceeds the exercise price, the option holder has a potential for unlimited profit because there is no limit on the stock price increase. Every dollar increase in the stock price above the exercise price will directly translate into the profit for the option holder. The fact that an option holder enjoys unlimited upside profit potential while being hedged against the downside risk implies that call options written on high volatility stocks will be more valuable than those written on low volatility stocks. Holders of call options written on a stock with substantial variance will have a larger chance of a big payoff than those holding a call option written on a stock with low variance. Since the downside risk is hedged for both option holders, only upside potential
determines the option value. As a result, the more volatile the stock price is, the higher the option value.

Fourth, time to maturity (t) has a positive influence on the option value. If there are t remaining periods, and the variance per period is \( \sigma^2 \), the value of the option should depend on cumulative variability \( \sigma^2 t \) (Brealey & Myers, 1984). Thus, given volatility, you would like to hold an option with a long life ahead of it.

Fifth, the interest rate (r) also has a positive influence on the value of the option. If a person owns an option which he or she knows will be exchanged for a share of stock, the person effectively owns the stock now. The only difference is that the option holder does not have to pay for the stock until later, when formal exercise occurs. An investor buying a call option pays the purchase price of the option today, but he or she does not pay the exercise price until they exercise. This delayed payment is particularly valuable if interest rates are high and the option has a long maturity. With an interest rate r and the time to maturity t, then the value of option will depend on the product of r and t. This is another reason why time to maturity (t) has a positive influence on the option value. In short, the value of an option increases with both the rate of interest and the time to maturity.

The above example is perhaps the most simplistic representation of the option valuation. It assumed that the option can only be exercised on the expiration date, which is termed a European option. On the other hand, holders
of American options can exercise the option on or even before the maturity date. Other things being equal, a rational investor would never exercise an American call option before maturity, because doing so would reduce time to maturity and therefore reduce the value of the option. Therefore, the Black-Scholes formula applies to both European and American call options.

However, the valuation gets more complicated when the effect of dividends are taken into account. Since dividend payments diminish the value of future share price, it also reduces the value of the option. In order to incorporate this effect, the net present value of the dividend payment over the option's life should be subtracted from the stock price ($P$) and this adjusted stock price should be included in the Black-Scholes formula.

More complicated valuation models are developed by financial economists to take into account more realistic assumptions. However, these discussions are beyond the scope of the current study. It will be sufficient to introduce here the major concepts of financial options and important variables associated with the valuation of options.

3.2. Theory of Real Options

Interest in real option may have arisen in part as a response to the dissatisfaction of academics and corporate practitioners with traditional net present value techniques for valuing corporate investments. It was Myers (1977)
who first recognized that traditional net present value methods underestimate the actual value of investments, especially when these investments are made in a highly uncertain projects. He observed that organizational resource investments under uncertainty can be analyzed and evaluated with the same framework developed for financial options. Despite the absence of formal option contracts, firm's incremental real resource investments attended by high uncertainty were shown to have a pattern similar to investment in financial options, and since then valuation of resource investments have expanded to this area.

The rationale behind this argument, according to the original insight of Myers (1977), is that a firm's initial resource investment in an uncertain domain of business not only gives the firm the discounted expected cash flows directly, but also confers further valuable “growth opportunities”. The prospect and exact nature of this growth opportunity produced by the initial investment is uncertain, ex ante, and that is exactly why the traditional net present value method completely discarded this growth potential in calculation of the value of the investment. However, once the firm has made an initial investment in an uncertain area, the firm is better positioned to explore the uncertain domain than those who did not make the investment. This implies that the firm that has made an investment is better positioned to assess the nature of uncertainty and capture the inherent growth opportunity than those that did not make this investment. If the uncertainty is resolved and it turns out that there is indeed a favorable growth opportunity in that project, the firm has an option to take.
advantage of the growth opportunity by making further investments. Since the firm that has made an investment is better positioned to evaluate growth potentials than other firms, this is an opportunity exclusive to these firms. This exclusive access to the growth opportunities can be thought of as examples of path dependent phenomena (Arthur, 1983).

Thus, making an initial investment in an uncertain project can be treated the same as buying an option because only the purchaser of the option is entitled to take advantage of the upside potential of the uncertainty, while controlling the downside risk simply by waiting for the future growth opportunity to come. Even in the worst case, the firm’s downside risk can be no longer than to losing the initial resource investment, which can be considered as sunk cost. Finally, making additional resource commitments when the firm recognizes a favorable growth opportunity (i.e., realization of upside potential) can be thought of as paying the exercise price of the option.

This line of logic is strikingly analogous to the financial call option discussed earlier, and was thus termed a "real option" by Myers. Viewed this way, the initial resource investment in an uncertain area can be considered as cost of buying an option, which confers access to the growth opportunity. The firm can wait for the growth opportunity to materialize, thereby realizing the upside potential of an investment by making further resource commitments when the uncertainty is resolved.
However, it is necessary to clearly examine what Myers originally meant by "growth opportunity" since this term can be interpreted quite loosely. In his original paper, Myers tied the notion of "growth opportunity" to the notion of a real asset, and defined what he means by real option using this concept:

What are the essential characteristics of the 'growth opportunity' discussed in the previous section? They flow from the fact that it can be regarded as a call option on a real asset. The option's exercise price is the future investment needed to acquire the asset. Whether the option has any value when itexpires depends on the asset's future value, and also on whether the firm chooses to exercise (Myers, 1977: 155)... Thus it is useful for expositional purposes to think of the firm as composed of two distinct asset types: (1) *real asset*, which have market values independent of the firm's investment strategy, and (2) *real options*, which are opportunities to purchase real assets on possibly favorable terms (163).

The above definition of real options - opportunities to purchase real assets on possibly favorable terms - clearly indicates that the real option is written on the real asset, just as the stock option is written on the underlying stock. It is important to note that the "growth opportunity" thus, is *an opportunity to buy the real asset at favorable terms*. It is also important to note that according to Myers' original insight, the real option has a corresponding specific underlying asset just as the financial option has its underlying security. The purpose of this emphasis will be revisited later.

Given the description of the real option theory so far, the following question can be raised: What types of uncertainty is real option view concerned
about? As was explained in the discussion of transaction cost theory, there exist different types of uncertainty: **primary (or environmental) uncertainty, secondary uncertainty** and behavioral uncertainty. Perhaps, the best way to define the nature of uncertainty being discussed in real option theory is to look at the original notion of uncertainty in financial option model. In the financial option model, the uncertainty was none other than the *volatility of the value of the underlying financial asset*. Therefore, it can be stated that it is the uncertainty in value of underlying asset that is central concern in financial option model. As a matter of fact, the same is true for the notion of uncertainty in real option theory. In real option, a major concern is the *uncertainty in the value of the underlying real asset*. This is clearly different from both behavioral uncertainty and secondary uncertainty. However, it can be expected that the value of underlying real asset is largely dependent on environmental factors. In other words, **primary (or environmental) uncertainty** may have considerable influence on the value of underlying real asset. This can be so because the value of an asset can be largely influenced by the environmental factors. For example, a firm’s valuable asset in producing high quality typewriter became almost obsolete when computer-based word processing technology was introduced. External environmental changes such as changes in technology and demand can severely influence the value of an existing asset. However, it is also true that not all of the environmental uncertainty is relevant to the value of an asset. While breakthroughs in internet communication technology may influence the value of
asset possessed by long distance telephone companies, changes in fashion in Paris may not have much influence. In other words, there exist a subset of external environment that has direct relevance to the value of a specific asset.

In this study, the uncertainty that influence on the value of a specific underlying real asset will be referred to as ‘capability uncertainty’. Again, this is clearly different from behavioral uncertainty defined as Williamson. Rather it has more to do with environmental uncertainty because sudden changes in environment can either increase or decrease the capability (or value) of the real asset. The implication of the capability uncertainty will be the focus of discussion in the next chapter.

It is now clear that the traditional discount cash flow analysis has ignored real option value in analyzing the value of investments made under uncertainty. A more comprehensive way of evaluating the investment is required. As Trigeorgis (1993a) notes, this new method should not only include the traditional static NPV of cash flows, but also consider the value of real options recognized by the management: Thus, the new rule, called expanded NPV, can be expressed in the following (Trigeorgis, 1993a: 203).

\[
\text{Expanded (strategic) NPV} = \text{static (passive) NPV of expected cash flows} + \text{value of options from active management}
\]

Since Myers, increased conceptual discussions on the drawbacks of NPV in making investment decisions and the advantages of a real option approach to
making investments have been published (e.g., Kester, 1984; Myers, 1984; Sharp, 1991; Dixit & Pindyck, 1995). These conceptual discussions of real option valuation not only called for mental shift from the traditional NPV method, but also clarified some of the confusions in the real option theory.

For example, Sharp (1991) correctly pointed out that two types of real option exist in the real option literature - *incremental options* and *flexibility options*. The first type, called incremental options are consistent with what Myers suggested earlier. This type of option provides the firm with “opportunities down the line to undertake profitable incremental investments” (Sharp, 1991: 71). This type of option is best characterized by the following sequential investment behavior. Firms first make a small trial investment in an uncertain project. When the uncertainty is cleared and there is indeed a growth potential, it makes a larger investment and takes advantage of the growth opportunity.

The second type of option, a flexibility option, refers to the flexibility of choosing different courses of action, which is enabled by having made multiple investments previously. Sharp states that:

> Whereas incremental options require additional investment, flexibility options make use of investment already in place. If a project’s cost structure can be changed fairly easily, such as by moving production if costs become expensive, then it contains a valuable flexibility option. A typical example is creating capacity in excess of immediate requirements at a second plant location, which allows managers to source from the alternative location when production is interrupted (Sharp, 1991: 72).
It is clear that these two types of option are conceptually quite different. Whereas the incremental option only requires small initial investments followed by learning and further resource commitment, the flexibility option requires extensive resource commitments from the very beginning, investment which are spread around major possible contingencies. In the flexibility option, exercising is switching a course of action toward one specific contingency. For example, in the study by Kogut and Kulatilaka (1993), the option value of the production flexibility of the multinational corporation under uncertain real exchange rates was examined. Specifically, they considered the value of global manufacturing network under uncertain exchange rates. They suggested that building plants in multiple countries generates flexibility value for the firm by shifting production depending on the changes in the real exchange rate. Shifting the production site to take advantage of favorable exchange rates was taken to be the same as exercising a flexibility option.

In light of the above distinction, it seems clear that Myers' original insight on the real option can be more appropriately classified as the incremental option. Although the flexibility option is an important topic in real option theory and has been studied by various authors (e.g., Kulatilaka & Marks, 1988, Kulatilaka, 1993; Kogut & Kulatilaka, 1993), only the incremental option theory will be adopted and applied in this study. There are two reasons for adopting the incremental option view. First, the application of real option view on the field of strategic management and international business, such as joint ventures (e.g.
Kogut, 1991; Foata & Leiblein, 1994; Chi & McGuire, 1996), minority investment (Hurry, Miller, & Bowman, 1992), and internationalization process (e.g., Chang, 1995) has mostly adopted incremental option view to explain a firm's investment behavior. This is probably because there exists a similarity between incremental real option view and these management processes in terms of their dynamic and sequential resource investments. Second, unlike the incremental real option, flexibility option requires a large initial investment scattered around possible contingent events. The flexibility in flexibility option is obtained by a large investment, whereas the flexibility in incremental option is obtained by making a small initial investment. Although the difference may look subtle, this is a serious difference. It is believed in this study that the incremental real option view is more consistent with the traditional financial option theory because in financial option theory, the option is created by making a small initial investment. Other than the above reasons, it is expected that the incremental real option view will be most suited to explain the phenomena under investigation.

Myers' original insight described above has instigated not only conceptual discussions on real options but encouraged different types of real option valuation and applications. In addition to the above dichotomous classification of option such as incremental vs. flexibility option, other researchers such as Trigeorgis (1993a) classified these emerging real option literature into the following seven categories depending on the type of option discussed. These are growth options, option to defer (or option to wait), option to abandon, option to
alter operating scale (e.g., to expand; to contract; to shut down and restart), time
to build option, option to switch, and finally multiple interacting options.

First, growth option refers to what Myers (1977) has originally suggested
and refers to a case in which an initial investment opens up future growth
opportunities. Discussion of growth option can be found in Myers (1984), Kester
(1984, 1993), and Chung and Charoenwong (1991). Second, the option to defer
resource commitments (or option to wait) was discussed by McDonald and
Siegel (1986), Ingersoll and Ross (1992), and Pindyck (1991). Third, Myers and
Majd (1990) analyzed the option to permanently abandon a project for its
salvage value which can be considered as an American put option. Fourth,
Trigeorgis and Mason (1987) and Pindyck (1988) examine options to alter
operating scale (i.e., expand or contract) or capacity choice. The option to
temporarily shut down and restart operations was analyzed by McDonald and
Siegel (1985). Fifth, time to build option is created when staging investment as a
serious of outlays creates the option to abandon the enterprise in midstream if
new information is unfavorable. Each stage can be viewed as an option on the
value of subsequent stages. This type of option is examined by Majd & Pindyck
(1987), Carr (1988), and Trigeorgis (1993b). Sixth, options to switch (e.g.
flexibility of choices) have been examined by Kulatilaka and Marks (1988),
Kulatilaka (1993), and Kogut and Kulatilaka (1993). As explained previously, this
is what has been called ‘flexibility option’ by Sharp (1991). Seventh, multiple
interacting options are real-life projects which often involve a collection of various
options, both upward-potential enhancing call options and downward-protection put options present in combination (Trigeorgis, 1993b). Their combined option value may interact and differ from the sum of separate option values.

Despite these various types of options, in the strategic management and international business research, the incremental option view has predominately been adopted. These real option applications in the field of strategy and international business will be reviewed below.

3.3. Review of Applications of the Incremental Real Option View in Strategic Management and International Business

Because the real option perspective, especially the incremental option view, is applicable in analyzing a firm’s resource investment behavior in a highly uncertain environments, a growing number of scholars in strategy and international business have recently adopted this view in research areas such as strategic alliances in an uncertain market and international investment strategy (e.g., Kogut, 1991; Bowman & Hurry, 1993; Sanchez, 1993; Folta & Leiblein, 1994; Hurry, Miller, & Bowman, 1992; Hurry, 1993, 1994; Casson, 1994; Chang, 1995; Chi & McGuire, 1996; Rivoli & Salorio, 1996). These researches can be broadly classified into three types.

First, some of these authors have viewed partial investment in strategic alliances such as joint ventures and minority investments as providing a firm a call option (e.g. Kogut, 1991; Chi & McGuire, 1996; Folta & Leiblein, 1994; Hurry,
1993; Hurry, Miller, & Bowman, 1992). According to this view, when the uncertainty surrounding the value of the venture is resolved, the firm exercises the option to acquire the venture and expand into the new market. Second, other researchers viewed wholly-owned foreign direct investment itself as an option to grow in the foreign market (e.g., Casson, 1994; Chang, 1995). Finally, other researchers conceptualized entire firm from the real option perspective (e.g., Bowman & Hurry, 1993; Sanchez, 1993). The real option view was adopted by these researchers not only as a strategy of making incremental and sequential resource investment under uncertainty, but also as a theoretical lens for analyzing the entire corporate resource configuration. These three streams of research will be examined in detail below. As emphasized before, all these researches adopted incremental option view as opposed to the flexibility option view. Although there are some strategy and international business researches who adopt the flexibility option perspective (e.g., Kogut & Kulatilaka, 1994; Sanchez, 1995; Lei, Hitt, & Goldhar, 1996), this stream of work will not be the focus of discussion because the current study intentionally adopts the incremental option view to develop a theory.

As for the first line of research on strategic alliances, Kogut’s (1991) work on joint venture is perhaps the first to adopt the real option view in strategy research. He viewed joint ventures as an option to expand into new product markets characterized by uncertain demand. He suggested that the joint venture gives the high valuing partner a call option to expand into a new market.
Exercising the option to expand is accompanied by the acquisition of the joint venture. He showed that the unexpected market signal that indicates the increase in value of the venture was accompanied by the acquisition of the venture, while the decrease in the value did not lead to dissolution of the venture. He suggested this asymmetrical result as a strong evidence that joint ventures are in fact designed as real options.

Exactly the same view was adopted by Chi and McGuire (1996), only in international environment. They suggested that the international joint venture was created as a real option. When the uncertainty surrounding the international joint venture is cleared and the international joint venture is found to be valuable, it was acquired by the party who had been considering the venture as a call option.

In a much similar context, Folta and Leiblein (1994) examined the real option value of equity joint ventures in biotechnology industry. Since the future technology in the biotechnology industry is highly uncertain, industry incumbents interested in acquiring innovative technology from small firms initially form an equity joint venture with these small firms possessing innovative, but uncertain technology. When the uncertainty is resolved and the technology proves to be valuable in the market place, the incumbent firm exercise the option by acquiring the joint venture.

Also, Hurry (1993) extended the real option view to the international strategic alliance between the Japanese and the U. S. firms. One important
proposition that he made, was that for some Japanese firms, the international strategic alliance was used as a vehicle to expand into the U. S. market. The strategic alliance allowed the Japanese firm to be able to evaluate the uncertainty in the U. S. market. When the uncertainty is cleared, the Japanese firm acquired its U. S. partner.

The real option view was also applied to explain the Japanese firm's minority venture investment in the U. S. companies. Hurry, Miller, and Bowman (1992) noted that the reason why Japanese venture investment in the U.S. was successful is that they followed real option logic in their investment. They report that the U. S. venture capitalists are mainly concerned with the return on investment on the venture consistent with the short-term orientation of the net present method of project valuation. Therefore, when the venture becomes successful, a typical U. S. venture capitalist would dispose of its stock holdings in the venture through the initial public stock offering and earned immediate capital gain. On the other hand, the Japanese venture capitalist took a longer term approach and considered the initial investment in the venture as a first step in learning the value of the technology. The ultimate strategic purpose of Japanese firms were in acquiring the new technology and expanding into the new market created by this technology. Therefore, when there existed a signal that the venture was becoming successful, then the Japanese firms exercised this call option by making even larger investments, still retaining their stock holdings in the venture. These larger investments usually take the form of joint programs for
product development, manufacture and distribution in Japan, and sometimes the acquisition of the venture itself.

The second group of researchers focused on the real option value of the initial wholly-owned foreign direct investment made in an uncertain domain of business. This line of logic is clearly consistent with Myers' original notion of growth opportunity. For example, Casson (1994) viewed wholly-owned investment in a foreign country as providing an option to grow in other foreign countries. He suggested that a wholly-owned FDI in one foreign country provides an option to expand to other foreign countries on the basis of the prior international experience and learning. Therefore, according to this perspective, initial FDI entry to a foreign market provides an option to subsequent entries to various foreign markets by FDI. Similarly, but in a narrower scope, Chang (1995) also considered foreign investment itself as an option and showed that Japanese companies invested first in their core business by FDI in the United States, and then sequentially invested in non-core businesses in the U.S. He suggested that Japanese sequential direct investment can be viewed as the exercise of a series of strategic options. Although the notion of exercising was rather narrow in Chang's case, both of these researches show that there is a real option value in the initial investment made in a highly uncertain domain of business.

In the third type of research, the real option view, especially the incremental option perspective, was conceptualized by some strategy researchers not only as a general organizational strategy of making incremental
and sequential resource investment under uncertainty, but also as a theoretical lens for analyzing the entire corporate resource configuration (e.g., Bowman and Hurry, 1993; Hurry, 1994; Sanchez, 1993, 1994). These authors expanded the real option view to consider the whole firm as a collection of real options. For example, Bowman and Hurry (1993) viewed the firm as a bundle of shadow options and real options. According to their definition, shadow options are options that awaits the recognition of the decision maker of the firm. When shadow options are recognized as possessing future opportunities, they will be activated to become real options. These real options provide further investment opportunities which may be triggered by external signal. When a real option is exercised by a follow-up investment, the resulting configuration of resources will, in turn provide new options for future exercise. Therefore, according to Bowman and Hurry (1993), the firm’s strategy can be considered as sequential strikings of the options. In a similar context, Sanchez (1993, 1994) viewed the objective of firm strategy to “continually identify, develop, arrange to acquire, and coordinate the resources and capabilities that will endow the firm with its most valuable set of strategic options” (Sanchez, 1993: 253).

3.4. Limitations of previous applications of real option view: Lack of attention to the non-equity alliances

These three streams of research applying the incremental real option view in strategy and international business are relatively new, and therefore seem to
have a very promising future down the road. Especially, the first line of research, which examined the real option value in certain types of strategic alliances such as joint ventures, is a very clever application of the real option theory and seems to provide a new insight in understanding the dynamic nature of interorganizational relationships. However, this approach requires more theoretical refinement in its major concepts and has been limited to addressing only equity-based strategic alliances.

Perhaps the only study that considered non-equity strategic alliance from the real option perspective is that of Foltz and Leiblein (1994). However, they emphasized the equity-based alliance over non-equity based alliance as possessing strong real option characteristics, and showed preference for the equity-based alliance such as joint venture instead of non-equity-based alliance such as market contract governance. Their reasoning in favor of equity-based alliance over non-equity based alliance as possessing real option value is as follows. They suggest that in order for an alliance relationship to be analyzed as a real option, the alliance relationship should provide a firm with an exclusive “claim” on future investments on its partner firm. Otherwise, any firms can acquire the partner firm when they recognize great value in it. The opportunity for further investment would be pre-empted by other competitors interested in the target firm if the firm does not have any exclusive claims on the partner firm. They suggested that there exist two such exclusive claims in alliance relationship, which can prevent competitor’s pre-emptive acquisition. The first is
an explicitly stated legal clause outlining the incumbent firm's exclusive acquisition rights to acquire part, or all, of the other firm or the joint venture. This type of explicit contractual right is often found in equity-based joint venture. For example, Folta and Leiblein (1994) note that in a biotechnology joint venture, Rhone-Poulenc Rorer had a stated contractual right to buy a majority stake of Applied Immune Sciences after taking an initial 37% stake in 1993. Similarly, Kogut (1991) reports that in the joint venture agreement between Asea Brown Boverie and Westinghouse, Asea Brown Boverie received the option to buy the venture at some time in the future. These contractual agreements in some of the equity-based joint ventures provide a legal option to acquire the partner firm in the future, and are direct evidences that these equity joint ventures are in fact created as real options for the incumbent firms.

The second claim on the acquisition of the partner firm is the opportunity for the incumbent firm to recognize value of the partner firm before other potential bidders. According to Folta and Leiblein, this claim arises because of private information shared through close interaction of the partners. In other words, the private learning that occurs after the formation of the alliance enables the incumbent firm to have an exclusive access to the acquisition of the partner firm. This is consistent with what Bowman and Hurry (1993) notes as 'preferential access' to exercising after accumulated learning.

Folta and Leiblein (1994) suggested that these two types of claims suggest important differences between equity and non-equity alliances. They
propose that equity-based alliances involve both types of claims, while the non-equity alliances (e.g. contract-based alliances) incorporate only the claim on private information. This is the major reason why Folta and Leiblein (1994) concluded that equity-based alliances such as joint venture have stronger real option characteristics than non-equity alliances. Moreover, they have found empirical support for this assertion. While the characterization of equity alliance as real option was strongly supported empirically, the case for non-equity alliance was less strongly supported. However, there was an exception in their empirical findings. Non-equity alliances were preferred over any other governance mode including equity alliances when the duration of alliance relationship was high, showing strong real option characteristics. As they noted, "longer project duration implies higher uncertainty and increased likelihood of unforeseen contingencies" (Folta & Leiblein, 1994: 28). Unfortunately, Folta and Leiblein (1994) did not provide an adequate answer as to why non-equity alliances bear stronger real option characteristics when longer duration and high level of uncertainty were involved in the exchange.

Based on these observations, the next chapter will develop a theory extending real option view to explain non-hierarchical alliances (i.e., market contract governance-based alliances). Furthermore, this dissertation extends the existing real option view to explain and predict when and why less hierarchical governance such as market governance is chosen over more hierarchical governance such as joint venture, and vice versa. Again, this choice will be
predicted on the basis of the real option perspective. By explaining and predicting the choice between more hierarchical governance such as joint venture vs. non-hierarchical market governance in inter-firm cooperation as well as predicting when the acquisition will occur, this dissertation intends to contribute to building an overall theory of the firm from the real option perspective.

3.5. Real Option View: Summary and Unique Characteristics

Before moving to the next chapter which presents real option-based theory of the firm, it may be necessary to summarize the basic real option investment behavior and some of the unique features of the real option theory. Based on the review of real option theory and its applications, we can summarize and characterize a firm's typical real option-based investment behavior in the following three steps. It is important to note that the following sequential investment behavior corresponds to the incremental option, not the flexibility option. The subsequent theory building will also rely on the following incremental option investment behavior.

(1) **Initial small investment under capability (value)** uncertainty:
A firm makes initial small investment in an project, when the value of the project is uncertain (capability uncertainty). This investment can be considered as the cost of buying a real option and is a sunk cost. Even though the project turns out to be a failure, downside risk can be minimized because only a small amount of money is invested initially. On the other hand, upside potential has no limit.
(ii) Waiting for the uncertainty to be resolved: Learn about the value of the project
After making the foothold investment, the firm waits for the favorable opportunity to come. While waiting, the firm tries to learn about the value of the project and tries to reduce the uncertainty as much as possible.

(iii) Exercising or abandoning the option when uncertainty is cleared
When the uncertainty is resolved, depending on the strategic value of the project, the firm either abandons the option and loses initial investment or exercises the option by making a full investment.

Since most of the previous theory development and application of the real option centers on the concept of uncertainty, it can be suggested that the uncertainty about the value of the project (capability uncertainty), and the resolution of it, are the most important concerns in the real option view. Since the uncertainty can be equally treated as the variance of the return of the underlying asset ($\sigma^2$) in the Black and Scholes financial option pricing model, it can be suggest that in real option theory, the concern for the uncertainty stands out among the five variables considered in the Black - Scholes model. However, this does not mean that other four variables in the B-S model is irrelevant in the real option analysis. As a matter of fact, Folta and Leiblein (1994) have shown that other remaining variables in the B-S model except the exercise price (EX), were significantly relevant to the value of the real option. The influence of the exercise price (EX) on the real option value was excluded because it is difficult to apply the concept of exercise price in the real option analysis. As a matter of fact, this
is only one of the unique characteristics in the real options, which were not found in the financial options. These unique features of real option, which were not considered in the traditional financial options are as follows:

1) There exist no public price for real option

In case of the financial option, people can freely buy the financial option from well-established option market at a fair market price. After buying the financial option, they can also sell the financial option to another party even before the option expiration date. However, in the case of real option, firms do not buy the real option from a market at a fair price. There is no active market for real option. The firm simply creates the real option by making initial investment toward the underlying asset. There may exist competition in establishing a contact and making initial foothold investment towards the underlying asset. However, that does not mean that the focal firm obtains the real option by ‘buying’ the real option from the market at the market price. Nobody charges the focal firm fair market price in obtaining the real option. Therefore, the term ‘buying a real option’ is misleading. Instead of buying the real option from the market, the focal firm simply ‘creates’ the real option by making small initial investment. This implies an important point. Since the focal firm do not buy the real option from the market and simply creates it, the initial payment do not have to correspond to the full market value of the real option. No one will ask the focal firm for a higher price for the real option when the real option seems very
valuable. *This suggest that the focal firm wants to make as small investment as possible regardless of the value of the real option suggested by the five factors in B-S model.*

2) **It is difficult to find the current price of underlying asset (P).**

In financial option, the value of the underlying asset can be easily obtained because there exist active market for the underlying financial instrument as well as the market for financial option. However, in the case of real option, it is difficult to price the exact value of the underlying asset. It can be assumed that this value generally depends on the subjective judgment of the management.

3) **The notion of exercise price (EX) is usually not defined.**

In financial option, the existence of exercise price provides a benchmark as to whether the option holder should exercise the option or not. It also determines the profit margin for the option holder when exercising the option. However, in real option, exercise price do not usually exist except for a few cases. In some joint venture agreement, one of the partners sometimes is given the right to acquire the remaining share of the venture at a *pre-specified price.*

For example, Folla and Miller (1996) note that Sandoz, by taking an initial equity stake of 3.6% in Genetic Therapy and contributing seed money in R&D, gained a right to acquire an additional 32% stake of Genetic Therapy at a *pre-specified*
price. In most of the cases, however, the exercise price of the real option is not explicitly mentioned. When there exist no pre-specified exercise price, there is no guarantee that the focal firm can make an abnormal profit by exercising the real option. In case of acquiring the partner firm, the focal firm may have to pay the fair market price for the partner firm. However, firms may be able to achieve abnormal profits even though there is no pre-specified exercise price. Folta and Miller (1996) pointed out that firms, when making real option investment to a partner firm, also makes other ancillary contracts with the partner firm to secure the profit after exercising the option. For example, these contracts confer the established firm with exclusive rights of marketing and distribution (Pisano, 1989). Such ancillary pre-specified agreements provide a means for the established firm to obtain abnormal return after exercising and therefore provides an similar effect as having a pre-specified exercise price.

4) **Time to maturity (t) do not exist.**

Unlike the financial option, the real option does not have a fixed maturity date (or expiration date), and theoretically, can have infinite lives without exercising. Nevertheless, Bowman and Hurry (1993) and Hurry (1994) discuss the timing of exercising applied in the real option analysis. They suggested that firms exercise real options in response to two types of market strike signals - opportunity arrival signal and expiration signal. Opportunity arrival signals indicate the arrival of favorable opportunity that the firm has been waiting for. For
example, a firm with a joint venture investment in a new market can consider expansion once the venture has succeeded in gaining a favorable product acceptance from the market (e.g. Kogut, 1991). The favorable product acceptance is the opportunity arrival signal in this case, and the firm will take this advantage by investing more into the market.

Another type of signal, expiration signal refers to the imminent closure of the opportunity such as “the threat of preemption by a competitor” (Bowman and Hurry, 1993: 769). For example, Hurry (1993: 75) notes that the Japanese firms which had an alliance relationship with a U. S. partner were alerted by “the presence of a rival bidder for the U. S. firm”, which “threatens a loss of opportunity for the Japanese firm’s expansion in the U. S.”. By illustrating that “Sony and Hitachi struck their takeover options following third-party bids for control of their long-standing U. S. partners”, Hurry (1993: 75) concluded that the recognition of this signal triggered the Japanese firm’s decision to strike its call option. Therefore, unlike the financial option, appearance of these two signals indicate that the real option expiration is impending.

5) Obtaining a real option does not give the real option holder an exclusive right to exercise

In financial option, when a person buys a financial option, only that person can purchase the underlying financial asset at the exercise price when exercising the option. However, a real option holder may not have an exclusive right to
purchase the underlying real asset when exercising. Having an real option does not provide ownership protection on the underlying asset because, as mentioned earlier, the real option is just created by the focal firm, not bought in the market place. If it were bought from the market place, it could also provide a property rights on the underlying asset. However, since the real option were not bought but created by the focal firm, it cannot claim exclusive ownership on the underlying asset over competitors. Competitors can pre-empt exercising any time during the life of an option. Then how can a real option holder secure the access to exercising from its other competitors?

As a matter of fact, Myers (1974) already recognized this problem in his original real option paper. He suggested that in order for a firm to have exclusiveness of the real option exercise, there should be some imperfections in the market for real options. Some of the conditions of the imperfection that he suggested are as follows:

The real option may be firm-specific, having no value to any other firm. This could occur if real options are to some extent embodied in real assets, so that the options cannot be purchased separately. Real option may also be firm-specific if generated by experience curves, learning-by-doing, or other similar phenomena (Myers, 1977: 163, italics added).

From the above statement, it can be inferred that the exclusive access to exercising in the real option arises from the established firm's unique experience or learning-by-doing which accumulates while waiting for the uncertainty to be
resolved. The importance of the accumulated experience or learning-by-doing in securing the access to exercising is also briefly mentioned by Bowman and Hurry (1993). They noted that:

An option confers preferential access to an opportunity for investment choice - in a sense of being better suited for one among several possible courses of action (Bowman & Hurry, 1993: 762).... The organization’s accumulated learning not only provides capabilities that give preferential access to opportunities, but it also influences sense making and the recognition of shadow options (T74).

However, this important role of experience and learning in securing real option exercising has not received much attention in the real option literature yet. More studies on the exact mechanism of securing the real option may be necessary. This issue will be treated with importance and explored in depth in this dissertation in later chapters because it is believed that the incentive to secure the real option has much to do with a firm’s governance decision. Especially, this dissertation intends to contribute to the real option literature by refining the role of learning in securing the exercise. This will be done in the next chapter.

The above five unique characteristics of real option suggest that there are indeed a great deal of differences between financial option and real option. Then, how can a corporate investment behavior be conceptualized as real option and be compared to financial option in the presence of such differences? That is probably because the three steps of investment patterns mentioned above have
metaphorical resemblance with the investment patterns of the financial option, rather than analytical equivalence. Both financial and real option investment patterns emerge primarily in order to cope with the uncertainty surrounding the investment. Thus, it is the overall metaphorical analogy that allows us to view uncertain corporate investment through an option lens, not the exact analytical match with the major characteristics of financial option.

The fact that some of the important characteristics of financial option cannot be found in real option may not pose serious problems in applying real option perspective on a firm's investment behavior. For example, the absence of exact current price of the underlying asset (P) does not invalidate the real option analysis on corporate investment. Although exact price may not be available, firms may have 'gut feelings' about the current value of the underlying asset. It can be suggested that even though the exact characteristics of financial option is not found in firm's investment behavior, when a firm's investment is in fact designed as real option, then it may be possible for us to identify a certain firm behavior that make up for the missing characteristics of financial option. In this sense, these five unique aspects of real option theory provide a rich soil for further theory developments since there will be an interesting firm behavior trying to replicate characteristics of financial option.
CHAPTER 4

REAL OPTION THEORY OF EXCHANGE GOVERNANCE: MARKET CONTRACT AS REAL OPTION

In this section, the existing real option applications on the equity-based governance such as joint ventures will be extended to non-equity-based (or non-hierarchical) governance such as market contract.

The initial step toward this goal is to identify real option characteristics in the non-hierarchical inter-firm governance such as market contract. As mentioned before, previous researches neglected the possibility that market contract between firms can possess real option value. By first identifying the real option value embedded in the non-hierarchical governance, this dissertation proceeds toward building a real option-based theory of the firm. Focusing on the market exchange as the initial unit of analysis will enable this dissertation to follow the transaction cost's approach in building the theory of the firm. However, as it will turn out, although the development of the real option theory of the firm may parallel that of transaction cost theory of the firm, major predictions of these two theories will be quite different.
As emphasized before, the first step towards building real option-based theory of firm is the recognition of the real option value embedded in the market governance. However, not all the market governance may possess real option characteristics. Therefore, it is important to identify what types of market transactions possess real option characteristics. In order to facilitate the discussion, market contract between a buyer firm and a supplier firm will be used as an illustration of the market governance throughout this section. Although this example may focus on the vertical contractual relationship, the argument may also be equally applied to other various contractual relationships such as horizontal and lateral transactions.

One of the central propositions in this study is that when the buyer firm makes a market contract with a supplier who seems to possess strategically important asset but the value (capability) of which is uncertain, the transaction possesses a real option value to the buyer. When this condition holds, the buyer has an option to acquire the supplier when the uncertainty resolves and there is indeed strategic value in the supplier's capability. Therefore, the major characteristic that provide real option value to the market governance is uncertain strategic value (capability) of the real asset. As is emphasized repeatedly, uncertainty confers a real option value in the transaction. And as noted earlier, the uncertainty being discussed in the context of real option is capability uncertainty. Behavioral uncertainty is not the focus of the theory.
Why would a market contract with an exchange partner possessing uncertain strategic capability has a real option value to the incumbent firm (the buyer)? The reason is very simple. When the partner's capability seems to be significant, the incumbent firm has two choices: outsourcing and acquisition. However, when the value of strategic capability that the partner may possess is highly uncertain, then the incumbent firm would probably prefer outsourcing over the outright acquisition. It would be reasonable to assume that under high level of capability uncertainty, firms may want to avoid costly commitment such as outright acquisition and rely on a market contract. Acquiring a firm to take advantage of its superior capability is a costly commitment and may be very risky when the capability in question seems highly uncertain. Regarding this matter, it is useful to remind what Balakrishnan and Wernerfelt (1986), Walker and Weber (1984, 1987) and Harrigan (1985) reported, which were mentioned in Chapter 2. These studies reported that when the environmental uncertainty is high, firms prefer market contract over vertical integration because market contract provides the firm with more flexibility and enable the firm to avoid costly acquisition which may turn out to be quite disastrous to the firm. Porter made similar arguments in his analysis (Porter, 1980). Again, it is quite likely that high environmental uncertainty will be associated with high capability (value) uncertainty. Since the focal firm is not so sure of the capability of the partner, it will first choose a market governance which doesn't require full resource commitment.
However, these researchers overlooked the fact that the environmental uncertainty does not last forever. The uncertainty can be resolved as time goes by. In fact, there is an upside potential that the uncertain nature of the transaction turns out to be favorable - sometimes it can turn out to be strategically important to the buying firm. Would the buying firm still want to maintain old outsourcing transaction relationship when the supplier's capability turns out to have a tremendous strategic importance with a high degree of certainty? Perhaps the focal firm might want to acquire the strategically important partner firm in order to prevent other firms from getting access to it and monopolize the benefit. In conclusion, while the presence of capability uncertainty encourages outsourcing, the resolution of capability uncertainty and the emergence of strategic value encourages acquisition. The acquiring firm can be more confident about the strategic value of the target firm because the previous market contract provided the firm with unique learning opportunity about the strategic value of the supplier.

Put differently, when a firm makes a potentially strategic outsourcing agreement with a capable supplier under the conditions of high uncertainty, not only the buying firm may enjoy the immediate operational benefit and flexibility, but it also has an option to acquire the supplier later when the uncertainty is resolved and the supplier's capability turns out to have high strategic value to the firm. Viewed this way, the market contract can be considered as real option written on the partner's uncertain strategic capability (real asset). The market
contract provides the firm with an exclusive learning opportunity about the nature of the partner's uncertain strategic capability, which in turn confers an option to acquire the partner firm. This is an option because the firm is not obliged to acquire the target firm. It can maintain the transaction relationship and wait for more favorable opportunities to come. Alternatively, it can also abandon the transaction relationship with minimal loss when it turns out that the value of partner's capability is below expectation. Downside risk is irrelevant because the initial cost is sunk and the firm can still wait for more favorable opportunities to come. This line of logic is strikingly similar to the real option investment characteristics identified earlier, and thus the market governance can be viewed from real option perspective when it has uncertain strategic value. Therefore, the following can be proposed as a real option view on market governance: When the uncertainty about the partner's capability is high, firms prefer market governance rather than full hierarchical governance. Full hierarchical governance such as vertical acquisition will occur when the capability uncertainty is low and the partner's strategic value turns out to be significant.

It should be noted, however, that uncertainty can be resolved in two ways. In the above statement, only the case in which the partner's strategic value turns out to be valuable was examined. However, it is equally possible that the uncertainty can be resolved in such a way that the value of real asset turns out to be extremely low. In such a low uncertainty and low value case, the focal firm
probably abandon the real option written on the partner's capability, losing the initial investment.

What would become of the partner firm? It could be easily imagined that a firm with a long history of no capability would not survive long in a highly uncertain and competitive environment. It can be expected that the assets of these firms will eventually be acquired by another firm. In other words, from real option perspective, acquisition will prevail whenever the uncertainty is cleared - whether the value turns out to be great or not. Acquisitions under low uncertainty and low value are also consistent with real option view because the real option view suggests that uncertain real assets will never be acquired. Only those assets that has a sure value - whether it is good or bad - will be acquired under real option view. In general, it can be stated from real option view that real assets with low uncertainty - whether they are valuable or not will have a high probability of being acquired.

As noted earlier, it is important to note that this real option logic not only applies to the vertical cooperative market relationship, but it can also be applied to horizontal and lateral cooperative market alliances.

The real option-based prediction with respect to uncertainty may provide a theoretical answer to the previous conflicting empirical results against transaction cost theory (Walker & Weber, 1994; Balakrishnan & Wernerfelt, 1986; Sudcliffe & Zaheer, 1998), and some of the arguments for market contract in case of high uncertainty (Harrigan, 1985; Porter, 1980). The high environmental uncertainty
may have affected capability uncertainty and in turn, it encouraged market governance, which possesses real option value. The market governance is chosen because the real option value was high. Hierarchical governance under uncertainty, on the other hand, would have killed the option and therefore, there will be no option value in the governance. Therefore, it can be suggested that the governance choice from real option view depends on the value of real option embedded in the governance, not the transaction cost in the governance choice.

This real option view of market contract is quite consistent with the capability-based view in a sense that both perspectives suggest that a firm engages in a market contract when it perceives that the partner firm possess superior capability. As it was noted, according to the capability-based view, firms choose market transaction when the exchange partner seems to be more capable of performing the productive activity than the focal firm (Argyres, 1996; Demsetz, 1988; Kogut & Zander, 1992). The only difference between the capability-based view of market contract and the real option view of market contract is that the latter (the real option view) incorporated the concept of uncertainty in the exchange partner’s. While the capability-based view correctly pointed out that the governance choices can be made on the basis of capability differentials and independent of transaction cost, it was also pointed out in Chapter 2 that this view could not predict when and why vertical acquisition occurs as opposed to outsourcing when the partner’s capability is superior.
However, it was shown that by incorporating the concept of capability uncertainty into the capability-based market contract, the real option view of the market contract could explain and predict when and why acquisitions, as opposed to the outsourcing, occurs. An example will clarify the above conceptual discussion.

For example, consider an automobile manufacturer who contemplates on outsourcing a newly developed component innovated by another firm, which may have a strategic value to the automobile manufacturer. Since the automobile manufacturer does not have the capability to produce the component, it will probably have to outsource the component. The capability-based view of outsourcing will just predict up to this point. However, note that the automobile manufacture is considering a highly uncertain, but possible strategic transaction. When the uncertainty is resolved and it turns out later that the innovative component increases the performance of the automobile substantially and therefore become strategically important, the manufacturer may have an incentive to vertically integrate with the supplier by acquisition to prevent other competitors from having access to it. Thus, the initial market contract can be viewed as a real option because it provides the manufacturer an option to acquire the supplier when the supplier becomes strategically important to the manufacturer.

In conclusion, the real option view of the market contract adds a more dynamic view on the buyer - supplier relationship. It not only explains why market transaction is chosen under high level of uncertainty, but also predicts
subsequent event, the acquisition of the partner firm. However, in order to understand the whole mechanism in more detail, the real option value in the market contract will be examined thoroughly in light of the three major characteristics of real option stated earlier, i.e., 1) initial small investment under uncertainty, 2) waiting for the uncertainty to be resolved and learning the value of real option, 3) abandonment or exercising the option. Since initial investment under uncertainty confers real option value, examining what kind of initial investment occur in the market contract should precede.

4.1. Initial small investment under uncertainty: Transaction Specific Investment (TSI) as a cost of buying a real option.

When a firm lacks internal capability and does not have the ability and time to build the capability in the near future, it may look externally to get access to strategic resources controlled by other firms. When the firm expects that a potential supplier's resources will have a strategic value in the future but perceives it as highly uncertain, instead of acquiring the whole firm outright, it will probably prefer to have a market contract first.

This type of market transaction will be experimental in nature and has option value embedded in it as mentioned earlier. When the uncertainty clears as the transaction begins, and the strategic value of the partner turns out to be high, the firm has an option to acquire the partner, although it is not an obligation. This incremental strategy will be favored under high level of uncertainty because the
firm can avoid the downside of the uncertainty by investing only a small amount initially.

Although other modes such as joint venture is also a possibility, the market contract will probably require the least amount of resource commitments comparing to other governance choices, and thus, least costly mode of exchange. It is evident that the market transaction is much less costly in terms of equity commitment than joint venture or acquisition. However, although there is no cost for buying equity in the case of market transaction, the market transaction do incur initial costs to the buyer and also to the supplier, i.e., the market transaction cost.

First of all, both buyer and supplier may initially incur transaction-specific investment (TSI). This is especially true when the buyer intends to have an outsourcing agreement with an innovative firm because innovative transaction may go beyond a normal transactional requirements and usually needs idiosyncratic resource investments from both sides. In the presence of high TSI, the Williamsonian version of transaction cost theory will never fail to predict high transaction cost. The theory predicts that the transaction cost can be as high as being appropriated the entire transaction specific investment for either of the transacting party (Klein, Crawford, & Alchian, 1978). However, there is a critical difference between the transaction cost theory and the real option view being presented here with regard to the interpretation of the initial transaction cost. For the buyer who considers the market transaction as a real option, the meaning of
TSI and accompanying transaction cost can be interpreted completely differently. If the buyer considers his TSI and accompanying transaction cost as a cost for experimenting the uncertain strategic value of the supplier's capability, TSI can be viewed as cost of buying an option, which is sunk cost. Even though the supplier behaves opportunistically and takes all the possible appropriable quasi-rent from the buyer's investment after the transaction initiates (Klein, Crawford and Alchian, 1978), it will be a sunk cost which can be much less than acquiring the whole supplier and facing the downside risk after the costly acquisition. The fact that TSI is sunk cost is already recognized by Williamson (1985, 1989). Nevertheless, he eventually related it in the context of incomplete contracting and considered it as a major source of transaction cost. However, a major assertion in the real option view of market contract proposed here is that the buyer firm can perceive the transaction specific investment (TSI) and resulting transaction cost as a cost of buying an option. The TSI can be considered as a small amount of investment if the buying firm believes that acquiring the target firm by an outright acquisition poses a high level of uncertainty and significant downside risk.

The real option view of market contract is fundamentally different from the transaction cost view of market contract in the following ways. While the transaction cost theory predicts that a firm will prefer vertical integration in the presence of transaction specific investment (TSI), the real option view of market transaction predicts that market transaction can be maintained even in the
presence of TSI. This is because the real option view assumes that firms approach to market transaction with a spirit of experimentation and learning, instead of suspicion and distrust. There is a huge difference in the attitude in approaching the transaction. The moment a buying firm considers its transaction specific investment (TSI) as a small sunk cost and as a tuition for experimenting with the uncertain strategic value of the partner firm, it will be willing to maintain the transaction relationship with the partner, instead of seeking a protection by vertical integration.

In short, with regard to TSI, the transaction cost theory has ignored a very important aspect in a firm’s governance choice, which were considered in the real option view. First of all, it ignored the real option value embedded in the market transaction, which can be obtained by making TSI. When there is a growth option value in the transaction, a firm may be willing to pay TSI and resulting transaction cost in order to capture greater growth opportunity later. Another important point neglected by the transaction cost theory, which is closely related to the first point is that vertical integration under uncertainty is highly costly and poses a threat of significant downside risk. While vertical integration may eliminate the threat of opportunism and protect the appropriation of the transaction specific investment, \textit{vertical integration itself is a really costly commitment} and can even be a dangerous strategy under a high level of uncertainty. In case of high uncertainty, the downside risk of the vertical integration can be a serious threat to the buying firm. Although the transaction
cost theory do acknowledge that there is a cost in vertical integration, the theory
was mainly concerned with the internal bureaucratic cost (Williamson, 1985; 
Hennart, 1986), rather than the cost of facing downside risk after costly vertical
integration. On the contrary, the real option view explicitly recognize the cost of
downside risk of vertical integration strategy under uncertainty, and advocate
market transaction until the uncertainty clears. It may be generally true that in
many cases, the expected cost of the downside risk of vertical integration under
uncertainty is much greater than the cost of transaction (including TSI). If this
holds, then we can expect that the firm will prefer market contract over the
vertical integration under the conditions of high uncertainty, and can interpret the
initial TSI as a cost of buying an option.

However, not only the buyer firm may perceive TSI as sunk cost and
option premium, it can be possible that the buyer may even go a step further and
arrange a transaction contract with a supplier in such a way that the supplier
feels safe in transacting in the presence of the supplier side TSI. In many
circumstances, the supplier feels vulnerable to the buyer’s opportunistic
behavior. In these cases, the buyer may be willing to take additional cost to
convince the supplier and make the transaction come true when he strongly
believes there is a great opportunity in the transaction with the potential supplier.
Basically the supplier is mainly concerned with two opportunistic behavior of the
buyer (Williamson, 1983). The first is the buyer’s cancellation of the order after
the supplier makes TSI. Second, the buyer may try to reduce the purchase price
after supplier’s TSI is made and expropriate the full amount of quasi-rent (Klein, Crawford, & Alchian, 1972). However, these two contingencies are relatively easy to foresee before the transaction, despite the transaction cost theory’s emphasis on unexpected contingencies (Williamson, 1975, 1985), and can be prevented by corresponding contracts.

The hostage model by Williamson (1983) illustrates how the appropriate contract terms can eliminate the first type of threat to the supplier, the buyer’s cancellation of the order. He shows that in the presence of supplier’s asset specificity, the buyer can facilitate the exchange by agreeing to pay a penalty to the supplier in case of the order cancellation by the buyer in the future. This unilateral “credible commitment” from the buyer may facilitate the transaction, which otherwise would have been difficult due to the threat of buyer’s order cancellation. But why would a buyer want to maintain the transaction by making such a credible commitment? Williamson (1983, 1985) answers that the buyer prefers market transactions because of the high bureaucratic costs and the lack of high-powered incentives in the internal organization. However, by saying so, he implicitly assumed that the buyer firm has similar internal resources and capabilities in carrying out the same activity as the potential supplier has. As suggested in the discussion of the capability-based outsourcing, sometimes firms have to rely on market transaction to have access to other firm’s capability. When the firm wants to try other firm’s strategic capability, market contract is the least risky and at the same time least costly method of testing and obtaining the
benefit of other firm’s strategic resources. We propose that this is why the buyer is eager to make the deal come true by making such a credible commitment. The buyer may simply be interested in seeking outside innovative capability. In this sense, the buyer’s promised penalty in case of order cancelation can be interpreted as paying for an option premium. This option premium, in turn can safeguard the supplier’s investment and will make the transaction possible between the two.

With regard to the second type of transactional hazard, the supplier can be protected from the buyer’s attempts to lower purchase price by making explicit contract against this behavior. This type of arrangements can be found in GM and Fisher Body case (Klein, Crawford, and Alchian, 1978; Klein, 1988). Again, any cost that arises from making this sacrifice can be treated as option cost for the buyer when the buyer believes that there is a great potential in the supplier’s capability.

Until so far, it has been argued that the TSI and the resulting transaction cost may be perceived as trivial by the buyer when the initial transaction possesses a growth option value and the downside risk of vertical integration poses much more significant threat. However, it is also possible that some buyer firms may not recognize the growth opportunity embedded in the transaction and perceive protecting the TSI as a more important task. When the threat of the partner’s opportunistic behavior is the most salient concern for the buyer, and when the amount of TSI and the transaction cost arising out of it is perceived to
be very significant to the buyer, then the buyer may not have the luxury to consider TSI as an option cost. In such cases, TSI and accompanying transaction cost may be considered as a major commitment itself rather than a small initial option investment. In this case, major arguments of the transaction cost theory regarding the TSI will apply. There may be a lot of factors which influence why a specific buyer perceives TSI and accompanying transaction cost as a major commitment to be avoided, instead of as an option cost for learning and experimentation. An immediate response to this question may be the firm's resource availability. For example, when the buyer firm is a big company with a lot of slack resources, it has more capacity to pay for the option premium in experimenting outside innovation. However, when the buyer firm does not have enough resources, it will probably be cautious about making initial investment in the transaction and be concerned with the threat of opportunism.

Nevertheless, the fact that some firms perceive real option value in the market transaction instead of threat of opportunism is a significant departure from the traditional mentality of the transaction cost theory. As a matter of fact, a number of authors have recently emphasized that firms do not always perceive transaction cost uniformly as the transaction cost theory predicts. They have pointed out that some firms may perceive low level of transaction cost depending on the firm's risk preference (Chiles and McMackin, 1996), skills in governing exchanges (Barney and Hansen, 1994), the management's philosophy and strategy the firm has been pursuing (Lee, 1995), and the general perceptual
differences among firms (Buckley and Chapman, 1995). Other authors even criticize the basic assumption of opportunism in the transaction cost theory as unnecessary (Hill, 1990; Donaldson, 1990; Ghoshal and Moran, 1996; Kogut and Zander, 1992, 1993; Granovetter, 1985). Coupled with the buyer's strong motivation to trade and experiment, and additional safeguard provided for the supplier, it can be assumed that the transaction can occur without both parties perceiving significant transactional hazard even in the presence of the asset specificity. Therefore, it is believed that whether a buyer views TSI as a potential source for hazard or as a premium for future value and opportunity depends on such things as the buyer firm's resource availability, the perception and risk preference of the buyer, and the firm's current transactional needs in approaching to a transaction. We can suggest for example, that when the buyer have available resources, perceive the exchange partner as trustworthy, prefer risk-taking, or is in desperate situation to rely on external capability, then it will probably consider an uncertain strategic market contract as having real option value and pay option premium to take advantage of future growth opportunity.

4.2. Resolving the capability uncertainty: Exogenous vs. endogenous learning

The initial small investment not only limit the downside risk for the buyer, but it also provides an important learning opportunity about the value of the uncertain real asset. Many authors have suggested that learning is an important
step bridging initial investment and exercising decision in incremental real option analysis (Bowman and Hurry, 1993; Myers, 1977; Sharp, 1991). Also, authors who applied real option view on the equity-based alliances implicitly recognize the importance of learning in such relationships (Kogut, 1991; Folta and Leiblein, 1994). In addition, it is well recognized that the Japanese investment progresses sequentially from a small, trial investment to the full investment after accumulated learning occurs from the initial investment (Chang, 1995; Hurry, Miller, & Bowman, 1992; Kester, 1991; Bettis, Bradley, & Hamel, 1992). It can be suggested that similar type of learning can occur in a market governance, which provides necessary information for making further strategic choices such as acquisition, waiting, or dissolution of the transaction relationship. When the focal firm learns that the strategic value of the partner firm is great without any uncertainty, it will probably pursue acquisition. On the other hand, when the focal firm learns that there is no strategic value in the partner firm, it will probably dissolve the transaction relationship with the partner. When the firm is still not sure about the strategic value of the partner’s capability after some learning, it can still maintain the transaction relationship and learn more about the nature of the uncertainty.

Since the objective of ‘learning’ is to resolve the ‘capability uncertainty’, it is important to know more about what we mean by the capability uncertainty, and how the capability uncertainty can be resolved by learning. Again, capability uncertainty is the uncertainty in the capability (value) of the underlying real asset.
And it was discussed earlier that the external environmental condition influences the capability (value) of the underlying real asset.

If the capability (value) uncertainty can solely be resolved by emergence of favorable opportunities from the external environment, then all a firm needs to do is just wait for the external opportunity to come. Since the value of underlying asset is determined by environment, there won't be much for a firm to do to clear the uncertainty. Examples of this type includes market demand uncertainty, changes in government policies, unexpected technological innovation, and etc. In these examples, the value of partner's uncertain asset can only be known after a certain external event occurs. Obtaining the value of real asset through these external sources will be called ‘exogenous learning’.

On the other hand, in a certain circumstances, the value of the exchange partner’s underlying asset can be known through sources internal to the exchange. After making an initial small investment, the focal firm will be able to interact with the partner and use the partner’s strategic capability in question. The usage of the partner’s capability throughout the exchange will provide the focal firm a unique opportunity to evaluate the potential of the partner’s capability in the market place. Thus, in this case, the uncertainty in question is not resolved by an objective environmental response such as changes in government regulation, but by private learning (or evaluation) about the partner’s capability. Obtaining the value of real asset through sources internal to the governance will be called ‘endogenous learning’.
it is important to note that the endogenous learning can be obtained by the focal firm's active interaction with the exchange partner, while the exogenous learning can only be obtained as the external event reveals itself. As for the market exchange governance designed as real option, it is possible that both exogenous learning and endogenous learning can occur after initial investment is made. It can be expected that not only the focal firm but also other competitors can have access to the exogenous learning since this information emerges in the public domain. For example, information on a favorable market response or changes in government policy can be easily obtained by other competitors. However, the endogenous learning only occurs to the firm who have been in exchange relationship with the partner firm. It was reported by Nordberg, Campbell, and Verbeke (1996) that market governance can be a vehicle to learn about the exchange partner. This learning can be obtained by examining the output of the market exchange partner or by interacting with the employees from the partner firm, while cooperating with the partner within a market exchange.

An interesting aspect of this process is that the endogenous learning also involves 'learning-by-doing', which increases asset specificity as the interaction continues. The learning-by-doing increases as the transaction between the two parties deepens. In transaction cost theory, the learning-by-doing was an example of asset specificity which increases the possibility of vertical integration. According to the transaction cost theory, when learning-by-doing deepens between the two organizations, the exchange relationship transforms to that of a
'bilateral monopoly' (Williamson, 1985). Since exchange partners will be more likely to engage in opportunistic behaviors in a bilateral monopoly, the theory predicts vertical integration when there exists significant learning-by-doing.

It can be assumed that the learning-by-doing occurs as a part of endogenous learning and plays a different role in the real option view. After the endogenous learning (which involves learning-by-doing), the focal firm may pursue vertical integration when the partner's capability turns out to be valuable. However, when the partner's capability turns out to be unimportant, the focal firm may dissolve the transaction relationship. Or if there is not enough learning, the focal firm may maintain the existing transaction hoping for more learning. Therefore, while the transaction cost theory uniformly predicts vertical integration in the presence of learning-by-doing, real option view on market contract suggests that the focal firm may choose among vertical integration, dissolution or maintaining the transaction, depending on the result of the learning. In real option view, there seems to be more choices other than just vertical integration.

Even when the real option view predicts vertical integration just as the transaction cost theory does, the internal logic leading to vertical integration is quite different from the transaction cost theory. Under the transaction cost theory, the motivation for vertical integration was high transaction cost due to learning-by-doing. Under real option view, the motivation for vertical integration is the identification of high strategic value through learning. Although the prediction is the same, the internal logic that leads to vertical integration is quite different.
While the transaction cost theory emphasizes the cost of transaction due to learning-by-doing, the real option emphasizes the value of transaction after the learning.

Although the discussion so far has important issues that directly challenges to the transaction cost theory, a more contradictory prediction is yet to come. It will be introduced in the next section. Also, a more complete theory that takes into account exogenous and endogenous learning will be presented in Chapter 5.

4.3. Exercising or abandoning the option

Although the learning was distinguished by exogenous and endogenous learning in the previous section, both types of learning can trigger the decision to exercise or abandon the option since both types of learning are aimed at identifying the value of the underlying real asset (i.e., the partner's strategic asset in our case). If the focal firm identifies that there is a strategic value in the partner's asset either by intensive interactions with the partner (endogenous learning) or from external sources such as market demand (exogenous learning), it will exercise the option by acquiring the partner firm. On the other hand, if the focal firm realizes after learning, that the partner firm has no strategic potential, then it will probably dissolve the transaction relationship. In this section, this
decision for exercising and abandoning (dissolution) will be examined. The case 
for exercising will be examined first.

4.3.1. Exercising the real option

Three issue are important in the issue of exercising the real option 
embedded in a market contract. They are: 1) Timing of exercising, 2) securing 
exclusive right to exercise, and 3) the degree of asset specificity (learning-
by-doing) and the need for exercising. These will be discussed sequentially.

First, the timing of exercising in real option embedded in market 
contract needs attention. In fact, this topic was briefly mentioned in an earlier 
section in which unique characteristics of real option were discussed. It was 
pointed out that, unlike a financial option, the real option does not have a fixed 
maturity date (or expiration date), and theoretically, can have infinite lives without 
exercising. Nevertheless, Bowman and Hurry (1993) and Hurry (1994) 
suggested the timing of exercising applied in the real option analysis. They 
suggested that firms exercise real options in response to two types of market 
strike signals - opportunity arrival signal and expiration signal. Opportunity arrival 
signals indicate the arrival of favorable opportunity that the firm has been waiting 
for. Another type of signal, expiration signal refers to the imminent closure of the 
opportunity such as “the threat of preemption by a competitor” (Bowman and 
Hurry, 1993: 769). Therefore, unlike the financial option, appearance of these 
two signals indicate that the real option expiration is impending.

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In this study, it is suggested that the timing of exercising the real option is triggered by the completion of the learning, either endogenous learning or exogenous learning. This is because the strategic value of the partner firm’s asset is known when either types of learning is complete. The focal firm has an incentive to exercise when it learns that there is a strategic value in the partner’s asset. As a matter of fact, the distinction between opportunity arrival signal and expiration signal is both closely related to the endogenous and exogenous learning. Both endogenous and exogenous learning can send an opportunity arrival signal to the focal firm because both learning enable the firm to recognize the strategic value in the partner firm. However, since endogenous learning occurs privately within the close relationship between the exchange partners, endogenous learning will not attract competitors. Thus, it can be expected that only the occurrence of the exogenous learning, which occurs in public domain, will attract competitors. Therefore, only exogenous learning will send expiration signal, while both endogenous and exogenous learning send opportunity arrival signal.

This issue of attracting competitors in exercising naturally leads us to examine the second issue in exercising: Exclusive right to exercise the option. As with the first issue in exercising, this issue has already been mentioned in an earlier section in which unique characteristics of real option were discussed. Again, unlike a financial option, a real option does not provide a real option holder with an exclusive right to claim its ownership on the underlying
real asset, except for a very few cases in which a legal clause confers the focal firm the right to acquire the partner firm at a pre-specified price. This is probably due to the fact that the real option is not bought from the market which provide a private claim on the underlying asset, but instead merely 'created' by the focal firm by making appropriate initial investment. This means that virtually anybody can preempt to acquire the partner firm any time during the life of a real option.

Then, what would enable the focal firm to have exclusive access to the underlying asset when exercising? The answer can be found in the initial small investment that the firm has made. As implied in the earlier chapter, real option investment follows *path dependent* phenomenon. Only the firm which made an initial investment will be able to take advantage of later opportunity. However, in a closer analysis, we can find that the nature of path dependence depends on two types of learning.

First of all, after initial investment, the focal firm develops a routine to handle the transaction. This is none other than learning-by-doing type asset specificity that Williamson has been emphasizing in transaction cost theory. As is well known in the transaction cost theory, the learning-by-doing type asset specificity deepens as the transaction continues. When there is such a learning-by-doing type asset specificity, the focal firm becomes a better candidate than any other competitors in acquiring the partner firm. The rationale behind this is well articulated by transaction cost theorists (Williamson, 1975, 1985). According to transaction cost theory, although there exist a large number of qualified
bidders competing for a contract at the beginning, after the contract is won and the task is carried out by the contract winner for some time, only the original winner of the contract will be most qualified bidder in the contract renewal point since learning-by-doing type asset specificity occurs during the course of the transaction. This is because the “winner of an original contract acquires a cost advantage, say by reason of ... unique location or learning, including the acquisition of undisclosed or proprietary technical and managerial procedures and task specific labor skills” (Williamson, 1971:116). The increased skills in handling the transaction through learning-by-doing will give the focal firm an important advantage in bidding not only for the next contract renewal but also for the purpose of acquisition itself. Therefore, the learning-by-doing provides the focal firm with a preferential access in acquiring the partner firm because it makes the focal firm a favorite choice for the partner firm. In short, the learning-by-doing, in real option analysis, plays an important role of securing the right to exercising the option. Even though a competitor tries to make a similar small investment (which the focal firm has initially made) after the uncertainty is resolved, it is at a significant disadvantage because it has not built up learning-by-doing capability, which is path-dependent in nature. Example of this kind can be found in the real option literature. For example, Bowman and Hurry (1993) shows how Japanese firms, who had developed a long relationship with its U. S. partner, could get a ‘preferential access’ in acquiring its U. S. partner over its competitors.
It is important to note that the learning-by-doing type asset specificity occurs *independent* of learning about the value of real asset. Learning-by-doing type asset specificity is the *increased degree of cospecialization* between two firms (Teece, 1988). It does not have much to do with *learning the value of the underlying asset*, such as endogenous learning and exogenous learning.

However, there is a second way that a focal firm can secure an exclusive access to exercising. Interestingly, this is related to learning, although a different type. As was mentioned just above, learning-by-doing type asset specificity occurs independent of the learning about the value of the underlying asset, whether it is exogenous and endogenous. However, endogenous learning can provide an additional advantage in exercising. It can be expected easily that the exogenous learning cannot be an effective tool against competitors because competitors can also have this information. However, endogenous learning can give the focal firm an exclusive access to the underlying real asset in the following two ways. *First of all*, *since the endogenous learning provides a private information on the strategic value of the partner firm through close interaction*, the focal firm can have a ‘first mover advantage’ *in exercising the real option based on this information*. Competitors may find it difficult to assess the correct strategic value of the partner since they didn’t make the initial investment with the partner, couldn’t have a direct chance to interact with the partner. Therefore, while the focal firm resolves the capability uncertainty by endogenous learning, the other competitors may still face significant uncertainty in valuing the partner.
firm. The fact that the private interactions between the focal firm and its partner provide an advantage in exercising was already recognized by some authors.

For example, Fota and Leiblein (1994) state that:

Options must provide firms with a claim on future investments, otherwise opportunities may be pre-empted by rivals... (A) claim on technology involves the opportunity for the partner to recognize value in the technology before other potential bidders. This claim arises because of private information shared through close interaction of the partners, and perhaps through involvement on the board of directors of the target firm (Fota & Leiblein, 1994: 28).

Although the above authors did not use the term endogenous learning, their description of 'private information shared through close interaction of the partners' closely corresponds to the definition of endogenous learning.

In summary, the initial investment provides the focal firm with two means of securing the right to exercise: 1) an advantage in bidding by way of increased capability through learning-by-doing, 2) endogenous learning about the value of the partner, which gives a first mover advantage in acquiring.

Although transaction cost theory and real option view both predict vertical merger in the presence of learning, the internal logic that leads to vertical integration is quite different. In transaction cost theory, the learning that occurs during transaction is considered negatively because it causes transaction cost to rise by increasing asset specificity. However, in real option view, both learning - learning-by-doing and endogenous learning - is considered positively. Learning-by-doing helps to secure the right to exercise (i.e., vertical merger) by providing
an advantage in bidding by way of increased capability. Also, the endogenous learning helps to secure the right to exercise (i.e., vertical merger) by providing private information about the value of the partner.

As a matter of fact, when firms view the market contract as real option, they will actively seek asset specificity in order to secure the right to exercise by way of becoming a favorite bidder over its competitors, or will actively involve in endogenous learning.

Although the notion that learning-by-doing type asset specificity can secure the right to acquire the underlying asset is itself an interesting proposition which has not been acknowledged previously, there exist a still more interesting prediction to come regarding this issue. This leads us to the third important issue in exercising: **The relation between the degree of asset specificity and the need for exercising.**

It has been just suggested in the above that learning-by-doing type asset specificity gives the focal firm an advantageous position in acquiring the partner firm because the learning provides the focal firm with a transaction-specific capability which is not available to other competitors. It is important to point out that this is when the degree of learning-by-doing was *low* to *medium* degree. When the degree of learning-by-doing type asset specificity becomes *significantly high*, a very different prediction can be made.

When the learning-by-doing type asset specificity occurs to a very *substantial degree*, the focal firm may not need to exercise the option by
acquiring it. This is because the deepened asset specificity through learning-by-doing creates a *perfect bilateral monopoly between the focal firm and its partner*. In such a perfect bilateral monopoly, the focal firm do not have to worry about the competitor's possible preemptive acquisition of the partner because the competitors may be frustrated in acquiring the partner firm. The focal firm can continue the existing market exchange relationship without having to acquire its partner firm even though the strategic value of the partner is highly regarded by the competitors. The learning-by-doing type asset specificity, when it is significant, can effectively block competitor's threat of acquisition. In short, no acquisition will be necessary in such a case. Since the competitors know that they cannot overcome the existing learning-by-doing at any cost, they will not even think about bidding the partner firm. Even though the partner’s asset is extremely valuable, when the asset of the partner firm gets specific to the focal firm to a substantial degree, it’s value will be worthless to the outside competitors. In conclusion, it can be suggested that while low to moderate degree of learning-by-doing type asset specificity gives a preferential access to acquiring the partner firm, high degree of learning-by-doing eliminates competition and at the same time eliminates the need for acquisition. Therefore, market contract can persist even in the presence of high asset specificity.

In the above statement, the prediction that firms maintain existing market transaction in the presence of a high degree of learning-by-doing type asset
specificity directly contracts to the core assertion of the transaction cost theory, which predicts vertical integration in the presence of high asset specificity. Perhaps a major reason for this contradictory prediction lies on the fact that while the transaction cost theory focuses on the threat of partner's opportunism, the real option view is more concerned about the threat of competitor's preemption of the underlying asset.

The real option-based prediction of persisting contractual relationship in the presence of high asset specificity may explain some of the traditional governance relationship between supplier and buyer in Japan. It is well known that the Japanese buyer and supplier relationship is characterized by high human asset specificity, but enjoys flexible market governance relationship. Also, it is well known that much of the competitiveness of Japanese firms comes from the relationship with the highly capable suppliers, who have made a specific investment to the buyer firm (Dyer, 1996). This evidence was puzzling to the transaction cost economics because it predicts vertical integration under high asset specificity. One explanation provided by transaction cost economics for this phenomena was that Japanese firms do not have high transaction cost in market contract because there exists 'trust' between exchange partners.

This evidence can also be puzzling to the real option view that does not take into account the degree of learning-by-doing type asset specificity. The simplistic real option view which does not consider the degree of asset specificity may suggest that vertical integration should occur to protect the strategically
valuable supplier from the preemption of the competitors. However, when we consider the effect of high asset specificity on the need for vertical integration in the real option view, the Japanese evidence can be easily understood. Since the Japanese buyer-seller relationship is highly specific, competitors will be frustrated in acquiring the valuable supplier, and thus there will be no need for vertical integration.

Another factor that removes the need for vertical integration in Japan is the fact that the market for corporate control is not very active in Japan. It is generally known that taking over a firm is not a common practice in Japanese business culture. The lack of potential bidders will enable the buyer to maintain the transaction relationship with the supplier even after the strategic value of the supplier is known to the public. However, Japanese firms show quite different investment behavior in the market exchange relationship with its U.S. partners. Since there exists an active market for corporate control in the U.S., Japanese firms do acquire their U.S. exchange partner when the value of their partners become strategically important. The fact that the Japanese firms followed this type of simplistic real option logic in acquiring their U.S. exchange partners can be illustrated by Kester's (1991) excellent description of Japanese firm's takeover motive for U.S. firms:

For all the differences among these Japanese companies, one finds a considerable degree of conformity in their overseas acquisitions. Not only are their foreign takeovers industrially rather than financially motivated, but they are stimulated to a considerable extent by a perceived need to defend vitally important strategic alliances forged over periods of years. I found that the threat of
disruption to ongoing business relationships, most often because of an impending sale of the American company to some other bidder, triggered action by the Japanese to acquire the company outright. Having made its decision, the Japanese bidder generally moved forcefully and decisively to bring its target under control by offering selling shareholders deals they could not refuse (1991: 113).

The above description clearly indicates that competitor's threat of acquisition triggered Japanese's takeover of its exchange partners. For Japanese firms, the need for acquiring the U.S. exchange partner firm may have arisen due to the two factors. First, the competitor's threat of preemption increased because of the active market for corporate control in the U.S.. Second, the learning-by-doing type asset specificity could have been low or medium because of the long distance relationship between U.S. and Japan. It can be understood that the longer the distance between the two exchange parties and the greater the 'cultural distance' (Kogut and Singh, 1988) is, the less learning-by-doing type asset specificity will occur.

In conclusion, while the traditional transaction cost theory viewed asset specificity such as learning-by-doing as something that increases opportunism and treated negatively, the real option view considers learning-by-doing type asset specificity as an important bonding mechanism with a strategically important asset. The real option view, thus takes a positive view on asset specificity. More importantly, these opposite approaches in analyzing the transaction taken by the two theories end up with a very contradictory prediction on the governance choice under high asset specificity.
4.3.2. Abandoning the option: Dissolution of the transaction.

When the result of either endogenous learning and exogenous learning suggests that the value of real asset is not significant, the focal firm may abandon the real option embedded in the market contract by dissolving the transaction relationship with the partner. The focal firm also have a choice of waiting for more favorable opportunities to come. However, it will eventually choose either exercising or dissolution.

In case the buyer decides to abandon the transaction during the contract period, it may have to pay for the penalty for premature termination of the transaction. As was mentioned before in the hostage model (Williamson, 1983), this type of penalty can be interpreted as a premium for an abandonment option. The fact that some strategic transaction possess the option to abandon and have an a corresponding premium has been in fact, explicitly recognized and articulated by some transaction cost theorists. For example, Crocker and Masten (1988) noted that stipulating the damage in a market contract in case of the buyer’s breach of the contract is the typical example of a “unilateral option”. They stated that:

One way in which parties provide for low-cost adaptation to changing circumstances is by using unilateral options.... Perhaps the simplest and most direct example of unilateral option is the use of stipulated damages to supercede court-determined penalties for breach of contract (1988: 329, italics added).
Although their purpose of the study was not applying real option view to the contract, the usage of the word "unilateral option" clearly indicate that some contracts are designed as options. Both the unilateral credible commitments mentioned in the Williamson’s hostage model and the stipulated damage as an unilateral option are based on what is called "private orderings" in the legal literature (Williamson, 1983, 1985). As opposed to the court ordering, some of these private orderings such as the use of stipulated damage will enable the buyer firm to breach the contract rather easily. When the environment turns out to be unfavorable, the buyer firm can adapt to it rather easily by resorting to the private orderings. It can be suggest that private orderings of this kind gives a party an option to abandon the transaction without incurring legal costs.
CHAPTER 5
THE CHOICE BETWEEN MARKET-BASED AND EQUITY-BASED ALLIANCE
GOVERNANCE AS INITIAL REAL OPTION INVESTMENT

In the previous chapter, it was proposed that market governance can be created as a real option. When a firm creates a market contract with real option purpose in mind, we could explain and predict the firm’s subsequent investment behavior based on the characteristics of real option. Therefore, it was suggested that when a focal firm forms a market contract with an exchange partner that possesses potentially important strategic asset, that market contract can be regarded as a real option which is written on the partner’s asset - the underlying real asset.

However, as was reviewed in the earlier chapter, some researchers have already been arguing that more hierarchical exchange governance such as joint venture (Kogut, 1991; Chi & McGuire, 1996; Folta & Leiblein, 1994) and minority equity investment (Hurry, Miller, & Bowman) can also be regarded as real option. They suggest that when a focal firm forms an equity-based alliance with an exchange partner that possesses potentially important strategic asset, that alliance can be regarded as a real option. Since this real option view of equity-
based alliance also treats the partner firm’s asset as the underlying real asset as
the real option view of market contract does, a question regarding the choice
between market contract-based alliance vs. equity-based alliance in creating real
option aimed at acquiring the partner firm’s asset needs to be answered. If a
focal firm wants to have a trial usage of partner’s capability with an implicit
intention of acquisition, which should it choose between market governance and
equity-based alliance? Since it was argued that both market contract and joint
venture can be viewed as real option, both of which has partner firm’s asset as
the same underlying real asset, it is necessary to identify some rationale behind
the choice between the two in order to make the real option view on exchange
governance complete.

Among the many differences between market contract and equity-based
governance, what are the most important differences that has relevance on the
real option theory of exchange governance? In this chapter, two important
differences between market governance and equity-based governance will be
identified and discussed. First, these two governance forms differ in their ability
in obtaining learning about the value of the underlying real asset. Second, they
also differ in their ability to secure the right to exercise the option. Generally
speaking, it can be proposed that the exchange governance, when designed as
real option, is used as a mechanism to obtain necessary learning about the
value of the underlying real asset, and also as a mechanism for securing the
right to exercise the real option. Market governance and more hierarchical
governance such as joint venture differs in these two dimensions. These two dimensions that determine appropriate initial cooperative mode will be examined sequentially.

5.1. Learning: Exogenous vs. endogenous

It was discussed in the previous chapter that two types of learning exist in the real option analysis: Exogenous learning and endogenous learning. *Exogenous learning* was defined here as the learning about the value of the underlying real asset through sources external to the exchange. This may include the learning about the market response, changes in government policy, and etc. Most of the external learning is beyond the control of focal firm and can only be learned after an outside event occurs. Also, since this information is in the public domain, this type of learning is available to many other firms. On the other hand, *endogenous learning* was defined as the learning about the value of the underlying asset through sources internal to the exchange. For example, endogenous learning can be obtained through a close interaction with an exchange partner who controls the underlying real asset. Due to the private nature of endogenous learning, the information on the value of the underlying asset in the partner firm is not available to other competitors. It was also suggested that both endogenous learning and exogenous learning can trigger exercising decision.
In the literature on inter-organizational cooperation, it is a ‘received wisdom’ that more hierarchical governance between firms can facilitate tacit knowledge transfer between two firms better than non-hierarchical governance such as market contract (Mowery, Oxley, & Silverman, 1996; Kogut, 1988; Conner and Prahalad, 1996). For example, Kogut (1988) argues that equity-based alliances are more effective vehicles for the transfer of tacit knowledge between the partners than contract-based alliances. This is because the very knowledge that is being transferred is organizationally embedded (Kogut, 1988). Recently, this hypothesis was supported by an empirical study by Mowery, Oxley, and Silverman (1996).

Based on the received wisdom in the alliance literature described above, it can be expected that more hierarchical governance such as joint venture can also facilitate endogenous learning. One can argue that transferring tacit knowledge is different from the endogenous learning because endogenous learning was defined as the learning about the value of the partner’s capability through sources internal to the exchange. However, although transferring tacit knowledge and learning about the value of tacit knowledge may be conceptually different phenomena, we can expect that as more tacit knowledge is transferred to the focal firm, the focal firm may be better able to judge the value of that tacit knowledge. Therefore, it can be propose that endogenous learning can also be facilitated by more hierarchical governance (i.e., equity-based alliance).
On the other hand, it can be expected that market governance will have less capability in facilitating the endogenous learning because it does not involve any equity investment in the interfirm cooperation. That does not mean that the focal firm can have no endogenous learning at all through market governance. For example, Nordberg, Campbell, and Verbeke (1996) showed that market contract relationship can provide an exchange partner similar endogenous type learning opportunity. However, it can be generally expected that the level of learning in market governance is much less than when the governance involves more hierarchical characteristics. One advantage of the market contract though, is the fact that it is less costly than more hierarchical governance. Market contract does not require either costly equity purchase or significant resource investment as in the case of new joint venture formation.

The discussion so far has an important implication on the selection of initial cooperative governance form with a partner. Again, since the object of the focal firm is to have a trial use of partner's capability without fully acquiring the partner firm, only market governance and partial equity investment such as joint venture and minority equity investment should be considered. The logic developed above suggest that when the learning is endogenous, a firm will prefer to choose more hierarchical interfirm governance such as joint venture or minority equity investment. On the other hand, when the learning is exogenous, a firm will prefer to choose market governance. Since the exogenous learning is
beyond the control of the focal firm, the focal firm choose market contract which is the cheapest mode of interfirm governance.

Therefore, when a focal firm intends to cooperate with a partner whose uncertain strategic value can be identifiable through intensive interaction, then we can expect that the focal firm will choose joint venture. However, sometimes the value of the partner's asset ultimately depends on the favorable signal from external environment. There are a number of situations when the strategic value of the exchange partner's technology can only be known in the actual usage in the market place. In such cases, the focal firm may prefer market contract. Therefore, the following statement can summarize the effect of learning in choosing the initial interfim governance in real option analysis: When the learning is endogenous, more hierarchical governance such as joint venture or equity investment (equity-based alliance) will be preferred to market contract in the real option-induced alliance. However, when the learning is exogenous, market contract will be preferred to more hierarchical governance in the real option-induced alliance.

5.2. Securing the right to exercise: Level of competitive threat as a major factor in securing the property right

Another important factor that influences the choice between market governance and hierarchical governance is the capability of a governance to secure the right to exercise the real option. As pointed out in chapter three
(section 3.5), one important characteristic of real option is the absence of exclusive access to the underlying real asset. Virtually any firm can preempt in acquiring the exchange partner.

However, governance can serve as an effective tool for securing the option exercise. Especially, it is not difficult to imagine that more hierarchical governance will provide more security in exercising the real option. Most of all, the fact that the focal firm has already made some equity commitment to the partner firm and as a result, have some hierarchical influence will send a symbolic signal to the potential competitors that the target firm is not easy to acquire. Besides this symbolic signal, investing equity also plays a substantive role in blocking the competitor’s threat. This is because the equity investment will increase the intensity of interaction between two firms and will eventually increase asset specificity. As noted earlier, a certain degree of asset specificity provides an advantage in acquisition when there are many competitors interested in acquiring the partner. When the degree of asset specificity is high, competitors will be frustrated from the beginning and will not be interested at all. Also, by having an equity investment and gaining more hierarchical control, a firm can have more influence over the partner firm’s major decisions such as merger and acquisition. This type of control can directly prevent other competitor’s acquisition attempts when such events occur.

In both cases, more hierarchical governance secures the underlying real asset. After all, it is not difficult to imagine that more hierarchical governance with
the partner firm will keep the underlying real asset more securely than non-
hierarchical governance. In this sense, the real option-based motivation to
secure valuable assets within the umbrella of hierarchy is quite consistent with
the property right view of the firm (Grossman & Hart, 1986), which views the firm
as a collection of assets (Moore, 1992), rather than ‘nexus of contract’. In their
seminal work, Grossman and Hart (1986) defined integration of firms in terms of
the ownership of assets. In order to prove their main argument that transferring
ownership from one firm to another brings costs as well as benefits, they viewed
integration as ownership of assets and in turn, defined the ownership as having
residual rights of control over these assets. Even though these definition were
significant departures from the major concepts of the transaction cost theory,
subsequent studies in this line of research eventually focused on the incentive
problems of the employees in the firm (Hart & Moore, 1990; Moore, 1992).

Nevertheless, the property rights view shares with real option view an important
insight that integration is viewed as transferring ownership of assets and the
ownership in turn, confers residual rights of control over the firm’s assets,
preventing other firm’s usage of those assets. This view is quite different from
the transaction cost theory’s interpretation of integration, which views that
integration occurs to change incentives of the transacting parties.

Since the property rights argument is concerned about the competitor’s
preemptive moves, the incentive to choose more hierarchical governance will go
up as the competitor’s preemptive threat increases. **As a result, it can be**
proposed that as the competitor's threat increases, firms may prefer more hierarchical governance over market contractual governance. On the other hand, when the competitive threat is low, firms will maintain market contractual governance because, again, market governance is cheaper mode of governance than more hierarchical governance.

5.3. Considering both factors: Learning and property rights.

The above two factors which influences the initial governance choice in creating real option are equally important and, thus can be considered simultaneously. The simultaneous consideration is depicted in the two by two table shown in the next page in Figure 5.1.

In Figure 5.1, cell 2 and 3 is where the two factors predict the same governance mode. In cell 2, both exogenous learning and low competitive threat favors contractual governance. Also in cell 3, both endogenous learning and high competitive threat favors more hierarchical alliances such as joint venture and equity investment. Therefore, we can expect that in these two cells, the prediction of the governance choice will be relatively strong, thus marked with asterisks. However, in cell 1 and 4, the influences of these two factors are mixed.

Until so far, the two initial governance choices, one representing non-hierarchical interfirm governance, the other representing a more hierarchical
## Learning: Endogenous vs. Exogenous

<table>
<thead>
<tr>
<th>Property Rights: High vs. Low Competition</th>
<th>Endogenous Learning (prefer more hierarchy)</th>
<th>Exogenous Learning (prefer market contract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Competitive Threat (prefer market)</td>
<td>(1) Mixed form</td>
<td>(2) Contractual Agreement *</td>
</tr>
<tr>
<td>High Competitive Threat (prefer more hierarchy)</td>
<td>(3) More Hierarchical Governance * (JV or minority investment)</td>
<td>(4) Mixed form</td>
</tr>
</tbody>
</table>

Figure 5.1: Consideration of learning and property rights in governance choice
interfirm governance has been considered. Again, it is important to note that investments in these two interfirm governance can be considered as the costs of obtaining real option, with an implicit purpose of acquiring the partner firm. Both governance choices are made in order to prevent the risk inherent in the full hierarchical control. Full hierarchical control over the exchange partner is considered as exercising to both of these two real options because these two options share the same underlying real asset, i.e., the partner firm.

By predicting when and why market contract-based vs. more hierarchy-based alliance are formed as well as when the full acquisition will occur from the real option view, this study have presented a theory which parallels the transaction cost theory. The fundamental idea behind this real option view on interfirm governance was that any interfirm governance choice involves some type of initial investment, and that, coupled with uncertainty surrounding the value of underlying real asset (the partner firm), this initial investment in governance creates real option to the investing firm. Two typical interfirm governance, market contract and equity-based alliance, were distinguished with respect to their capacity for learning and the capacity for securing property rights. As discussed in this section, identification of these two factors in the real option-induced interfirm governance is also an important feature of the theory. Based on these two factors, we can suggest that while initial small investment towards an uncertain exchange partner creates real option to the investing firm, the interfirm governance mode using this small investment is chosen as a tool for
obtaining learning and securing property right. Although it is the initial small investment under uncertainty that creates real option value, it is the consideration of learning and securing property rights that influences the specific choice of interfirm governance mode.

The theory developed so far can generate a set of propositions and testable hypotheses. These will be presented next chapter along with methodological considerations.
CHAPTER 6
HYPOTHESIS, RESEARCH METHODOLOGY,
AND STATISTICAL RESULTS

The theory development so far can be concisely summarized by a set of propositions and hypothesis about governance choices. The propositions and testable hypothesis that will be presented in this chapter can be broadly divided into two parts.

The first part summarizes the major assertions made in Chapter 4, which viewed market governance from a real option perspective. This part will examine if contract governance are indeed designed as real option under high level of uncertainty. Simply put, the first part tests whether market contract can be chosen under a high level of uncertainty. Accordingly, it will also be tested whether hierarchical governance such as acquisition can be chosen under low level of uncertainty.

The second part deals with the arguments made in chapter 5, which predicts the choice between market governance and joint venture. Again, since both market-based alliance and equity-based alliance can be designed as real
option, it is necessary to understand under which circumstances each of the
governance mode is chosen. It will be examined whether learning and property
rights arguments can distinguish between the two.

U. S. biotechnology industry was chosen for the empirical study.

Biotechnology industry seems appropriate for this study because of the
existence of high uncertainty and extensive alliance network.

6.1. Propositions and Hypothesis

6.1.1. Market governance vs. Hierarchical governance (Acquisition)

In chapter 4, the real option view was applied to the market governance. It
was first pointed out that uncertainty being discussed in real option theory is
about 'capability uncertainty'. Under this definition, it was suggested that high
uncertainty about the value of underlying capability of the partner firm
encourages forming market contract, while low uncertainty about the value of
underlying capability encourages hierarchical governance such as acquisition. It
was further argued that both types of low capability uncertainty - high and low
value of real asset - can lead to acquisition. Behind these governance
predictions lies one central logic of real option: Under high uncertainty,
governance choice between market vs. hierarchy depends on the real option
value for these two alternatives. This discussion leads to the following general
proposition.
**PROPOSITION 1**

Capability uncertainty will have a separate influence on a firm’s governance choice from behavioral uncertainty. Under high capability uncertainty, governance choice can be made on the basis of real option value embedded in the governance.

From proposition 1, we will be able to test a specific hypothesis predicting a firm’s choice between market vs. hierarchy (or acquisition) regarding capability uncertainty. Target firm’s capability can be measured by the number of patents received in the past three years. Therefore, it can be expected that depending on the number of patents received, target firm’s capability uncertainty can either be decreased or increased.

**Hypothesis 1.1**

When the uncertainty surrounding partner’s capability is high (i.e., high capability uncertainty), firms will prefer market governance rather than full hierarchical ownership of the partner. However, when the uncertainty about the partner’s capability is low, governance that involves larger investment will be chosen and real asset (capability) will be traded outright by acquisition.
In contrast to the capability uncertainty, we can also test for the behavioral uncertainty to see whether transaction cost prediction is empirically supported in our study. As stated before, some of authors who tested transaction cost theory in the past with regard to uncertainty, actually tested the relationship between environmental uncertainty and governance choice (e.g., Walker & Weber, 1984, 1987; Balakrishnan & Wernerfelt, 1986; Helfat & Teece, 1987). However, the environmental uncertainty such as demand and technology uncertainty should rather be classified as capability uncertainty than behavioral uncertainty because uncertain changes in demand and technology have significant influences on the value of the capability of the firm. In order to test Williamson’s transaction cost theory (Williamson, 1985) correctly, the relationship between behavioral uncertainty and governance choice should be examined. Therefore, the following hypothesis is suggested to test the transaction cost theory in choosing between market governance and acquisition.

**Hypothesis 1.2**

When the partner’s behavioral uncertainty seems to be high, then a firm will prefer hierarchical governance (acquisition) to market governance. On the other hand, when the partner’s behavioral uncertainty seems to be low, then a firm can choose market governance.
In addition to the above consideration, the target firm's experience of operation, or age, is considered. It is believed that the age of the target firm not only serve as a control variable, it can represent either the target firm's accumulated capability or its behavioral tendency. First of all, we can expect that a target firm with very short history of operation may not have accumulated much capability than those firms with long history. Accordingly, the focal firm will perceive higher capability uncertainty when considering alliance with a newly established firm, and will choose market governance. The opposite can be predicted for the alliance with experienced target firm. While capability uncertainty in hypothesis 1.1 will be measured by the estimates of the target firm's current capability (see the measurement section of this chapter), the age of the target firm will measure its accumulated capability.

However, the age of the target firm also measures the partner firm's experience in governance. According to Barney and Hansen (1994), if a firm develops skills in governance through experience, it can avoid having a costly inter-firm governance. In other words, it can manage problems of opportunism effectively even with less hierarchical governance. According to this view, experienced firms will perceive low behavioral uncertainty and can maintain market governance. Inexperienced firms will be more sensitive to opportunism and require more hierarchical governance. Interestingly, the prediction is opposite to the accumulated capability view of experience. Thus, these two were presented as alternative hypothesis.
Hypothesis 1.3a (Capability uncertainty)

If the target firm's history of operation is short before an alliance decision is made (high capability uncertainty), market governance will be likely. If the history is long, then hierarchical governance will be more likely.

Hypothesis 1.3b (Behavioral uncertainty)

If the target firm's history of operation is short before an alliance decision is made (high behavioral uncertainty), hierarchical governance is likely. If the history is long, then market governance will be likely.

6.1.2. Market governance vs. Partial equity-based governance

Extending the real option view, chapter 5 focused on predicting the choice between market-based governance vs. equity-based governance when both of them could be designed as real options. The theory developed in chapter five suggest that two important factors, i.e., type of learning and concern for the property rights determine the choice between market governance and joint venture. As for the learning, it was pointed out that different governance modes have different capacity for learning. Equity-based governance was expected to
provide more endogenous learning, while market governance was cheaper for exogenous learning. In general, the following can be proposed.

**PROPOSITION 2**

*Types of learning* needed to know the value of underlying asset and the concern for *property rights* on the underlying real asset influence the initial choice of interfirm governance in designing real option.

Based on this proposition, different types of learning - endogenous vs. exogenous - was first considered in the following hypothesis.

**Hypothesis 2.1**

When the learning is endogenous, equity-based alliance will be preferred to market contract-based alliance as real option. However, when the learning is exogenous, market contract will be preferred to equity-based alliance as real option.

The second factor considered was the concern for the property rights on the underlying real asset. The concern for property rights stems from the fact that, unlike financial option, real option do not provide legally exclusive access to the underlying real asset for the real option holder. It was discussed that
choosing more hierarchical governance as an initial real option will provide better protection of the underlying real asset in the two ways. First, more hierarchical governance involves more asset specificity, which frustrates competitor's acquisition attempts. Second, by having more hierarchical control, the firm can have more influence on the partner's strategic decision such as merger and acquisition. Based on this logic, the following hypothesis is suggested. A firm will perceive more threats in the property rights on the underlying real asset when there exists a large number of competitors. Therefore, the following can be suggested.

**Hypothesis 2.2**

When the threat of competitor's preemptive acquisition of underlying real asset is high, a firm will choose more hierarchical (equity-based) alliance as real option to secure the underlying real asset. When the threat is low, a firm may choose market governance as real option.

Finally, we might expect some type of interaction between learning and property rights. Specifically, we can hypothesize that the effect of competition may differ for the different types of learning. For example, when there exists high levels of competition, the focal firm might have more incentive to learn the value
of the real asset through more hierarchical governance. Therefore, a hypothesis regarding the interaction effect is suggested.

**Hypothesis 2.3**

There will be an interaction effect between types of learning and concern for the property rights.

Also, it will be interesting to examine whether transaction cost theory is influential in determining the choice between the market governance and equity-based governance. Therefore, the last hypothesis will test whether behavioral uncertainty will affect the governance choice.

**Hypothesis 2.4**

If the behavioral uncertainty is high, then equity-based alliance will be chosen. If the behavioral uncertainty is low, then market governance will be chosen.

6.2. Data and Measurement

6.2.1. Data

For the empirical investigation of the above propositions and hypothesis, U.S. biotechnology industry was selected. In general, biotech industry is
characterized by high uncertainty and extensive inter-firm alliance network (Dodgson, 1991; Powell & Brantley, 1992; Liebeskind, Oliver, Zucker, & Brewer, 1996). For example, Powell and Brantley (1992) describe biotech industry as characterized by "competence-destroying" innovations. Lacking an understanding of the new biotechnological innovation, established firms keep in touch with the latest technology by way of long-term contracts or by forming equity-based alliances (Arora & Gambardella, 1990; Pisano, 1990).

For the study, strategic alliance sample was drawn from the Institute for Biotechnology Information Actions Database, which includes information regarding over 4,000 external transactions in the biotechnology industry from 1978 to November, 1997. The sample for this study will only include alliances formed between two U.S. companies in the past ten years (1987 - 1997). The database contains detailed information about most of the strategic alliances (such as contract-based alliance, joint ventures and minority equity investment) and mergers & acquisitions occurred during that period. In each of the transactions, a focal firm and a target firm was identified by the description of the transaction. In most of the cases, the target firms were usually small innovative biotech firms, consistent with the real option theory of alliance. However, there were some alliances formed between two large biotech companies. Often, the purpose of the alliance between the two large companies is to have a mere access to the target firm's well-known and proven capability, rather than to regard the alliance as real option and explore the partner's uncertain capability.
Since this type of alliance does not fit within real option view of alliance, alliances that targets a large partner were deleted from the sample. Only alliances that involves small target firm were selected in the sample. One advantage resulting from this process is the control for firm size in the sample, since there will only be small firms. A decision of whether a firm is considered small or large is made consistent with the classification of the database. The database considers a firm large when it has diversified operations within biotechnology industry. However, no further information was available how many diversified operations are considered large. A disadvantage of this sample is that public information on these small, privately held firms were difficult to obtain. A diverse sources were utilized to obtain correct data for these firms.

After this adjustment, the following adjustments were made. First of all, alliances involving foreign companies, non-profit organizations are deleted from the sample whether they are target firms or not. Only profit-seeking biotechnology firms in the U.S. are included. Second, alliances that involves more than two partners are deleted. Although future research might expand real option view to explain the dynamics of alliance that involves multiple parties, the current study will focus only on alliances formed by two parties. Finally, some corrections were made regarding the classification of alliance types in the sample. This was done by examining the content of each transactions in the sample. Also, some of the transactions that were double counted were counted as one.
Two sets of data were generated to test our hypothesis. One set contains only market contract-based alliance and acquisitions. This set was used to test how different types of uncertainty influence the choice between market contract-based alliance and acquisition. The sample size is 478 in this data set. The other set contains only market contract-based alliances and partially hierarchical alliances such as joint ventures and minority equity investments. This data set was used to test whether concerns for learning and property rights influence the choice between market governance and more hierarchical governance. The sample size is 832 in this data set.

To measure independent variables in the hypothesis, the following additional data sources were used: Biotechnology guide U.S.A. (1995), National biotech register (1994), Medical & healthcare marketplace guide, The Dun & Bradstreet reference book of American business (1997), Ward’s business directory of U.S. private and public companies (1998), CorpTech directory of technology companies (1997), and CD-ROM version of patent information from U.S. patent office. Again, since most of the target firms are small firms, a great deal of effort was made to gather information from these diverse sources.

6.2.2. Measurement

Independent variables in the hypotheses are measured as follows. For hypothesis 1.1, capability uncertainty was measured by the number of patents received within three years by the target firm before a specific alliance
governance decision was made. It is believed that the current technological capability of the target firm can be inferred from the number of patents it has received recently. For example, if a target firm has received a large number of patents for the past three years comparing to other firms, it can be concluded with low uncertainty that the target firm has recently developed valuable technological capability. On the other hand, if the target firm has received only a small number of patents, the capability uncertainty will be higher. On the other hand, if it has received no patents at all, we can believe with certainty that the target firm does not have capability. As mentioned earlier, low uncertainty can have two types - high value and low value, both of which can lead to acquisition.

Therefore, it is very important to set the appropriate criteria as to how many patents are large enough to ensure the certainty in the firm's capability and how many patents are considered small enough to create uncertainty in the firm's capability. It would be relatively easier to operationalize low uncertainty - low value case. It will be simply assumed that if the target firm has received no patents at all during past three years, it currently has not developed any capability with certainty. This is a reasonable assumption given the fast rate of innovation and technological change in the biotechnology industry. In the sample, the average number of patents the target firm has received in three years is 4 and the standard deviation is 7.57. The largest number of patents received is 79, while the smallest number is 0. Given this distribution, capability uncertainty was considered high when the number of patents ranges from 1 to 9.
if the target firm received more than 10 patents, it is assumed that the firm has high capability with certainty. Also, if a firm received zero patents, it will also be assumed this firm has low capability with certainty.

For hypothesis 1.2, behavioral uncertainty was measured by the number of patent infringement lawsuits experienced by both exchange partners. This measure directly reflects the exchange partner's previous opportunistic behavior and thus can be a good proxy for the concern for the partner's future opportunism. It can be expected that if the concern for the partner's future opportunism is high, then the focal firm will choose more hierarchical governance to prevent opportunism. It is important to note that the number of patent infringement lawsuits experienced by both focal and target firm was considered to measure the behavioral uncertainty in the governance choice. This is because the governance decision, especially from the transaction cost theory, assumes that the opportunism influences reciprocally rather than unilaterally. For example, if a target firm suspects that the focal firm will behave opportunistically, then it will try not to have market transaction with the focal, and the haggling between the two will lead to vertical integration. On the other hand, if the focal firm perceives threat of the target firm's opportunism, it will probably rely on vertical integration. Thus, the critical point in transaction cost theory is that the possibility of opportunism from either one of the exchange partner can lead to vertical integration. This may be why Williamson (1988) suggested that the direction of
integration is not important in transaction cost theory. Based on this rationale, the potential of opportunism from both parties needs to be included.

For hypothesis 1.3a and 1.3b, the age (or history) of the firm was measured by the number of years of operation (from the foundation year to the year in which the alliance was formed). A substantial efforts were made to find when the target firm was initially founded. Firms that changed its name in the past were traced back to the origin of their first establishments.

For hypothesis 2.1, alliances that involve exogenous learning or endogenous learning were identified examining by the information regarding the nature of inter-firm cooperation. Based on the examination of the transactions, marketing alliances were classified as involving exogenous learning because the value of the partner's capability will ultimately determined by the external market signal. Marketing alliance is usually formed when a firm with an innovative product forms an alliance with a firm which has a distribution capability. On the other hand, research alliances were classified as involving endogenous learning. It can be expected that the value of underlying real asset in research alliance can be known through the collaborative governance mode.

For hypothesis 2.2, the degree of the threat of competitor's preemptive acquisition of underlying real asset can be best measured by the number of competitors in the domain in which the alliance was formed. If there are large numbers of competitors in the domain in which the alliance is formed, then there will be more threat of competitor's preemptive acquisition. If not, the threat will be
less. In order to do this, the domain in which the alliance is formed is initially identified. However, instead of using traditional SIC code for classifying the domain, biotechnology industry classification by Institute of Biotechnology Information was used. Accordingly, the number of competitors in the domain also followed the same classification. It can be expected that the IBI classification of biotechnology industry is much better in measuring the actual competition than SIC code classification (IBI classified biotechnology industry into the following thirty two subcategories: Animal agriculture, aquaculture, biomass conversion, biomaterials, biosensors/bioelectronics, bioseparations, cell culture, clinical diagnostics, commodity chemicals, consulting, cosmetics/health/beauty, drug delivery, energy, environmental treatment/testing, equipment, fermentation/production, food, fungi, immunological products, marine natural products, medical devices, mining, plant agriculture, reagents, research, specialty chemicals, testing/analytical services, therapeutics, toxicology, vaccines, venture capital/financing, and veterinary).

For hypothesis 2.4, behavioral uncertainty is measured in the exactly same way as in hypothesis 1.2. The number of patent infringement lawsuits experienced by both firms were used to measure it.

Dependent variables are alliance governance choices and identified by examining the transaction in the sample. Governance choices includes market governance, partial equity governance (joint ventures and minority equity investment), and full mergers and acquisitions. The cutoff point of 50% was used
for distinguishing minority equity investment (<50%) and mergers and acquisitions (≥50%).

6.3. Statistical Model

In order to test hypothesis 1.1, 1.2, & 1.3, the following logit model is considered.

\[ P(Y) = \frac{1}{1 + e^{-Y}} \]

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \]

Where, \( Y \): Choice of interfirm governance.

\( Y = 0 \) if it was market governance
\( Y = 1 \) if it was mergers & acquisitions

\( X_1 \): Capability Uncertainty as measured by number of patents received in the past three years

\( Y = 0 \) if low uncertainty (if number of patents ≥ 10 and if = 0)
\( Y = 1 \) if high uncertainty (0 < number of patents ≤ 9)

\( X_2 \): Behavioral Uncertainty as measured by both firm’s total number of previous legal lawsuits due to patent infringement

\( X_3 \): Age of the firm

In order to test hypothesis 2.1, 2.2, 2.3, & 2.4, the following logistic model is considered.

\[ P(Y) = \frac{1}{1 + e^{-Y}} \]

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_1 X_2 \]
Where $Y$ : Choice of initial interfirm governance

$Y = 0$ if it was market governance,
$Y = 1$ if it was partially hierarchical governance;

$X_1$ : Learning

$X_1 = 0$ if the learning is exogenous
$X_1 = 1$ if the learning is endogenous

$X_2$ : Number of competitors in a domain in which the alliance is formed.

$X_3$ : Number of previous patent infringement lawsuits

6.4. Statistical Results

For the first logistic model, Table 1 on the next page presents sample means, standard deviations, and the full correlation matrix. The correlation between independent variables do not seem to be high in the table.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predictors:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Capability Uncertainty</td>
<td>0.51</td>
<td>0.50</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Behavioral Uncertainty</td>
<td>3.66</td>
<td>7.57</td>
<td>.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>3. Age of the Firm</td>
<td>9.88</td>
<td>12.25</td>
<td>-.03</td>
<td>.16*</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Dependent Variable:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Governance choice</td>
<td>0.45</td>
<td>0.49</td>
<td>-.18*</td>
<td>-.07</td>
<td>.25*</td>
</tr>
</tbody>
</table>

* $p < .01$, two-tailed test

Table 6.1: Descriptive Statistics and Correlations: Market vs. Mergers/Acquisition
The results of the first logistic regression model predicting the choice between market governance and acquisitions are presented in Table 6.2 on the next page. As mentioned earlier, the selection of sample automatically controls for firm size since large firms are eliminated. A coefficient for a predictor variable tells how the log-odds in favor of the occurrence of event (i.e., acquisition, in our example) change as the predictor variable changes by one unit. A positive coefficient, thus can be interpreted that it tends to increase the probability of the event occurring as the predictor variable increases.

In table 6.2, the coefficient for capability uncertainty is negative and significant at $p < .10$. Since we coded high uncertainty as 1, this result supports hypothesis 1.1. However, the coefficient for behavioral uncertainty is negative and insignificant. Since the hypothesis 1.2 assumes positive relationship between the number of patents infringement suit experienced and hierarchical governance, the empirical result was not supported. On the other hand, the age variable was found to be positive and significant at $p < .001$, indicating that capability hypothesis 1.3a is supported instead of hypothesis 1.3b. The possibility of high collinearity among independent variables is extremely low, since all the variables in the model have high tolerance statistic and low VIF value (Menard, 1995). The overall model has a high explanatory power, with a Chi-square value significant at $p < 0.001$. As Menard (1995) suggests, for
<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient (Wald statistic)</th>
<th>s.e.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.001 (19.902) ***</td>
<td>0.224</td>
</tr>
<tr>
<td>Capability Uncertainty</td>
<td>-0.369 (2.794) †</td>
<td>0.221</td>
</tr>
<tr>
<td>Behavioral Uncertainty</td>
<td>-0.098 (1.385)</td>
<td>0.083</td>
</tr>
<tr>
<td>Age</td>
<td>0.074 (15.817) ***</td>
<td>0.019</td>
</tr>
</tbody>
</table>

Model Chi-square 33.276 ***  

<table>
<thead>
<tr>
<th>df</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>396</td>
</tr>
</tbody>
</table>

† p < .10  
* p < .05  
** p < .01  
*** p < .001

Table 6.2: Results of Logistic Regression Analysis: Market Governance vs. Hierarchy
researchers concerned about theory testing, the goodness of fit measures like
Chi-square value will be the most important measure.

For our second model, the sample means, standard deviations, and the
full correlation matrix of independent variables are presented in Table 6.3 below.
As was the case in our first model, the correlations between independent
variables in our second model are not high. Also, in a separate collinearity
diagnostic, a very high tolerance statistic and very low VIF value were obtained
for independent variables, indicating that there is no multicollinearity problem in
the model.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Learning</td>
<td>0.69</td>
<td>0.46</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Property Rights</td>
<td>227.67</td>
<td>129.36</td>
<td>.17**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>3. Behavioral Uncertainty</td>
<td>0.83</td>
<td>1.69</td>
<td>.10**</td>
<td>.12**</td>
<td>1.00</td>
</tr>
<tr>
<td>Dependent Variable:</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Governance Choice</td>
<td>0.14</td>
<td>0.34</td>
<td>.20**</td>
<td>.14 **</td>
<td>.03</td>
</tr>
</tbody>
</table>

* p < .01, two-tailed test

Table 6.3: Descriptive Statistics and Correlations: Market vs. Equity-based
Alliance

The results for the second logistic model is presented in Table 6.4 on the
next page. Column 1 in this table shows the results of the model without the
<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Intercept</td>
<td>-4.034 ***</td>
<td>-5.619 ***</td>
</tr>
<tr>
<td>Learning</td>
<td>1.795 ***</td>
<td>3.498 *</td>
</tr>
<tr>
<td>Property Rights</td>
<td>.003 **</td>
<td>.009 †</td>
</tr>
<tr>
<td>Behavioral Uncertainty</td>
<td>- .001</td>
<td>-.004</td>
</tr>
<tr>
<td>(Learning) * (Property)</td>
<td></td>
<td>-.006</td>
</tr>
<tr>
<td>Model Chi-square</td>
<td>52.231 ***</td>
<td>54.769 ***</td>
</tr>
<tr>
<td>(p-value)</td>
<td>(.0000)</td>
<td>(.0000)</td>
</tr>
<tr>
<td>Δ Chi-square</td>
<td></td>
<td>2.538</td>
</tr>
<tr>
<td>(p-value)</td>
<td></td>
<td>(.1111)</td>
</tr>
<tr>
<td>df</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>n</td>
<td>832</td>
<td>832</td>
</tr>
</tbody>
</table>

† p < .10
* p < .05
** p < .01
*** p < .001

Table 6.4: Results of Logistic Regression Analysis: Market vs. Partial Equity Alliance
interaction between learning and property rights. Column II includes interaction terms. In column I, the coefficient of learning is positive and highly significant, as consistent with hypothesis 2.1. Also, the coefficient of property rights is positive and highly significant, as was predicted by hypothesis 2.2. Again, firm size is also controlled in this model by focusing only on small firms. However, the behavioral uncertainty in hypothesis 2.3 was negative and insignificant, and thus was not supported.

Also, the inclusion of interaction term in column II does not seem to support hypothesis 4, and fail to improve the overall model significantly. The coefficient of the interaction term is not significant. In addition, the changes in model Chi-square is not significant either. On the other hand, both learning and property rights are still significant in the column II. The overall model Chi-square is significant in both column I and II, indicating that including learning and property rights increase overall explanatory power significantly.
CHAPTER 7

CONCLUSION AND DISCUSSION

The empirical results in the previous chapter strongly support major predictions of the real option theory of exchange governance presented in this dissertation. Specifically, it was shown that firms prefer less hierarchical governance when there exists high uncertainty about the target firm’s capability. Also, it was proven that types of learning and concern for property rights were two important considerations in designing strategic alliance with real option purpose.

Although the transaction cost hypothesis regarding behavioral uncertainty was not supported, this does not suggest that the core logic and predictions of transaction cost theory are incorrect. The disappointing empirical result may be specific to the biotechnology industry, in which the uncertainty regarding a small innovative firm’s technological capability is of the most importance. In a highly dynamic and competitive industry, being too cautious and suspicious in forming an alliance may cost the firm an important opportunity to benefit from external innovation. However, there will be other industries in which the majority of
interfirm governance is influenced by concern for transaction cost. In some cases, the partner’s opportunistic behavior can cost the firm for its entire fortune.

A firm can consider an initial investment in transaction as cost for experimenting with an uncertain partner’s capability for future acquisition or it may consider the same initial investment a trap that locks the firm into the partner’s opportunistic behavior. The choice between these two organizational mentality results in a drastic effect on a firm’s governance choice. If the firm relies on the former mentality - a mentality of experimentation, then market governance will be chosen. If the firm relies on the latter mentality - a mentality of suspecting appropriation, then hierarchical governance will be chosen.

Then, what influences the firm’s choice of mentality when engaging in a transaction? As suggested earlier, industry condition regarding speed and amount of outside innovation, among other factors, can be an important consideration. In a highly competitive and innovative industry like biotechnology industry, many new strategically important capabilities are being created outside of the firm. If a firm ignores new innovations being developed outside of the firm, it will soon be outdated and may not survive the market in the long run. To ensure long-term survival and to keep up with the latest technology, a firm may have to engage in various types of alliances for experimentation. That does not mean that the firm will simply acquire any firm that seems to be strategically important. The experimentation will be done while minimizing irreversible resource commitment, i.e., the real option way.
If the focal firm does not follow this real option logic and behaves consistent with transaction cost logic, then the following can happen. Since the firm is concerned about the target firm's ex post opportunism after asset specificity occurs, it has the following choices. First of all, the focal firm can acquire the target firm outright and make it as a subsidiary or a division, consistent with Williamson's prediction. However, this choice has a negative side effect under the fast rate of technology change. The costly acquisition can turn out to be a failure when the target firm's capability turns out to be of no market value. Second, it can invest in its own capability through greenfield investment, which is another form of vertical integration. Opportunism will be minimized because the exchange will be governed under the same authority. However, this alternative assumes that the firm is capable of imitating and carrying out the innovative activity by itself. However, most of the time it is impossible to imitate another firm's innovation due to lack of capability. As a matter of fact, this is why the focal firm is interested in having a transaction with the target firm in the first place. The third choice is abandoning the initial plan to have exchange with the target firm. In this case, the firm will be left alone with the competition, and may not survive very long. In conclusion, in all three cases, if a biotechnology firm sticks to the transaction cost mentality, it will either make an irreversible commitment to an obsolete asset or will not be able to effectively catch up with the fast pace of innovation required for the survival in the biotechnology industry.
This is probably why empirical results supported real option view of governance in the biotech industry.

Although it has been suggested that the real option view and transaction cost theory can predict different governance choices based on different mentalities, there are instances when these two theories can simultaneously provide alternative explanations regarding to a same governance choice. This point will be best illustrated by examining the Fisher Body - General Motors case (Klein, Crawford and Alchian, 1978; Klein, 1988). As is well known in the literature, the Fisher Body – General Motors case is frequently used as a typical example of vertical integration caused by high transaction cost. However, the same governance choice – i.e., vertical integration – can also be explained from the real option perspective:

The original production process for automobiles consisted of individually constructed open, largely wooden, bodies.... in 1919 General Motors entered a ten-year contractual agreement with Fisher Body for the supply of closed auto bodies. In order to encourage Fisher Body to make the required specific investment, this contract had an exclusive dealing clause whereby General Motors agreed to buy substantially all its closed bodies from Fisher. This exclusive dealing arrangement significantly reduced the possibility of General Motors acting opportunistically by demanding a lower price for the bodies after Fisher made the specific investment in production capacity.... But large opportunity were created by this exclusive dealing clause for Fisher to take advantage of General Motors, namely to demand a monopoly price for the bodies...However, contractually setting in advance a "reasonable price in the face of possible future changes in demand and production conditions is somewhat more difficult to effectively accomplish than merely "fixing" required suppliers (Klein, Crawford, & Alchian, 1978: 308-309).
Later, demand for the closed metal bodies manufactured by Fisher increased dramatically because the closed metal bodies were "essentially a novelty" at that time (Klein, 1988). This shift in demand made Fisher to behave opportunistically by adopting a relatively inefficient, highly labor-intensive technology, which made it profitable to Fisher but costly to GM (Klein, 1988). In order to solve this problem, GM finally decided to acquire Fisher in 1924. At that time, more than 65% of automobiles produced by GM were of the closed body type (Kein, Crawford, & Alchian, 1978).

This example shows that the primary uncertainty - the increase in the demand - can induce increase in the opportunistic behavior of the partner. Therefore, GM finally decided to acquire Fisher in 1924. From transaction cost theory standpoint, it can be explained that the vertical merger occurred due to the high transaction cost arising from Fisher's opportunistic behavior.

However, it can be possible that this case can be an excellent example of the real option view of vertical merger. We can easily imagine that GM was interested in Fisher's innovative capability in producing closed metal bodies, but was uncertain about the demand - i.e., capability uncertainty. Therefore, GM may have started transactions with Fisher in order to explore its true potential. In order to secure the real asset from the competitor's threats, GM may have signed an exclusive contract. From this real option view of market contract, it is not surprising that GM acquired Fisher when the demand for the metal body
soared. In other words, acquisition occurred exactly when capability uncertainty was cleared.

After all, why would there be an initial contract between the two parties? The initial outsourcing contract may be consistent with the real option view rather than the transaction cost theory. Supplier's unwillingness to invest in TSI could have been mitigated by appropriate design of the contract terms. As opportunity arrival signal appears in the form of high market demand, GM strikes its option to acquire Fisher. This may be the most prudent strategy in acquiring the strategic resource that the supplier has. Although the transaction cost logic may still be true in explaining the vertical merger of Fisher, we cannot exclude the possibility that there still existed an option value in the initial transaction between GM and Fisher. Otherwise, the initial market contract under uncertainty is hard to explain.

In addition to the emphasis placed on the role of uncertainty and asset specificity, this study extended the existing real option view to incorporate the concept of learning and property rights. The empirical results which support the role of learning and property rights are also encouraging. These have significant implications in the real option theory of exchange governance because we can predict various forms of intermediate or hybrid forms of exchange governance based on this logic. The most important improvement in real option theory after incorporating learning and property rights will be that investment in governance not only provides real option value, but also provides learning about the value of real asset, and secures the real asset when exercising. In conclusion, it can be
suggested that there are three roles of governance in the real option view. Investments in governance creates real option value, provides learning about the real asset, and secures real asset.

Then, what is the conceptualization of the firm in the real option view? To answer this, we need to look more closely at the ultimate purpose of creating real options and the role of governance in securing real asset. First of all, it was argued that real options are usually written on real asset, the value of which is highly uncertain. From this, we can understand that the ultimate purpose of creating a real option is to obtain the real asset possibly at a lower-than-market price. Then, it is easy to understand why inter-firm governance becomes more hierarchical when the chance of acquiring real asset is being threatened by competitors. This is because more hierarchical governance means more ownership and control of the real asset.

From here, two components of firm in real option view emerge: Real asset and ownership. In the real option view of hierarchical governance, hierarchical governance exists to protect the real option from outside threats. While transaction cost theory views the hierarchy as suppressing a partner's opportunism, in the real option view of the firm, hierarchy is viewed as suppressing a competitor's opportunities for preempting the partner or partner's strategic asset. In other words, while market governance and less hierarchical governance exists to create the real option value and learn, hierarchical governance exists to protect underlying property rights. Any hybrid form of
governance between these two extreme governances will be chosen based on both the need for preserving real option value and the need for protecting the real asset.

From this view, a firm can be perceived as an ownership of valuable real assets nested in a single hierarchy, the role of which is to protect the valuable real assets from being used by competitors. An ideal firm in the real option view will only collect valuable, rare, and costly to imitate real assets, the values of which are certain under its umbrella of hierarchy. If the real asset is valuable, rare, costly to imitate but uncertain, it will be monitored through more flexible form of governance. In short, real assets within a firm will be valuable without uncertainty, while real assets outside a firm are uncertain in value. The views presented here may be different from Bowman and Hurry (1993), who viewed the firm as a collection of real options, rather than real assets. However, real assets that reside in the hierarchy can always become new real options when managers find them new and uncertain values for other uses. Thus, the two views are not contradictory in this way.

As mentioned in an earlier chapter, Grossman and Hart (1986) and their colleges have made an assertion that firms should be conceptualized as collection of assets rather ‘than nexus of contract’. However, their logic of the process of collecting assets in the firm is quite different from the one presented here. These property rights economist still uses the opportunism as the central notion in the model, as Williamson did. The theory presented here rather fits
comfortably with resource based view (Barney, 1991) and capability-based view (Kogut & Zander, 1992, Argyres, 1996) in the following way.

Although recent theories in strategic management such as the resource-based view emphasized developing and nurturing internal strategic resources to obtain competitive advantage, the possibility of identifying strategic resources from external organizations and finding out the most efficient ways to utilize them has been largely neglected in strategy research except the strategic factor market argument which explored the possibility of trading of the strategic resources (Barney, 1986b, 1989; Diericks and Cool, 1989). Even though Chi (1994) examined transaction modes between firms involving strategic resources, it was merely an extension of the existing transaction cost theory.

However, recent capability-based view on outsourcing suggests that market contract, which occurs independent of the transaction cost consideration, is one way to tap into other firm’s strategic resources. Nevertheless, this view doesn’t explain why outsourcing has to be chosen instead of outright vertical M&A. It is interesting to note that Barney’s (1986b) strategic factor market and its application to M&A (Barney, 1988) provide some capability-based rationale of why a vertical M&A occur. Based on the notion that the cost of acquiring strategic factor should not exceed the realized value of the strategic factor in the product market in order to obtain abnormal return, Barney emphasized the importance of manager’s vision in identifying undervalued strategic resource and capabilities. Applied in M&A, Barney (1988) suggested that the abnormal return
in M&A can occur by buying a strategically important firm at the undervalued price. However, how can a manager develop such an insight on identifying undervalued external strategic resources? If one is a visionary manager, he or she would recognize which one is undervalued company and will acquire them outright. But if one is a mediocre manager, he or she can use real option approach in acquisition. The real option approach will provide an ordinary manager with a detailed answer on how a firm should acquire a target firm without the price of the target firm exceeding the value of the firm? The option approach will recommend capability-based outsourcing first instead of outright acquisition. Subsequent learning and private information on market response will enable the manager to buy the target firm at the undervalued price. It can be easily inferred that in order to buy the firm at a lower price, the buying firm should strike the option before the competitor’s threat of bidding. As Diericks and Koza (1991) notes, M&A deals succeed better when negotiating companies have known each other a long time.

Just as the capability-based view of outsourcing doesn’t consider the alternative of vertical M&A, the strategic factor market view doesn’t consider the alternative of the market contract in taking advantage of external strategic factors. The strategic option view presented here therefore complements both perspectives and provides a conceptual bridge between the two theories.

In the beginning of this dissertation, three major criticisms of the transaction cost theory were presented. They were 1) the ambiguous role of
uncertainty in determining exchange governance, 2) the under-emphasized role of capability differences between the exchange partners in governance choice, and 3) excessive emphasis on the negative side of the transaction such as opportunism, asset specificity, and cost. It can be suggested that adopting a real option view of exchange governance presented in this study magically resolves all of these three problems at once.

First of all, it has been shown why market a contract is preferred when there exist uncertainties in the partner's capabilities. Second, the real option view of governance clearly considers the capability differences between the exchange partners. It only adds 'uncertainty' to the partner's strategically superior capability. Third, opportunism is not a major consideration in the real option theory of governance. Also, as repeated earlier, the real option view of governance proposes governance choices based on real option value embedded in each governance mode rather than the cost of each governance choices. The shift from cost to value can be a fundamental one. Finally, asset specificity played a very positive role in the real option theory of governance. The presence of asset specificity enables the focal firm to secure the real asset when exercising. This study even made a rather bold assertion that when the degree of asset specificity is very high, exercising in the form of acquisition may not be necessary. Since this assertion is rather provocative, it is hoped that more theoretical debate follows this study before careful empirical studies are done.
An exciting aspect of the real option view of governance choice is that this is not a static theory but a dynamic perspective that considers changes in environment. As Saxton recently noted (1997: 444):

Traditional economic theories emphasizing a rational approach to profit or resource maximization consistent with the partner focus tend to “undersocialize” (Granovetter, 1985) complex relationships between market actors. This approach results in static model of efficiency (Nootenboom, 1992) in which the importance of relationship is ignored. A dynamic model of interaction that goes beyond traditional transaction cost analysis will more completely capture the dynamic efficiency characterizing these relationships (Hill, 1990; Nootenboom, 1992).

Although the real option approach to governance choice is based on a financial economic model, its focus is not on the static model of efficiency as Saxton criticizes. As a matter of fact, a real option view can be treated as “a dynamic model of interaction that goes beyond traditional transaction cost analysis”. It is dynamic because this model considers from the formation of the alliance, the ongoing relationship in the alliance, to the termination and dissolution of the alliance.

Due to its dynamic nature, the real option theory has a great deal of potential to be developed and applied to today’s business phenomena. The application on governance choice will be a good start. Further applications of real option view to explain and predict other dynamic aspects of business phenomena are options that will hopefully turn out to be real assets for future researchers.
BIBLIOGRAPHY


