1-1-1991

Three Approaches to Modeling Corporate Games: Some Observations

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THREE APPROACHES TO MODELING CORPORATE GAMES: SOME OBSERVATIONS

*by Ian Ayres**

It is a special honor to be able to comment on the excellent papers of Professors Gordon, Leebron and Shubik because these authors have each previously taught me important things about game theory and/or corporations. Like legions of other Yale students, I audited part of Professor Shubik's game theory course in order to learn from one of the modern masters of the field. And Professors Gordon and Leebron are two of the reasons that Columbia Law School has the strongest corporate group in the country. Professor Gordon in particular has taught me much of what I know about stock market efficiency.[1]

Professor Shubik, in his contribution to this symposium, divides game-theoretic scholarship into three levels of mathematical sophistication: high church, low church, and conversational.[2] His tripartite distinction is an especially useful place to begin analyzing the papers of Shubik, Leebron and Gordon, because they are fine examples of each branch of the literature. Professor Shubik himself discovered many of the techniques that dominate the high church literature. His article introduces some of the more fundamental but initially inaccessible results of explicit high church (or some economists alternatively use the jargon "high-brow") modeling.

Professor Leebron's paper is an excellent low church application of several of these insights to a specific legal context. Leebron's use of matrix and extensive form representations of what Shubik calls the "information sausage"[3] allows readers new to the field to see these game theoretic techniques in action. And finally, Jeff Gordon's analysis of the absolute delegation rule shows how a more conversational approach to game theory can still reveal strategic in-

1. *See generally* Jeffrey A. Gordon & Lewis A. Kornhauser, *Efficient Markets, Costly Information, and Securities Research* 60 N.Y.U. L. REV. 761 (1985) (critiquing efficient market hypothesis corporate law).

2. Martin Shubik, *Game Theory, Law, and the Concept of Competition*, 60 U. CIN. L. REV. 285, 298 (1991).

3. *See* David Leebron, *A Game Theoretic Approach to the Regulation of Foreign Direct Investment and the Multinational Corporation*, 60 U. CIN. L. REV. 305 (1991); Martin Shubik, Remark at Symposium — Just Winners and Losers: The Application of Game Theory to Corporate Law and Practice, University of Cincinnati College of Law (Mar. 1, 1991) [hereinafter Shubik, Remark].

teraction that may strongly affect optimal public policy. Gordon is able to tell plausible narratives without the heavy artillery of matrices and game trees in part because he can refer to what, by now, have become the well-accepted high and low church models of the past. For example, Professor Gordon's discussion of cycling is animated by the extensive literature that has grown up around the well documented phenomenon. Gordon's paper shows that one of the great contributions of conversational approaches is to identify similarities between a new context and a well analyzed game. Once the scholar discovers that a legal problem is analogous to the prisoners' dilemma or the battle of the sexes,[4] then the resulting equilibrium can often be discussed without formally writing down and solving an explicit model. In the following paragraphs, I will provide brief and desultory observations about each of these works. These comments are made in the same order that the papers were presented at the symposium.

I. COMMENTS ON SHUBIK

One of the important theses of Professor Shubik's paper is his discussion of the "solution" or "equilibrium" concept.[5] Only in game theory do modelers have to explicitly choose the equilibrium concept that is most appropriate. Shubik succeeds in making opaque what many law and economic scholars think is transparent. Few law and economics theorists fret about whether they have chosen the appropriate solution concept. But the very difficulty of making assumptions about what sets of strategies will create stable equilibrium makes the process of modeling much more contestable — especially because other social scientists may be able to bring to bear empirical information about how decision makers actually react to various strategic situations.

The new advances in modeling dynamic games with incomplete information underscore the importance of players' belief in supporting an equilibrium. Equilibrium concepts can place a variety of important restrictions on what beliefs players can have and how they are updated. For example, game theory may turn out to be the final vindication of Bayesian analysis. "Bayes law" is a controversial statistical relation that describes how rational decision makers would update prior beliefs with new information. Bayesian analysis of evi-

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4. The games are discussed in ERIC RASMUSEN, GAMES AND INFORMATION (1989). A good example of how legal scholars can discover analogies to well-specified games, see Kenneth W. Abbott, *Modern International Relations Theory: A Prospectus for International Lawyers*, 14 YALE J. INT'L. L. 335 (1989).

5. Shubik, *supra* note 2, at 293.

dence has run into stiff opposition from legal scholars. Laurence Tribe, for example, has a widely-cited law review article criticizing the idea of applying Bayesian analysis to legal issues.[6] Yet in game-theoretic models, Bayesian updating is the standard assumption which restricts the equilibrium beliefs that players have in latter stages of the game after they witness how their opponents have behaved.

As controversial as the assumption of Bayesian updating has been for law and economic analysis, the choice of an equilibrium concept has even more arbitrary dimensions relating to inferences drawn from out-of-equilibrium behavior. That out-of-equilibrium behavior is not supposed to occur allows modelers to advance a number of "exotic refinements" to restrict players inferences.[7] How people react to things that should not happen can dramatically effect the stability of an equilibrium. Game theorists have developed a number of assumptions about what inferences people will draw from unexpected, out-of-equilibrium behavior. For example, in an asymmetric information game in which investors initially cannot tell whether they are financing "good" or "bad" investment projects[8], what inference should an investor draw from a debt contract offer that neither good or bad borrowers would make in equilibrium? Some modelers assume "passive conjectures" so that prior beliefs about the probability of dealing with a "good" project are un-changed by the out of equilibrium behavior. Other modelers try to assess whether one type would be more likely to make the particular error that led to the out-of-equilibrium behavior and draw infer-ences from that behavior accordingly. The non-robustness of the models to these second order informational assumptions about the solution concept reveal important subtleties in how we process in-formation. Game theory shows that a wide variety of diverse behav-ior can fly under the banner of rational decision-making when there is incomplete or imperfect information. Which equilibrium concept embodying these inferential assumptions most fully captures reality is a question that may be best answered by other schools of social science.

Rob Gertner and I have argued that contract default rules should be chosen by comparing the costs associated with different default

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6. Laurence Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329 (1971).

7. *See* RASMUSEN, *supra* note 4, at 112-14.

8. This investment model is analyzed more formally in my accompanying paper. Ian Ayres, *The Possibility of Inefficient Corporate Contracts*, 60 U. CIN. L. REV. 387, 392-402 (1991).

equilibria.[9] Yet predicting the equilibrium of strategic bargaining games of incomplete information will often turn on the equilibrium concept that is assumed. Professor Shubik's article points out that game theorists' choice of an equilibrium concept is an assumption that — like other assumptions about information and order of play — can be contested.[10] Indeed, the choice of the appropriate solution concept may be one of the areas where non-game theorists have the most to offer in refining the modeling practices of even high church theorists.

II. COMMENTS ON LEEBRON

Professor Leebron's paper ably presents several models that exemplify and apply the new game-theoretic techniques that are introduced at a more abstract level by Professor Shubik. Here, I would like to discuss two relationships between the pieces.

Like Professor Shubik, Leebron begins by emphasizing the importance in choosing the appropriate solution concept. He openly defends his choice of a non-cooperative approach because externally enforced contracts are not available in the international debt context. But Professor Leebron errs in arguing that "most applications of game theory to the law will involve the analysis of cooperative games."[11] First, at a descriptive level, the vast majority of existing game-theoretic treatments of legal issues have to date been almost exclusively non-cooperative.[12] This includes the extensive literature on trial settlements and the growing literature in contract negotiation and bankruptcy. As a predictive matter, I believe that there are technical reasons why future work will remain in the non-cooperative framework. As a primary example, the non-cooperative models have been more adept at handling problems of noncontractibility and asymmetric information that are at the core of many legal issues.

While the defining aspect of cooperative games is the ability to make binding commitments, the leading game-theoretic models of bargaining and contracting are non-cooperative. In these models, the binding, externally-enforced nature of the contractual commitments are "black boxed" as binding payoffs for struck bargains.

The alternative cooperative framework for modeling bargaining games, such as "split the dollar," proceeds by choosing axioms that

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9. Ian Ayres & Robert Gertner, *Filling Gaps In Incomplete Contracts: An Economic Theory of Default Rules*, 99 YALE L. J. 87, 91 (1989).

10. *See* Shubik, *supra* note 2, at 288-90.

11. Leebron, *supra* note 3, at 309.

12. *See* Ayres, *supra* note 8, at 387 n.2.

would characterize the agreements that players would anticipate making with each other. Eric Rasmusen has given voice to some of the misgivings that non-cooperative game-theorists have toward the cooperativists axiomatic bent:

> Although Nash's objective was simply to characterize the anticipations of the players, I perceive a heavier note of morality in cooperative game theory than in noncooperative game theory. Cooperative outcomes are neat, fair, beautiful, and efficient. . . . [N]oncooperative bargaining models . . . while plausible, lack every one of those features. Cooperative game theory may be useful for ethical decisions, but its attractive features are inappropriate for most economic situations, and the spirit of the axiomatic approach is very different from the utility maximization of current economic theory.[13]

Rasmusen's open disavowal of the cooperativist approaches descriptively captures the dominant approach of the theorists. But in the end, the validity of cooperative and noncooperative solution concepts will turn on empirical questions of human behavior. In the end, it may be that cooperativists do better at explaining the world. Noncooperative bargaining games usually lead to all or nothing results, with a single offer and acceptance. As an empirical matter, it is possible that the equity axioms of the cooperative solution concepts correspond more directly to reality.

There is a second interesting relationship between the Shubik and Leebron papers. Leebron's discussion of the "golden goose" game[14] provides an interesting qualification to Shubik's favorite bridge aphorism (delivered orally at the symposium) that "a peak is worth two finesses".[15] Shubik's statement is true *ex post,* but the possibility of peaking *ex post* may make it difficult to find someone to play against *ex ante.*

Leebron's model of foreign investment illustrates that allowing the borrowing country to peak *ex post* — and discover the profitability of the investment project — might make it difficult to secure investment *ex ante.* Consequently, the borrowing country may have *ex ante* incentives to commit to *ex post* ignorance. Leebron's golden goose game is part of an interesting class of models in which a player can be made better off *ex ante* if it commits to ignorance *ex post.*

Two examples of this include a variation on the classic prisoner's dilemma game and a simple game of nuclear deterrence. In the

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13. RASMUSEN, *supra* note 4, at 231.
14. Leebron, *supra* note 3, at 321.
15. Shubik, Remark, *supra* note 3.

prisoners' dilemma case, prisoners might have an incentive to hire the same lawyer and instruct the lawyer only to pass on settlement offers which offer identical deals to both prisoners. By precommitting through joint counsel to ignorance, the prisoners can thus mitigate their incentives to fink on each other.[16]

In the nuclear deterrence context, imagine that the United States and the Soviet Union have nuclear delivery capabilities that become inoperative randomly 10% of the time — because, for example, the B-52s are getting pretty old. If the other side knows when the planes are inoperative, then half-the-world becomes a very dangerous place because there is no effective deterrence during these down times. If it is equally possible that either side's weapon system could become inoperative first, then rational arms control policy might mandate commitments to ignorance. Treaties against U-2 flights or the construction of satellites or AWACs planes could increase security by impairing intelligence. Counter to Reagan's famous couplet, sometimes it is in our best interest to "trust and not verify."

Finally, I should add that Leebron's golden goose game provides several testable implications. If insuring *ex post* ignorance is important to *ex ante* investment incentives, we might see investment projects skewed toward those whose knowledge about *ex post* profitability was easier to shield — so as to maintain *ex post* asymmetric information. This might imply, for example, a bias toward more risky projects. Projects whose returns have a low expected variance will have inherently little asymmetric information because the difference between the upper tail and lower tail is so small.

III. COMMENTS ON GORDON

Professor Gordon's paper offers several innovative explanations for a specific corporate phenomena — the absolute delegation rule in publicly traded corporations.[17] While he offers reasons why shareholder voting on corporate policies is likely to be efficient,[18] his explanations have equal force with regard to director voting in corporations that have cumulative voting. This is because the same costs of inefficient cycling and rent-seeking can infect the voting of minority representatives on a cumulatively elected board. Thus, his

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16. *See* Pam Karlan, *Discrete and Relational Criminal Representation* HARV. L. REV. (forthcoming 1992).

17. *See* Jeffrey Gordon, *Shareholder Initiative and Delegation: A Social Choice and Game Theoretic Approach to Corporate Law*, 60 U. CIN. L. REV. 347, 351-52 (1991).

18. *Id.* at 353.

argument also provides strong evidence for the decline of cumulative voting regimes in publicly held corporations.[19]

While Professor Gordon provides plausible explanations for the broad existence of the absolute delegation rule, I think that there is more work to be done to suggest whether the current rule is optimally tailored. Even accepting many of Professor Gordon's arguments, one might still argue that the absolute delegation rule:

> (a) goes too far — because there are less restrictive alternatives that can prevent the strategic inefficiencies; or
>
> (b) doesn't go far enough — because the same inefficiencies that infect shareholder initiative voting also may infect shareholder votes in electing boards of directors.

Both these criticisms take as correct Professor Gordon's basic arguments. Yet the possibility of strategic inefficiencies may be constrained with a more tailored response, or else may entail a broader ban against shareholder voting for boards of directors.

Although Professor Gordon discusses the possibility of a less restrictive alternative with regard to a potential anti-greenmail rule,[20] it is possible that the individual problems attributed to shareholder voting initiatives could be handled with other discrete rules. For example, the heterogeneous preferences concerning payouts and the inefficient cycling that might ensue might be constrained by a rule prohibiting shareholder votes about how or when profits should be distributed, so that *Transamerica* type problems would not arise.[21]

Moreover, initiatives actuated by ancillary profits that shareholders could gain — from, say, the placement of a new factory — could be constrained by the same kind of conflict of interest rules that constrain director participation in self-interested board votes.

These rules might be evaded. Professor Gordon details the difficulty in enforcing an anti-greenmail rule, when a shareholder like H. Ross Perot doesn't actually propose an initiative. And it is possible that disinterested "straws" could propose initiatives on behalf of in-

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19. The failure of corporations to allow shareholders to supervise managerial decisions might also be compared to the refusal of corporations to allow courts or other stakeholders to supervise managerial decisions. The courts are largely denied oversight by operation of the business judgement rule. Other stakeholders in the nexus of contracts (bondholders, employees) fail to contract for much voice or control. Sometimes, the bondholders exercise some control through bond indenture covenants, but seldom contract for the right of *ex post* initiatives. The decline of the purpose clause requirement might be seen as a way that shareholders have given away even this form of *ex ante* managerial supervision.

20. Gordon, *supra* note 17, at 383.

21. *Id.*

terested shareholders. But even leaky buckets can carry some water. Not surprisingly, it becomes an empirical question about whether less restrictive alternatives might provide more effective corporate governance.

Even if Professor Gordon is correct that less restrictive alternatives are not cost effective, then his proof that shareholder voting can generate strategic inefficiencies may prove too much. For, although Professor Gordon refers to the current rule as an absolute delegation doctrine, the current rule may not go far enough in disenfranchising shareholders from corporate governance. The same species of strategic inefficiencies that infect shareholder voting on specific policy issues could also infect shareholder voting on electing the board of directors. Carl Icahn, for example, has sought representation on the board of directors and the costs of inefficient cycling, bargaining and greenmail threats could be at play as shareholder factions vie to have their initiatives undertaken by the elected board members.

Professor Gordon's analysis might suggest that the traditional immutable state law requirement of yearly elections might not maximize firm value. His theory might be extended to explain the growth of staggered elections as firms try even further to reduce the importance of shareholder voting. If the strategic concerns that Professor Gordon has identified are especially costly, shareholders may prefer to make their delegation to management even more absolute by giving up their election rights. It is possible that the threat of hostile takeover is sufficient to discipline incumbent management. Under this scenario, managers could only be removed from office through pre-specified takeover conditions analogous to a freeze-out merger.

These two broad points — that the current delegation rules might not go far enough or might go too far — again underscore the empirical nature of Professor Gordon's claim. An absolute rule is only efficient if it on net provides benefits both with respect to less restrictive rules that allow more initiatives and with respect to an even more absolute rule which forbade even shareholder votes on election of directors.

CONCLUSION

The legal academy has a long tradition of preferring *a priori* theoretical arguments. Whether this is because theory pieces are easier to generate and consequently provide a bigger "bang for the buck" in careerist terms, or because legal scholars and lawyers are often poorly trained in empirical matters is difficult to assess. But descrip-

tively, the legal academy has been resistant to varying degrees to the empiricism of the realists and then to the law and society movement. Perversely, game-theoretic approaches to law, which are if anything more theoretically abstract and reductivist, may serve to push legal discussion back toward empiricism. As my observations on these three excellent papers have illustrated, the pathological "possibility" theorems that strategic games produce push us as legal scholars to ask if the possible is empirically the "probable" or the "actual".