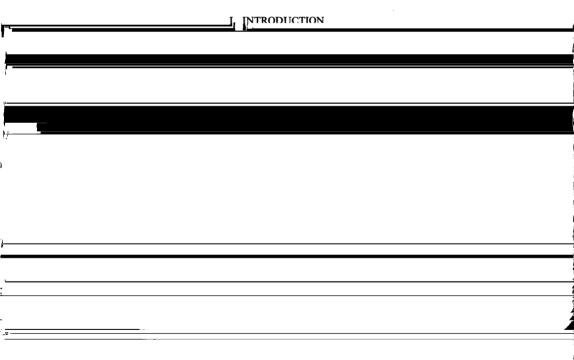# THE STABILITY OF JOINT VENTURES:
RECIPROCITY AND COMPETITIVE RIVALRY*

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The focus of the following empirical analysis is the influence of reciprocity and long-term relationships on the stability of joint ventures. These cooperative incentives are offset by industry structural conditions which may promote competitive rivalry among the partners. To separate these effects on joint venture survival, the hypothesized relationships are proxied by variables drawn from industry and questionnaire data and estimated under a hazard model specification. A theoretical implication of the findings is to suggest a shift of attention from the transaction to the economic relationship as the unit of analysis.

I. INTRODUCTION

Competitive factors commonly motivate the creation of a venture in the expectation of reducing rivalry among the partners or attenuating contractual hazards. Yet, the competitive factors which motivate the venture can be only imperfectly redressed and persist as sources of future instability.

Even when the purpose is primarily for the transfer and creation of knowledge, competitive conflicts disturb the stability of the cooperative agreement. These conflicts include the imitation of the partner's technology, the distortion of transfer prices between the venture and partners, and competition among the partners in the downstream market. Though shared investment weakens some of the incentives to disrupt the venture for the benefit of the partners, equity shares short of full ownership cannot fully resolve the potential for competitive conflict.

There is strong evidence that joint ventures are highly unstable. In Table I

TABLE I
HAZARD RATES* OF MANUFACTURING JOINT VENTURES IN THE UNITED STATES

	Age							
	1	2	3	4	5	6	7	> 7
Total Termination	5.4	9.2	15.2	10.4	13.3	11.8	16.6	35
Dissolution	4.3	3.4	3.8	4.5	6.7	5.9	7.1	12
Acquisition	1.1	5.7	11.4	6.0	6.7	5.9	9.5	22
Number at Risk**	92	87	79	67	60	51	42	31

* Hazard rate is the ratio of terminated joint ventures to all joint ventures which survive to that age.
** Number of initial joint ventures minus previous terminations and those still alive but younger than column age.

The significant number of terminations of joint ventures in the early years suggests, however, that many of these terminations are a result of business failure or a fundamental instability in governance.

In the following, an investigation into some possible causes of joint venture instability is carried out through an empirical analysis of dissolutions. In particular, our analysis permits insight into a theoretical premise that the stability of cooperation is promoted by the potential to reciprocate. This premise is central to the arguments of Schelling [1960], Telser [1980], Williamson [1983], and Axelrod [1984], among many others. Cooperation, in this view, is established by the ability of parties to an agreement to reciprocate penalties in the case of competitive behavior and to reward altruistic behavior.

Despite the importance of this premise, most of the supporting evidence has been drawn from computer and simulated laboratory experiments. Using data on the life histories of 92 joint ventures, the statistical analysis described below confirms that joint ventures between partners who have other long-term relationships are more stable. An implication of this validation is that the transaction cannot be a unit of analysis in the absence of a broader understanding of the relationship among the parties. In particular, there is evidence that other horizontal ties, including technology transfer, promote cooperation.

II. CAUSES OF INSTABILITY

Cooperation motivated by the need to mitigate contracting difficulties or to effect collusive outcomes is likely to be fragile. It is axiomatic that an agreement among rational actors endures as long as the benefits, net of any penalties, of defecting are perceived to be outweighed by the benefits of further cooperation. An agreement motivated by the difficulty of regulating tacit collusion or contracting obligations is likely to prove easily unstable.

Two sets of variables can be expected to be associated with the decision to

terminate a joint venture. The first consists of the incentives among the partners to cooperate. Ventures are likely to be characterized by competitive rivalry over the residual claims (as influenced by dividend or transfer price policies), over control of the operating management of the assets, or concerns over the loss of technology and brand labels. Whether such rivalry leads to termination is not only a function of the future benefits of the venture but also the degree of reciprocity among the partners. Instability of the venture should increase, the greater the competitive incentives among the partners and the lower the degree of commitment to the overall relationship.

A number of theoretical treatments of cooperative stability emphasize the importance of reciprocity within an economic relationship. Schelling [1960] suggested that good faith may be maintained through trust or the exchange of hostages. Noting the importance of trust, he argued it could also be understood in terms of the potential for reciprocity. "Trust is often achieved," he writes, "simply by the continuity of the relation between parties and the recognition by each that what he might gain by cheating in a given instance is outweighed by the value of the tradition of trust that makes possible a long sequence of future agreement" (Schelling [1960] pp. 134–135).

Where social conventions of trust are not pertinent, he went on to argue, then enforcible agreements may be achieved by hostage agreements. More recently, Williamson [1983] extended mutual hostage positions as a means to stabilize transactional relationships which entail dedication of assets to the exchange.[2] A similar notion of the potential for reciprocity—but of both a positive and detrimental kind—underlies Axelrod's [1984] recent work on the stability properties of "tit-for-tat" behavior. Using computer tournaments, Axelrod found the winning strategy was one where a cooperative or a competitive move evoked a reciprocal and equal response.

A joint venture can be conceived in similar terms. Through joint equity contributions, both partners have committed themselves to the venture, sharing proportionately in the gains and losses. As Buckley and Casson [1988] argue, joint ventures are mechanisms by which to enforce "mutual forebearance" among the partners. But, of course, initial equity shares are unlikely to reflect perfectly the rewards to cooperative action or to outweigh always the gains to defect from the agreement. Thus, to the extent that the venture can be coupled with other mechanisms, it can be expected that the greater the norms of reciprocity, or the potential to retaliate, the greater the stability of a venture.

The second set of variables describes the nature of competitive rivalry within an industry. Of particular relevance are the findings of Caves and Porter [1978] which showed that market share instability is greater for industries of intermediate concentration.[3] Interestingly, Pfeffer and Nowak

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[2] For an application to joint ventures, see Kogut [1986].

[3] See also Caves and Porter [1980], Bloch [1981], and Meisel [1981].

[1976] found that joint venture incidence tends to be highest in industries of median concentration, presumably because institutionalized coordination is not possible in competitive, and not necessary in highly concentrated industries.[4]

If a joint venture represents a mechanism by which to stabilize competition between two firms, then changes in the degree of interdependence may prove destabilizing. On the one hand, decreasing interdependence may negate the benefits of institutionalized cooperation. On the other hand, increasing interdependence might improve mechanisms of monitoring and enforcement of tacit agreements, or might lead to greater instability in the initial agreements. In either case, changes in the initial variables to the decision to cooperate are likely to be destabilizing.

Like any business, a venture will last as long as the conditions for profit are promising. However, the relationship of the stability of a joint venture to industry growth is more problematic than that of a simple business. Joint ventures are commonly used for firms to pool different skills for the application to new and emergent markets. Whereas the growth of the industry is likely to increase industry profits, it is also accompanied by a process of consolidation and jockeying for position. It is arguable that the potential for conflict among partners increases with high rates of industry

dominate the decision to continue appears to be largely an empirical question.

III. DATA

To test the relationship of the above variables on joint venture stability, data were collected on the venture and industry characteristics. Information on joint ventures was first acquired from the publication *Mergers and Acquisitions* for the years 1975 to 1983.[5] The sample included only ventures

The questionnaire was designed to elicit factual information regarding the starting and, in the case of termination, ending dates for the venture, as well as its primary purpose. On the basis of this information, termination rates (that is, the number of ventures dissolved or acquired by one of the partners or a third party) are estimated to be in the environ of 43%. A follow-up questionnaire was sent one year later to those ventures reported still alive, which resulted in raising the termination rate to 55%; a second follow-up a year later raised the termination rate to 70%.

Because the ventures consist of both domestic and international (that is, ownership shared between an American and non-American firm), it is possible that estimates may be biased if the hazard rates differenced among the two groupings. To test for this difference, the sample was stratified. The Breslow and Mantel–Cox statistics indicate no significant difference between the two strata.

IV. VARIABLES

The regression equation provides an estimate of the contribution of the covariates to the (log) likelihood of dissolution. Clearly, termination is not

ventures which terminate early relative to those which terminate later provide inferences on the factors which influence the order of termination. The estimation procedure, as discussed later, incorporates the ordering of termination. Termination may consist of the dissolution of the venture and liquidating the assets or of the acquisition of the venture by one of the partners or a third party. We examine only the dissolution of the venture, as it

the partners.[6]

The first set of variables concerns the relationship between the partners. The previous discussion identified the central hypothesis that the potential to reciprocate establishes commitment and stabilizes cooperation. The usual formulation of the probability of cooperation is through a comparison of the foregone benefits if cooperation continues against the immediate gains of defection (Schelling [1960]; Tesler [1980]). This argument appears to impose substantial requirements of rationality and information. However, Axelrod's [1984] tit-for-tat exchange suggests that a short horizon with immediate penalty for defection is sufficient to ensure cooperation.

The proxy for reciprocity used in this study draws on the stability property of bundling agreements in order to provide for potential tit-for-tat exchanges.

In his analysis of self-enforcing contracts, Telser [1980] notes that though individual contracts may be violable, the probability of cooperative behavior can be increased through bundling one agreement with other contractual relationships of value to both parties. Non-cooperative behavior by a joint venture partner is punishable by reciprocating in the context of other agreements. Thus, a joint venture agreement is more likely to endure if it is

service. Marketing and advertising expeditures are taken from the Line of Business, FTC.

The sign on this interaction is predicted to be positive.

The joint interaction of production assets and minimum efficient scale poses a more complex consideration. On the one hand, it could be argued that production ventures should be less easy to dissolve simply because the assets are physical rather than intangible and are also slower to depreciate in value.

production activities on the likelihood of termination. However, in industries where minimum efficient scale is high, it may be better to force each partner to

volatility. These considerations suggest the proxy of the absolute value of change in the degree of sellers' concentration can serve as an index of instability.

> *CHANGE IN CONCENTRATION*: Change in sellers' concentration is the absolute value of differences in concentration between the years nearest to the start and close of the venture for which there are data. Data are taken from the Bureau of the Census, Manufacturing, 1972, 1977, 1982.

CHANGE IN CONCENTRATION is predicted to be positively related to the log hazard.

One source of instability is the growth rate of the industry. A proxy for the business health of an industry is the growth in shipments at the 4-digit level during the life of the venture.

> *SHIPMENT GROWTH*: Annual average geometric growth in shipments at the 4-digit level in constant dollars. Shipment data are taken from unpublished data of the Department of Commerce.

If industry growth improves the profitability of the venture, *SHIPMENT GROWTH* is expected to be negatively related to the likelihood of termination. However, if business growth also enhances the competitive rivalry among the partners, it should be positively signed.

The final structural variable is the influence of intermediate sellers' concentration. As argued above, the instability inherent in industries of intermediate concentration, which some studies show to lead to a higher incidence of joint venture creation, may also be responsible for higher rates of terminations. Once the venture is created, the same problems of instability, and the benefits of defecting, should plague the duration of the venture. Joint ventures can serve as rational mechanisms to achieve cooperation in unstable oligopolistic industries. At the same time, however, cooperation is likely to be more fragile in the occurrence of random shocks.

In absence of the knowledge to identify these shocks, we follow the

TABLE II
PREDICTED SIGNS OF INDEPENDENT VARIABLES

Variable Name	Predicted Sign
TIES	−
R & D INTENSIVE	−
SCALE INTENSIVE	+
MARKETING INTENSIVE	+
CHANGE IN CONCENTRATION	+
SHIPMENT GROWTH	NP
MEDIAN CONCENTRATION	+
R & D	NP
PRODUCTION	NP
MARKETING/DISTRIBUTION	NP

NP: No Prediction.

TABLE III
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

	Mean	Standard Deviation	Lowest	Highest
(1) TIES	0.41	0.50	0.0	1.0
(2) R & D INTENSIVE	0.45	2.34	−2.89	7.4
(3) MARKETING INTENSIVE	−0.002	0.70	−0.90	3.4
(4) SCALE INTENSIVE	5.62	77.83	−47.35	403.6
(5) CHANGE IN CONCENTRATION	6.59	5.44	0.0	25.0
(6) SHIPMENT GROWTH	0.03	0.09	−0.21	0.35
(7) MEDIAN CONCENTRATION	0.51	0.50	0.0	1.0
(8) R & D	0.51	0.50	0.0	1.0
(9) PRODUCTION	0.57	0.50	0.0	1.0
(10) MARKETING/DISTRIBUTION	0.53	0.50	0.0	1.0

Spearman Correlation Matrix

	1	2	3	4	5	6	7	8	9
1	—								
2	0.05	—							
3	0.04	0.15	—						
4	0.21	0.04	−0.25	—					
5	0.10	−0.12	0.13	0.10	—				
6	0.07	−0.26	−0.31	−0.06	0.02	—			
7	0.11	−0.12	−0.12	−0.02	−0.04	−0.17	—		
8	0.02	0.06	0.08	−0.04	0.07	0.22	0.04	—	
9	0.12	−0.10	−0.35	−0.06	0.02	−0.08	−0.05	−0.05	—
10	0.06	−0.10	−0.14	−0.17	0.02	−0.25	−0.06	0.06	0.07

argument and specification of Caves and Porter [1978, 1980]. They modelled intermediate concentration by segmenting their sample by inspection into two groups, with one group being identified as representing median concentration. We use this approach, though the cutpoints are defined by segmenting the concentration rates around the median into quarter partitions and grouping the second and third quarters as median concentrated industries.

MEDIAN CONCENTRATION: Median sellers' concentration is measured by a dummy variable set to one if the industry of the venture has a concentration ratio which deviates from the median by less than the quarter of the observations in either direction; to zero if otherwise. Data are taken from the Bureau of the Census, Manufacturing, for 1972, 1977, 1982, selection of the year being determined by proximity to the midpoint between the starting and terminating dates of the venture.

This variable should be negatively related to termination.

The above arguments are summarized in Table II. The variables are described in Table III. As can be seen, the collinearity is low among the variables. Only the shipment growth variable showed any outliers, but the elimination of these cases did not influence significantly the estimations.

V. MODEL SPECIFICATION

Previous studies on joint venture mortality have relied on statistical tests which do not correct for problems of censored data and aging effects.[9] To adjust for these effects, a partial likelihood model is used. Partial likelihood, as first proposed by Cox [1972], estimates the influence of explanatory variables (or covariates) on the hazard of termination without specifying a

in terms of the sequence of terminations and maximizes the partial likelihood that the ith venture should terminate conditional on the characteristics of the other ventures at risk at the time of termination.

Based on this ordinal ranking, a likelihood is given that the ith failure (event) should occur as conditional on the hazards of the other organizations at risk at this time:

$$(1) \qquad L_i = ho(t_i) \exp(X_i/B)/ho(t_i)\left(\sum_j \exp(X_jB)\right)$$

For simplicity, the coefficients and covariates are given as vectors B and X, respectively, with i indexing the venture which failed at time t_i, j indexing the ventures at risk at time t_i, and L_i is the likelihood for the ith event. Since the baseline hazard is considered to be the same for all organizations, the denominator can be factored into the baseline hazard multiplied by the weighted sum of the covariates. Taking logs, we have therefore:

$$(2) \qquad \log L_i = X_iB - \sum_j X_jB$$

where $\log L_i$ is the log likelihood; the other expressions are as before. Note that the baseline hazard rate has cancelled out. Thus, the likelihood is equivalent to allowing only the covariates to contribute directly to the statistical inferences.

The overall likelihood is then calculated as the sum of the individual log likelihoods. Estimation of the coefficients is derived numerically by

estimations since only information on ventures for each interval during which a venture failed is used. Partial likelihood is, therefore, appropriate when the time to failure is not of interest and there is no theoretical guidance to the specification of the parametric function.

Though partial likelihood assumes continuous time, it has been found that estimates are robust as long as the number of ties to those at risk is not high (Kalbfleisch and Prentice [1980]; Cox and Oakes [1984], pp. 101–4). Allison [1984] gives the thumb rule of less than 50% events per the total at risk.[10] Our data fully satisfy this condition.

VI. STATISTICAL RESULTS

The estimated regression coefficients are given in the first column of Table IV. We report one-tailed tests for the variables with predicted signs; two-tailed for those with no prediction.

The principal hypothesis in our study is that other relationships among the partners will stabilize cooperation in the joint venture. This hypothesis is proxied by the variable *TIES*, which is estimated to reduce the hazard rate, with a significance less than 0.05. Embedding the venture in other long-term economic relationships among the partners has a stabilizing influence on cooperation.

R&D INTENSIVE ventures tend to be significantly (at 0.05) more stable. The direct effect of research and development is weakly associated with greater instability, as might be expected from R & D activities which often carry

TABLE IV
PARTIAL LIKELIHOOD ESTIMATES OF COVARIATES TO LOG HAZARD OF DISSOLUTION

Variable Name	(1) Dissolution	(2) Plus Proportionality Test	(3) Plus Horizontal Ties
TIES	−1.09	−1.08	—
	(−2.29b)	(−2.27b)	
R & D INTENSIVE	−0.35	−0.34	−0.34
	(−2.12b)	(−2.07b)	(−2.05b)
SCALE INTENSIVE	0.004	0.004	0.004
	(1.92b)	(1.96b)	(2.15b)
MARKETING INTENSIVE	−0.10	−0.07	−0.09
	(−0.23)	(−0.16)	(−0.19)
CHANGE IN CONCENTRATION	0.08	0.08	0.07
	(2.20b)	(2.00b)	(1.74b)
SHIPMENT GROWTH	4.61	9.30	10.05
	(1.48)	(2.01b)	(2.12b)
MEDIAN CONCENTRATION	0.93	0.95	1.14
	(1.83b)	(1.86b)	(2.20b)
R & D	0.59	0.73	0.57
	(1.32)	(0.46)	(1.27)
PRODUCTION	−0.42	−0.33	−0.38
	(−0.97)	(−0.75)	(−0.84)
MARKETING/DISTRIBUTION	0.42	0.48	0.33
	(0.92)	(1.05)	(0.71)
PROPORTIONALITY TEST	—	−1.34	−1.24
		(−1.24)	(−1.17)
HORIZONTAL TIES	—	—	−1.52)
			(−2.40a)

a: $P < 0.01$
b: $P < 0.05$
(T statistics in parentheses)

the venture is itself not competitive due to a failure to achieve full efficient scale. A sorting out of the interpretations cannot, though, be answered by the present data set.

The industry structural variables display mixed findings. *CHANGE IN CONCENTRATION* has a positive and significant effect on the hazard rate. Thus, volatility in sellers' concentration, as a reflection of competitive disequilibrium, is associated with instability of joint ventures.

Given the traditional focus on competitive rivalry in industries of intermediate concentration, it is of interest that *MEDIAN CONCENTRATION* is correctly signed as positive and significant at 0.05. There is the suggestion of a paradox in this result. The instability of industries of intermediate concentration leads to attempts to reduce competitive behavior through informal and formal, such as through joint ventures, agreements. Yet, the underlying conditions of instability are not surprisingly also associated with higher dissolutions rates of these agreements, at least for joint ventures. In conjunction

with the finding on *CHANGE IN CONCENTRATION*, these results emphasize the fragility of cooperation in industries where the underlying structure is conducive to competitive instability.

VII. DISCUSSION

The significant effect of ties among the partners on stabilizing the venture is of interest for two reasons. First, it provides a statistical confirmation of the importance of how bundling contracts can result in greater stability. But more provocatively, it also challenges a contrary tendency to analyze governance issues as restricted to the economic properties specific to a transaction. An implication of these results is that an analysis of the governance of a transaction must include the wider network of ties among the partners, if not also other affected parties. Indeed, an extreme inference would be that the economic relationship, as opposed to the transaction, is the proper unit of analysis.

A result less easy to interpret is the finding of the insignificant effect of industry growth on the probability of dissolution. One possibility is a potential bias due to a violation of the assumption of proportionality of the hazard rates over time.[11] Since high industry growth rates are difficult to maintain, *SHIPMENT GROWTH* may be negatively correlated with time.

hazard rate.

To test this possibility, a variable was created to capture the interaction between shipment growth and time at risk (called *PROPORTIONALITY TEST*). These results are given in the second column of Table IV. The insignificance of the new variable *PROPORTIONALITY TEST* indicates that there is no evidence for a violation of proportionality. To the contrary, it strengthens the estimated significance of the effect of shipment growth on the hazard rate.

The positive relationship between industry growth and the hazard of dissolution suggests that competitive conflicts among the partners are engendered by the growth of external opportunities. Of some interest, this destabilizing effect swamps the probable positive effect of growth on financial results. This finding tentatively suggests that whereas cooperative ventures may indeed be encouraged by the need to share risks in emergent industries, once the market uncertainties have been favorably resolved, the attractiveness for further cooperation lessens.

The results also have a peripheral implication towards supporting Caves

However, largely unexplored is the influence of industry structural variables and the relationship among the parties on the durability of an explicit cooperative agreement and its governance structure. The above statistical findings show that median concentration is associated, though weakly so, not only with the instability of market shares, but also with that of formal cooperative agreements.

VIII. HORIZONTAL TIES AND STABILTY

The *TIES* variable is a composite of three measures: supply, other joint venture, or licensing agreements. Whereas a supply agreement typifies a vertical relationship between a buyer and seller, a licensing or joint venture agreement is usually best conceived as a horizontal transaction involving technology. A license provides the user with the technology used in the manufacturing of similar products as produced by the seller. Joint ventures in manufacturing are invariably a pooling of differential abilities or cooperation among competitors. In either case, the agreement usually involves the transfer of technology to the venture.

As a result, separate tests were run with each of the three measures making up the dummy scale. The results, which are not given in the table, show that supply agreements have no effect on the hazard rate, but other licensing and joint ventures are marginally significant at 0.05 in decreasing the likelihood of dissolution. Stronger results were attained, as shown in column three of Table IV, when only licensing and other joint venture relationships are used to build the dummy scale, which we have labeled *HORIZONTAL TIES*, which is significant at 0.01.

Although the results are not remarkably different than the earlier estimations, they reinforce that ties between the partners are especially instrumental in promoting cooperation when they involve technology and the pooling of differential skills. Thus, the influence of ties on stabilizing the joint venture has two interpretations. One is that prior experience among the partners embeds the joint venture in a bundle of agreements which encourages cooperation and reciprocity. The other is that technological exchange, in particular, appears to favor cooperation. The two interpretations are clearly not mutually exclusive and, in fact, are likely to be proven as complementary.

IX. CONCLUSIONS

This article proposed and tested the proposition that a joint venture is cooperation within a competitive context. In supporting this proposition, the empirical findings are relevant to two broader questions regarding the cooperative aspects of R & D ventures and the importance of reciprocity. The statistical tests point to a distinction between R & D and other activities.

Ventures including research and development in R & D intensive industries tend less to be dissolved than other ventures. A plausible interpretation of this result is that ventures motivated by the transfer or creation of knowledge reflect more potent cooperative incentives relative to other kinds of ventures. Whether this cooperation reflects the gains from enhanced efficiency or more effective means to enhance market power awaits more rigorous specifications of the downstream competitive market.

The dampening of the hazard of dissolution when there are other relationships among the partners (as proxied by *TIES*) conforms to the contentions of a wide-body of economic research. Reciprocity in the potential to reward and penalize behavior among transacting parties is fundamental to the achievement of long-term cooperation. Whereas the evidence regarding reciprocity and stability has largely been derived through case studies and computer tournaments, the above results offer a modicum of large sample validity. Moreover, the findings indicate the importance of understanding contractual hazards and benefits in terms of the relationship among firms. That cooperation prospers in the context of a wider set of transactional agreements between two firms is of far reaching consequences for the design and governance of economic exchange.

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