Game Theory

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In game theory, scholars construct generalized models in which players choose actions and obtain utility. Game theorists assume rational choice, that is, players maximize their own utility. A stable situation that results from this setup is called an equilibrium. The reason game theorists focus on the equilibrium is that it is expected to be representative of the real world and the model should explain how the real world operates.

Static games of complete information and Nash equilibrium

Static games of complete information are the simplest type of game and a good starting point for an explanation of game theory. For instance, the Negative Campaign Game is modeled in the spatial theory framework as follows (Harrington & Hess, 1996). The "players" are known as candidates 1 and 2. They simultaneously decide the amounts of positive and negative campaigning, P_i and N_i, respectively, with $P_i + N_i \leq A$. Their policy positions on the traditional right–left policy space between 0 and 1 are x_1 and x_2 where $0 \leq x_1 = x_1{}^0 + g(P_1) - h(N_2) \leq x_2 = x_2{}^0 - g(P_2) + h(N_1) \leq 1$, and $x_1{}^0$ and $x_2{}^0$ are both candidates' initial positions. That is, a positive campaign makes candidates' own positions moderate and a negative campaign makes opponents' positions extreme. In all games, players are supposed to make "rational choices," that is, maximize their utility. The utility to a voter at y from candidate i is $U(y,\ i) = a_i - V(y - x_i)$, where a_i is the valence of candidate i ($a_1 \geq a_2$), voter's position y is continuously distributed between 0 and 1, and V is concave. The marginal voter's position is denoted by $z = z(P_1,\ N_1,\ P_2,\ N_2)$ where $U(z, 1) = U(z,\ 2)$. The utilities of candidates 1 and 2 are their vote shares z and $1 - z$.

Negative Campaign Game is "static" in the sense that players decide their actions simultaneously. Players have "complete information" in the sense that they know all parameter values. A player's "strategy" is their choice of action from a range of alternatives. In the Negative Campaign Game, the pair P_i and N_i constitutes candidate i's strategy. The set of strategies of all players is called the "strategy profile." The "best response" is defined as the strategy that brings about maximum utility given the strategies of all the other players. "Nash equilibrium" is a strategy profile where each player's strategy is the best response given all other players' strategies (Nash, 1950). Equilibrium is a stable situation in the sense that, once it is established, no player has incentive to unilaterally deviate from it.

In the Nash equilibrium of the Negative Campaign Game, it is shown that $P_1{}^* = A - N_1{}^* \geq P_2{}^* = A - N_2{}^*$. The message is straightforward; the candidate who is stronger

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in terms of personal attributes conducts a relatively more positive campaign. Moreover, if $g(P) = bP$ and $h(N) = cN$, it follows that $P_1^* = A$ in the case of $b \geq c$; otherwise, $P_2^* = 0$. That is, when a positive (negative) campaign is at least as effective as negative (positive) campaigning, the candidate with stronger (weaker) personal attributes conducts a purely positive (negative) campaign.

Dynamic game of complete information and subgame perfect equilibrium

A game is "dynamic" if players choose their actions sequentially rather than simultaneously, of which the Priming and Issue Ownership Game is an example (Aragonès, Castanheira, & Giani, 2012). The players are known as parties A and B. In the first stage of the game, parties draft proposals for issues, a, b, and c. The quality of party P′s proposal for issue k is denoted by $q_k{}^P$. In the second stage, party P "primes" issue k by spending $t_k{}^P$% of their communication time on it. Voter's salience weight for issue k is $s_k = \beta(t_k{}^A + t_k{}^B) + (1-\beta)\sigma_k$, where σ_k is the pre-communication weight and β is priming effectiveness. In the third stage, the pivotal voter casts his/her ballot for the party that proposes the highest weighted average quality $\Sigma s_k q_k{}^P$. The utility of party P increases in its probability of winning and decreases in drafting cost, $\Sigma\,(q_k{}^P)^2/\theta_k{}^P$, where $\theta_k{}^P$ represents P′s reputation on issue k, $\theta_a{}^A = \theta_b{}^B = \theta > 1 = \theta_b{}^A = \theta_a{}^B$ and $\theta_c{}^A = \theta_c{}^B$. This implies that parties A and B "own" issues a and b, respectively.

Now we redefine "strategy" as the set of actions for all possible situations. The equilibrium concept corresponding to a dynamic game is "subgame perfect equilibrium." The "subgame" is a part of the game that starts from any stage given the actions taken in the previous stage(s). A strategy profile is a subgame perfect equilibrium if it is a Nash equilibrium in all the subgames (Selten, 1965).

In a subgame perfect equilibrium for the Priming and Issue Ownership Game, we will observe: in the first stage, parties A and B invest $q_a{}^{A*} = q_b{}^{B*} = \theta q_b{}^{A*} = \theta q_a{}^{B*}$ and $q_c{}^{A*} = q_c{}^{B*}$. That is, the issue ownership arises endogenously. In the second stage, parties A and B spend $t_a{}^{A*} = t_b{}^{B*} = 100$, $t_b{}^{A*} = t_c{}^{A*} = t_a{}^{B*} = t_c{}^{B*} = 0$. Namely, both parties prime their own issue only. In the third stage, the pivotal voter casts his/her ballot for A or B with a 50% probability. This attention-shifting effect of the campaign holds because parties are better at drafting a proposal on the issue the party owns than on the other issues. However, if β is large (priming is too effective) and/or if θ is small (parties are not so differentiated from each other in terms of issue ownership), another subgame perfect equilibrium emerges, where issue stealing occurs, that is, both parties invest in all issues. The reason is that it is worth improving the quality of the proposal and communicating the sections related to the issues the party does not own when priming is effective or when the other party, which owns the issue, is not so advantageous (the homogenization effect of the campaign).

Dynamic game of incomplete information and perfect Bayesian equilibrium

So far, we have assumed that players have perfect information. In reality, however, people live with uncertainty. In game theory, players are said to have "incomplete information," if they do not know the utility of the other players. An example of a dynamic game of incomplete information is the Media Bias Game (Adachi & Hizen, 2012). The players are an incumbent politician and a (representative) voter. There are two "types" of incumbent, ethical and opportunistic. In the first stage, "Nature" randomly decides which type the incumbent is, with a 50% probability of an ethical incumbent. The incumbent knows his/her own type, although the voter does not know the incumbent's type (incomplete information). In the second stage, an opportunistic incumbent selects a dishonest action with probability σ and an honest action with probability $1-\sigma$. An ethical incumbent always selects an honest action. In the third stage, if the mass media observe honest (or dishonest) action, they misreport it as bad (or good) news with probability η_A (or η_P) and report it as good (or bad) news with probability $1-\eta_A$ (or $1-\eta_P$), where η_A and η_P imply anti-incumbent and pro-incumbent bias, respectively. In the fourth stage, the voter decides whether to reelect the incumbent or to elect a challenger, who is ethical with probability α and opportunistic with probability $1-\alpha$. In the fifth stage, players move to the second period and the reelected incumbent or elected challenger selects an honest or dishonest action. For each period, voter's utility is either 1 and 0 if he/she elects an ethical and opportunistic politician, while a politician obtains utility from either an official salary s if he/she sits in office and private rent R if he/she selects a dishonest action.

This game is dynamic of incomplete information. At every stage (strictly speaking, at every "information set"), every player has a "belief," namely, the probability distribution of the other players' type. Players are assumed to maximize their "expected utility" based on their own belief and the best response is redefined accordingly. A "Perfect Bayesian equilibrium" is a pair of strategy profile and belief such that (1) given the belief, the strategy profile is "sequentially rational," that is, every player's strategy is the best response to the other players' strategies at every stage, and (2) the belief is consistent with the strategy profile, that is, when actions are chosen according to the strategy profile ("on the equilibrium path"), the belief is updated by way of Bayes's rule given the strategy profile (Kreps & Wilson, 1982).

In the case of the Media Bias Game, if a challenger is less likely to be ethical than the incumbent ($\alpha < 0.5$) and the private rent accrued from a dishonest action (R) is not large, in the perfect Bayesian equilibrium, even though the opportunistic incumbent sometimes selects a dishonest action ($0 < \sigma^* < 1$), the voter always reelects the incumbent if he/she observes good news but sometimes elects a challenger if he/she observes bad news.

Merits and demerits

One of the merits of game theory is that we can examine the change in the counterfactual equilibrium if the setup changes, which can never actually be observed. Typically, "comparative statics" analysis is used, where researchers study whether and by how much the equilibrium changes when a parameter value changes. Therefore, comparative statics can identify what causes changes in parameter values in equilibrium. As a result, game theory allows us to examine how the real world functions. Moreover, researchers can compare the utilities of each player under various scenarios and consider what setup is (most) beneficial or harmful to each player.

For example, in the Media Bias Game, when anti-incumbent (η_A) bias increases, the probability of dishonesty (σ^*) also increases. However, as long as there is no anti-incumbent bias ($\eta_A = 0$), pro-incumbent bias (η_P) does not increase the probability of dishonesty. In this sense, anti-incumbent bias is a more fundamental reason for the incumbent's dishonest action under the condition specified above. Besides, media bias increases the probability of dishonesty by weakening the discipline effect (fails to deter the opportunistic incumbent from dishonesty in the first period) or the selection effect (fails to prevent the voter from reelecting the opportunistic incumbent in the second period). It is also shown that media bias never improves voter welfare.

Another contribution of game theory is to formally or theoretically derive hypotheses that can be tested by empirical analysis, either quantitative (e.g., empirical implications of theoretical models, EITM) or qualitative (e.g., analytic narrative). For instance, a case study of the US presidential campaign in 1988 shows that the campaign followed the logic of the Negative Campaign Game. Usually, game theory formalizes the stylized facts, while it sometimes offers unintuitive but theoretically well-founded and empirically confirmed propositions. In the latter case, game theory leads to new findings and gives us a new way to look at the world.

Game theory, however, has some shortcomings. To begin with, a game theoretic model cannot validate what it assumes. As long as the assumptions are valid, so are the implications of the model. If this is not the case, we cannot be sure how relevant the findings of the game theoretic model are for the real world. Moreover, game theorists assume that only the issues considered in their analysis affect the equilibrium of the game. Nonetheless, readers may well doubt this assumption and thus the implications of the game theoretic model. The Priming and Issue Ownership Game considers a valence aspect, that is, all voters prefer higher quality issues, although this is not the case with divisive issues. Moreover, that game does not deal with partisanship and retrospective voting, both of which affect voting behavior.

Finally, though game theory is well developed (for example, equilibrium concepts have been refined) and many applications are found mostly in economics, its application to political communication is still wanting.

SEE ALSO: Issue Management; Media Bias; Priming; Rational Choice

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