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Application of Game Theory in Corporate Takeovers and Mergers

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Abstract: Game theory is known to give a framework, though it may not be entirely precise, that can examine behaviors in mergers and acquisitions (M&A). Competing companies, they engage in different bidding battles, negotiations and interact strategically. This paper mainly sees how game theory is applied to M&A. Various models, like Nash equilibrium, subgame perfect equilibrium, signal games, among others, help predict and explain companies' behavior when they take part in mergers or acquisitions. Certain mathematical models are looked into, though not exhaustively, and general examples in reality like the bidding between Disney and Comcast for 21st Century Fox, and another instance of a takeover attempt, where Kraft Heinz tried for Unilever, are shown to show how game theory can matter in corporate strategies.

Keywords: Game theory, Mergers and acquisitions, Mathematical models.

1. Introduction

Mergers and acquisitions (M&A) are important strategies for companies seeking growth and competitive advantage. These transactions usually involve complex strategic interactions between the acquiring company, the target company and other bidders. Game theory, a mathematical framework for analyzing strategic decisions, is particularly useful for understanding these dynamics. Game theory was proposed by Neumann and Morgenstern[1] and models the behavior of rational actors seeking to maximize their returns in competitive situations.

In mergers and acquisitions, a common situation is a bidding war in which firms compete to acquire a target firm. This can be modelled as a sequential game in which each firm strategically adjusts its bid according to the behavior of its competitors. The perfect balance of the subgame, found via backward induction, can help firms determine the optimal strategy at each stage.

Another important application is hostile takeovers, where the signal game helps to model the information asymmetry between the acquiring company and the target company. The offer itself is a signal and the target firm has to decide whether to reject the offer or negotiate based on the credibility of the offer [1].

This article examines these game-theoretic models and their application to real M&A scenarios to provide a structured approach to understanding corporate strategy in acquisitions.

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2. Game Theory in Corporate Takeovers

2.1. Bidding Wars as Sequential Games

A bidding war occurs when several companies compete to buy a target company. This competition can be modeled as a continuous game in which each company makes a bid in turn, taking into account both the reactions of the other companies and the reaction of the target company.

2.1.1. Model: Subgame-Perfect Equilibrium in Bidding Wars

In a sequential bidding process, each firm submits a bid for the target. The target firm can accept or reject the offer, and if it rejects, the next company has the opportunity to make a counteroffer. The strategies in this type of game are determined by a subgame perfect equilibrium (SPE), which refines the Nash equilibrium by ensuring that the players' strategies are optimal at each stage of the game [2].

Consider a bidding war between Firm A and Firm B for a target T. Let:

V_T be the value of the target company.

C_A and C_B represent the acquisition costs for Firms A and B, respectively.

$[b_1, b_2, \cdot]$ be the bids made by each firm in sequence.

At any stage, bidding firms must consider the possibility that competitors will bid more. The equilibrium strategy is for each firm to bid slightly above its expected rival bid until the marginal benefit of being above the rival equals the marginal cost of the acquisition.

The payoff function for Firm A can be written as:

$$\text{Payoff for Firm A} = \begin{cases} V_T - b_1 \text{ if Firm B does not counterbid} \\ 0 \text{ if Firm B counterbids and wins} \end{cases} \quad (1)$$

The subgame-perfect equilibrium for both firms involve determining the optimal bid given the competitor's strategy and the expected payoff from winning or losing the bidding war.

2.1.2. Disney vs. Comcast for 21st Century Fox

In 2018, Disney and Comcast fought a high-profile bidding war for the assets of 21st Century Fox. Disney initially offered $52.4 billion in shares for Fox, but Comcast responded with a cash offer of $65 billion. Disney eventually increased its offer to $71.3 billion, which Fox accepted [3].

This bidding war can be interpreted as an ongoing game where each company not only developed a superior strategy to the other but also demonstrated its willingness to continue competing. Comcast's initial cash offer was a signaling strategy to demonstrate its seriousness and willingness to pay more, which forced Disney to increase its offer. In this case, the perfect equilibrium in the underplay is that the two companies bid until Disney's final offer is high enough to prevent further counteroffers [4].

2.2. Hostile Takeovers and Signaling Games

In a hostile takeover, a firm attempts to acquire another company without the agreement of management. In this case, the acquiring company encounters resistance from the management of the target company, which may try to stave off the acquisition with defensive tactics such as poison pills or white knight strategies.

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2.2.1. Model: Signaling Games in Hostile Takeovers

In a signaling game, one party (the 'signaler') sends a message to the other party, which interprets it and makes a decision. In a hostile takeover, the acquirer sends signals through a bid strategy and the target company interprets these signals to decide whether to resist or negotiate [5].
Let:

S_A represent the signal (bid) from the acquiring firm.

T_T be the interpretation of the signal by the target firm (whether to resist or accept).

P represent the defensive tactics employed by the target firm.

The target firm's profit depends on whether it succeeds in fending off a hostile takeover, while the acquiring company's profit depends on whether it succeeds in convincing shareholders or management to accept the takeover without having to significantly increase its offer.

An equilibrium in the signaling game occurs when the signals sent out by the acquiring firm are credible enough to force the target firm to negotiate rather than resist. This can be modelled mathematically in the form of a separation equilibrium in which the acquiring firm's offer distinguishes it from the target firm as a strong competitor.

2.2.2. Kraft Heinz's Hostile Takeover Attempt of Unilever

In 2017, a bid by Kraft Heinz was put forward to buy Unilever for a large sum of $143 billion. The offer was not taken into consideration by Unilever, with their management thinking the valuation was not fitting and also that Kraft Heinz's way of business did not match with what Unilever aimed for in the long run. This attempt by Kraft Heinz can be explained by something like a signaling game, where the first offer wasn't fully appealing to Unilever's leadership, which made the rejection happen [6].

Unilever's board made the choice to reject the offer with strategic thinking, deciding that the offer was undervalued and not something shareholders would benefit from. Kraft Heinz then decided to stop its efforts and withdrew. This showcases how the signaling effects in attempts that are hostile can play a role in how the final outcome of a takeover attempt ends up.

2.3. Game Theory in Negotiating the Terms of Acquisition

2.3.1. Bargaining Models in M&A

In a friendly takeover, both the acquirer and the target firms are interested in the transaction and usually enter into negotiations. These negotiations can be modelled using bargaining theory, in particular the Rubinstein negotiation model, which takes into account alternating offers from the parties [3].

2.3.2. Model: Rubinstein Bargaining Model

In the Rubinstein model, two players take it in turns to make offers. Each player wants to reach an agreement as early as possible, but also on the best possible terms [7]. Let:

δ_A and δ_T be the discount factors representing the time preferences of the acquiring firm (A) and the target firm (T), respectively.

V_A and V_T represent the valuations of the acquiring and target firms for the deal.

The equilibrium outcome of the bargaining process depends on the relative bargaining power of the two firms and the costs associated with delay. The equilibrium offers, x^*, is determined by:

$$x^* = \frac{1-\delta_T}{1+\delta_A} \tag{2}$$

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This solution represents the remainder that the target firm would receive in equilibrium, with the rest going to the acquiring firm.

2.3.3. Vodafone and Mannesmann Merger

The merger between Vodafone and Mannesmann in 2000, it was one of those large takeovers, hostile even, that ended up being successful in the end. In the beginning, Mannesmann's Management Board was not welcoming to Vodafone's offer, which was not even asked for. Resistance was shown initially. But months passed with back-and-forth negotiations, so in the end, Mannesmann agreed and allowed the takeover to happen. This resulted in a deal worth around 180 billion dollars. Rubinstein's model for negotiation shows us, if looked at, how negotiations can drag on for long and then lead to better conditions for Mannesmann, and, eventually, to the company being taken over by Vodafone successfully [8].

3. Conclusion

The application of game theory in context to corporate takeovers, it is a framework which helps in better grasping the strategic interactions influencing mergers, acquisitions, and other corporate behaviors. Bidding wars go on one after another, hostile takeovers occurring, and with negotiations too, can be described by game theory models like subgame perfect equilibrium and signaling games, which, together with bargaining theory, give tools to better explain. As seen in examples with Disney and Comcast or Kraft Heinz's takeover attempt of Unilever, game theory predicts behaviors that companies will likely follow when they engage in such risky strategies. Mathematical models, although quite general, still show useful insights about how competition and negotiation often play out in corporate finance scenarios.

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