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Option to Acquire or Divest a Joint Venture

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OPTION TO ACQUIRE OR DIVEST A JOINT VENTURE

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SUMMARY

This paper develops a model for assessing options in joint ventures. The model is used specifically to examine the option to acquire or divest a joint venture, both in the case where the acquisition/divestiture price is specified *ex ante* in the initial contract and in the case where the price is to be negotiated *ex post*. The results derived from the model show how the value of the option and each partner's payoff from the venture vary with the structure of the option and how the presence of the option may affect the structuring of the joint venture. The main theoretical insights are stated in twelve potentially testable propositions, and possible ways to operationalize some of the propositions for empirical testing are also explored.

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INTRODUCTION

Since Kogut (1991) demonstrated the power of viewing joint ventures (JVs) as options, the option perspective has become widely recognized as an essential analytical framework for understanding the strategic nature of JVs. Although further conceptual and empirical work based on this approach has yielded additional insights into the nature of JVs (Chi and McGuire, 1996; Folta and Leiblein, 1994; Folta, 1998), there has been limited effort to scrutinize the properties of JV options (e.g., options to acquire, divest and expand) through rigorous theoretical modeling.

As the extensive work on financial and real options has shown (see Pindyck, 1993, for a review), the nature of an option (e.g., its values to the “buyer” and “seller”) varies markedly with its structure (e.g., the structure of uncertainty and terms of the option contract), and it is difficult to figure out an option’s implications without modeling its structure precisely. Even the most commonly recognized option in a JV—the option to acquire the partner’s stake—tends to have some unique structural attributes. First, as noted by Kogut (1991), a JV contract typically does not give either partner the right to acquire or divest the venture at an *ex ante* specified price. In such a case, the partners will have to negotiate a price *ex post* if one of them wants to acquire the other’s stake or divest its own stake, thus making the option’s exercise price indeterminate *ex ante*. Without modeling this structure explicitly, one would have to use the knowledge of options with a different structure (e.g., the commonly known European call and put options) to analyze JV options.¹ This not only subjects one’s analysis to greater chance of error but also limits one’s ability to develop precisely specified hypotheses for empirical testing. Furthermore, even when a JV contract does include *ex ante* an option clause that structurally mimics a standard financial option, the extant models on such options can only inform us of the option’s economic value for

¹ To our knowledge, there have been no rigorous models built to investigate options of this structure in the current literature. Chi and McGuire (1996) used a highly simplified model to study JV options with such a structure.

the option holder. One still needs to analyze the option from a game-theoretic perspective in order to understand what factors determine the gain from trading in such an option between the two JV partners, as will be discussed in detail in this paper.

The main objective of this study is to seek additional understanding of JV options by developing a rigorous theoretical model. Although the development of an option model typically involves the use of advanced mathematics, our model employs a simple approximation method that entails only some basic tools of quantitative analysis. In the process, we will try to translate some of the model's theoretical insights into testable propositions and relate them to current empirical findings, particularly those obtained by Folta (1998). Through a comparison of the different ways that the JV partners can specify their contract with regard to future acquisition or divestiture, we will also examine an apparent inconsistency between the emphasis of the option approach and that of the transaction cost approach. The proponents of the option approach tend to emphasize value creation through the development of strategic and organizational flexibility (Bowman and Hurry, 1993; Sanchez, 1993). One of the issues that the transaction cost approach puts its emphasis on is, however, the use of commitment (usually at the expense of flexibility) to curb opportunism (Williamson, 1985). When trying to apply these two approaches to the analysis of JV structuring, therefore, one can easily find them to suggest conflicting solutions. In a later part of the paper, we will combine ideas from the two approaches into a more unified conceptual framework for analyzing the trade-off between flexibility and commitment in structuring a JV.

The paper is organized as follows. The next section sets up our basic model that will be employed in later sections to explore the properties of the option to acquire or divest a JV. The third section analyzes the situation where the JV contract does not have an option clause so that both partners may acquire the other's stake in the venture at an *ex post* negotiated price. The fourth section analyzes the situation where the JV contract gives one of the partners the right to

acquire or divest the venture at an *ex ante* specified price. The fifth section compares the two types of contractual arrangements from both the option and transaction cost perspectives and discusses the trade-off in deciding whether to install an explicit option clause in the initial JV contract. The last section summarizes the paper and suggests possible extensions of the study.

THE BASIC MODEL

This section describes the basic structure of the model that will be used in later sections to explore the features of JV options. To keep our model tractable, we will only analyze JVs with exactly two partners. The structure of the model makes it most applicable to equity JVs.

Motivation for the Model

Before going into the technical details of the model, it may be helpful to discuss the basic reasons for two firms to form a JV and the likely reasons for one of them to acquire the other's stake or divest its own stake in the venture. As has long been recognized in the literature on JVs, the fundamental reason for two firms to cooperate is to explore some perceived complementarity between the resources that they respectively possess (Beamish and Banks, 1987; Hennart, 1988; Teece, 1986). In an international JV, for instance, one partner may be a multinational enterprise (MNE) with superior technology, and the other may be an indigenous firm with expertise in marketing to local consumers and dealing the host government. But the JV's accounting profit that is shared between the two partners often is not the only source of benefit a party gets from the venture and sometimes accounts for only a small portion of its total gain from partnering with the other party (Contractor, 1985). Income from supplying inputs to the JV, lower cost of inputs purchased from the JV and higher profit from a JV partner's other operations due to production knowledge acquired from the other partner can each be a significant portion of the total payoff. Both the income directly from the JV and all these other benefits are likely subject to significant uncertainty from each partner's perspective, especially in the initial stage of their joint operation.

For instance, two firms may establish a JV to develop some new technology that is expected to benefit both. But the outcome of their joint effort may turn out to suit one partner's needs much better than the other partner's. An example that illustrates this type of uncertainty is Taligent—a JV between IBM and Apple that was originally set up to develop a new operating system for their next generation of personal computers but was later folded into IBM because the actual products of the JV turned out to have little value for Apple (Ziegler, 1995).

Some of the uncertainties are likely to be resolved to a large extent as the partners learn more about the outcome of the JV in the course of their collaboration. When a significant piece of new information is acquired by one or both of the parties, they will undoubtedly reassess their JV to see if they will be better off acquiring or divesting it. The new information may change the value they each place on the venture's assets (in case they acquire the assets from their partner). At some point in time, they may find it mutually beneficial for one of them to acquire the other's stake even if there is no explicit option clause in their JV contract, or the party holding a right to acquire the JV may find it opportune to exercise the option. In short, the JV partners have good reasons to expect *ex ante* that new information will arrive during their joint operation and that some type of new information can result in one of them acquiring the other's stake.

A question that naturally follows is: What determines who will be the one acquiring the other's stake? Kogut (1991) suggests that it will depend on which party places a greater value on the venture's assets at the time. To see how two JV partners may arrive at differing valuations of the venture's assets *ex post*, let us think of a hypothetical JV set up by a multinational beer company with an indigenous brewer to introduce the MNE's premium beer to the local market. Initially, both parties are likely to feel considerable uncertainty about the market's reception to the new beer. Although the MNE may hope to benefit from its partner's experience in selling beer to local consumers, it is unlikely to know exactly how much the local firm can contribute

and how much of its brewing know-how will be transferred to the local firm. If the market responds favorably but the local firm turns out to contribute little to the marketing of the beer and has a limited capacity to absorb the MNE's brewing know-how, the MNE will probably be willing to acquire the venture at a price that the local firm finds attractive. In the meantime, if the MNE successfully transfers much of its brewing know-how to the local firm but finds other parts of the world to offer better uses for its resources being used in the JV, the MNE will probably be willing to sell its stake at a price that is attractive to the local firm. Hence, the outcome that one party finds the venture's assets more valuable than the other does is a possibility that the two JV partners should normally be able to foresee in the beginning.

Structure of Uncertainty

For expositional convenience, we will call the two JV partners Party i and Party j , where $i = 1, 2$ and $j = 2, 1$. Let their respective valuations of the venture's assets at time t be denoted by $V_1(t)$ and $V_2(t)$, where $0 \leq t \leq T$, with T being the JV partners' planning horizon (in years).²

Stochastic Evolution

Based on our discussion in the preceding subsection, $V_1(t)$ and $V_2(t)$ should be defined as stochastic variables that evolve over time. In this paper, we model their evolution using a method proposed by Kamrad and Ritchken (1991). Specifically, the evolution of $V_1(t)$ and $V_2(t)$ in each time increment Δt is assumed to follow a joint probability distribution described below:

Outcome:	Both Up	Up/Down	No Change	Down/Up	Both Down
$V_1(t + \Delta t):$	$V_1(t)u_1$	$V_1(t)d_1$	$V_1(t)$	$V_1(t)d_1$	$V_1(t)d_1$
$V_2(t + \Delta t):$	$V_2(t)u_2$	$V_2(t)d_2$	$V_2(t)$	$V_2(t)u_2$	$V_2(t)d_2$
Probability:	p_{UU}	p_{UD}	p_{HH}	p_{DU}	p_{DD}

² The author is indebted to an anonymous referee for suggestions that clarified the definitions of $V_1(t)$ and $V_2(t)$.

where $u_i > 1$ and $d_i < 1$ are referred to as “jump” parameters that define the potential upward and downward changes in $V_i(t)$ in a given time increment. For computational convenience and logical consistency, we require $u_i d_i = 1$ and the five probabilities sum to 1. As can be seen, in a given time increment each party's valuation either jumps up by a factor of u_i or jumps horizontally (i.e., stays constant) or jumps down by a factor of d_i , and these three possible types of changes in $V_1(t)$ and $V_2(t)$ in combination yield five possible outcomes.

Given that $V_1(t)$ and $V_2(t)$ are defined as trinomial variables, their expected growth factors (i.e., one plus the expected growth rate) in each time increment Δt have the following form:

$$E[V_1(t + \Delta t)]/V_1(t) = (p_{UU} + p_{UD})u_1 + p_{HH} + (p_{DU} + p_{DD})d_1, \quad (1.1)$$

$$E[V_2(t + \Delta t)]/V_2(t) = (p_{UU} + p_{DU})u_2 + p_{HH} + (p_{UD} + p_{DD})d_2. \quad (1.2)$$

Let μ_i denote the expected annualized rate of growth in $V_i(t)$ over Δt . Then, when Δt is sufficiently small, the expected growth factor approximates $\exp[\mu_i(\Delta t)]$, and μ_i can be expressed as³

$$\mu_1 = \ln[(p_{UU} + p_{UD})u_1 + p_{HH} + (p_{DU} + p_{DD})d_1]/\Delta t, \quad (2.1)$$

$$\mu_2 = \ln[(p_{UU} + p_{DU})u_2 + p_{HH} + (p_{UD} + p_{DD})d_2]/\Delta t. \quad (2.2)$$

Note that the growth rate depends not only on the size of u_i relative to the size of d_i but also on the quantities of the five probabilities. The value of μ_i can also vary with time if either the jump parameters or the probabilities are functions of time. Obviously, $\mu_1 \neq \mu_2$ means that the two parties differ in their expectations about the rate of growth in the value of the venture's assets. Any growth, of course, must start from the initial value of $V_i(0)$. Although we can set $V_1(0)$ and $V_2(0)$ at any value in our model, the impact of the parties' initial valuations is not the focus of the present paper. So we assume $I = V_1(0) = V_2(0)$; that is, the two parties happen to place the same

value on the venture's initial investment.⁴ It should also be noted that $V_i(t)$ for $t > 0$ represents only the value of the initial investment plus the value of any additional assets accumulated up to the current time t and does not account for the venture's growth potential beyond t .

The stochastic nature of $V_i(t)$ means that its growth is subject to volatility. Under the stochastic process specified above, $V_i(t)$ can only change by either a factor of u_i or a factor of $d_i = 1/u_i$ in a given time increment Δt ; so, when Δt is sufficiently small, the rate of change in $V_i(t)$ over Δt is approximately either $\ln(u_i)$ or $-\ln(u_i)$. Let ε_i denote this (non-annualized) random rate of change over Δt . Then, we can measure the volatility of growth in $V_i(t)$ as the variance of ε_i :

$$\begin{aligned} \text{Var}(\varepsilon_1) &= (p_{UU} + p_{UD})[\ln(u_1)]^2 + (pp_{DU} + p_{DD})[-\ln(u_1)]^2 \\ &= \ln(u_1)^2(p_{UU} + p_{UD} + p_{DU} + p_{DD}), \end{aligned} \quad (3.1)$$

$$\begin{aligned} \text{Var}(\varepsilon_2) &= (p_{UU} + p_{DU})[\ln(u_2)]^2 + (pp_{UD} + p_{DD})[-\ln(u_2)]^2 \\ &= \ln(u_2)^2(p_{UU} + p_{DU} + p_{UD} + p_{DD}). \end{aligned} \quad (3.2)$$

Learning and its Impact on Uncertainty

The analysis of Folta (1998) shows that it is helpful to distinguish between two types of uncertainty: Endogenous uncertainty can be reduced by the action of the firm while exogenous uncertainty is largely independent of what the firm does.⁵ In the context of a JV, each partner's valuation of the venture's assets is conceivably susceptible to both types of uncertainty. As the collaboration between them progresses, they will both learn more about the market's response to the venture's product and about the extent to which their independently held assets complement those of the venture. This kind of learning can be expected to reduce the degree of uncertainty in

³ The discrete stochastic process defined above will become a continuous one if we force Δt to be infinitesimally small. For any variable that grows continuously by a factor of $\exp[\mu(\Delta t)]$ in each time interval Δt (such as a bank deposit that earns interest with instant compounding), its growth rate is given by $\mu = \ln\{\exp[\mu(\Delta t)]\}/\Delta t$.

⁴ If $V_i(0) \neq V_j(0)$, the exercise of the option is likely to be accelerated under $V_i(0) > V_j(0)$ and $\mu_i > \mu_j$ and decelerated under $V_i(0) < V_j(0)$ and $\mu_i > \mu_j$. In addition, the initial negotiation on the formation of the JV is likely to be more difficult if the two parties have differing valuations of what they each are supposed to contribute to the venture.

⁵ This distinction was initially suggested by Roberts and Weitzman (1981)

their valuation, but is unlikely to remove all the uncertainty because there are always elements of unpredictability in such factors as the competitive forces in the industry.⁶ It is hence appropriate to model the volatility of their valuation $V_i(t)$ as declining over at least some early part of their time horizon but never going away entirely. By observing (2) and (3), we can see that there are two ways to incorporate this assumption in our model. One way is to define the jump parameters $u_i = 1/d_i$ as decreasing functions of t . The other way is to define the probabilities for the upward and downward jumps as decreasing functions of t , which in turn also requires the probability for the horizontal jump (i.e., p_{HH}) to be an increasing function of t in order to ensure the probabilities sum to one. For computational convenience, we keep the jump parameters time-invariant and define the five probabilities as functions of time. Our definitions of these functions are based on the derivations of Kamrad and Ritchken (1991) but involve an important modification to accommodate the assumption of time-dependent volatility:

$$u_1 = \exp(\sigma_1 \sqrt{\Delta t}), \quad (4.1)$$

$$u_2 = \exp(\sigma_2 \sqrt{\Delta t}), \quad (4.2)$$

$$p_{UU}(t) = \frac{1 + \rho}{4[\beta(t)]^2} + \frac{\sqrt{\Delta t}}{4\beta(t)} \left\{ \frac{[\alpha_1(t) - \sigma_1^2/2]}{\sigma_1} + \frac{[\alpha_2(t) - \sigma_2^2/2]}{\sigma_2} \right\}, \quad (5.1)$$

$$p_{UD}(t) = \frac{1 - \rho}{4[\beta(t)]^2} + \frac{\sqrt{\Delta t}}{4\beta(t)} \left\{ \frac{[\alpha_1(t) - \sigma_1^2/2]}{\sigma_1} - \frac{[\alpha_2(t) - \sigma_2^2/2]}{\sigma_2} \right\}, \quad (5.2)$$

$$p_{HH}(t) = 1 - \frac{1}{[\beta(t)]^2}, \quad (5.3)$$

$$p_{DU}(t) = \frac{1 - \rho}{4[\beta(t)]^2} - \frac{\sqrt{\Delta t}}{4\beta(t)} \left\{ \frac{[\alpha_1(t) - \sigma_1^2/2]}{\sigma_1} - \frac{[\alpha_2(t) - \sigma_2^2/2]}{\sigma_2} \right\}, \quad (5.4)$$

⁶ The author thanks two anonymous referees for their comments that helped clarify the nature of uncertainty facing the two JV partners.

$$p_{DD}(t) = \frac{1 + \rho}{4[\beta(t)]^2} - \frac{\sqrt{\Delta t}}{4\beta(t)} \left\{ \frac{[\alpha_1(t) - \sigma_1^2/2]}{\sigma_1} + \frac{[\alpha_2(t) - \sigma_2^2/2]}{\sigma_2} \right\}, \quad (5.5)$$

where ρ and σ_i are constants and $\beta(t)$ and $\alpha_i(t)$ (to be defined below) are increasing functions of t . The parameter ρ represents the coefficient of correlation between the two parties' assessments and thus measures the likelihood that unexpected events will have convergent effects on the two partners' valuations of the venture's assets.

As can be seen from (4), the value of σ_i influences the size of the upward and downward jumps and thus affects the volatility of $V_i(t)$ via u_i and d_i . So, we refer to them as the volatility parameters, with $\sigma_1 \neq \sigma_2$ signifying that one of the partners expects greater uncertainty than the other does. By inspecting (5), one can see that the value of $\beta(t)$ determines the distribution of the probability mass between the horizontal jump and the upward and downward jumps: a larger $\beta(t)$ reduces the probabilities for the upward and downward jumps, thus decreasing the volatility of growth. For instance, $\beta(t) = 1$ yields $p_{HH} = 0$, and $\beta(t) = 1.11803$ yields $p_{HH} = 1/5$. The condition $p_{HH} \geq 0$ requires $\beta(t) \geq 1$. Since learning over time requires the value of $\beta(t)$ to be an increasing function of time, we define $\beta(t)$ as

$$\beta(t) = \begin{cases} 1 & \text{for } t < \psi \\ \gamma\{1 - \exp[-\eta(t - \psi)^\kappa]\} & \text{for } t \geq \psi \end{cases} \quad (6)$$

where γ , η and κ are all parameters that influence the value and shape of the function and ψ is a threshold time after which the volatility starts to decline. The plot in Figure 1 illustrates how the volatility of a party's valuation (measured as the standard deviation of the growth rate in each time increment) varies with time (measured in years) under the functional form defined in (6). As can be seen, this functional form allows the volatility to remain high in the beginning and then falls first at an accelerating rate and later at a decelerating rate. The values of γ , η , κ and ψ that

are employed to generate the plot in Figure 1 will also be used in the numerical computations of later sections. Under this set of parameter values, the volatility falls to only about 1/3 of its initial value and does not go to zero within the planning horizon.

----- Insert Figure 1 about here -----

We can see from equations (2.1) and (2.2) that the expected growth rate μ_i varies with both $\beta(t)$ and $\alpha_i(t)$ because they both enter the probability functions as arguments. Hence, a time-varying $\beta(t)$ would also make μ_i time-dependent, unless the effect of any change in $\beta(t)$ is offset by a change in some other parameter that also affects μ_i , such as $\alpha_i(t)$. To keep each party's growth expectation μ_i constant over time as the value of $\beta(t)$ changes with time, we give $\alpha_i(t)$ the following functional form based on the derivations of Kamrad and Ritchken (1991):⁷

$$\alpha_i(t) = \frac{\frac{1}{2[\beta(t)]^2} \left(2 - u_i - \frac{1}{u_i} \right) + \frac{\sqrt{\Delta t}}{4\beta(t)} \sigma_i \left(u_i - \frac{1}{u_i} \right) - 1 + \exp(\mu_i \Delta t)}{\sqrt{\Delta t} \frac{u_i^2 - 1}{2u_i \beta(t) \sigma_i}}. \quad (7)$$

Although there may be situations in which it is reasonable to make a party's growth expectation dependent on time, keeping μ_i time-invariant in the current model facilitates the exposition of the theoretical relationships to be derived in the next few sections.

In the JV agreements that we have observed, there is almost always a restriction on the time when the right to acquire or divest the venture at an *ex ante* specified price can be exercised. Typically, the option does not take effect until some time (e.g., 6 months) after the start of the JV and expires at a later date (e.g., within one or two years). We believe that the specified window for the option coincides with what the partners expect to be a period of rapid learning in which a large amount of information is acquired and verified. Although the partners may collect a lot of

data in the very early stage of their collaboration, the data will likely need further verification before they can put confidence in it. True reduction of uncertainty can only occur when any data gathered is verified as reliable. But when the arrival of reliable new information becomes sparse after a period of collaboration, the value of any option also diminishes. Hence, outside this time window, concern over opportunism may justify greater restrictions on the exercise of the option, as will be discussed in a later section. So, in this paper, we assume that the option can only be exercised in a window between the start of the 7th month and the end of the 2nd year, with the length of the planning horizon T also set to 2 years.

Summary

Our model treats each partner's valuation of the venture's assets $V_i(t)$ as a stochastically evolving variable that follows a trinomial distribution. The value of $V_i(t)$ is expected to grow at an annual rate of μ_i , and the actual growth rate is subject to a variability whose level is indexed by σ_i . The randomly evolving assessments of the two parties have a coefficient of correlation ρ . In addition, the model also assumes that the level of uncertainty falls over time as the partners learn more about the outcome of their venture and its impact on their own operations outside the venture, but the fall in uncertainty peters out toward the end of their planning horizon.

Dynamic Optimization

In this study, we assume the JV partners to be rational decision makers in the sense that they choose, among the available alternatives at any given point in time, the one that maximizes their individual payoffs. Let s_i denote Party i 's share of the initial investment and ownership in the JV's equity, with $s_i + s_j = 1$. For the time being, we restrict each party's choices at any given point in time to three alternatives: acquiring its partner's stake, continuing the JV in the current

⁷ The form of each function is obtained by solving the respective equation in (2) for $\alpha_i(t)$ in terms of the other parameters. The model proposed by Kamrad and Ritchken (1991), however, assumes β and α_i to be constants.

form or selling its own stake to the partner. Based on the meaning of $V_i(t)$ defined earlier in this section, the discounted value of the venture's assets to Party i at time t , including the expected value of additional growth up to the end of the planning horizon, can be expressed as

$$X_i(t) = V_i(t) \exp[(\mu_i - r)(T - t)] \quad (8)$$

where r denotes the discount rate and $\exp[(\mu_i - r)(T - t)]$ represents the discounted factor of expected growth up to the end of the planning horizon T . In addition, let $Q(t)$ denote the price of the JV's equity stock at which a party has to compensate its partner if it acquires the partner's stake at time t . For the time being, we can think of this price as either negotiated *ex post* between the two parties or specified *ex ante* in their JV contract. We will discuss in the next section how the two parties might determine the value of $Q(t)$ *ex post*.

Obviously, $X_i(t) - s_j Q(t)$ represents the value that a party receives from acquiring its partner's stake, and $s_i Q(t)$ represents the value that a party receives from selling its own stake to the partner. Then, if a party is given the choice among the three alternatives spelled out above, its expected payoff from optimizing its decision at any time $t \geq 1/2$ can be expressed as

$$J_i(t) = \max\{X_i(t) - s_j Q(t), J_i(t + \Delta t) \exp[-r(\Delta t)], s_i Q(t)\}, \quad (9.0)$$

where $J_i(t + \Delta t)$ denotes the expected value of what the party gets from continuing the JV until at least the next period and optimizing the available choices the same way then. As in our model the option can only be exercised after $t = 1/2$, we have $J_i(t) = J_i(t + \Delta t) \exp[-r(\Delta t)]$ for $t < 1/2$. The expected net payoff for each party at the start of the JV is just $J_i(0) - s_i I$. It is worth noting here that the dynamic objective function defined in (9.0) and its variants constitute the basis for the computation of all the numerical results derived in this paper. Using (9.0), we can then express the value of the option to acquire or divest the JV at an *ex post* negotiated price as

$$O_i(0) = J_i(0) - s_i I \exp[(\mu_i - r)T] \quad (10)$$

since $s_i I \exp[(\mu_i - r)T]$ represents the present value of what Party i can expect to get from the JV in the absence of the option.

Following the method suggested by Kamrad and Ritchken (1991), the derivation of the solution in the next few sections utilizes the procedure of dynamic programming. This solution procedure requires that the planning horizon T be divided into N time periods of length $\Delta t = T/N$. Our experimentation with different values of N revealed that its values do not affect the results qualitatively, so we settled at a value of $N = 24$, which makes the length of each time period Δt exactly one month given that the length of the planning horizon T is set to two years. One may think of this as an arrangement whereby the two partners reevaluate their JV every month, but this is not the only meaningful interpretation because the model can approximate the situation where it is possible for the partners to negotiate a termination of their collaboration at any time.⁸

OPTION TO ACQUIRE OR DIVEST AT AN *EX POST* NEGOTIATED PRICE

When the initial JV contract does not include an explicit option clause, the two partners must first negotiate on an acquisition price before either of them can acquire the other's stake.⁹

⁸ It should be pointed out here that optimization of each partner's decision at $t = 0$ requires a comparison of the payoff from joint venturing with the payoffs from available alternatives such as acquiring the potential partner's assets. Since the focus of the current paper is on factors that affect each partner's payoff from a JV and the value of the option to acquire or divest the JV, we simply assume joint venturing to be the best alternative for both partners at $t = 0$. The conditions under which this assumption is likely to be true are identified by Hennart (1988): (i) each party possesses some assets that the other finds valuable but difficult to replicate and (ii) transfer of the assets or their use rights from either party to the other creates serious transaction cost problems. In addition, Chi and McGuire (1996) demonstrated that the options to acquire the partner's stake and divest one's own stake, which are either unavailable or generally more costly to exercise if one party acquires the other's assets, also gives joint venturing an edge over outright acquisition.

⁹ They could contractually stipulate a share transfer price without giving either party the exclusive right to acquire or divest, but the specified price can easily turn out to be too high or too low for a mutually beneficial trade to occur.

Negotiation of Acquisition Price

We know that neither party will be willing to buy the JV for more than or sell the JV for less than its own expectation of the venture's wealth-generating potential $X_i(t)$. The price that the two partners can agree on, $Q(t)$, is necessarily constrained by

$$\min[X_i(t), X_j(t)] \leq Q(t) \leq \max[X_i(t), X_j(t)]. \quad (11)$$

Bargaining models developed in game theory can offer us further insights on the determination of $Q(t)$ in this feasible range (Fudenberg and Tirole, 1991). First, if both parties know exactly how much the other values the assets, they should be able to settle on the price easily based on their relative bargaining power because haggling yields little gain in such a situation. But if at least one of them is uncertain about the other's valuation, they are likely motivated to engage in such bargaining behaviors as misrepresentation or intimidation. Although these behaviors may help one party gain an advantage over the other, they can also increase the cost of negotiation and degrade the quality of the negotiated outcome. We will look at both the case of efficient bargaining and the case of costly bargaining.

To incorporate the influence of bargaining power, we assume the acquisition price $Q(t)$ to be a weighted average of the two parties' expectations about the value of the venture's assets,

$$Q(t) = \theta X_i(t) + (1 - \theta) X_j(t), \quad (12.0)$$

where $0 \leq \theta \leq 1$ is a parameter that represents their relative bargaining power. It can be seen that the price $Q(t)$ moves from the value of $X_j(t)$ to the value of $X_i(t)$ as θ changes from 0 to 1. Since a party derives less gain from the purchase or sale of an object as the price is closer to the party's own assessment of the object's value, a larger θ signifies lower bargaining power for Party i relative to Party j . The pricing rule described in (12) follows the Nash equilibrium solution to a cooperative bargaining game and is Pareto-optimal (i.e., their joint gain is maximized). The two

parties can be expected to play a cooperative game for maximum joint gain when they do not face much uncertainty about the other's valuation or when they have reasons to trust each other.

Pareto optimality, however, is likely unattainable if at least one of them faces significant uncertainty about the other's valuation. Masten (1988) suggests that the cost of bargaining is likely to be an increasing function of the potential gain that is available for appropriation because a larger potential gain induces the parties to invest more resources in jockeying for bargaining positions. The appropriable gain in our case is the distance between the respective estimations of the two parties with regard to the value of the venture's assets. Based on this idea, we adopt the following definition for the cost the two partners are expected to incur in negotiating a transfer of their ownership stakes:

$$C(t) = \omega |X_i(t) - X_j(t)|, \quad (13)$$

where $0 \leq \omega \leq 1$ is a parameter that indexes the costliness of their negotiation. It should be noted that the effect of $C(t)$ captures not only the cost of negotiation *per se* but also the loss from an increased chance of failure to reach an otherwise mutually beneficial agreement (Chatterjee and Samuelson, 1983).¹⁰ For simplicity, we assume that each party bears half of $C(t)$. When $\omega > 0$, $C(t)/2$ needs to be deducted from the value that a party gets from acquiring or divesting the JV, entailing a slight modification of the optimal payoff function (9.0).

In this paper, we consider the case of $\theta = 1/2$ and $\omega = 0$, which signifies equal bargaining power and efficient negotiation, to be the base case. The sharing rule $\theta = 1/2$, often called a focal point (Shelling, 1960), has been found to be the most frequently agreed-upon solution in bargaining experiments (Camerer and Thaler, 1995). We will first examine the option's

¹⁰ Myerson (1989) shows that it is always possible to devise a bargaining rule that gives both parties the incentive to reveal their true valuations although such a rule in general still makes a certain amount of mutually beneficial trade unrealizable. Even though this kind of "incentive compatible" bargaining rule tends to be different from the Nash bargaining rule specified in (12), its basic effect of reduced trade is captured in our model through the effect of $C(t)$.

properties in this base case thoroughly before exploring how the variation of θ and ω affects the outcome.

Properties of the Option

Our analysis of the option to acquire and divest the JV at an *ex post* negotiated price will focus on how the value of the option varies with the key parameters of our model, namely, ρ , μ_i , σ_i , s , θ and ω . The definition for the option's value, $O_i(0)$, is given in (10) in the last section. In our exposition, we take the initial investment in the JV as a "numeraire" by setting its value to one (i.e., $I = 1$) so that all other monetary values can be easily compared against it.

Effects of Asymmetry

Figure 2 shows how the value of the option varies with the extent of correlation between the valuations of the two partners. It can be seen that the option's value is a decreasing function of ρ and reaches 0 when ρ equals 1. Note that ρ determines the likelihood for unexpected events to impact the two partners' valuations in the same direction: A larger ρ makes it more likely that an event that increases (decreases) one party's valuation also raises (reduces) the other party's valuation. When $\mu_1 = \mu_2$ and $\sigma_1 = \sigma_2$, a perfect correlation between their assessments (i.e., $\rho = 1$) means that the two parties will hold identical valuations of the venture's assets all the time and thus derive no gain from acquiring or divesting the JV later on. This result yields the following proposition.

PROPOSITION 1. The option to acquire or divest the JV at an *ex post* negotiated price is more valuable to the two partners when their valuations of the venture's assets are less correlated, *ceteris paribus*.

----- Insert Figure 2 about here -----

It is interesting to explore what conditions may cause the effects of unexpected events to converge or diverge on the two parties' valuations. Each party's valuation of the assets obviously

depends on the amount of economic gain that they expect to derive from the use of the assets. Their ability to profit from the assets, meanwhile, depends not only on the quality of the assets *per se* but also on the extent that their independently-held assets complement those they acquire from the JV (which may include technology, production capacity or market access). Unexpected events should have convergent effects on their valuations if the effects are limited to the quality of the venture's assets *per se*. The effects will diverge only when they impact in a differential manner the extent to which each party's independently-held assets complement the venture's assets. Such divergence necessarily involves some *ex post* asymmetry between the two partners. As suggested earlier, for example, the outcome of a research JV could turn out to be much more useful for one of the partners than for the other, even though they might have intended to develop a new technology that they both would adopt. Also, when two firms with differing skills set up a JV to serve a particular market, the same kind of *ex post* asymmetry could also result if one party turns out to be more successful in absorbing the other's skills than anticipated.

A clear understanding of what influences the value of ρ can help one develop empirical tests of the theoretical insights derived from our model. Based on our discussion in the preceding paragraph, we can expect ρ to be smaller for a research JV than for a JV set up to explore a new geographical market, and to fall in value as the expertise of the two partners is more dissimilar (perhaps measured in terms of their SIC codes). A difficulty in testing the relationship between ρ and the value of the option is that the option's value is in general not directly observable to an empirical researcher. One may be able to get around this problem, however, using data on the outcomes of JV negotiations. If a smaller option value lowers the chance that two firms involved in JV negotiations would succeed, then we can expect failed negotiations to be associated with conditions that indicate a higher chance for uncertain events to have a convergent effect on the two firms' valuations of the venture's assets. One of such conditions, as suggested above, may be

similarity between the two firms' respective areas of expertise. A stronger condition may be similarity between their areas of expertise plus a similar intent for the JV (e.g., entry into a third-country market). An alternative way to test this relationship is perhaps to compare the likelihood for two firms to choose an alternative mode of transaction with the likelihood for them to form a JV. In a recent study, Folta (1998) found similarity between two firms' expertise to increase the chance for one of them to acquire the other as opposed to the formation of a JV between them.

----- Insert Table 1 and Table 2 about here -----

Table 1 shows how the value of the option varies with the two JV partners' expectations about the rate of growth in the value of the venture's assets. The most interesting pattern in the data is that the value of the option is not a monotonic function of μ_i or μ_j and tends to rise as the values of μ_i and μ_j become more divergent. The data in the upper pane of Table 2 displays the same pattern in the relationship between the option's value and the volatility of growth when the two parties' valuations are highly correlated ($\rho = .8$). But this pattern only appears faintly in the middle pane ($\rho = .6$) of Table 2 and does not show up at all in the lower pane ($\rho = 0$). This pair of relationships lead us to make the following two propositions.

PROPOSITION 2. Any variation in a party's growth expectation that causes the two partners' growth expectations to diverge tends to increase the value of their option to acquire or divest the JV at an *ex post* negotiated price, *ceteris paribus*.

PROPOSITION 3. When the two partners' valuations of the JV's assets are expected to be highly correlated, any variation in a party's volatility assessment that causes their volatility assessments to diverge tends to increase the value of their option to acquire or divest the JV at an *ex post* negotiated price, *ceteris paribus*.

The absence of a monotonic relationship between the option's value and the growth or volatility parameters is particularly interesting because existing models almost always find the value of an option to rise monotonically with the values of those parameters. Why are the results of this model different? The reason is that in our model the exercise price $C(t)$ depends on the

values of two stochastic variables—the valuations of the two JV partners, whereas in the vast majority of existing option models the exercise price is fixed. Because in our model the size of the two parties' gain from trading in the JV's assets is determined by the distance between their valuations, the effect of a change in the distribution of the valuations depends on whether the change makes it more likely for their valuations to converge or diverge. A rise in μ_i or σ_i will enhance (suppress) the option's value if it causes their valuations to diverge (converge). The pattern displayed in Table 1 and the upper pane of Table 2 can therefore be explained on the ground that proximity between μ_i and μ_j or σ_i and σ_j under the given circumstances causes their valuations to converge, thus reducing their potential gain from trading in the venture's assets.¹¹

It is helpful to understand what $\mu_i \neq \mu_j$ and $\sigma_i \neq \sigma_j$ really mean and what factors may give rise to these conditions. The condition of $\mu_i \neq \mu_j$ means that one party is likely to have a higher valuation of the venture's assets than the other does. Following the line of reasoning put forth in our discussion of ρ , this kind of asymmetry must be due to a difference in the extent to which their independently held assets complement those of the venture. Empirically, one can expect greater asymmetry of this kind, for instance, if a JV involves a startup bio-engineering firm and an established pharmaceutical company which possesses not only R&D ability but also strong manufacturing and marketing capacity than if the JV involves two comparable parents (Teece, 1986). The condition of $\sigma_i \neq \sigma_j$ means that one of the partners experiences greater uncertainty in evaluating the venture's assets than the other does. This kind of asymmetry is likely to be empirically significant when two firms (e.g., Philips and Whirlpool) use a JV to facilitate the transfer of ownership to some existing assets (e.g., Philips's appliances business) (Nanda and

¹¹ Stultz (1982) also found the absence of monotonicity in the option value's relationship with the drift and volatility parameters in a model of option on two risky assets.

Williamson, 1995). Given that $\mu_i \neq \mu_j$ and $\sigma_i \neq \sigma_j$ represent conditions of asymmetry that are known before the start of the JV, we refer to them as *ex ante* asymmetry.

It is interesting to note, however, that the value of the option rises monotonically as the values of μ_i and μ_j or σ_i and σ_j both increase (i.e., moving diagonally from the upper-left to the lower-right in Table 1 or Table 2). These predictions are consistent with the empirical result of Folta (1998) that variables which are expected to increase the growth or volatility assessments of both parties tend to increase the chance of them forming a JV relative to one acquiring the other.

This result gives us

PROPOSITION 4. The option to acquire or divest the JV at an *ex post* negotiated price is more valuable to the two partners as the growth or volatility assessments of both partners are higher, *ceteris paribus*.

Role of Initial Share

Table 3 illustrates the effect of the initial share distribution on the option's value to the two parties and on their expected payoffs from the JV. We can see in column (A) that a party's initial share has no impact on the value of its option to acquire or divest the JV if the two parties have identical expectations with regard to the growth potential of the venture's assets, that is, if $\mu_i = \mu_j$. If they have differing growth expectations, however, the initial share distribution does affect the value of the option: the option becomes more valuable as a larger initial share is apportioned to the party holding a higher growth expectation, as shown in columns (B) and (C) of the table. Thus, we have

PROPOSITION 5. The option to acquire or divest the JV at an *ex post* negotiated price is more valuable to the two partners when the partner that expects a higher growth rate holds a lower initial share of the JV's equity, *ceteris paribus*.

----- Insert Table 3 about here -----

The rationale for this result lies in the relative chances for the two parties to acquire and divest the JV. Obviously, the party that anticipates faster (slower) growth *ex ante* is likely to

have a higher (lower) valuation of the venture's assets *ex post* and is thus more likely to acquire (divest) the assets. Note that their gain from trading in the JV's assets *ex post* arises from buying (selling) the assets at a lower (higher) price than they find the assets to be worth and that the size of the gain is greater if a larger portion of the assets is traded between them.¹² Hence, giving a lower (higher) initial share to the party that is likely to find the assets to be more (less) valuable enlarges the expected volume of such gainful trade and thus increases the value of the option.

The option to acquire or divest the venture, however, is not the only source of gain that the partners derive from their JV. A more fundamental source of gain is the growth in the value of the venture's assets resulting from a buildup of the assets' rent-generating potential over time. For the time being, we restrict our attention to the case where both partners expect nonnegative asset growth after discounting (i.e., $\mu_i \geq r$) because otherwise there is likely insufficient reason for them to start the JV.¹³ The data in columns (D) through (L) of Table 3 shows that in such a case each party's net payoff from the JV is an increasing function of its own initial equity share. More interestingly, the sum of their net payoffs, which measures their joint gain from the JV, is invariant with the division of the venture's equity between the two parties. This result yields the following proposition.

PROPOSITION 6. If both partners can acquire or divest the JV at an *ex post* negotiated price, the initial share distribution only serves to redistribute the venture's total payoff between the two partners when both of them expect the value of the venture's asset to exhibit nonnegative asset growth (i.e., $\mu_i \geq r$).¹⁴

¹² As an example, suppose that their valuations are 1 and 1.5, respectively. If the party whose valuation is 1.5 holds 90% of the equity, they can only trade in 10% of assets and gain a total of $.1(1.5 - 1) = .05$. This gain is much smaller than if their initial share holdings are reversed, in which case their total gain would be $.9(1.5 - 1) = .45$.

¹³ The case where one of them anticipates negative asset growth (i.e., $\mu_i < r$) may arise if the JV is set up to facilitate the transfer of a money-losing business from one partner to the other. The impact of the initial share distribution in such a case will be explored in the next section.

¹⁴ Note that this result is derived from an option model that assumes away other considerations. From a property rights economics perspective, the division of a JV's equity can affect the value to be created in the JV if difficulty in performance measurement entails equity sharing as an incentive mechanism (Chi, 1996).

Bargaining Power and Negotiation Cost

We now relax the assumption of $\theta = \frac{1}{2}$ and $\omega = 0$ to explore how the option's value to each party might vary with their relative bargaining power and their negotiation cost.

As shown in Table 4, the effects of relative bargaining power and negotiation cost on the value of the option are straightforward: the option's value to each party is an increasing function of the party's own bargaining power and is a decreasing function of their negotiation cost. Given that a shift in bargaining power redistributes the gain from the option from one party to the other, the two parties may have an incentive during the venture's operation to engage in behaviors that tend to strengthen their own bargaining power. The current literature on JVs suggests that shifts of bargaining power in JVs can often be traced to asymmetric transfers of proprietary knowledge between the partners (Hamel, Doz and Prahalad, 1989; Inkpen and Beamish, 1997). The possible shift of bargaining power can, therefore, discourage inter-partner knowledge sharing—a practice considered essential to the creation of competitive advantage through interfirm collaboration (Inkpen, 1998; Parkhe, 1991). In addition, it can also induce the partners to expend excessive resources in acquiring the other's specialized knowledge instead of focusing on joint exploitation of the potential synergy between their respective resources. So, the option to acquire or divest the JV at an *ex post* negotiated price, combined with the possibility for the two parties to engage in costly activities that may strengthen their respective bargaining power, can have the effect of dissipating the rent from their collaboration.

----- Insert Table 4 about here -----

Interestingly, since the negotiation cost $C(t)$ raises the cost of dissolving the JV through a negotiated transfer of ownership between the two partners, it can also reduce their incentives to engage in the kind of costly activities that strengthen their bargaining power in negotiating such a dissolution. Hence, if the JV partners are able to install certain contractual mechanisms that

raise the cost of a negotiated ownership transfer, we can expect them to do so when they foresee a high chance for this kind of inter-partner power jockeying to arise and cause serious dissipation of the rent from their collaboration. A later section of paper will examine in greater detail the trade-off in designing the option and termination clauses in a JV contract.

OPTION TO ACQUIRE/DIVEST AT AN *EX ANTE* SPECIFIED PRICE

As suggested earlier, the JV partners may agree to give one of them the contractual right either to acquire the other's stake or to sell its own stake to the other at an *ex ante* specified price. The current section analyzes this type of option not only in terms of its value to the party holding the option but also in terms of its cost to the party issuing the option, paying special attention to the conditions for such an explicit option clause to create a joint gain for the two JV partners. For expositional convenience, we assume that the JV contract only grants a party either the right to acquire or the right to divest, but not both types of option rights.

Modifications in Model Specification

The JV partners obviously have an infinite number of choices in specifying the price at which the option holder can acquire/divest the JV. The simplest specification is perhaps the book value of the JV's equity. An alternative is to use a formula that takes into account the time value of money. The two parties can, of course, use a formula to reflect any factor that they consider relevant. It is easy to see that how high the acquisition/divestiture price is set affects the chance for the option to be exercised and therefore the option's economic impact on each party. So, in order to examine how the level of the price affects the option's value, we assume the price to equal a multiple of the initial investment in the JV adjusted for the time value of the money,

$$Q(t) = \xi \exp(rt)I, \quad (12.1)$$

where $\exp(rt)$ adjusts the book value for time and ξ is a parameter that reflects the level of the acquisition/divestiture price. For most of our derivations in this section, however, we set $\xi = 1$.

Since the option being modeled here gives a right for the option holder and imposes an obligation on the option issuer, the two parties' expected payoffs from the JV need to be written differently than expression (9.0). For the ease of exposition, let Party i be the option holder and Party j be the option issuer. Then, their expected payoffs can be expressed as

$$J_i(t) = \max\{Y_i(t), J_i(t + \Delta t) \exp[-r(\Delta t)]\}, \quad (9.1)$$

$$J_j(t) = Y_j(t)\iota + J_j(t + \Delta t) \exp[-r(\Delta t)](1 - \iota), \quad (9.2)$$

where $Y_i(t)$, $Y_j(t)$ and ι are defined as

$$Y_i(t) = \begin{cases} X_i(t) - s_j Q(t) & \text{if the option provides a right to acquire,} \\ s_j Q(t) & \text{if the option provides a right to divest,} \end{cases} \quad (14.1)$$

$$Y_j(t) = \begin{cases} s_j Q(t) & \text{if the option imposes an obligation to divest,} \\ X_j(t) - s_i Q(t) & \text{if the option imposes an obligation to acquire,} \end{cases} \quad (14.2)$$

$$\iota = \begin{cases} 1 & \text{if } Y_i(t) > J_i(t + \Delta t) \exp[-r(\Delta t)], \\ 0 & \text{otherwise.} \end{cases} \quad (15)$$

Properties of the Option

One may notice that the option is equivalent to a standard European option for $t \leq \frac{1}{2}$ and a standard American option for $\frac{1}{2} < t \leq T$, except that the option's holder and issuer have differing valuations of the assets that underlie the option.¹⁵ Without the volatility's dependence on time, one could use models of standard European and American options to compute the option's value to the option holder. But those models cannot correctly compute the option's value (cost) to the option issuer because this value depends on the evolution of two correlated stochastic processes.

¹⁵ An European option can only be exercised on the expiration date, while an American option can be exercised any time between the date of issuance and the date of expiration. For details on these financial options, see any standard corporate finance textbook such as Brealey and Myers (1999).

Asymmetry: Again an Important Condition

Tables 5 and 6 show how the two parties' growth expectations and volatility assessments influence the value of the option to each party and the sum of its values for the two parties. As can be expected, the option's value to Party i varies only with its own assessments regarding the venture's growth and volatility, and the option's value to Party j varies with the assessments of both parties. Specifically, when the option involves the right to acquire (divest) the JV, the option is more valuable to Party i as its growth expectation is greater (smaller) or as its volatility assessment is higher. This result is consistent with the standard call (put) option's relationships with the growth and volatility parameters. The relationships of the option's value for Party j with the growth and volatility parameters are more intriguing. First, Party j 's cost for issuing the acquisition (divestiture) option is a monotonically increasing (decreasing) function of its own growth expectation but is not a monotonic function of Party i 's growth expectation. Its relations with the two parties' volatility assessments also exhibit a similar but less pronounced pattern. This pair of relationships yield two propositions that correspond to Propositions 2 and 3, which were derived earlier for the case where the acquisition/divestiture price is negotiated *ex post*.

PROPOSITION 7. A contractual clause that gives one of the partners the option to acquire (divest) the JV at an *ex ante* specified price tends to create a larger joint value, *ceteris paribus*, when the growth expectation of the option holder is higher (lower) or when the growth expectation of the option issuer is lower (higher).

PROPOSITION 8. A contractual clause that gives one of the partners the option to acquire/divest the JV at an *ex ante* specified price tends to create a larger joint value, *ceteris paribus*, when the option holder faces more uncertainty or the option issuer faces less uncertainty about the value of the venture's assets.

----- Insert Table 5 and Table 6 about here -----

The loss of monotonicity here is again due to the condition that similarity between their growth or volatility assessments tends to cause their valuations to converge further when the two parties' valuations are already highly correlated. An even more interesting feature of the data on

the option's value for Party j is that bearing the obligation of an acquisition (divestiture) option can even yield Party j an expected gain when Party i has a high (low) growth expectation and Party j has a low (high) growth expectation. The rationale for this result is that inter-partner asymmetry tends to cause their valuations to diverge, thus increasing the chance that Party i 's acquisition or divestiture of the JV at the *ex ante* specified price also yields a gain for Party j .

Although giving one party the right to acquire/divest the JV at an *ex ante* specified price generally imposes a cost on the other party, the sum of the option's values to the two parties can be highly positive, as shown in Tables 5 and 6. We can see from the two tables that their joint gain from an acquisition (divestiture) option is larger as the option holder's growth expectation is greater (smaller) and the option issuer's growth expectation is smaller (greater) or as the option holder's volatility assessment is higher and the option issuer's volatility assessment is lower. A comparison of the lower-left pane of Table 5 with the upper pane of Table 1 reveals how the distance between the two parties' growth expectations affects the calculus of whether to have an explicit option clause in the initial contract. When their growth expectations differ greatly, their joint gain from giving a contractually specified acquisition option to the party expecting a higher growth rate approaches their joint gain from the option to acquire at an *ex post* negotiated price; but when their growth expectations are similar, their joint gain from not specifying an explicit option clause is much larger.¹⁶ This result suggests that *ex ante* specified options to acquire are more likely to be observed empirically when there is a large divergence between the two JV partners' growth expectations. Nanda and Williamson (1995) observed that firms often turn a under-performing unit of theirs into a JV with another firm that possesses greater competencies

¹⁶ For instance, when $\mu_i = .16$ and $\mu_j = .08$, their joint gain from giving Party i the option to acquire at an *ex ante* specified price is .0781 (see Table 5), and their joint gain from the option to acquire at an *ex post* negotiated price is $2(.0417) = .0834$ (see Table 1). The difference between the joint gains from the two types of arrangements is only .0053, which suggests that a contractually specified option clause can easily be economical in the presence of

in the business and provide their partner with an option to acquire the JV later. The firm that the original owner of the JV's assets teams up with is likely to foresee a higher growth potential for the venture due to its stronger competencies and is also likely to face more uncertainty initially in evaluating the venture's assets for its lack of information. The apparently frequent use of explicit option clauses in such JVs is consistent with the results derived here.

Role of Initial Share: Not Merely Distributional

The work of Nanda and Williamson (1995) suggests that the reason for putting an explicit option clause in the JV contract is most likely to facilitate the transfer of some currently under-performing assets from one partner to the other by giving the other a chance to evaluate the assets closely as a partial owner. So, when we examine the impact of the initial share distribution in this section, we focus on conditions that are likely to be present in such a JV. Specifically, we assume the option holder to have a greater growth expectation and a higher volatility assessment than does the option issuer. In addition, we also expect that the two partners' valuations of the venture's assets can exhibit either a high correlation or a low correlation when the JV's intent is to facilitate one partner's sale of some existing assets to a likely acquirer. If the likely acquirer is going to introduce new product or process technology to the JV, then the uncertainty about the impact of the new technology is likely to have convergent effects on the two partners' valuations of the venture's assets. But if the primary source of uncertainty for the likely acquirer concerns the extent of complementarity between the venture's assets and its other assets held outside the venture, then the correlation between the two parties' valuations is likely to be low.

----- Insert Table 7 about here -----

significant *ex post* bargaining costs. But when $\mu_i = \mu_j = .16$, the difference in the favor of not specifying an explicit option clause is as large as $2(.0126) - .0018 = .0234$.

The examples provided in Table 7 illustrate the effects of the initial share distribution on the net payoff to each party and on the sum of their net payoffs in the presence of an acquisition option. Similar to the case where both partners have the option to acquire the JV at an *ex post* negotiated price, the net payoff to each partner is an increasing function of its own initial share. In contrast to the earlier case, however, the initial share distribution now does affect their joint gain from the venture. Although their joint gain can increase or decrease as the option holder's share is raised, the results of our analysis indicate that the size of the gain tends to become a decreasing function of the option holder's share when their valuations of the venture's assets are less correlated. The theoretical insight of Table 7 can be stated in the following proposition.

PROPOSITION 9. The two partners' joint gain from giving one of them an option to acquire the JV at an *ex ante* specified price is more likely to fall with the option holder's equity share as the their valuations are less correlated, *ceteris paribus*.

The intuition behind this result can be explained as follows. Although the option issuer's cost for providing the option rises with its initial share, its marginal cost falls as the two parties' valuations are less correlated. In the meantime, although the option holder's gain from the option rises as its initial share falls, the correlation between the two parties' valuations has no impact on its marginal gain. Hence, when the correlation is sufficiently low, the gain from decreasing the option holder's share becomes greater than the cost of increasing the option issuer's share. This result suggests that empirically the holder of an acquisition option is likely to have a low initial share under conditions that cause the two parties' valuations to exhibit a low correlation.

Impact of Acquisition/Divestiture Price

We next turn to the question of how the level of the *ex ante* specified price affects the joint gain that the two partners derive from their JV. As explained at the beginning of this section, the level of the price can be varied by adjusting the parameter ξ in (12.1). A smaller (larger) ξ sets a lower (higher) price, enabling the holder of an acquisition (divestiture) option to

gain more from its option right. So, a change in the value of ξ can be expected to have a distributional effect on the two partners. What is more interesting is that it also affects their joint gain from the venture and that the nature of the effect varies with the degree of correlation between their valuations of the venture's assets. As can be seen from Figure 3, when their valuations are strongly correlated ($\rho = .8$), their joint gain reaches a maximum at a low acquisition price ($\xi \leq .9$) or high divestiture price ($\xi \geq 1.25$); when there is little correlation between their valuations ($\rho = 0$), however, their joint gain reaches a maximum at some intermediate price (around $\xi = 1.05$). Hence, we have

PROPOSITION 10. When a JV contract gives one partner an option to acquire or divest the venture at an *ex ante* specified price, the price set in the contract is likely to be less favorable to the option holder when the two partners' valuations of the venture's assets are expected to exhibit less correlation, *ceteris paribus*.

----- Insert Figure 3 about here -----

This result is quite surprising in terms of both the relationship's nonlinearity and the correlation coefficient's effect on the nature of the relationship.

COMPARISON OF DIFFERENT CONTRACTUAL STIPULATIONS ON JV OPTIONS

The preceding section was devoted to understanding the conditions that influence the size of the economic gain from giving one of the JV partners a contractual right to acquire or divest the JV at an *ex ante* specified price. Yet this understanding does not explain why the JV partners need to put an option clause in their contract when they can acquire or divest their ownership stakes through a negotiated settlement *ex post*. By comparing the results shown in Tables 5 and 6 with those shown in Tables 1 and 2, we can see that an explicit option creates no more value for the two partners than an implicit option if negotiating a settlement *ex post* is no more costly than negotiating an option clause *ex ante*. The reason for putting an option clause in the JV contract,

therefore, has to arise from the condition that the two parties consider an *ex post* settlement to be more costly under the given circumstances.¹⁷

As pointed out in our earlier discussion of bargaining power and negotiation cost, two types of costs can arise from an arrangement that allows the JV partners to terminate their JV at any time through a negotiated transfer of their ownership stakes. One type involves the difficulty of negotiating a mutually beneficial agreement, including the cost of negotiation *per se* and the cost of possible failures to reach such an agreement. This type of cost is reflected in our model through the effect of the negotiation cost $C(t)$. The other type involves the rent-dissipating effect of various power-jockeying behaviors that the partners may engage in with the intent to improve their own bargaining positions for a possible breakup of the JV in the future. This type of cost is not explicitly dealt with in our model but based on our earlier analysis can be reduced by a rise in the cost of negotiating an *ex post* settlement, $C(t)$, which lowers the incentive for the JV partners to engage in those power-jockeying behaviors. Hence, if they foresee a high chance for such behaviors to arise and result in serious rent dissipation, they may find it useful to install certain mechanisms in their initial contract that diminish their expected gain from *ex post* jockeying, including mechanisms that result in a large $C(t)$. The primary mechanisms that can be used for this purpose are contractual stipulations on option rights and conditions for termination.

Putting an option clause in the JV contract can lower both types of costs because, by specifying the parameters for the most likely kind of ownership transfer, it reduces both the need for *ex post* negotiation and the temptation for *ex post* power jockeying. But why doesn't every JV contract have an option clause? From a property rights perspective, such an option clause can also create perverse performance incentives when the growth of the JV depends on efforts from

¹⁷ As a period of joint operation can substantially reduce information asymmetry between the two parties, it should be less difficult for them to negotiate a transfer of their ownership stakes in the JV than negotiation of an outright

both parties. Suppose Party i is given an option to acquire (divest) the JV at a prespecified price. Because the option limits Party j 's gain (Party i 's loss) from the JV, Party j (Party i) is given little incentive to enhance the venture's value beyond (prevent the venture's value from falling below) the level that triggers Party i 's acquisition (divestiture). In view of these incentive problems, we can expect to see contractually specified option clauses only in situations where one partner has a much greater influence on the venture's outcome than the other partner does. We thus have

PROPOSITION 11. A JV contract is more likely to contain an explicit option clause as there is greater asymmetry in the extent to which the efforts of the two partners influence the outcome of the venture, and the holder of an acquisition (divestiture) option is likely to be the party whose effort has a greater (smaller) influence.

When the two parties decide not to give either of them an explicitly specified option, they may need to make a trade-off between flexibility and commitment in designing their JV contract. This trade-off, as discussed earlier, basically involves whether to make it easy or difficult for each party to terminate the JV through a negotiated transfer of their ownership stakes. A flexible termination clause might allow each partner to initiate a negotiation for JV dissolution any time after a brief startup period (e.g., 6 months) by simply sending the other partner a formal notice. Such a clause allows the partners to fully exploit the gain from a divergence in their valuations of the venture's assets but can also invite behaviors that boost their own bargaining power at the expense of the JV's rent-generating potential. A restrictive termination clause, on the other hand, could specify a long contracting period (e.g., 15 years) and hold each partner responsible for a number of obligations that can not be fulfilled until the end of the contracting period. Such long-term obligations may include payment of royalties and use of the other partner as an exclusive sales agent. Some of these obligations (e.g., royalty payments) may not even be terminable when the JV is dissolved early due to such events as the other partner's merger with a third party. Such

acquisition without the JV experience. But adding an explicit option clause might substantially reduce transaction

a clause makes it more costly to negotiate a termination *ex post* since each party can potentially use some of the restrictions to gain bargaining leverage by refusing to relieve the other party of certain contractual obligations. Although the higher negotiation cost can dampen the incentive for the partners to engage in certain power jockeying behaviors, it also diminishes the value of their option to acquire the venture at an *ex post* negotiated price. This trade-off suggests that the termination clause is likely less restrictive when there is less reason for the JV partners to alter their bargaining power opportunistically (Klein, 1992). This condition can be expected to exist if they have already built a mutually beneficial long-term relationship (Inkpen and Beamish, 1997) or if they both value the reputation of being a reliable collaborator (Hill, 1990). Hence, we can expect to see a less restrictive termination clause empirically if the JV partners have collaborated with each other extensively before or are both collaborating with many other firms.

PROPOSITION 12. A JV contract is likely to be less restrictive about venture termination when there is less reason for the two partners to manipulate their relative bargaining power opportunistically.

CONCLUDING REMARKS

Options in JVs possess some unique structural attributes that are not incorporated in any existing option models. One key attribute is that the two JV partners can easily develop differing valuations of the venture's assets because how much they each can gain from the assets without their partner depends on the extent to which their independently-held assets complement those of the venture. As first shown by Chi and McGuire (1996), a possible divergence in their valuations is a necessary condition for the presence of any value in their option to acquire or divest the JV. Because the properties of an option are determined by its structural attributes (Dixit and Pindyck, 1994), it is difficult to gain an accurate understanding of the properties of JV options without modeling their structures explicitly.

costs to be incurred during their joint venturing, as will be discussed in more detail below.

By modeling the two parties' valuations of the JV's assets as two stochastically evolving variables that follow a joint probability distribution, this study is able to uncover some properties of JV options that deviate from those of standard options and may appear counterintuitive at first glance. First, an option's value is widely known to be a monotonically increasing function of the expected growth and volatility in its underlying asset. But we find that this relationship does not apply to the option to acquire or divest the JV at an *ex post* negotiated price if the two partners' valuations of the venture's assets are highly correlated. Second, another well accepted "fact" is that an option always imposes a cost on its issuer. But because the option's holder and issuer in our model have potentially different valuations of the venture's assets, a JV partner can actually derive a gain from granting the other partner an option to acquire or divest the JV at an *ex ante* specified price. Third, our model also yields a surprising result that the price at which the option holder can acquire or divest the JV affects the two partners' payoffs in a nonlinear fashion such that there exists an optimal price that maximizes their joint gain from the option. The main theoretical insights from our model are stated in twelve propositions, and our discussions in the paper also explored ways to operationalize some of the propositions for empirical testing.

The analysis of this paper also suggests that two parties contemplating the formation of a JV may face a trade-off in designing their contract with regard to their flexibility in dissolving the JV through a negotiated transfer of their ownership stakes *ex post*. Although exploitation of the potential gain from a divergence in their valuations of the JV's assets favors high flexibility, the need to ensure their commitment to joint exploitation of the potential synergy between their resources may call for restrictions on JV termination. Our examination of the trade-off between flexibility and commitment shows that the option approach and the transaction cost economics approach are two complementary perspectives, although they may seem to put their emphases on different sides of the same coin.

This study can be extended in a number of directions. First, the model has considerable flexibility to include additional options such as the option to expand or contract, and to scrutinize JV options under different structural constraints such as a lower growth rate after acquisition due to the loss of access to the partner's assets. Second, it is also possible (but computationally much more difficult) to include in the model a third stochastic variable to reflect directly the influence of uncertainty about the extent of complementarity between the resources of the two partners. The current model can only reflect directly the influence of uncertainty about the extent to which the independently-held assets of each partner complement those of the JV. Finally, the present study provides abundant new opportunities for further empirical research on JVs under an option framework, as most of the twelve propositions derived in the paper are potentially testable.

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