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THE *EX POST* JV SUSTAINABILITY AND ACQUIRERS' PERFORMANCES UNDER THE POTENTIAL THREAT OF ADVERSE SELECTION PROBLEM

Abstract. *Concerning on JV (joint venture) dissolution, real option approach has focused on benefit-cost analysis. However, a latent risk in JV is adverse selection problem. If wrong partners are matched, parent firms, i.e., acquirers, can select an outside option to terminate JV. Unfortunately, the outside option can be executed only after JV has begun. Our game theoretic model suggests that JV acquirers are more likely to be matched with low type partners as their expected ex ante JV value outweighs the one when they are matched with high type partners. By Bayesian belief update, acquirers are able to tell their partners' type posteriorly and then JV dissolution can occur. Empirical tests based on US JV data reveal that only manufacturers gain from JV strategy and hierarchical ownership structure is helpful to enhancing acquirers' performances. It is interesting to see that unrelated JV rather than related JV contributes more and, differently from a conventional wisdom, international JV turns out to be as important as domestic JV to acquirers' performances.*

Keywords: *Joint Venture, Adverse Selection, Outside Option, Performance, Panel Analysis.*

JEL Classification: **L24, L25, M21**

1. Introduction

Any type of JV (joint venture) accompanies by fiduciary contract, which requires monitoring cost. Also, incomplete information prevails from partner selection to JV dissolution. Hence, JV acquirers, parents originally offering JVs, tend to show rather opportunistic attitude (Luo, 2007; Arino and Reuer, 2004). If JV partners are cooperators and competitors at the same time, ownership conflict is unavoidable (Das and Teng, 2000).

JV partners can seek out cooperative equilibrium initially; however, bounded rationality can disrupt the cooperative equilibrium, which hurts the sustainability of

JV. This feature proposes two naturally intriguing questions. First, can acquirers circumvent adverse selection before JV contracts? Second, are the JVs sustainable indeed? If so, under which condition it would be sustainable? These questions suggest us to approach *ex ante* JV partner selection separately from *ex post* mutual interdependency.

Even if there are a lot of metaphors describing JV, real option provides a clue to understand JV sustainability. From the perspective of real option, once the cost of cooperation outweighs the benefit of cooperation, JV will be terminated (Habib and Mella-Barral, 2007). In fact, the nearly half of JVs are terminated (Ruer and Leiblein, 2000; Chi, 2000). Due to this problem, JV ownership is typically hierarchical. Asymmetric bargaining power between acquirers and partners justifies unequal governance structure, and socially exchangeable split control is accepted by JV participants accordingly.

An acquirer must find out its project partner but only with limited information, and so the acquirer has to rely on the signals sent from a group of potential candidates. Unfortunately, the acquirer can know its partner's type correctly only after a JV begins. Initially, partners can agree on a cooperative solution for the JV; however, inter-organizational factors like commitment or trust are not enough to enforce the cooperative solution (Benavides-Espinosa and Ribeiro-Soriano, 2014). In this respect, Habib and Mella-Barral's work (2007) provides two important implications concerning on JV duration. First, the longevity of JV largely depends on the degree of partner's moral hazard, and second, partner's type is directly correlated to JV sustainability. Hence, acquirers need to update *ex ante* believes on their partners since adverse selection problem is generically embedded in JV no matter what partners' good will is committed.

Acknowledging this, we attempt to construct a creative game theoretic model. The model is designed to tackle two interesting issues relying on Bayesian belief update process. First, wrong partner identification is a hidden and even intrinsic risk in JV formulation. Second, acquirers can divest JVs if they are confident that low type partners are falsely chosen for JV projects. Acknowledging such theoretic foundations of the paper, some panel fixed effect models are designed. In particular, we focus on how hierarchical governance structure, the related or unrelated JVs, and the domestic or international JVs contribute to the stock market evaluation, size expansion, and profitability of acquirers.

To our best knowledge, there is no previous research theoretically approaching JV sustainability using WPBE (weak perfect Bayesian equilibrium) and empirically examining the strategic advantages of JV on firm performances at the same time.

The paper is organized as follows. In section 2, an expected JV *ex ante* value system creates adverse selection problem in JV partnership. Section 3 exhibits that acquirers are able to tell their partners' type through Bayesian belief update. In section 4, panel fixed model estimation results are discussed. Section 5 summarizes important business implications.

2. Model

2.1. Assumptions

An acquirer, *A*, owns a project that can contribute to *A*'s business portfolio and it actively seeks out a partner firm. Note that *A*'s project type is known to *A* only and incomplete information remains on *B*'s type. From the perspective of *B*, JV type is incomplete information. *A*'s project is either a high type project or a low type project. Between them, a high type project can yield higher outcome. In the paper, a high type *A* is denoted as an acquirer owning a high type project and a low type *A* does an acquirer owning a low type project. Let a high type *A* be A_h and a low type *A* be A_l. *B* is a JV partner and it is either a high type or a low type.

A high type *B* is cooperative and can create synergy for a successful JV but a low type *B* would cause negative externality instead. Denote a high type *B* to be B_h and a low type *B* to be B_l. By sending signals, B_l is able to pretend as if it is B_h and vice versa. Therefore, B_l is motivated to send high type signals as it can increase the chance to participate in A_h's project.

Let S_g be the case when *A*'s high type project is matched with B_h and let S_b be the case when either *A*'s project type is low or *B*'s type is low, or both are low types. A JV between *A* and *B* can contribute highly to *A*'s portfolio with probability p or lowly with probability $1-p$. Therefore, $p = p_g$ is regarded as 'good' under S_g, whereas $p = p_b$ is 'bad' under S_b. Throughout the paper, it is assumed to be $p_g > p_b$. Without the loss of generosity, *A* is assumed to earn higher *ex post JV* outcome under S_g. The duration of JV is described by $T = M + N$ where M represents 'productive' stage and N does 'non-productive' stage.

In the model, the distribution of JV's outcome follows time-independent Bernoulli draws because, in each time during T, *A* can draw either p_i or $1-p_i$ where $p_g > p_b$. *A* can learn the true value of p as T progresses and thus *A* can determine posteriorly whether to continue the JV with *B* or not.

2.2. The Expected *Ex Ante* JV Value System

A high type project is believed to be a high type one with an *ex ante* probability $\overline{\alpha}$ and a high type *B* is believed to be a high type partner with an *ex ante* probability $\overline{\beta}$. An *ex ante* probability that a low type project is believed to be a high type project is denoted by $\underline{\alpha}$ and an *ex ante* probability that a low type *B* is believed to be a high type partner is $\underline{\beta}$. Such prior belief system produces

expected *ex ante* JV values.

Under incomplete information, *A* initially relies on the expected *ex ante* JV values. Incentive compatibility conditions given to equations (1) and (2) yield two restraints: $\bar{\alpha}+\bar{\beta}\geq 1$ and $\underline{\alpha}+\underline{\beta}\leq 1$.

$$\bar{\alpha}\bar{\beta}\geq(1-\bar{\alpha})(1-\bar{\beta}) \quad (1)$$
$$(1-\underline{\alpha})(1-\underline{\beta})\geq\underline{\alpha}\underline{\beta} \quad (2)$$

By the definition of probabilities, $\bar{\alpha}$, $\bar{\beta}$, $\underline{\alpha}$, and $\underline{\beta}$ are all positive. One thing that must be mentioned is that a low type *B* is able to induce $\bar{\beta}\leq\underline{\beta}$ by sending high type signals, which creates adverse selection problem. It is plausible to assume that $\bar{\alpha}>\underline{\alpha}$ because an acquirer owning a high type project will seek out a high type partner more aggressively.[1] Henceforth, the probabilities are defined to be equations (3) and (4) where $\mu>0$ and $\tau>0$.

$$\bar{\alpha}=(1+\mu)\underline{\alpha} \quad (3)$$
$$\bar{\beta}=(1-\tau)\underline{\beta} \quad (4)$$

It is a common knowledge that the expected *ex ante JV* value when both A_h and B_h are believed to be high types dominates the one when both low types are believed to be their original types: $\bar{\alpha}\bar{\beta}\geq(1-\underline{\alpha})(1-\underline{\beta})$. Hence, $\mu-\tau\geq\mu\tau>0$, which suggests $\mu>\tau$.[2] Lemma 1 exhibits that the incentive criterion in equations (1) and (2) cannot prevent B_l's potential deviation. This is why A_h must update the prior information on *B* after JV begins.

Lemma 1. *Under incomplete information on JV partner's type, it is always* $\underline{\beta}\geq\bar{\beta}$.

Proof. Since $\mu>0$ and $\tau>0$, $(1+\mu)(1-\tau)>0$. Then, it is rewritten as $1+\mu>\tau(1+\mu)$, which binds the interval of τ to be $0<\tau<1$. Thus, $\underline{\beta}>\bar{\beta}$.

[1] As long as JV requires huge capital investment and equity share, A_l cannot offer JV aggressively as the opportunity cost of early JV dissolution is non-negligible.

[2] Substituting (3) and (4) into $\bar{\alpha}\bar{\beta}\geq(1-\underline{\alpha})(1-\underline{\beta})$, it is $(1+\mu)(1-\tau)\underline{\alpha}\underline{\beta}\geq(1-\underline{\alpha})(1-\underline{\beta})$. Then, $(\mu-\tau-\mu\tau)\underline{\alpha}\underline{\beta}\geq 1-\underline{\alpha}-\underline{\beta}$, which results in $\mu-\tau-\mu\tau\geq 0$.

Note that $(\bar{\alpha}-\underline{\alpha})(\bar{\beta}-\underline{\beta})<0$, and thus $\bar{\alpha}(\underline{\beta}-\bar{\beta})>\underline{\alpha}(\underline{\beta}-\bar{\beta})$. This provides an important insight. Even under the potential threat of B_l's deviation, A_h's expected *ex ante* gains from JV is always payoff dominant to A_l's expected *ex ante* gains from JV. This makes B_l send high type signals when it observes *A*'s aggressive move. Therefore, the potential threat of deviation is intrinsically prevailing in JV contract and the acquirer becomes to be exposed to adverse selection problem priorly. Nevertheless an acquirer with a high type project is generically inclined to initiate new JV owing to a prior belief that it can be matched with a high type partner as shown in Result 1.

Result 1. *The expected ex ante JV value when both high types are matched is always payoff dominant to the ex ante JV value when both low types are matched.*

Proof. Note that $\bar{\alpha}\underline{\beta}=(1+\mu)\underline{\alpha}\underline{\beta}$ and $\bar{\alpha}\bar{\beta}=(1-\tau)\bar{\alpha}\underline{\beta}$, which can be rewritten into $\bar{\alpha}\bar{\beta}=(1+\mu)(1-\tau)\underline{\alpha}\underline{\beta}$. Therefore, $\bar{\alpha}\bar{\beta}\geq\underline{\alpha}\underline{\beta}$ because $\mu-\tau-\mu\tau\geq 0$.

Result 2 implies that, from the perspective of *A*, the expected *ex ante* JV value relies more on JV project itself than its partner selection. Accordingly, this prior value system drives A_h to launch new JV project although uncertainty on partner's type is prevailing in *ex ante* JV contract.

Result 2. *The expected ex ante JV value out of the combination of a high type project and a low type partner, but believed to be a high type partner, is greater than that out of the combination of a low type project, but believed to be a high type project, and a high type partner.*

Proof. Note that $\bar{\alpha}\underline{\beta}=(1+\mu)\underline{\alpha}\underline{\beta}$ and $\underline{\alpha}\bar{\beta}=(1-\tau)\underline{\alpha}\underline{\beta}$ from (3) and (4). Because $(\mu+\tau)\underline{\alpha}\underline{\beta}>0$, it is $\bar{\alpha}\underline{\beta}\geq\underline{\alpha}\bar{\beta}$.

The order of expected *ex ante* JV values under incomplete information is clearly determined in Result 3. It contains two important implications. First, the expected *ex ante JV* values associated with a high type project obviously outweigh those associated with a low type project. Thus, regardless of its type, *B*'s dominant strategy becomes to accept *A*'s project when *A* shows aggressive move. Second, a high type *A* is always exposed to adverse selection problem as long as it depends on prior belief system. This can explain frequent JV failures in real business.

Result 3. *The order of the expected ex ante belief system is* $\bar{\alpha}\underline{\beta} \geq \bar{\alpha}\bar{\beta} \geq \underline{\alpha}\underline{\beta} \geq \underline{\alpha}\bar{\beta}$.

Proof. Note that $\bar{\alpha}\underline{\beta} \geq \bar{\alpha}\bar{\beta}$ because $\underline{\beta} > \bar{\beta}$. It is also true that $\bar{\alpha}\bar{\beta} \geq \underline{\alpha}\bar{\beta}$ and $\underline{\alpha}\underline{\beta} \geq \underline{\alpha}\bar{\beta}$ where $\bar{\alpha} \geq \underline{\alpha}$.

3. The *Ex Post* JV Sustainability

3.1. Bayesian Update

The sustainability of a JV project with *B*, once it begins, relies on A_h's *ex post* JV evaluation. Due to the bounded rationality discussed in the previous section, the acquirer needs to update its belief on *B* posteriorly.[3] *A* can terminate the JV project later if *B* turns out to be B_l because it can learn the real value of p_i as time goes by.

For Bayesian update, the biggest concern is whether A_h can eliminate B_l's deviation because A_h is supposed to devote high effort for S_g but low effort for S_b. Denote the expected *ex ante* JV value when both project and its partner are high types as $\Phi = \bar{\alpha}\bar{\beta}$, then $1-\Phi = \bar{\alpha}\underline{\beta} + \underline{\alpha}\bar{\beta} + + \underline{\alpha}\underline{\beta}$. By Baye's rule and total probability, the joint conditional probability for S_g during T is given to (5). The unconditional probability where *A* is a high type (α_h) is given to (6) and the unconditional probability where *B* is a high type (β_h) is given to (7).

$$\theta_{h|h} = \frac{p_g^M (1-p_g)^N \Phi}{p_g^M (1-p_g)^N \Phi + p_b^M (1-p_b)^N (1-\Phi)} \tag{5}$$

$$\alpha_h = \frac{p_g^M (1-p_g)^N \Phi + p_b^M (1-p_b)^N \bar{\alpha}(1-\bar{\beta})}{p_g^M (1-p_g)^N \Phi + p_b^M (1-p_b)^N (1-\Phi)} \tag{6}$$[4]

[3] For example, acquirers delay investments for JVs when uncertainty is high (Kulatilaka and perotti, 1998). It is not until they obtain useful information then that acquirers put weight on investing for additional equities. Folta and Miller(2002) also argue that additional equity acquisition is more likely to occur as lower the uncertainty is and vice versa.

[4] $\alpha_h = Pr\{A \text{ is a high type} \cap B \text{ is a high type}\}$
$+ \text{pr}\{A \text{ is a high type} \cap B \text{ is a high type but it is believed to be low}\}$.

$$\beta_h = \frac{p_g^M (1-p_g)^N \Phi + p_b^M (1-p_b)^N (1-\overline{\alpha})\overline{\beta}}{p_g^M (1-p_g)^N \Phi + p_b^M (1-p_b)^N (1-\Phi)} \quad (7)^5$$

The *ex post* joint conditional probability of S_g is increasing in the expected *ex ante* JV value on S_g but with diminishing scale, i.e., $\partial\theta_{h|h}/\partial\Phi > 0$ and $\partial^2\theta_{h|h}/\partial\Phi^2 < 0$. So, we can know that A_h with an optimistic view priorly tends to put high effort posteriorly.

Two implications are important from Lemma 2. First, the higher the gap between p_g and p_b, JV can produce more. Second, too low p_b plays as a huddle to entering mutual collaboration because *A*'s opportunity cost without any JV might be outweighing its opportunity cost to afford a JV under adverse selection problem.

Lemma 2. *The probability to produce JV output in each period during* T *is a linear function of* $\theta_{h|h}$.

Proof. The expected probability for JV to produce output in each time during T is defined as $\theta_{h|h}p_g + (1-\theta_{h|h})p_b$, which is rearranged into $p_b + \theta_{h|h}(p_g - p_b)$.

3.2. JV Sustainability

Now, A_h updates its belief on *B*. Without the loss of generosity, two conditions must be met. The first condition is $\theta_{h|h} \geq \overline{\alpha}\beta_h$, which indicates that A_h's Bayesian *ex post* belief on S_g must be greater than such unconditional *ex post* belief that A_h, while it is believed to be its original type, is matched with B_h by coincidence. The second condition must be met is $\theta_{h|h} \geq \alpha_h\overline{\beta}$. Otherwise, a high type *A* will not rely on WPBE at all as Bayesian update becomes useless.

Thus, we have Result 4. Observing $p_g^M (1-p_g)^N \geq p_b^M (1-p_b)^N$, A_h updates *B* to be a high type partner. Otherwise, mutual collaboration will be terminated as A_h believes that it is located in S_b. Under $p_g^M (1-p_g)^N \geq p_b^M (1-p_b)^N$, $\theta_{h|h} \geq \alpha_h\beta_h$ and $\theta_{h|h} \geq \overline{\alpha}\overline{\beta}$ are satisfied at the same

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5 $\beta_h = Pr\{B \text{ is a high type} \cap A \text{ is a high type}\}$
$+ pr\{B \text{ is a high type} \cap A \text{ is a high type but it is believed to be low}\}$.

time. This means that WPBE based on Bayesian belief update is more efficient compared to the unconditional belief system or the *ex ante* JV value that both high types are accidentally matched.

In practice, learning-by-doing supports A_h's Bayesian update because $\theta_{h|h}$ responds to $p_b^M(1-p_b)^N$ more sensitively but with a negative way. Henceforth, A_h can tell B_l's type posteriorly for sure.[6]

Result 4. *As long as* $p_g^M(1-p_g)^N \geq p_b^M(1-p_b)^N$, *a high type acquirer is posteriorly assured that it is matched with a high type partner.*

Proof. $\theta_{h|h}$ should be greater than the unconditional belief system given to Pr{ A_h is believed to be its original type}* β_{h} and α^{h} * Pr{ B_h is believed to be its original type} simultaneously. By a simple algebra, one can know that $p_g^M(1-p_g)^N \geq p_b^M(1-p_b)^N$ can satisfy both conditions.

4. Empirical Framework

4.1 The Panel Fixed Effect Model

In order to collect JV information, Bloomberg dataset is used from 1999 to 2011. The dataset provides JV information on three different industry categories, i.e. manufacturing, finance, and service. It divides two groups of firms, i.e., sellers and buyers, and the sellers fall under acquirers in the paper. The database reports limited information only such as JV announcement date, ownership structure, nationality, and the seller's SIC (standard industry classification code). We particularly focus on the JV information of US firms for two reasons. First, compared to other foreign firms, a large pool of US public firms shows active JVs. Second, US firms have both sizable domestic and international JVs.

An underlying endogeneity is that acquires are more likely to try new JVs as their JV management know-how is accumulated. This suggests us to distinguish JV activity, as a strategic event, from JV know-how acquired by previous JV experience. Acknowledging this, equation (8) is designed to identify the impact of JV activeness on three performance measures. It is Panel 2SLS (two stage least squares) FE (fixed effect) model where the subscript i represents acquirer index, and c and i represent constant and firm dummy.[7] $y_{i,t}$ is a dependent variable

[6] Note that $\partial\theta_{h|h}/\partial p_b^M(1-p_b)^N < 0$ and $\partial\theta_{h|h}/\partial p_g^M(1-p_g)^N > 0$ while $\left|\frac{\partial\theta_{h|h}}{\partial p_b^M(1-p_b)^N}\right| > \left|\frac{\partial\theta_{h|h}}{\partial p_g^M(1-p_g)^N}\right|$.

[7] Because JV data does not show any peculiar time pattern, time effect is excluded in the model. Actually, JV contract occurs discretely.

measured by three different ways. Stock return, the natural log of sales, and gross profit correspond to stock market evaluation, firm size, and profitability, respectively..

In equation (8), $jv_{i,t}^{n}$, $jv_{i,t}^{f}$, and $jv_{i,t}^{s}$ represent the annual JV numbers of manufacturers, finance institutions, and service firms, respectively. $nw_{i,t}$ represents JV know-how that is measured by the annually accumulated total numbers of JV throughout the sample period. In the 1st stage, acquisition sales contribution dummy, which gives the value of one if acquisitions have positive contributions to sales growth, is used as an instrument variable (z_m) for $nw_{i,t}$.[8] Obtaining $\hat{n}w_{i,t}$ that is orthogonal to $\varepsilon_{i,t}$, we insert it into the panel FE model in the 2nd stage in order to derive an unbiased estimator for $nw_{i,t}$. Hence, JV behavior, as a concrete firm strategy, and JV know-how, acquired by previous JV experience, are separately treated.

$cl_{i,t}$ is the ratio of capital expenditure over liability and it controls the degree of acquirer's affordance on aggressive investment. The growth rate of market capitalization ($mkg_{i,t}$) is a proxy for management skill but sales growth rate ($sg_{i,t}$) is used when return is used as a performance measure. The natural log of gross equipment ($ge_{i,t}$) reveals acquirer's aggressiveness for acquiring additional equipments. Firm size is controlled by the natural log of total employees ($emp_{i,t}$). The GDP growth rate ($gdp_{i,t}$) is a proxy to filter out exogenous market shock on the size and profitability of acquirers but Dow-Jones return ($drj_{i,t}$) is used when the stock return is a dependent variable.

$$
\begin{aligned}
& y_{i,t} = c + i + jv_{i,t}^{n} + jv_{i,t}^{f} + jv_{i,t}^{s} + \hat{n}w_{i,t} + cl_{i,t} + dl_{i,t} + mkg_{i,t}(+sg_{i,t}) + ge_{i,t} \\
& + emp_{i,t} + gdp_{i,t}(+djr_{i,t}) + \varepsilon_{i,t} \quad where \quad E(\hat{n}w_{i,t} \mid jv_{i,t}^{n}, jv_{i,t}^{f}, jv_{i,t}^{s}) = 0 \\
& \hat{n}w_{i,t} = \eta z_m + \upsilon_{i,t} \quad \text{where} \quad E(\upsilon_{i,t} \mid z_m) = 0
\end{aligned}
\tag{8}
$$

In equations (9)-(11), we attempt to examine under which condition JV is more likely to produce better outcome. First, equation (9) focuses on ownership structure. jv_m^h is a dummy that represents the case when acquirer's ownership is higher than partner's and jv_m^l vice versa. Second, equation (10) considers the

[8] Aggressive strategic behavior is desirable as an instrument variable. In this respect, acquisition sales contribution, available in *Compustat*, uniquely falls into the criterion because acquisition strategy is an aggressive firm strategy.

related and unrelated JVs where jv_m^r means a related JV dummy and jv_m^{nr} does an unrelated JV dummy. An acquirer's JV is considered to be a diversified one if its first two digit SIC coincides with a partner's SIC in that year when the JV occurs. Third, equation (11) scrutinizes how domestic JV and international JV affect firm performances differently. jv_m^d represents a domestic JV dummy and jv_m^f does an international JV dummy.

$$y_{i,t} = i + jv_m^h + jv_m^l + nw_{i,t} + cl_{i,t} + dl_{i,t} + mkg_{i,t}(+sg_{i,t}) + ge_{i,t} + emp_{i,t} + gdp_{i,t}(+djr_{i,t}) + \varepsilon_{i,t} \quad (9)$$

$$y_{i,t} = i + jv_m^r + jv_m^{nr} + nw_{i,t} + cl_{i,t} + dl_{i,t} + mkg_{i,t}(+sg_{i,t}) + ge_{i,t} + emp_{i,t} + gdp_{i,t}(+djr_{i,t}) + \varepsilon_{i,t} \quad (10)$$

$$y_{i,t} = i + jv_m^d + jv_m^f + nw_{i,t} + cl_{i,t} + dl_{i,t} + mkg_{i,t}(+sg_{i,t}) + ge_{i,t} + emp_{i,t} + gdp_{i,t}(+djr_{i,t}) + \varepsilon_{i,t} \quad (11)$$

Equations (12) and (13) investigate scenario analyses. Equation (12) considers four combinations. DD_m is a dummy that characterizes domestic-only acquirers pursuing domestic JVs, and DF_m is the case when domestic-only acquirers pursue international JVs. ED_m is the case when exporters pursue domestic JVs, and EF_m is the case when exporters do international JVs. Equation (13) investigates four scenarios regarding to what if domestic-only acquirers or exporters pursue either related JVs or unrelated JVs. D_m^r (F_m^r) is a dummy when domestic-only acquirers (exporters) have related JVs, and D_m^{nr} (F_m^{nr}) is a dummy when domestic-only acquirers (exporters) have unrelated JVs.

$$y_{i,t} = i + DD_m + DF_m + ED_m + EF_m + nw_{i,t} + cl_{i,t} + dl_{i,t} + mkg_{i,t}(+sg_{i,t}) + ge_{i,t} + emp_{i,t} + gdp_{i,t}(+djr_{i,t}) + \varepsilon_{i,t} \quad (12)$$

$$y_{i,t} = i + D_m^r + D_m^{nr} + F_m^r + F_m^{nr} + nw_{i,t} + cl_{i,t} + dl_{i,t} + mkg_{i,t}(+sg_{i,t}) + ge_{i,t} + emp_{i,t} + gdp_{i,t}(+djr_{i,t}) + \varepsilon_{i,t} \quad (13)$$

All the explanatory variables other than JV information are collected from *Compustat* and *Bureau of Labor Statistics*. Due to data availability, only public firms are included and, as a result, total 442 firms with 582 JV observations are used for empirical works.

4.2. Empirical Results

Table 1 summarizes the estimation results on JV's contributions. Surprisingly, JV has significant and positive effects only on the three performance measures of manufactures. [9] This explains why JV related previous works focused on manufacturing sector (Terjesen, *et al*., 2011; Bontempi and Prodi, 2009). In particular, stock market evaluates manufacturers' JVs well. It is also interesting to see that the frequency of manufacturers' JV can enhance profitability.

This contrasting prediction originates from the fact that stock market evaluation is a sort of external intervention done by investors while JV know-how is an invisible internally coordinated managerial skill deeply associated with acquirers' managerial ability. As a matter of fact, JV and its related announcements are rather treated to be individual discrete events in stock market as previous studies argue (Marciukaityte *et al*., 2009; Gleason *et al*., 2006; Chiou and White, 2005). In contrast, JV know-how mingled together with JV event is likely to affect either firm size or profitability since the expertise between JV participants can yield synergy effects. For instance, low cost advantage supported by complementary assets is able to enhance profitability. Consequently, JV know-how has significant and positive effects on size expansion and profitability. This is consistent to Gong, *et al*., (2007) and Tsang (2002) who point out that JV experience can diminish transaction costs.

Table 2 contains answers on what if acquirers' ownership is higher. Surely, hierarchical ownership enhances *ex post* firm size and profitability. This result is consistent to Zhang *et al*., (2007) and Jing *et al*., (2008) who confirm that acquirers' higher ownership is the most salient design to posit foreign partner's persistent commitment. This mechanism ultimately mitigates moral hazard. In contrast, stock market does not respond to ownership structure, which again exhibits that JV is treated just as a single-shot event in stock market.

In Table 3, unrelated JV contributes more to acquirers' performances. The unrelated JV performs better in all three performance measures. Revoking that JV is likely to fail to create synergy effect when partners are competitors (Das and Teng, 2000), the results in Table 3 highlights an important business implication. The synergy effect out of unrelated JV might be more self-sustaining because unrelated JVs are pursued for obtaining such useful complementary assets like new capabilities on R&D or organizational efficiency while related JVs are pursued for accessing existing resources (Nielsen and Nielsen, 2009; Lu and Beamish, 2001). In addition, Table 3 indicates that acquirers can obtain complementary assets more extensively in unrelated fields, which is parallel to Cui and Kumar (2012)'s prediction; high resource complementarity can reduce the likelihood for acquirers

[9] In the dataset, manufacturers, finance institutions, and service firms account for the 63.6%, 23.1%, and 13.3% of JVs. This implies that manufacturers are well rewarded for huge physical commitments.

to terminate JV and this effect would be generally greater to unrelated JV than related one.

Table 4 summarizes how differently domestic JV and international JV contribute to firm performances. Neither domestic-only acquirers nor exporters enjoy additional value in stock market. However, firm size and profitability show contrasting results against stock market evaluation. Both domestic and international JVs have positive and significant effects on sales and gross profit, and domestic-only acquirers turn out to enjoy such effects more than exporters do.

In practice, US firms' cross-border JVs, particularly in technology stressed industries, are a lot welcomed. Of course, host governments are open to JVs because wholly owned subsidiary internalize all business processes while deterring knowledge transfer to local firms (Brouthers *et al.*, 2002). It is also true that host government's strategic trade policy casually expedites favorable JV opportunities to US firms in developing countries. International JVs toward China are good examples (Yao *et al*., 2013). Hence, the international JVs of US firms can be said to be triangular win-win-win strategy as host governments can enjoy welfare effects as well.

Table 5 reports the combined impacts of firm originality and JV target destination. It exactly reveals that international JV works for size expansion. In general, both domestic-only acquirers and exporters gain from international JVs, and stock market positively responds only to the case when domestic-only acquirers implement international JVs. Hence, the results of international JV in Table 4 are reassured. One noteworthy finding is that the sales of domestic-only acquirers significantly owe to both domestic and international JVs. Another finding is that exporters gain from profitability, which enables us to deduce that US exporters actively seek out low cost advantage through JV strategy.

Also, all three performance measures are positive and significant when exporters pursue unrelated JVs. This result exactly coincides with Georgieva *et al*. (2012)'s empirical work; US firm are more likely to collaborate with foreign partners from unrelated industries or with foreign firms not cross-listed in US.

5. Conclusions

The salient feature of the paper is that a theoretic model, putting emphasis on adverse selection problem casually occurring in JV contract, is carefully constructed to approach JV sustainability and some supportive empirical evidences are tested. The main findings of the theoretic model are summarized into the followings.

First, under asymmetric information, hoaxing high type acquirers becomes the best response of low type partners all the time. Second, to our discouragement, our model predicts that acquirers, looking for right partners, are more likely to be matched with wrong partners. Therefore, adverse selection problem originating from asymmetric information is embedded in JV contract. Third, as a result, the cost of JV might be outweighing the benefit of JV. This can explain why acquirers

prefer hierarchical ownership. In the model, acquirers can implement real option; if wrong partners are chosen, they can terminate JVs. For this purpose, Bayesian belief update, not unconditional belief system, is required. In that, a conditional mixed probability, which is comprised of partner type and the productive and non-productive periods, plays as a switch button to terminate JV.

Empirical test results can support the theoretic predictions of the model. First, JV, as a strategic event, significantly contributes to the stock market evaluation, size expansion, and profitability of manufacturers, but not to non-manufacturers'. Second, hierarchical ownership architecture is helpful to acquirers' performances. Third, international JV shows positive relationships with acquirers' performance measures and its contribution is as important as domestic JV. In particular, both domestic-only acquirers and exporters can gain from international JVs. Fourth, between the related and unrelated JVs, the unrelated JV turns out to be enforcing acquirers' performances.

The implication of our work is straightforward. Acquirers should have in mind that low type partners can pretend as if they are high type partners and, as such, adverse selection problem is latent. So, sustainable JV can be achievable only through updating partner's type posteriorly, which asks for continuous monitoring effort. After then, JV can yield satisfactory *ex post* outcome according to WPBE. The limit of the paper is evident. By its virtue, acquirers' belief system is not feasible at all. So, we had to construct empirical framework implicitly assuming that JVs, if they appear throughout whole sample period, are well working based on Bayesian belief update. Surely, this assumption does not deteriorate some useful empirical findings of the paper.

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Table 1. Panel 2SLS FE Model: The Effects of Annual JV Numbers on the Performances of Acquirers

Variables	Return	Log Sales	Gross Profit
Constant	5.1759*** (1.3541)	3.6496*** (0.1191)	-2.8339*** (0.3104)
Annual number of JVs: Manufacturing ($jv^n_{i,t}$)	0.3976* (0.2298)	0.0753*** (0.0192)	0.1601*** (0.0502)
Annual number of JVs: Finance ($jv^f_{i,t}$)	0.2194 (0.6209)	0.0713 (0.0527)	-0.0048 (0.1368)
Annual number of JVs: Service ($jv^s_{i,t}$)	0.3438 (0.5614)	0.0290 (0.0469)	0.0344 (0.1226)
JV know-how ($nw_{i,t}$)	0.1299 (0.4337)	0.1113*** (0.0366)	0.2268** (0.0955)
The ratio of capital expenditure over liability ($cl_{i,t}$)	0.1333*** (0.0284)	-0.0576** (0.0237)	0.1045** (0.0617)
The ratio of long term debt over liability ($dl_{i,t}$)	0.3245* (0.1759)	-0.0336** (0.0147)	0.0267 (0.0383)
Sales growth rate ($sg_{i,t}$)	-0.0981 (0.0969)	-	-
Market cap. growth rate ($mkg_{i,t}$)	-	-0.0379	0.0930

		(0.0291)	(0.0759)
The natural log of gross equipment ($ge_{i,t}$)	-0.8675*** (0.2248)	0.4709*** (0.0195)	0.5779*** (0.0510)
The natural log of total employees ($emp_{i,t}$)	-0.0567 (0.2537)	0.4689*** (0.0220)	-0.3231*** (0.0573)
Dow returns ($djr_{i,t}$)	0.2466*** (0.0391)	-	-
GDP growth rate ($gdp_{i,t}$)	-	-0.2863 (0.2288)	0.2635 (0.5964)
R^2	0.0315	0.9096	0.2284
Observation	3,309	3,270	3,275

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Table 2. Panel FE Model: The Effects of JV Ownership on the Performances of Acquirers

Variables	Return	Log Sales	Gross Profit
Constant	4.8617*** (1.3048)	3.6312*** (0.1186)	-2.8530*** (0.3090)
A dummy given the value of one when acquirer's ownership is higher (jv_m^h)	0.0485 (0.2289)	0.0768*** (0.0201)	0.1329** (0.0525)
A dummy given the value of one when partner's ownership is higher (jv_m^l)	0.1931 (0.7517)	0.0392 (0.0679)	0.1601 (0.1770)
JV know-how ($nw_{i,t}$)	0.1161 (0.3372)	0.1152*** (0.0302)	0.2406*** (0.0788)
The ratio of capital expenditure over liability ($cl_{i,t}$)	0.1339*** (0.0280)	-0.0570** (0.0237)	0.1041* (0.0617)
The ratio of long term debt over liability ($dl_{i,t}$)	0.3235* (0.1734)	-0.0336** (0.0147)	0.0253 (0.0383)
Sales growth rate ($sg_{i,t}$)	-0.0853 (0.0955)	-	-
Market cap. growth rate ($mkg_{i,t}$)	-	-0.0363 (0.0291)	0.0967 (0.0759)
The natural log of gross equipment ($ge_{i,t}$)	-0.8157*** (0.2132)	0.4740*** (0.0195)	0.5819*** (0.0507)
The natural log of total employees ($emp_{i,t}$)	-0.0617 (0.2356)	0.4675*** (0.0220)	-0.3254*** (0.0574)
Dow returns ($djr_{i,t}$)	0.0238*** (0.0037)	-	-

GDP growth rate ($gdp_{i,t}$)	-	-0.2891 (0.2285)	0.2504 (0.5958)
R^2	0.0294	0.9095	0.2279
Observation	3,490	3,270	3,275

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Table 3. Panel FE Model: The Effects of the Related and Unrelated JV on the Performances of Acquirers

Variables	Return	Log Sales	Gross Profit
Constant	5.0521*** (1.3062)	3.6486*** (0.1186)	-2.8355*** (0.3093)
Related Diversification Dummy (jv_m^r)	0.3586 (0.4953)	0.0270 (0.0424)	0.1974* (0.1108)
Unrelated Diversification Dummy (jv_m^{nr})	0.3570* (0.2041)	0.0794*** (0.0180)	0.1091** (0.0471)
JV know-how ($nw_{i,t}$)	-0.0272 (0.3431)	0.1033*** (0.0307)	0.2216*** (0.0800)
The ratio of capital expenditure over liability ($cl_{i,t}$)	0.1345*** (0.0280)	-0.0573** (0.0237)	0.1031* (0.0617)
The ratio of long term debt over liability ($dl_{i,t}$)	0.3325* (0.1733)	-0.0333** (0.0147)	0.0249 (0.0383)
Sales growth rate ($sg_{i,t}$)	-0.0851 (0.0955)	-	-
Market cap. growth rate ($mkg_{i,t}$)	-	-0.0367 (0.0291)	0.0915 (0.0760)
The natural log of gross equipment ($ge_{i,t}$)	-0.8489*** (0.2134)	0.4710*** (0.0195)	0.5793*** (0.0508)
The natural log of total employees ($emp_{i,t}$)	-0.0560 (0.2354)	0.4687*** (0.0220)	-0.3244*** (0.0573)
Dow returns ($djr_{i,t}$)	0.0239*** (0.0037)	-	-
GDP growth rate ($gdp_{i,t}$)	-	-0.2787 (0.2284)	0.2270 (0.5959)
R^2	0.0305	0.9096	0.2279
Observation	3,490	3,270	3,275

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Table 4. Panel FE Model: The Effects of the Domestic and International JV on the Performances of Acquirers

Variables	Return	Log Sales	Gross Profit
Constant	5.0402*** (1.3055)	3.6447*** (0.1186)	-2.8358*** (0.3092)
Domestic JV Dummy (jv_m^d)	0.3566 (0.3230)	0.0705** (0.0282)	0.1407* (0.0737)
International JV Dummy (jv_m^f)	0.3531 (0.2283)	0.0740*** (0.0202)	0.1128** (0.0527)
JV know-how ($nw_{i,t}$)	-0.0174 (0.3421)	0.1041*** (0.0306)	0.2266*** (0.0798)
The ratio of capital expenditure over liability ($cl_{i,t}$)	0.1345*** (0.0280)	-0.0574** (0.0237)	0.1033* (0.0617)
The ratio of long term debt over liability ($dl_{i,t}$)	0.3324* (0.1733)	-0.0335** (0.0147)	0.0252 (0.0383)
Sales growth rate ($sg_{i,t}$)	-0.0851 (0.0955)	-	-
Market cap. growth rate ($mkg_{i,t}$)	-	-0.0378 (0.0291)	0.0934 (0.0760)
The natural log of gross equipment ($ge_{i,t}$)	-0.8473*** (0.2133)	0.4716*** (0.0195)	0.5791*** (0.0508)
The natural log of total employees ($emp_{i,t}$)	-0.0558 (0.2354)	0.4687*** (0.0220)	-0.3243*** (0.0573)
Dow returns ($djr_{i,t}$)	0.0239*** (0.0037)	-	-
GDP growth rate ($gdp_{i,t}$)	-	-0.2867 (0.2283)	0.2485 (0.5956)
R^2	0.0304	0.9096	0.2276
Observation	3,490	270	3,275

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Table 5. The Scenario Analyses

The Effects of the Combinations between Acquirer's Type and the Domestic/ International JVs on the Performances of Acquirers			
Variables	Returns	Log Sales	Gross Profit
Constant	5.0324*** (1.3059)	3.6461*** (0.1187)	-2.8607*** (0.3066)
A dummy: domestic-only firms make domestic JV (DD_m)	0.2491 (0.3561)	0.0798** (0.0310)	-0.0366 (0.0803)
A dummy: domestic-only firms make international JV (DF_m)	0.5514** (0.2605)	0.0744*** (0.0230)	-0.0127 (0.0594)
A dummy: exporters make domestic JV (ED_m)	0.7821 (0.7464)	0.0264 (0.0667)	1.0206*** (0.1726)
A dummy: exporters make international JV (EF_m)	-0.2293 (0.4544)	0.0692* (0.0405)	0.5853*** (0.1049)
R^2	0.0313	0.9096	0.2454
Observation	3,490	3,270	3.275
The Effects of the Combinations between Acquirer's Type and the Related/Unrelated JVs on the Performances of Acquirers			
Variables	Returns	Log Sales	Gross Profit
A dummy: domestic-only firms make related JV (D_m^r)	-0.5706 (0.5036)	0.0637 (0.0571)	0.1730 (0.1490)
A dummy: domestic-only firms make non-related JV (D_m^{nr})	0.0869 (0.2861)	0.0721** (0.0324)	0.1354 (0.0847)
A dummy: exporters make related JV (F_m^r)	0.3908 (0.5531)	-0.0177 (0.0626)	0.2258 (0.1637)
A dummy: exporters make non-related JV (F_m^{nr})	0.3570* (0.1863)	0.0834*** (0.0211)	0.1016* (0.0551)
R^2	0.2952	0.9096	0.2276
Observation	3,275	3,270	3,275

1. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.