Strategic Choice of Joint Venture vs. Merger - An Incomplete Contract Approach

Len-Kuo Hu[1], Chu-Hua Wu[2]

Abstract

Drawing upon the incomplete contract theory, this study provides some clue tox the strategic choice between joint venture and merger when a company seeks to expand its business scope. As a result of non-contractibility (or non-verifiability) of some variables (e.g., value increase from the manufacturer's R & D investment or cost deduction for the dealer in this paper), some ownership provision to the acquired company after the merger may prove to be more lucrative to the acquirer than 100% takeover. Unloading 35% of equity share to the acquired company would enable the acquirer to fetch the maximum welfare from the merger. This study also compares the welfare and the effort of both companies in joint ventures and mergers, and concludes that joint ventures would provide greater social efficiency and welfare than mergers even after considering ownership incentive to the target company for the latter. The social cost of integration outweighs its benefit.

Keyword: joint venture, mergers & acquisitions, incomplete contract, stock ownership, agency theory, corporate control

[1] Professor, Department of International Trade, National Chengchi University
[2] PhD student, Department of International Trade, National Chengchi University

I. Introduction

Financial researchers[3] have classified corporate acquisitions as part of "the market for corporate control". Under this concept, management teams are viewed as facing constant competition from other management teams. If the team that currently controls a company is not maximizing the value of the company's assets, then an acquisition will likely occur and increase the value of the company by replacing its poor managers with good managers.

However, many mergers are motivated by and aimed at the acquisition of intangible assets hidden in the managers' (or employees') productivity. After losing corporate control, the target company's employees will no longer make such due diligence in the integrated company as before. Since worker's effort is non-verifiable, a merger's contract cannot take every contingency into account. Lacking the ownership of property or control right, the target company turns up not as valuable as what the acquiring company initially anticipates. Maybe it is the reason why the empirical evidence[4] constantly indicates that mergers do create value but that shareholders of target companies reap virtually all of the benefits.

Mergers are the one way for two companies to join forces, but many companies are striking cooperative deals, called corporate alliances, which fall far short of merging. Whereas mergers combine all of the assets of the firms involved, as well as managerial

---

[3] E.g., Harris & Raviv (1988) and Stulz (1988) emphasize the ability of shareholders to affect the nature of a takeover attempt by changing the incumbent's ownership share.
[4] For an excellent summary of the effects of mergers on value, see Michael C. Jensen and Richard S. Ruback, ``The Market for Corporate Control: The Scientific Evidence,'' *Journal of Financial Economics, April 1983, 5-50.*

and technical expertise, alliances allow firms to create combinations that focus on specific business lines that have the most potential for synergies. One form of corporate alliance is the joint venture, in which parts of companies are joined to achieve specific objective. A joint venture is controlled by a management team consisting of representatives of the two parent companies. Since the companies remain distinct legal entities, the ownership of control right of the company will not be jeopardized by the joint venture. The aforementioned pitfall undermining the merger’s value will not fall upon the joint venture. Nowadays, joint ventures have been used extensively and successfully by U.S., Japan, European and many Asian firms to share technology and /or marketing expertise.

Drawing upon the contract theory (e.g., Salanie (1998), Laffont (2000)), this study is intended to examine and compare the effort and welfare of the companies engaging in joint venture or merger. In a world of complete contracts, the allocation of property rights only matters for distributive purposes. Complete contracts can specify in full detail what each party must do in each state of the world and how the surplus should be shared. For example, if a firm M (the manufacturer) produces computers that a firm D (the dealer) sells to the public, it is socially indifferent whether the two firms are legally distinct, whether M buys D or whether D buys M. The theory of complete contracts appears to have nothing to say on what pins down the boundaries of firms.

In reality, the boundaries of firms are not random. When business leaders discuss vertical integration, they constantly refer to efficiency concept. The theory of incomplete contracts allows us to give this question a central role and to link them to the legal issue. The anglo-saxon legal tradition defines property rights as residual control rights. When an unforeseen contingency occurs, the owner has the right to decide how the good should be used. The owner also gets exclusive rights on all income streams that have not been shared in advance by a contract. These rights clearly have no value if contracts are complete, since no unforeseen contingency then ever arises. They only matter if contracts are incomplete.

The study of incomplete contracts is still at a preliminary stage. The models used by different authors are rarely comparable, and the general foundations of the theory have not been established yet. A major problem is that the theory has not been able to provide a satisfactory description of the limits imposed by the non-contractibility problem in the allocation of resources. Either one accepts the Maskin-Tirole (1999) critique and first-best social welfare maximization is achieved (note that this approach still requires a benevolent court) or arbitrary restrictions are put on possible contracts. As in most of the literature, I will concentrate here on examining the case where information is symmetric: All variables are observed by all parties, but some of them may not be included in a contract. Such excluded variables are observable but non-verifiable, meaning that no court or other third party will accept to arbitrate a claim based on the value taken by these variables.

Section II sets up an incomplete contract model with two companies involving in the manufacturing and marketing of an innovative product. The analysis of joint venture relationship between these two companies is then undertaken in section III. Analogous to the Stackelberg approach, the optimal investment effort and equity share arrangement by the acquiring company is then investigated in section IV. The welfare and effort of the two companies under different corporate relations are compared in section V. Some concluding remarks are made in section VI.

II. The Basic Model

In the following we are setting a model facilitating our discussion of the integration of firms. Analogous to the example in Holmstrom-Tirole (1989), we assume that the two firms contemplating a merger or joint venture are the computer manufacturer M and his dealer D. M then decides to invest in research and development of an innovation that will increase the market value of his computers. The increase in value expected from this innovation is a random variable ν. The dealer, instead, can modify his product line and his commercial practices, which entails a random cost ρ. The variable ν may take two values: $\underline{\nu}$ and $\overline{\nu}$. M can influence the probability distribution of ν by making specific effort x that costs him $\phi(x)$ but ensures that the probability that $\nu = \overline{\nu}$ is x. Similarly ρ may be $\underline{\rho}$ or $\overline{\rho}$, and D can ensure that the probability of $\rho = \underline{\rho}$ is y by taking specific effort y that costs him $\varphi(y)$.

This study aims to structure an appropriate relationship for these two firms so that the best outcomes can be accomplished for the shareholders of either firm. For a given allocation of property rights, the game is structured as follows: (1) M and D choose the values of x and y and pay the corresponding costs $\phi(x)$ and $\varphi(y)$. (2) M and D observe the values taken by ν and ρ. (3) M and D renegotiate to decide whether or not the innovative computer is to be put on sale and, if yes, how to share the surplus.

Assume that $\underline{\rho} < \underline{\nu} < \overline{\rho} < \overline{\nu}$. The innovation will be sold in the three cases (out of four) where ν is larger than ρ; the exception is the case where $\nu = \underline{\nu}$ and $\rho = \overline{\rho}$, which has the probability of $(1-x)(1-y)$. Denote $S(x,y)$ the expected gross social surplus, that is, $S(x,y) = E(\max(\nu-\rho,0)|x,y) = (\underline{\nu}-\underline{\rho})(1-x)y + (\overline{\nu}-\overline{\rho})x(1-y) + (\overline{\nu}-\underline{\rho})xy.$

The social optimum can be obtained by maximizing the net expected social surplus, i.e., $\max_{x,y}[S(x,y)-\phi(x)-\varphi(y)]$. By assuming $\phi(x)=x^2$ & $\varphi(y)=y^2$ for simplicity, the social optimal efforts (investments) for M and D are

$$x^* = \frac{2(\overline{\nu}-\overline{\rho}) + (\underline{\nu}-\underline{\rho})(\overline{\rho}-\underline{\nu})}{4-(\overline{\rho}-\underline{\nu})^2} \qquad (1)$$

$$y^* = \frac{2(\underline{\nu}-\underline{\rho}) + (\overline{\nu}-\overline{\rho})(\overline{\rho}-\underline{\nu})}{4-(\overline{\rho}-\underline{\nu})^2} \qquad (2)$$

Since x & y play a dual role of effort and probability, we need to normalize their size so as not to exceed one or below zero. Let the social optimum efforts thus derived ascertain that the innovation is sold with probability one. Given $x^* = y^* = 1$, the relationship among $\overline{\nu}-\overline{\rho}, \overline{\rho}-\underline{\nu}$ & $\underline{\nu}-\underline{\rho}$ will become $\overline{\nu}-\overline{\rho} = \underline{\nu}-\underline{\rho} \equiv \mu$ & $\overline{\rho}-\underline{\nu} = 2-\mu$ based on equations (1) and (2). The parameter μ is hereby used to gauge the size of gain from this innovation. To make it possible that the investments by M and D in the most adverse case will render this innovation economically infeasible, i.e., $\bar{\rho} - \underline{v} > 0$, we assume here that $0 \le \mu \le 2$. The expected social optimum surplus (W_{SO}) as a result of the optimal efforts (investments) of M and D can be derived as $W_{SO} = \mu$.

III. The Joint Venture Case

Firstly we consider the case of joint venture between M and D in which M and D are treated as distinct legal entities. Based on the Nash bargaining solution we assume that M and D decide to share the gross expected social surplus equally when renegotiating. Hence M chooses his effort (investment) x by maximizing

$$W_{JV(M)}(x, y) = \frac{S(x, y)}{2} - x^2$$

and y maximizes

$$W_{JV(D)}(x, y) = \frac{S(x, y)}{2} - y^2$$

The reaction functions for M and D respectively are

$$x = \frac{1}{4}[(\bar{v} - \bar{\rho}) + (\bar{\rho} - \underline{v})y] = \frac{1}{4}[\mu + (2 - \mu)y] \tag{3}$$

and

$$y = \frac{1}{4}[(\underline{v} - \underline{\rho}) + (\bar{\rho} - \underline{v})x] = \frac{1}{4}[\mu + (2 - \mu)x] \tag{4}$$

The Nash equilibrium of this game gives

$$\hat{x} = \hat{y} = \frac{\mu}{2 + \mu} \tag{5}$$

Therefore the net welfare of the joint venture for M and D becomes

$$W_{JV(M)} = W_{JV(D)} = \frac{(4+\mu)\mu^2}{2(2+\mu)^2} \quad (6)$$

And the total social welfare from this joint venture is

$$W_{JV} = W_{JV(M)} + W_{JV(D)} = \frac{(4+\mu)\mu^2}{(2+\mu)^2} \quad (7)$$

which is always less than the social optimum where $W_{SO} = \mu$. Both M and D therefore under-invest, since they know that they can only get half of the income steam generated by their investments.

It can be easily verified that the greater potential gain from the innovation, the better efforts will be made by both M and D in their joint venture (i.e., $\mu \uparrow \Rightarrow \hat{x} \uparrow \& \hat{y} \uparrow$). Moreover, as the potential gain from this innovation project increases, the social welfare from the joint venture as a ratio of the social optimum (i.e., $\frac{W_{JV}}{W_{SO}} = \frac{(4+\mu)\mu}{(2+\mu)^2}$ which is always less than one) will increase as a result of the greater efforts made by both M and D.

IV. The Merger Case

Now assume that M buys D (downstream integration)[5]. In addition to the decision of how much effort he will put in the investment of research and development, M needs to decide the percentage of shares given up to D so that sufficient amount of effort can be undertaken in D' portion. In other words, M will seek to solve the following problem:

$$\max_{x,\pi}[\pi * S(x,y) - x^2] \quad (8)$$

[5] The case that D buys M (upstream integration) can be similarly analyzed, and ignored in my discussion.

where y should be induced to satisfy D's incentive constraint, i.e.,

$$\max_{y}[(1-\pi)S(x,y)-y^2] \tag{9}$$

where π is defined to be the proportion of shares retained by the manufacturer M, and $(1-\pi)$ is the proportion given to D[6].

The above problem can be solved by way of the Stackelberg approach. Firstly we derive the reaction function for D from equation (9) as

$$y=\frac{1-\pi}{2}[(\underline{\nu}-\underline{\rho})+(\overline{\rho}-\underline{\nu})x]=\frac{1-\pi}{2}[\mu+(2-\mu)x] \tag{10}$$

Substitute this reaction function into (8) and take the total differentiation of x, we can derive the first order condition for M's best effort x as

$$\tilde{x}=\frac{\pi(\overline{\nu}-\overline{\rho})+\pi(1-\pi)(\overline{\rho}-\underline{\nu})(\underline{\nu}-\underline{\rho})}{2-\pi(1-\pi)(\overline{\rho}-\underline{\nu})^2}=\frac{\pi\mu+\pi(1-\pi)\mu(2-\mu)}{2-\pi(1-\pi)(2-\mu)^2} \tag{11}$$

Substituting (11) into (10) yields the induced D's effort as

$$\tilde{y}=\frac{(1-\pi)(\underline{\nu}-\underline{\rho})+1/2[\pi(1-\pi)(\overline{\rho}-\underline{\nu})(\overline{\nu}-\overline{\rho})]}{2-\pi(1-\pi)(\overline{\rho}-\underline{\nu})^2}=\frac{(1-\pi)\mu+1/2[\pi(1-\pi)\mu(2-\mu)]}{2-\pi(1-\pi)(2-\mu)^2} \tag{12}$$

From the comparison of (12) and (11), it is shown that more effort will be rendered by M than D as long as the proportion of shares retained by M is not too small.

For the sake of easy comparison between joint venture and merger, we assume that $\mu=1$ below. Hence the expected gross social surplus from the merger becomes

---

[6] Any consideration other than equity, e.g., cash, given toward the target company is some constant added to equation (9) and subtracted from equation (8). Ignoring this constant term will not affect the optimal choice of efforts x & y and equity share π.

$$S(\tilde{x},\tilde{y}) = \tilde{x}(1-\tilde{y}) + (1-\tilde{x})\tilde{y} + 3\tilde{x}\tilde{y} = \frac{4-2\pi^4+5\pi^3-11\pi^2+8\pi}{2[2-\pi(1-\pi)]^2} \quad (13)$$

We also can derive the net welfare from the merger for M and D as follows:

$$W_{M(M)}(\tilde{x},\tilde{y}) = \pi * S(\tilde{x},\tilde{y}) - \tilde{x}^2 = \frac{\pi(-2\pi^4+3\pi^3-3\pi^2+4)}{2[2-\pi(1-\pi)]^2} \quad (14)$$

$$W_{M(D)}(\tilde{x},\tilde{y}) = (1-\pi) * S(\tilde{x},\tilde{y}) - \tilde{y}^2 = \frac{(1-\pi)(-2\pi^4+4.5\pi^3-9.5\pi^2+8\pi+2)}{2[2-\pi(1-\pi)]^2} \quad (15)$$

And the total net social welfare from the merger is

$$W_M(\tilde{x},\tilde{y}) = W_{M(M)}(\tilde{x},\tilde{y}) + W_{M(D)}(\tilde{x},\tilde{y}) = \frac{-3.5\pi^4+11\pi^3-17.5\pi^2+10\pi+2}{2[2-\pi(1-\pi)]^2} \quad (16)$$

From equation (11), we see that $\frac{d\tilde{x}}{d\pi} = 0$ implies $\pi = 2(\sqrt{2}-1) \approx 0.828$. The maximum effort $(\tilde{x})$ that M is willing to provide can thereby be estimated to be 0.52 when M's equity share (π) of the integrated company is equal to 82.8%. With this arrangement of equity share D is willing to provide 0.13 amount of effort, i.e., $\tilde{y} = 0.13$. In contrast, M injects 0.5 amount of effort and D refuses to incur any investment cost (effort) in case that M entirely takeovers D (i.e., $\pi = 1$). In other words, by shedding out 13% of equity share to D, M enables to arouse better efforts from either M or D and accomplishes a more favorable outcome as can be shown from equation (15) ($W_{M(M)} = 0.325$ when $\pi = 0.828$ versus $W_{M(M)} = 0.25$ when $\pi = 1$). As far as D's interest is concerned, the greater proportion of equity shares released to D (i.e., the smaller π), the better effort will be provided by D (i.e., the greater $\tilde{y}$). This can be seen from the equation (12) that $\frac{d\tilde{y}}{d\pi} = \frac{\pi(\pi - 4)}{[2 - \pi(1-\pi)]^2} < 0$ for all π.

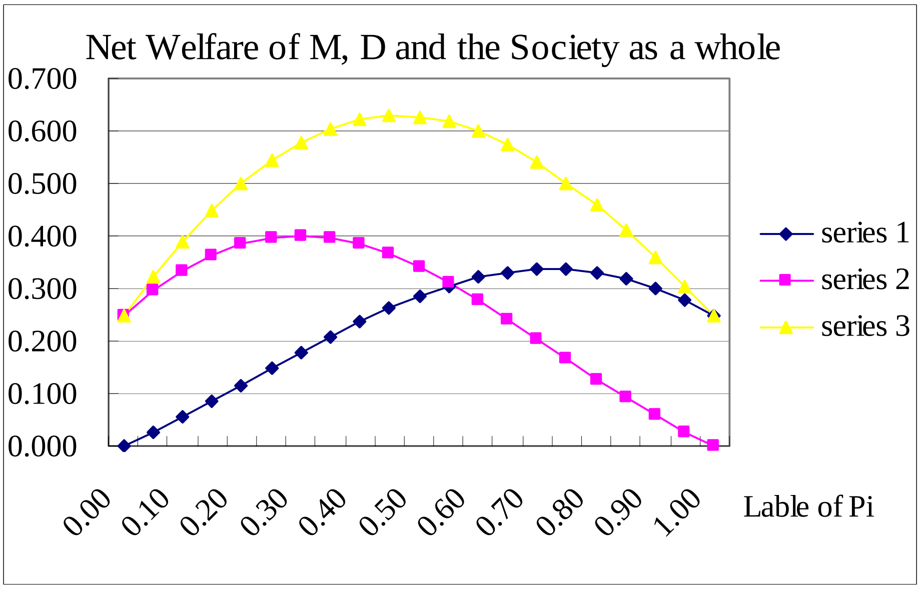
V. Welfare Analysis

We now turn to the problem of choosing an optimal equity share so that M's welfare (equation (8)) could be maximized subject to D's incentive constraint (i.e., equation (9)). The answer lies in the equation (14). Since the equation (14) is so complicated that no simple analytic solution for the optimal π can be found. Instead we resort to the chart of this equation to spot the optimal π which lies in the area around 0.70. Together with the welfare for D and the society as a whole we depict these values in the following table and chart:

Table of Equity Share, Effort, and Welfare for M, D and the Society

Label of Pi	1	2	3	4	5	6	7	8	9	10	11
Pi	0.000	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5
M's effort (x)	0.000	0.050	0.099	0.148	0.196	0.241	0.285	0.326	0.364	0.398	0.429
D's effort (y)	0.500	0.499	0.495	0.488	0.478	0.466	0.450	0.431	0.409	0.384	0.357
M's welfare (W_M(M))	0.000	0.026	0.054	0.084	0.115	0.147	0.178	0.208	0.236	0.263	0.286
D's welfare (W_M(D))	0.250	0.296	0.334	0.364	0.385	0.398	0.402	0.397	0.386	0.367	0.342
Social welfare (W_M)	0.250	0.322	0.389	0.448	0.500	0.544	0.579	0.605	0.622	0.629	0.628

Label of Pi	12	13	14	15	16	17	18	19	20	21	22
Pi	0.550	0.600	0.650	**0.700**	0.750	0.800	0.828	0.85	0.90	0.95	1.00
M's effort (x)	0.455	0.477	0.495	**0.508**	0.517	0.522	0.522	0.522	0.518	0.511	0.500
D's effort (y)	0.327	0.295	0.262	**0.226**	0.190	0.152	0.131	0.114	0.076	0.038	0.000
M's welfare (W_M(M))	0.305	0.320	0.331	**0.3363**	0.3362	0.330	0.325	0.319	0.302	0.279	0.250
D's welfare (W_M(D))	0.312	0.278	0.242	**0.204**	0.165	0.128	0.107	0.091	0.058	0.027	0.000
Social welfare (W_M)	0.617	0.599	0.573	**0.540**	0.501	0.458	0.432	0.410	0.359	0.306	0.250



Series 1 in the chart above stands for the value of M's net welfare as his equity share increases from zero to one, while series 2 stands for the welfare for D and series 3 for the society as a whole. It is clear from the chart that both M and D gain gradually as π increases from zero. The welfare for D reaches its peak around $\pi = 0.3$ (or $1-\pi = 0.7$), then the total social welfare reaches the maximum around $\pi = 0.45$ and finally M's welfare is maximized around $\pi = 0.7$. Afterwards all three welfare declines as M's equity share π approaches one. In other words, one hundred percent control of the entire consolidated company should not be construed as the best strategy for either the acquiring company (M) or the target company (D).

The table and chart above also facilitate our comparison of the effort and the welfare between joint venture and merger. When $\mu = 1$, the Nash equilibrium for the joint venture gives $\hat{x} = \hat{y} = 1/3$, $W_{JV(M)} = W_{JV(D)} = 5/18(\approx 0.278)$ and $W_{JV}(= W_{JV(M)} + W_{JV(D)}) = 5/9(\approx 0.556)$. M will exert more effort in the merger than in the joint venture when his share of equity exceeds 0.4, while D's effort in the merger will be mitigated compared to the one in the joint venture when D's equity share is less than 0.5. In order for M's welfare from the merger to exceed its welfare in the joint venture, M's equity share should be located between 0.5 and 0.95. In D' part, his welfare from the merger exceeds the one in the joint venture when its equity share is at least 0.4 and less than 100%. Both of them get more welfare than the joint venture when the equity share is almost equally shared between 0.4 and 0.6 ($\pi = 0.5 \sim 0.6$) in the merger case. As for the society as whole, the merger suffers from the efficiency welfare than the joint venture when the equity share is arranged between 0.3 and 0.65.

We can sum up the findings above in the following proposition:

PROPOSITION:

(1) The merger can bring in more welfare to the acquirer than the joint venture as long as the acquirer's share of equity holding exceeds 50% but less than 95%. His welfare from the merger would be maximized when the acquirer accounts for 70% of the equity share.

(2) One hundred percent takeover of the target company would not be the best strategy as long as the acquirer's welfare is concerned. By shedding some amount of equity shares (up to 60%) to the target company, the acquiring company can engender more effort from the target company than in the 100% takeover.

(3) The shareholders of the target company can get more welfare than in the joint venture case when their equity shares exceed 40% but less than100%. 100%

takeover reduces their welfare from 0.278 in the joint venture to 0.25 when being merged.

(4) ***The overall welfare to the society from the merger is more than the one in joint venture as long as the acquirer's share of equity holding is between 30% and 65%. The cost of integration may not always outweigh its benefit.***

(5) ***The effort exerted by the acquirer will be greater than the one in the joint venture as long as his equity shares are not less than 40%. On the other hand, the target company needs to be compensated by at least 50% of equity shares in order to allure him into undertaking more effort.***

VI. Conclusion

There is no disputing the fact that the employee stock ownership plan (ESOP) and stock options are hugely popular mechanisms for retaining and compensating employees and managers. For example, in a 1995-96 survey of top management compensation, Watson Wyatt World reports that the average grant value of stock options for CEOs, at $1.7 millions, was 334% of their average base salary. Rather than relying on lump-sum cash payments, the shareholders can take advantage of ESOP or stock options to lessen the so-called agency problem and assure the adequate effort put forward by the employees or managers.

Any takeover strategy that simply gratifies an acquirer's ego of enlarging his own control power and grudges granting any ownership incentive to his acquired company is very likely to fall victim to the above agency problem and ends up with poor postintegration performance. This study explores the optimal equity share arrangement for the integrated company and concludes that unloading 30% of the stock ownership to the acquired company can achieve the maximum integration surplus for the acquirer.

This study discusses the strategies of joint ventures or mergers. When the equity shares can be arranged between 0.3 and 0.65, the mergers can efficiently utilize the social resources. Otherwise, retaining full ownership of its own legal entity each party of the joint venture does his utmost to secure the venture's benefit. We provide a theoretical model for the companies to make strategies in choosing joint ventures or mergers. However, from the perspectives of the social planner, he should encourage the companies to merge in the equity shares distributing from 0.3 to 0.65 in which the case can efficiently utilize the social resources.

To facilitate the derivation of optimal effort and equity share this paper assumes a simple functional form of the investment cost, i.e., a quadratic function of manager's effort. It merits further study to examine the robustness of the above results to the specification of any other functional forms.

References

Harris, M., and A. Raviv, 1988, `Corporate Control Contests and Capital Structure,' *Journal of Financial Economics*, 20, 55-86.

Holmstrom, B., and J. Tirole, 1989, The theory of the Firm. *Handbook of Industrial Organization*, vol. 1, Amsterdam: North-Holland.

Jensen, M.C., and R.S. Ruback, 1983, `The Market for Corporate Control: The Scientific Evidence,' *Journal of Financial Economics,* April 1983, 5-50.

Laffont J.J., 2000, *Incentives and Political Economy*, Oxford University Press: New York.

Maskin, E., and J. Tirole, 1999, `Unforeseen Contingencies and Incomplete Contracts,' *Review of Economic Studies*, 66, 83-114.

Salanie, B., 1998, *The Economics of Contracts,* The MIT Press: Cambridge.

Stulz, R., 1988, `Managerial Control of Voting Rights: Financial Policies and the Market for Corporate Control,' *Journal of Financial Economics,* 20, 25-54.