Game Theory and Its Applications to Takeovers

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By

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This book is dedicated to my parents in their loving memory, who inspired me to go into higher education, although they never got a chance to have their own education.

CONTENTS

FOREWORD

Professor Suresh Deman makes an excellent contribution with his book "Game Theory and Its Application to Takeovers" and resolves some of the controversies existing in the economic profession. In particular, the author critically analyses the theory put forward by Grossman and Hart (1980) in their seminal paper, published in *Bell Journal*, and provides a satisfactory explanation to the takeover problems.

The beauty of the 'Game Theory' is not so much in its eloquent mathematical modelling but in its application to real-world problems. In Chapter 2, the author identifies game theory applications in different areas and connects modern concepts, like 'Common knowledge' to Confucius's dialogue with his teacher, "I know that you know, you know that I know, I know that you know that I know, and so on" (Last Emperor of China)". In fact, this chapter, combined with definitions of corporate terminology in an appendix at the end of the book, is very useful for communicating the complex ideas to practitioners and policy makers in simple language.

In Chapter 3, the author summaries Grossman and Hart's game theoretic approach and deals with the issues of takeovers and the free-rider problem. A raider wanting to take over a firm, where shareholders are dissatisfied with the incumbent management, offers higher than the prevailing market price to shareholders to entice them to sell their shares. However, even this strategy may fail as each shareholder, before selling his shares, hoping that share prices will rise further, waits for other shareholders to sell their shares, leading to a situation where no sale of shares takes place. This behaviour, known as the free-rider problem, ensures failure of the takeover bid due to the assumption of continuum of shareholders in which no individual shareholder can change the success of the tender offer because only the aggregate play is observed. As a solution to this problem, Grossman and Hart argued that a mechanism evolved whereby, if the raider were to be successful, he would be permitted to dilute the value of the shares withheld. This would facilitate the takeover bid, resulting in an outcome beneficial to all shareholders. However, their results are based on somewhat restrictive

assumptions of a game with a continuum of players and extreme scenarios, in which either shareholders sell or do not sell, known as pure strategy equilibriums.

Dr. Deman's major contribution lies in his assertion that even without resorting to dilution, a takeover bid may succeed, assuming there are a finite number of players, with no residual problem of the disappearance of information due to even a very small change in the aggregate play whenever a player deviates, but remains perfectly observable. Hence, deviations can be rewarded or penalised regardless of the number of players. A random risk element is introduced in the model. Arguing that this is a case of complete but imperfect information, shareholders do not know with certainty what would be the value of their shares after the takeover. This uncertainty reduces the expected value of their shares and they agree to sell at lower prices.

The author applies this logic to another important area of urban renewal in Chapter 4. He applies corporate finance and game theoretic models in that chapter to real estate and urban renewal problems. He shows that the urban land market is also beset with free-rider problems. If a developer wishes to purchase a dilapidated housing area, each homeowner, before selling his house, waits for other homeowners to sell so that he could benefit from improved prices. Here, the developer would succeed only if the local authorities intervene. The author shows that it is not necessary. Dr Deman argues that homeowners have dissimilar expectations regarding the gains from urban renewal and thus, do not operate as a block of holdouts. The concept of mixed strategy equilibrium is a limit of equilibriums where each player's payoffs are randomly perturbed by a small amount that is unobservable to his opponent.

In Chapter 5, Dr Deman extends the application of game theory to another important area—the disappearance of building societies in the UK. Again, using game theoretic models, he explains how mergers of building societies with the high street banks in the UK led to the disappearance of building societies, giving suboptimal outcomes to the building societies, and defeating the very purpose for which building societies were created.

In conclusion, the author has done a superb job in analysing the various factors affecting the takeover process and its impact on welfare by using game theoretic concepts. His work makes a valuable contribution to the theory and application of game theory in explaining economic phenomena, and it will be a good addition to the subject matter.

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CHAPTER 1

INTRODUCTION

In the last decade, hostile takeovers have become prevalent in the corporate world and have generated a great deal of controversy in the world of economics and in society at large. The so-called "Chicago School" of Antitrust has offered the intellectual reasoning for a considerable loosening of antitrust laws, which, particularly in the recent past, has gained the attention of both economists and journalists. The fourth wave of hostile takeovers in the US and UK has led many leaders of the business community and the public to question the desirability of takeover activity.

During the 1980s, economists and finance researchers made strenuous efforts to understand the factors which result in hostile takeovers. Factors identified have included: disciplining managers; rationalisation of industries; realising economic efficiency; exploitation of economies of scale; synergy gains; the acquisition of market power; diversification; the acquisition of undervalued assets; vertical integration; managerial self-interests; "the urge to merge", etc. Of course, not documented in the above list are the more idiosyncratic reasons, which tend to apply on a case-by-case basis. Economists tend to ignore these case specific factors in their search for stylised facts and general principles to explain broad takeover patterns and trends.

There is therefore a twin focus to this study of takeovers. The first is to identify important game-theoretic studies that involve the theoretical underpinnings and rationale behind the hostile takeover process. The second focus of this study is to apply a game theoretic theoretical model of the corporate takeover to other sectors of the economy in order to understand the process of takeover and mergers across two institutional systems, namely, the US and the UK. In pursuit of these aims, this study will endeavour to marry both economic theory and application, in that an application only makes good sense if it is grounded within a sound theoretical framework.

In this study, I propose to re-examine some of the earlier work of Grossman & Hart (1980a) on corporate takeovers. They strongly argued in favour of exclusionary devices as being socially desirable and necessary for successful takeovers, arguing that they lead to a Pareto improvement outcome.

There has been widespread concern in the business community since the 1970s over the various provisions of "dilution" under the Securities law. The existing Law of Securities and Exchange Commission in the US allows the raider to "dilute" the corporation's shares to some extent, if the takeover bid is successful, to prevent minority shareholders from receiving all of the gains in the value of their shares. Opponents of dilution say that such provisions are tantamount to legitimised stealing from those shareholders who have not earlier tendered their shares to the raider in response to a tender offer. This analysis implies that raids can succeed with this mechanism if the raider's offer to buy shares from the shareholders is coercive.

Grossman & Hart (1980) offered arguments in the defence of "dilution" which are widely accepted. They show that the prospect of "dilution" can induce shareholders to sell their shares to the raider, and the long-term cost of "dilution" may be more than offset by the gains due to improvement in the management.

In Chapter 2, I focus on the importance of game theory, and review developments in the application of game theory to takeover and merger activities in various sectors of the economy. Deman (1989, 1991, 1994, 2000) reconsiders Grossman and Hart's (1980) paper under complete and imperfect information. The paper identifies the main shortcomings of Grossman and Hart's model and addresses them using a subgame perfect approach. More general results are presented on the basis of an extended model. I show the existence of mixed strategy symmetric equilibriums with or without the dilution, and that the prisoner's dilemma and the free-rider problem can be overcome in a takeover process. Furthermore, I identify two kinds of equilibriums: one is a 'separating equilibriums' in mixed strategies in which each type of raider behaves differently and the shareholders randomise their payoffs. The raider of a high-type will not offer a low price because such an offer would more than likely not succeed, and he would lose the potential gain on his initial shares. A less plausible kind of equilibrium is 'pooling equilibriums' in which different types of raiders behave in the same way. However, pooling equilibriums are ruled out by the reasonable 'out-of-equilibrium belief' that the price offer will signal the

raider's type. In that case, a low-type raider could profitably differentiate himself from the pooling equilibrium by offering a low price, and the shareholder would accept his offer. In fact, a model of finitely many players under noise gives the same results as the continuum of players' model in which any individual player's decision does not affect the success of the bid. In Chapter 3, I present a game theoretic model of takeovers to re-examine Grossman & Hart's earlier work on takeovers, state propositions, and also discuss the implications of the main results.

In Chapter 4, I suggest an application of corporate finance-game-theoretic models to real estate takeovers. For example, when considering the problem of the developer negotiating with landowners, a model of finitely many owners appears to be much more realistic. It is well known that takeovers do occur with positive probabilities in models with finitely many players. This result holds independently whether or not these finitely many owners believe that they have an impact on the success of the sale as pointed out by Shleifer and Vishny (1986), Bagnoli and Lipman (1988), Bebchuk (1989), and Deman (1991, 1994, 1999, 2000). An analytical structure and formal model of the merger of building societies has been presented in Chapter 5. In this section, I also explore the theoretical underpinning and motivation underlying takeover and merger activities and ex-ante efficiency. Conclusions and directions for future research are discussed in Chapter 6. A Glossary of terms of the language of takeovers and game theory is presented in Appendix B, which is widely accepted. See Deman (1997).

CHAPTER 2

TAKEOVERS-STATE OF THE ART & NONCOOPERATIVE GAMES

2.1 Noncooperative Game Theory & Takeovers

The Game theory begins with the publications of von Neumann (1928) and von Neumann and Morgenstern (1944); however, its roots can be traced back to the pioneering study of Cournot (1838), Model of Duopoly. The classical origin is dated even earlier, and one can find a flavour of non-sequential learning games and best response in well-known sayings of Confucius translated into the military writing of Mao Zedong and, more popularly, in fortune cookies in Chinese restaurants:

> "Consistency is the virtue of fools and wise people change their minds as they grow wiser."

> "If the enemy is sharp, you become sharper; and if the enemy is sharper you become the sharpest."

Similarly, the formulation of common knowledge is not obvious but commonly believed to be due to Aumann (1976). However, one can also sense the notion of common knowledge in Confucius's dialogue with his teacher, which runs as follows:

> "I know that you know, you know that I know, I know that you know that I know, and so on" (See, last Emperor of China).

Economists began to realise the importance of limitation on the information possessed by individuals in understanding economic behaviour because such limitation induces agents to change their behaviour. The standard assumptions of perfect competition, that individuals are mere price-takers, are no longer relevant. Rather, the strategic interactions have potentially profound implications on the behaviour of agents in the decision-making process, by altering the behaviour in the rest of the market. Game theory is well-suited for modelling takeovers because of the importance of

information, and its ability to include a number of sharply delineated sequences of moves and events. Precommitment and information transformation are the two pillars of modern game theory. Thus, the stylised facts and rationality of game theory may apply better to markets for corporate control than to markets for vegetables in developing countries.

Finance as a field has developed in its own right, incorporating the element of uncertainty into asset pricing and the recognition of the failure of classical analysis to explain many aspects of corporate finance. The First generation of game theoretic models revolutionised finance, but much remains to be explained. Game theoretic methods keep developing, and we believe that some developments, involving richer informational models, are especially relevant for finance.

Although Keynes (1936) and Hicks (1939) took account of risk by adding a risk premium to the interest rate, there was no systematic theory underlying the risk premium. The main theoretical development, eventually leading to such a theory, was an axiomatic approach to choice under uncertainty, due to von Neumann and Morgenstern (1947). Their notion of expected utility, developed originally for use in game theory, underlies the vast majority of theories of asset pricing.

In the business world, the power of game theory as a management tool rests on reasonably comprehensive assumptions that are embedded in the rules of the game. Players can experiment with different solutions and concepts to problems that are intrinsically unsolvable. In other words, there are no unique solutions to the problems. The analysis of the results can be used for greater insights into the real problems the game simulates. In a game involving a large number of players, using a wide range of strategies, it is possible to identify strategies that do better than others, even if there is no unique correct strategy at all. Aumann (1987) defines game theory as like an umbrella or ‘unified field’ theory for the rational side of the social sciences, where ‘social’ is interpreted broadly, to include human as well as non-human players (computers, animals, plants).

In game theory, the prisoner’s dilemma is commonly used for describing certain real-world problems. The central characteristics of a prisoner’s dilemma are an array of benefits and detriments associated with the alternative strategy, so that the dominant individual strategy is not to cooperate. The parties do not cooperate in pursuit of individual self-interest. This strategy yields less than optimal results.

There is a wide range of applications of Game theory in finance. However, in this chapter, I will focus on the application of a few that are relevant to my thesis in order to convey the sense of game theory. The typical example of models is signalling through information transmission in corporate takeovers, the capital structure as a commitment, and incentive design for financial intermediation. There is other literature in finance, for example, market microstructure, executive compensation, dividends and stock repurchases, external financing, debt signalling, etc., in which game theory has also been applied.

2.2 The Game Theoretic Applications

The standard economics and finance theories failed to provide satisfactory explanations for observed phenomena, which led to a search for theories using new techniques. Chiefly, this was true in corporate finance where the existing models were so clearly unsatisfactory due to complexities of data due, in turn, to high volume and frequency. Game theory has provided a methodology that has led to insights into many previously unexplained phenomena by allowing asymmetric information and strategic interaction to be incorporated into the analysis. We start with a discussion of the use of game theory in corporate finance where, to date, it has been most successfully applied.

Game theory is well suited for modelling takeovers because of the importance of information, and its ability to include a number of sharply delineated sequences of moves and events. Precommitment and information transformation are the two pillars of modern game theory. Thus, the stylised facts and rationality of game theory may apply better to markets for corporate control than to markets for vegetables in developing countries. It is worth exploring how the first generation of game theoretic models tackled those problems.

In the corporate world, the power of game theory as a management tool rests on reasonably comprehensive assumptions that are embedded in the rules of the game. Players can experiment with different concepts and solutions to problems that are intrinsically unsolvable. In other words, there are no unique solutions to the problems. The analysis of the results can be used for greater insights into the real problems the game simulates.

2.3 Historical Background

The takeover of corporations is not a new phenomenon. In fact, it has been in existence since the corporate set-up started. However, prior to the 1960s, mergers and acquisitions were widespread in the market for corporate control.

Economic historians, like Lamoreaux (1985), Sismic (1984), Greer (1980), and Nelson (1959) identified three, or perhaps four, major merger waves from 1893 to 1980. The US corporations affected over 3,000 mergers in the first wave of mergers (1893–1904). The Sherman Antitrust Act of 1890, which outlawed the collusion in corporations, but not mergers, was ended by the Supreme Court's Northern Trust decision, in 1984.

The second wave (1926–30) was characterised by horizontal mergers, resulting in oligopolies in which a few large firms dominated an industry, and was ended by the collapse of securities market associated with The Great Depression.

The third wave (the mid-1950s to 1970) is associated with conglomerate mergers, in which corporations diversified their activities through mergers, driven by the Celler-Kefauver Merger Act, 1950. The merger wave ended in 1970, with the decline in the stock market, which eroded the equity base for leveraged purchases.

The fourth major wave of acquisitions in the 1980s, perhaps beginning at the end of the 1970s, is characterised by the inter-firm tender offers. Mergers and acquisitions of a number of companies and transactions in billions of dollars during the second and third waves are given in **Figure 1**. Austin and Fishman (1970) pointed out in a study that tender offers did not become a popular mechanism for transferring corporate control until the 1960s. The tender offer mechanism is explained in **Figure 2**. According to Austin and Fishman, only nine inter-firms tender offers were made between 1956 and 1960. In fact, prior to the 1960s, the tender offer was used exclusively to acquire shares in the issuer's repurchase programme; the so-called intrafirm tender offers. In contrast, 238 tender offers were made over the next eight years, 1960–1967. One can infer from the available data that the increase in the separation of ownership and corporate control in large corporations led to the development of the inter-firm tender offer as an important vehicle for transferring corporate control. A recent report of the Securities and Exchange Commission (SEC) reveals that between 1981–1984, a total of 228 successful tender offers of all kinds were made.

Tender offers are distinguished from mergers in that the former bids are made directly to shareholders to buy some or all of their shares for a specified price during a specified time. Thus, unlike merger proposals, which require the approval of the managers (directors) of the target corporation, many tender offers for takeovers are made and successfully executed over the objections of the target management. The word "takeover" is used as a generic term to refer to any acquisition through a tender offer.

Economic analysis has identified two broad classes of takeovers. The first one in economics literature is known as disciplinary takeovers. The purpose of such takeovers seems to be to correct the non-value-maximising practices of the managers of the target corporations.

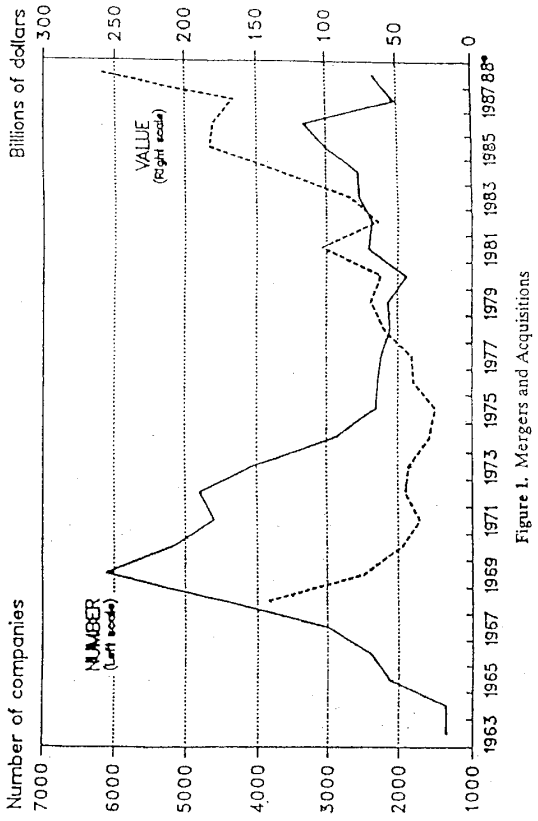

Figure 1. Mergers and Acquisitions

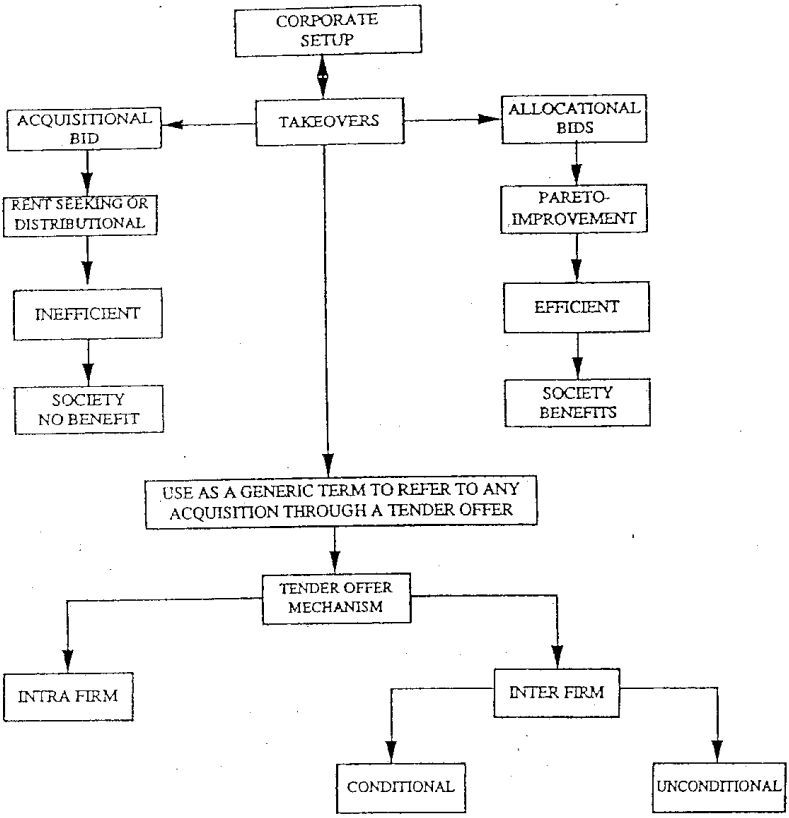

Figure 2. Takeover Bids and Tender Offer Mechanism

The second class of takeovers can be characterised as synergistic. The motivating force behind them is the possibility of realising benefits from combining the businesses of two corporations. Synergistic gains can accrue to the corporation from the consolidation of research and development labs or of market networks, etc. The intuition behind corporate takeovers is represented in **Figure 3**.

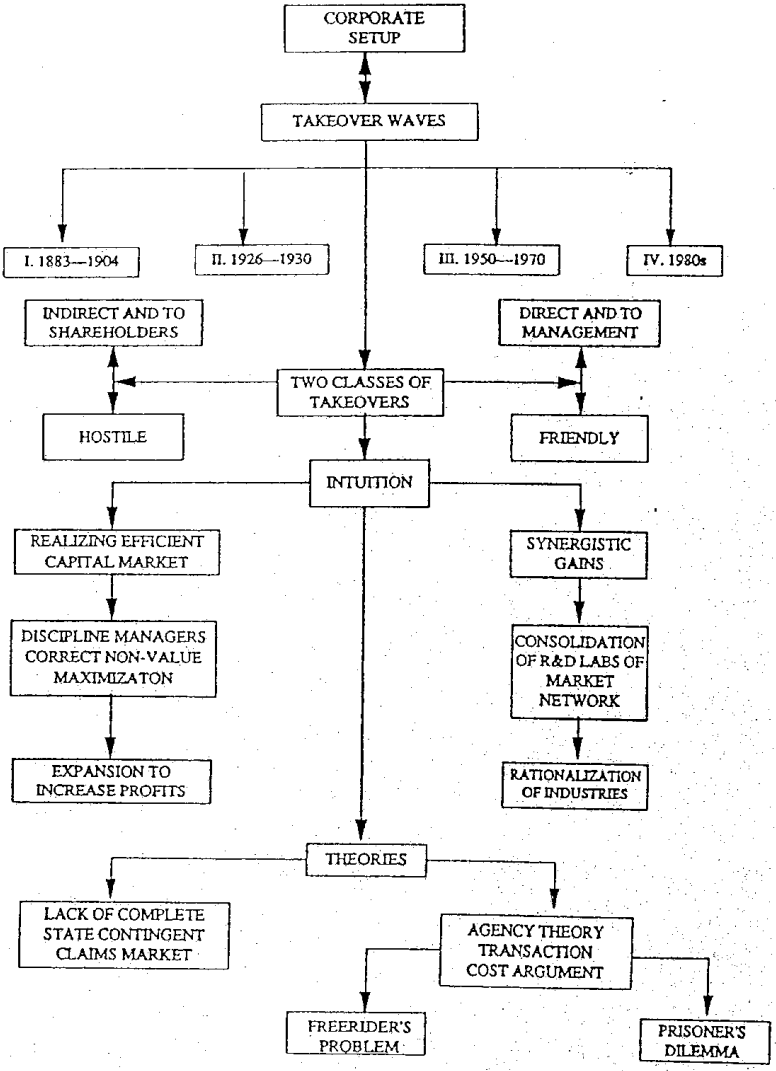

Figure 3. Takeover Waves, Intuition, and Theories

In the literature, the first type of takeovers is called hostile takeovers and the second type is called friendly takeovers. There are major analytical differences between these two classes of takeovers. Formal takeover models by Baron (1983), Png (1984), Fishman (1985), Giammarino and Henkel (1986), etc., represent the class of friendly takeovers, whereas Grossman and Hart (1980), Bradley and Kim (1985), Shleifer and Vishny (1986), Bagnoli and Lipman (1986), Bebchuk (1989), Holmstorm and Nalebuf (1992), Hirshleifer and Titman (1990), Deman (1991, 1994), etc., belong to the class of models representing hostile takeovers. There is a sharp contrast within the latter category, however. For example, Grossman & Hart (1980) consider a case of a continuum of owners, whereas Kovenock (1984), Shleifer and Vishny (1986), Bagnoli & Lipman (1988), Hirshleifer and Titman (1990), Deman (1991, 1994), etc., have considered finitely many owners.

An important difference between these two classes of models is that the former assumes that the firm behaves as a unit, since an offer is made directly to management, hence, the free-rider problem does not arise. On the other hand, in hostile takeovers, since the offer is made directly to shareholders, the free-rider problem plays a major role because shareholders individually make their tendering decisions. Furthermore, the value of the firm, conditional on the takeover bid's failure, is an important decision variable in friendly takeover bids. In contrast, competing for takeover bids in hostile takeover contests is relevant only if they are made prior to the expiration of the initial tender offer. For a given tender offer, and the ex-post value of the firm conditional on the success of the offer, the tendering decisions of small shareholders are not affected by whether or not a better offer was forthcoming. Hence, the possibility of competing bids can have a different impact on takeover contests depending on whether or not the bids are friendly or hostile.

2.4 Issues Surrounding Corporate Takeovers

Fishman (1986) and Deman (1994) identified the existence of two main theories of corporate takeovers. The first theory hypothesises that takeovers exist due to a lack of complete state-contingent claims markets. The main argument can be summarised briefly as follows: if complete state-contingent claims markets exist, then shareholders' valuations of any state-distribution of returns are identical (because of one price for every state-contingent claim) hence, they agree on the value-maximising production plan. However, in the absence of complete-state contingent claims markets, any

change in technologies (i.e., change in state-distribution of payoffs) is not, in general, valued identically by all shareholders. Thus, a majority support for such change in plans may be lacking. A takeover is a contingent contract, which enables a simultaneous change in technologies and portfolio holdings. This line of argument, with the exception of Giammarino and Henkel (1986), does not seem to be either popular or useful, which is judged by the paucity of literature on such models. The second line of argument of the theory on takeovers, which has gained the attention of economists and journalists, especially over the last decade or so, is the "agency theory" argument. According to this theory, the firm's managers maximise their own interests, which may not coincide with shareholders' interests (lavish consumption of perks or perquisites, overpayment to employees and suppliers, inefficient management, etc.). However, if any shareholder monitors the managers, all the shareholders reap the benefits and the individual shareholder does not get commensurate returns from his investment in monitoring managers. Thus, it does not pay any individual shareholder to monitor the firm. Under these circumstances, however, there may be an incentive for some outsider to take over the firm, improve its management and sell its share of the firm at a higher value. Such a takeover may result in the loss of utility to the target's manager (loss of salary, being branded inefficient, etc.). Hence, the threat of takeover motivates the managers to work harder in the interests of the shareholders.

The second line of reasoning of the theory of takeovers by the inter-firm tender offers has raised two theoretical issues. Firstly, the well-known free-rider problem is associated with the takeover mechanism. Manne (1965) argued that if a firm is inefficiently run by the incumbent management, then a raider, if he is more efficient than the current management, can offer more than the status-quo value of the shares, buy out the firm and run it more efficiently. This improvement in management will raise the value of the firm so that the raider can earn a profit by reselling it. Grossman and Hart (1980) have shown that atomistic shareholders have an incentive to free ride on the improvements affected by the raider. The free-rider problem becomes obvious where there is a continuum of shareholders, since no individual shareholder can change the success of the tender offer. Assuming shareholders have rational expectations if the takeover is going to succeed, no shareholder will sell unless he is offered a price, at least to the post-takeover value of his share. Consequently, the raider cannot purchase a share unless he pays at least what the share is worth to him if the raid is successful. If he does so, then even ignoring any costs of making a takeover bid, a raider cannot earn profits by taking over the firm.

The second issue is the application of the Prisoner's Dilemma to target shareholders. The argument suggests that target shareholders, if left to their own devices, will respond to a tender offer in a manner contrary to their best interests, not because they lack wisdom, but because of the "special dynamics," of the tender offer process. It is argued that, as in the game theorist's prisoner's dilemma, it may be in the best interests of an individual shareholder to tender in response to an offer, even if the shareholders as a group would be better off if no one tendered. Management discretion to block an offer then rescues shareholders from the unfortunate result of pursuing their individual, as opposed to their collective, self-interest.

For shareholders who face a prisoner's dilemma, even if they require a champion to protect their interests under such circumstances, it is arguable whether the target management is a likely candidate for that role. Since management has an inevitable clash of interest with respect to the hostile takeover tender offers, one cannot tell whether their opposition results from circumstances that give rise to a genuine prisoner's dilemma or from self-interest to protect their jobs. Many of those who call for increased government regulations of the tender offer process draw on these two arguments to make their case for policy recommendation.

Grossman and Hart (1980a) addressed the first theoretical issue concerning the free-rider problem. Their argument runs like this: it is commonly believed that a loosely held corporation that is not being run in the interests of its shareholders will be vulnerable to a takeover bid. They show that this is false, since shareholders can free ride on the raider's improvement of the corporation, thereby seriously limiting the raider's profit. They strongly advocate exclusionary devices, which can be built into the corporate Charter for making the takeover mechanism successful. They offer arguments which are widely accepted in defence of the dilution. They also analyse the free-rider problem using the charter of the corporation and ensure that it is privately and socially optimal under alternative assumptions of competition and a monopoly market for corporate control. Under the assumption of a continuum of agents, since shareholders will not sell their shares for any price less than the expected value to them after the takeover, the presence of dilution creates the difference between the status-quo value and the potential value of the shares to the raider. Hence, this mechanism has the effect of lowering the acquisition price, and allows the raider to deprive minority shareholders of receiving the improvement in the value of their shares produced by the takeover mechanism.

Furthermore, they show that the prospects of dilution can induce shareholders to sell their shares to the raider, and the long-term cost of dilution may be more than offset by the gains due to an improvement in the management.

The existing laws of the Securities and Exchange Commission allow the raider to dilute the corporation's share to some extent, if the takeover bid is successful. Although actual corporate shareholders do not specify a monetary limit on dilution, they do specify the extent to which minority shareholders are protected from dilution. Grossman and Hart (1980a) expressed concern over the effect of implicitly requiring the disclosure of any intention to dilute the rights of shareholders who do not tender. Their analysis suggests that government policy on takeover bids following the Williams Act of 1968, may have had certain undesirable consequences by creating obstacles in the takeover process. Somewhat similar changes were also incorporated in the UK.

Bradley and Kim (1985) addressed the second issue. In their paper, they examined the evolution of the offer as a takeover device. The tender offer had been used for years by investors who wanted to acquire a block of a firm's stock in a short period of time. However, it was not until the significant increase in the public holdings of corporate stocks, in the 1960s, that the tender offer device became a popular vehicle to take control of a firm and replace its management. In other words, the tender offer is an effective takeover mechanism, only if there are sufficient shares outstanding and trading in public markets. Using this same logic, they develop a model that implies that, as the number of shares held by management increases, there is greater likelihood that a takeover bid will take the form of a negotiated merger instead of a public tender offer. In their paper, they show that in a sample of 112 successful tender offers, the median percentage of shares held by insiders is 6.4%, and in a sample of 192 successful mergers median insiders holding is 14.1%. They also find that the maximum insider holding for the tender offer sample is 38%, whereas in the merger sample the maximum is 99%. They also show that the tender offer is an efficient takeover mechanism, since it can be constructed to solve both the free-rider problem of the bidder and the prisoner's dilemma of the target stockholders.

Therefore, as argued above, the two-tier tender offer must be outlawed because of its coercive nature.

There are two other important papers, Bagnoli and Lipman (1988) and Hirshleifer and Titman (1990), which address somewhat similar issues and have shown some other equilibrium in the game. An earlier paper by Kovenock (1984) also shows mixed strategy sub-game equilibrium as shown by Bagnoli and Lipman, but he does not consider the optimal strategy of the raider. However, their models are somewhat different in the following respects. First, the assumptions in the above papers are quite different from that of Grossman and Hart. They, in fact, relaxed the assumptions of atomistic shareholders in their models. Bagnoli and Lipman allow shareholders to own more than one share of stock, and Hirshleifer and Titman deal with the large shareholder case and use different assumptions in the game of finite shareholders. Secondly, both these papers fall short of conditions under which mixed strategy equilibrium will exist. Thirdly, the profit equation in the Bagnoli and Lipman paper appears somewhat arbitrary and results in meticulous expression. Fourthly, they do not address the limitations of the welfare implications of Grossman and Hart's model. My approach is to take virtually the same assumptions as Grossman and Hart and show that mixed strategy equilibriums do not exist, which was overlooked in their paper. However, the mixed strategy equilibriums exist if the dilution is not infinite (100%). Hence, there are limiting equilibriums and not the equilibriums in the limit (i.e. as the dilution approaches infinity, pure strategy symmetric equilibriums are realised, because if anyone deviates from the pure strategy, the value of his or her shares will be zero after the takeover), which establishes some parallel with the concept of limit pricing in Milgrom and Roberts (1982). In the following section, I briefly describe the Grossman and Hart (1980a) model, operating in the background to the ongoing debate on corporate takeovers. I also discuss the growing importance of game theory and its application in critically reviewing some of the earlier work on takeovers.

2.5. The Market for Corporate Control

Manne (1965) was the first to develop the notion of the market for corporate control. He argued that in order to utilise the resources efficiently, it is necessary that firms are run by the most competent managers. It was suggested that the most efficient way this could be realised in modern capitalist economies is through the market for corporate control. There are many ways in which this operates, including tender offers, mergers, buyouts, proxy fights, etc.

The traditional theory of finance, with its assumptions of symmetric information and perfectly competitive and frictionless capital markets, had very little to offer in providing insights into the market for corporate control. In fact, the huge premiums over initial stock market valuations paid for targets appeared to be at variance with market efficiency and posed something of a puzzle. It was not until the beginning of game theoretic concepts and techniques that much progress was made in this area.

Grossman and Hart's (1980) paper provides a formal theoretical model of the takeovers process and generated a great deal of controversy and interest in the economics profession. They explain a particular free-rider problem using a game-theoretic model with a continuum of players. Suppose that under status-quo management, a corporation has value v and if the raider can improve the target's value by x, then its potential value is v + x. If the takeover bid is conditional and $v < p < (v + x)$ i.e. price p is below the potential value, no shareholder will sell, even though they would jointly profit. If the shareholder will only be willing to trade at a price equal to the post-takeover value, and shareholders free ride on the value-improvement, then the raider will not be able to recover even the cost of making a tender offer. The shareholders are in a prisoner's dilemma and if the takeover bid is going to be successful then a holdout is better, and no worse if it fails. Hence, tendering is not a dominant strategy. So, every shareholder holds out and in Nash-Equilibrium, the takeover will never occur. Grossman and Hart (1980a) strongly argued in favour of exclusionary devices, known as the dilution factor by suggesting that the raider is allowed to dilute the value of the minority shareholder if the raid is successful.

TAKEOVER GAME

		Shareholder S1
Shareholder 2	**40, 40**	**25, 50**
	50, 25	**37.5, 37.5**

Matrix 1

An analysis of the free-rider problem in Bradley and Kim (1985) demonstrates that a necessary condition for a tender offer to be successful is that it should be front-end loaded. This condition should hold regardless of whether the tender offer is a partial or two-tier offer. This is another application of the prisoner's dilemma, for example, Matrix-**1**. Suppose two shareholders equally own a corporation and its underlying value is $80. The raider makes a tender offer in which >50% shares will be purchased at a

price of $50 and the remaining <50% offered a lower price of $25 on condition that >50% shares tendered. If both tender, the share will be purchased on pro-rata basis. Under these conditions, tendering is a dominant strategy, even though all the shareholders would be better off refusing to sell. It is argued that the two-tier tender offers must be outlawed because of their coercive nature. However, Bradley and Kim argue that there is no reason to outlaw two-tier offers because they help reallocate corporate resources to their highest valued use. This allows for greater flexibility in financing takeover activity by reducing the amount of cash that a potential raider must accumulate to pursue an acquisition. They further suggest that the potential for competition among raiders and a dominating intra-firm tender offer could solve the prisoner's dilemma.

There is a growing focus in the literature on problems of achieving equilibrium in markets where agents are imperfectly or asymmetrically informed. The information failures can lead to capital rationing in loan and credit markets. It has been argued that an alternative German system of corporate governance, now better known as "insiders", provides an interesting example, although recent global crises have limited its scope. However, this approach points out the importance of institutional factors, which affect the way information is distributed among the agents and argues that it can have an important bearing on the allocative and technical efficiency. Unfortunately, like the theory of complete contingent-claim markets, very little work has been done in this direction.

Fishman (1986) develops a model of the takeover bidding process. The model can be described as a form of auction in which a bidder can acquire costly information after the bidding has begun. Implications concerning the interrelationships between bidders' and targets' profits, bidders' initial offers, single and multiple bidder contests, and the effects of takeover legislation are developed. Additionally, the model provides a rationale for bidders to make high premium ("pre-emptive") initial bids, rather than making low initial bids and raising them if there is competition.

Shleifer and Vishny (1986) point out that if the raider is a large shareholder and, if permitted to profit from secretly purchasing α proportion of shares prior to the tender offer, then the free-rider problem can be solved, even without dilution. The tender offer can be profitable because, the raider can profit on his own shares even if he offers $p > (v + x)$ and loses out on the tendered shares. Their model also sheds light on the following questions: Under what circumstances will we observe a tender offer as opposed to a proxy fight or an internal management shake-up? How strong are the forces

pushing toward increasing concentration of ownership of a diffusely held firm? Why do corporate and personal investors commonly hold stock in the same firm, despite their disparate tax preferences?

However, the empirical evidence is inconsistent with this argument. Bradley, Desai, and Kim (1988) found that the majority of bidders own no shares prior to the tender offer.

Hirshleifer and Png (1989) present a model of corporate acquisitions in which initially uninformed bidders must incur costs to learn their (independent) valuations of a potential takeover target. The first bidder makes either a pre-emptive bid that will deter the second bidder from investigating, or a lower bid that will induce the second bidder to investigate, and possibly compete. They show that the expected price of the target may be higher when the first bidder makes a deterring bid than when there is competitive bidding. Hence, by weakening the first bidder's incentive to choose a pre-emptive bid, regulatory and management policies to assist competing bidders may reduce both the expected takeover price and social welfare.

Bebchuk (1989) focused on takeover bids for which the outcome can be predicted in advance with certainty. Grossman and Hart (1980) established the proposition, which subsequent work accepted, that successful bids must be made at or above the expected value of minority shares. This proposition provided the basis for Grossman and Hart's identification of a free-rider problem and became a major premise for the analysis of takeovers. This paper shows that this important proposition does not always hold once we drop the assumption that the only successful bids are those whose success could have been predicted with certainty. In particular, it is shown that any unconditional bid that is below the expected value of minority shares, but above the independent targets per share value, will succeed with a positive probability. The bidder's expected payoff from such a bid (not counting the transaction costs of making the bid) is always positive, and bidders might elect to make such bids. These results have implications for the nature of the free-rider problem and for the operation of takeovers. In particular, it has been shown that, when the raider can increase the value of a target's assets, the raider might elect to bid even if no dilution of minority shares is possible and it holds no initial stake in the target.

Hirshleifer and Titman (1990) relax the assumptions of Shleifer and Vishny (1986) and present a model of tender offers in which the bid perfectly reveals the bidder's private information about the size of the value