The Prisoner's Dilemma and the Role of Information in Setting Advertising Budgets

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This study examines how advertising budget setting, framed as a prisoner's dilemma, is affected by information on the competitive situation and characteristics of the decision maker. Hypotheses are tested using experiments in which subjects set advertising budgets. Results indicate that subjects were generally competitive, but also based their strategy selections on what they expected their opponents to do, what their opponents did last time, whether the competitive relationship was expected to continue, market shares, and whether the subject's profit objectives were short- or long-term. Individual differences also played a part in determining strategy selection.

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Introduction

Advertising budgeting continues to be a controversial topic. The recent switch in emphasis from advertising to promotion spending has had a major impact on the advertising industry and touched off a spirited debate on the long-run effects of advertising and promotion. Part of this debate suggests that, by using promotion in place of advertising, managers are making less than optimal decisions. Yet, surprisingly little is known about how managers actually set advertising budgets and little attention is paid to this issue. For example, Muncy (1991) found that only nine of 603 articles published in the *Journal of Advertising* over the preceding 20 years focused on budgets.

The payoffs from advertising budgeting decisions (and most other management decisions) depend not only on the decision-maker's own actions, but on the actions of other parties as well. This is particularly true in competitive environments. Advertising, promotion, pricing, and product quality decisions, for example, are all decisions where payoffs are determined, in part, by competitive reaction. This study is designed to contribute to our understanding of some of the important information and decision-maker characteristics that affect the advertising budget decision. Many studies have addressed what information managers *should* use, but little research confronts what they actually use in forming their strategies and how their personalities and experience affect their choices.

To explore these questions we begin with a prisoner's dilemma, presented as the management decision task of setting advertising budgets for four regional brands of a mature product in a duopoly, and examine when decision-makers make choices due to information or individual tendencies not incorporated in the standard prisoner's dilemma. Information available for their use includes the profits possible for both firms, the history and duration of the competitive relationship, relative market share, and profit objectives.

Findings indicate that when the classic prisoner's dilemma is enriched to represent more closely the complex strategic task of setting advertising budgets, subjects often do not adhere to the normative recommendations of the basic game. Specifically, we found that subjects generally set high advertising budgets and predicted that their opponents would set low advertising budgets more often than the subjects did themselves. Also impor-

tant were the length of time the competitor was expected to remain in the market, the term of the subjects' profit objectives (short vs. long), the competing firms' market shares, and individual characteristics.

Background

Advertising Budgeting

Most research on the advertising budget decision falls into one of the following two categories: normative work concerned with developing optimal rules (Bensoussan, Bultez and Naert 1978; Deal 1979; Erickson 1985; Friedman 1958; Schmalensee 1978; Shakun 1965; Thompson and Teng 1984) and a much smaller body of descriptive work which relies on self-ratings of behavior (Blasko and Patti 1984; Jones 1990; Lynch and Hooley 1990). Since Dorfman and Steiner's (1954) seminal article, a number of researchers have focused on deriving optimal budgets given various sales response functions (e.g., Little 1979). Partly because of the difficulty of specifying the correct sales response function, other researchers have attempted to develop "reasonable" decisions, often using subjective inputs (e.g., Little 1970; Lodish 1986). Most of the small number of descriptive studies have used surveys (e.g., Hung and West 1991; Lancaster and Stern 1983; Lynch and Hooley 1990). This work has demonstrated the slowly increasing use of quantitative models, but also widespread use of heuristics, such as percent of sales and competitive parity. Overall, evidence suggests that optimizing methods are not the basis of many decisions.

Recently, Low and Mohr (1992) developed a series of propositions concerning the impact of various factors on the budget allocation decision among advertising, consumer promotions, and trade promotions. Based on a survey of the literature and 21 in-depth interviews, they identify 18 market level, product, and firm characteristics which they expect to affect the allocation decision. We test the importance of several of these factors here (market share, margin, profit objective, short-term focus, reward system, and information use) and also consider additional decision maker characteristics which might influence advertising budget setting.

Competition

Considerable past research in marketing, game theory, and decision-making under uncertainty has described what managers *ought* to do in competitive situations (Cyert and DeGroot 1973; Eliashberg 1981; Hotelling 1929; Moorthy 1985). However, far less attention has been paid to describing what they actually do (Burke 1988; Burke, Huber and Jeck 1985; Neslin and Greenhalgh 1983; Roth and Murnighan 1982).

Social psychologists have used experimental games to investigate how people behave in a wide variety of situations (varying in payoff structure and nature, threat and promise use, player personality, game presentation, etc.), yet these studies have largely been conducted in artificial experimental settings using unrealistic tasks (Deutsch 1971; Tedeschi, Schlenker and Bonoma 1973). They have also made little attempt to describe how specific situational and player characteristics work together to determine how games are played.

Eliashberg and Chatterjee (1985, p. 258) suggest that work on descriptive (rather than normative) models of competition based on empirical evidence and psychological theory deserves priority and observe that "a good starting point could be laboratory experiments with simple paradigms such as those presented by Rapoport, Guyer, and Gordon (1976), but where the decision making is in a marketing context." Burke (1988) and Burke, Huber and Jeck (1985) took this approach in their studies of the effects of signaling on managers' pricing decisions in prisoner's dilemma settings. The study presented here frames the advertising spending task as a prisoner's dilemma and examines the use of other kinds of information on the competitive situation.

A related field of study examines the performance and behavior of competitors in management games. Most of these games are computer-controlled and involve competitors playing against each other while receiving feedback on their performance each period. This study differs from management game research in that it provides a simplified and controlled situation in which the effects of changes in the competitive situation and differences in results are easier to detect. Further, research in management games tends to have a normative focus and is concerned with decision-making quality rather than exploring the decisions per se (Chakravarti, Mitchell, and Staelin 1979, 1981; Hogarth and Makridakis 1981; McIntyre 1982), although some of these studies also make descriptive observations (Bowman 1963; Glazer, Steckel and Winer 1987).

The Prisoner's Dilemma

The prisoner's dilemma is a two-person, two-choice, mixed-motive (non-constant-sum) game in which each

Table 1
The Two-Person, Two-Choice Game

		Player O's Strategy	
		Cooperate	**Compete**
Player S's Strategy	**Cooperate**	R=3, R=3 **Reward for mutual cooperation**	S=0, T=5 **Sucker's payoff and Temptation to compete**
	Compete	T=5, S=0 **Temptation to compete and Sucker's payoff**	P=1, P=1 **Punishment for mutual competition**

player has a dominant strategy and there is a single strongly stable deficient equilibrium (i.e., the equilibrium is not Pareto-optimal). It is the only 2x2 game with these characteristics (Rapoport and Guyer 1966). The game is traditionally presented in matrix form as shown in Table 1. Each of the two players, S and O, may choose from two decision alternatives—a cooperative strategy or a competitive strategy. The numbers in the cells are payoffs and player S's outcome or payoff is listed first in each cell. In this game the players choose their strategies simultaneously and without communication.

The players' dominant strategies are to compete. If player O is expected to compete, S is clearly better off competing (gaining 1 rather than 0). If O is expected to cooperate, S is, again, better off competing (gaining 5 rather than 3). Regardless of what O does, S is always better off competing, making this the player's dominant strategy. Yet, because the same is true for player O, if both choose the dominant strategy, they are individually and collectively worse off than if both had chosen the cooperative strategy (which would have given each of them 3 points). This is the dilemma. The relative riskiness of the strategies available to each player (the payoff variance) is a function purely of the payoff magnitudes. From the perspective of player S, the cooperative strategy is lower in variance if and only if $|R-S| < |T-P|$ (i.e., the absolute difference between the payoffs from being cooperative is less than the absolute difference between the payoffs from being competitive). See Exhibit 1 for proof.

When there are repeated plays of the game with the same opponent (the game is in extensive form), Axelrod (1984) has demonstrated that tit-for-tat is robustly successful against a wide variety of other rules, although it is not always optimal. This strategy prescribes that a player cooperate in the first play of the game and from then on do whatever the opponent did in the preceding play. The success of tit-for-tat is due to its unique combination of being nice (never the first to compete), retaliatory (competing following competition by the opponent), forgiving (cooperating following cooperation despite past competition), and clear.

Theory and Hypotheses

The situation we consider is an advertising budget-setting task framed as a prisoner's dilemma in which the player/manager chooses whether to advertise at a low level (the cooperative strategy) or a high level (the competitive strategy). The opponent is the competitor firm in a duopoly and the payoffs are the firms' profits. The dominant solution for a single play is to choose the high advertising budget. In this way the manager avoids the possibility of being the only one to chose the low budget, which would result in lost sales and a profit lower than that possible if both chose the high budget. If the manager anticipates continuing to set advertising budgets in future competition with the competing firm, it becomes an iterative game and a nicer strategy involving more cooperation is likely to be more successful. (Note that the opponent could also be a group of competitors whose average behavior is of concern. Thus the dilemma can

Exhibit 1
Riskiness of Strategies

If 1 is the cooperative strategy and 2 is the competitive strategy, S chooses the cooperative strategy, S1, and $P_o(i)$ is the probability that player O will choose strategy i:

$$\sigma_{S1} = P_o(1)\, R^2 + P_o(2)\, S^2 - [P_o(1)\, R + P_o(2)\, S]^2$$
$$= P_o(1)\, [1 - P_o(1)]\, (R^2 + S^2 - 2RS)$$

If S chooses the competitive strategy:

$$\sigma_{S1} = P_o(1)\, T^2 + P_o(2)\, P^2 - [P_o(1)\, T + P_o(2)\, P]^2$$
$$= P_o(1)\, [1 - P_o(1)]\, (T^2 + P^2 - 2TP)$$

Thus, the relative variance of the alternative strategies depends only on the payoff magnitudes. The cooperative strategy, S1, is lower in variance if and only if

$$R^2 + S^2 - 2RS < T^2 + S^2 - 2TP$$
$$\text{or } (R-S)^2 < (T-P)^2$$
$$\text{or } |R-S| < |T-P|.$$

be generalized beyond the duopoly.)

Mixed-motive games in general, and the prisoner's dilemma specifically, are of particular relevance and interest in the study of strategic decisions such as advertising budget setting. Many characteristics of this game make it useful for approximating real-world competition (Axelrod 1984; Lipman 1986) including competition in business, in general (Burke 1988; DiBenedetto 1986), and advertising, in particular. First, in advertising spending decisions, the possible courses of action are well-defined. Although in modeling advertising spending with the prisoner's dilemma we simplify the task to two choices—a high or low budget—we retain the nucleus of the decision, which is the level at which a firm wishes to advertise *relative* to a primary competitor (i.e., higher, lower, or at the same level). Managers are very aware of their own firm's advertising expenditures relative to their competition, as their concern with "share of voice" illustrates. Second, the players' preferences for the outcomes are well-defined. Even though the precise profits associated with the potential outcomes are not known with certainty in the real world, the relative magnitudes certainly are, which is sufficient to create the dilemma. Third, in both cases the competitors' profits are determined by the actions of both competitors and they are aware of this. Fourth, the total benefits of advertising spending are not fixed. With the right combination of strategies both competitors can increase (or decrease) their profits. Fifth, competing firms often choose strategies simultaneously and do not communicate except by action. In an ongoing competitive relationship (an iterative prisoner's dilemma) a firm is likely to treat past advertising spending as a *signal* (perhaps of commitment to the product, strengthened share objectives, intention to distribute more widely or intensively, etc.) and formulate subsequent strategies in light of that information (Montgomery and Weinberg 1979; Porter 1980; Schelling 1960). Finally, although competition is frequently the optimal strategy in a single period, there are often longer term common interests that can make a more cooperative strategy optimal. Specifically, in mature markets with constant demand, expenditures on advertising that are matched by the competition reduce both firms' profits.

As good a representation as the prisoner's dilemma is of the budget-setting scenario, it seems likely that managers use information on the situation beyond that provided in the prisoner's dilemma game, when it is available, and that their individual traits influence their choices. In addition to the role of profits, we are interested in how managers' aggressiveness in setting advertising budgets is affected by information on the history and duration of the competitive relationship, relative market shares, the term and

framing of profit objectives, and the expected actions of the opponent. To explore the influence on the decision of the person making it, we focus on the effects of competitiveness, empathy, integrity, self-esteem, attitude toward risk, importance of religion, age, and gender. Each of these factors is discussed in the following sections.

The Situation

Profits and the relationship. Provided in the prisoner's dilemma payoff matrix is information on the profits that will accrue to each competitor in each possible combination of budget selections. Since advertising at a high level is the dominant solution, we expect subjects generally to select a high level of advertising. If managers believe that their relationship with the opponent firm will be short-term—that this is the last time they will be setting competing budgets—they have nothing to lose by choosing the single-play dominant solution which is the competitive strategy. By contrast, in a long-term relationship, awareness of mutual dependence and the advantages of bilateral cooperation may encourage managers to choose the cooperative strategy (Corfman and Lehmann 1993; Murnighan and Roth 1983; Roering, Slusher and Schooler 1975). Although managers may prefer to cooperate in long-term relationships, they may also choose to modify their behavior in reaction to a competing firm's behavior. It does not make sense to persist in cooperative behavior when an opponent is not responsive. The tit-for-tat strategy, for example, calls for retaliation against competition and forgiveness of past competition following a cooperative move. If managers are retaliatory or forgiving, they will attend to the opponent's last action as well as the projected length of the relationship. From the preceding discussion come three hypotheses:

H1: Players will advertise at a high level (compete) more often than at a low level (cooperate).

H2: Players will advertise at a high level (compete) more often in short-term than in long-term relationships.

H3: Players will advertise at a high level (compete) more often when their opponents have advertised at a high level in the past.

Time horizon of objectives. Much is made of how management objectives, time focus, and reward systems motivate behavior (e.g., Burke 1984; Strang 1980). Here we examine how the term of the profit objective (one vs. five years) affects advertising budgeting. If the profit objective is set for a single year, the competitive, high budget selection has the highest one year expected value and should be selected. If the profit objective is longer term, a cooperative strategy will often lead to greater profits over that period of time, than would competing (setting a high budget) every year. This should make managers more cooperative, on balance, when their profit objectives are long-term. Thus,

H4: Players will advertise at a high level (compete) more often when the term of the profit objective is short than when it is long.

Framing. The attainability of profit objectives affects motivation and performance (Teas and McElroy 1986; Walker, Churchill and Ford 1977; Vroom 1964) and may have an effect on competitiveness. In this setting, the players are given target profits that are either guaranteed to be achieved (hence, gains with respect to the target are guaranteed) or impossible to achieve (losses are certain relative to the target), regardless of the strategies chosen in the game. (Note that the "loss" frame does not mean the firm experiences losses, but that the profit objective set for the manager cannot be met.) In a pilot study subjects were more competitive when target profits could not be met. This suggests they felt it unnecessary to advertise at higher levels when they were assured of meeting their objective, while in the loss frame they chose the higher budget. Perhaps they select the higher budget so that when they do not meet their objectives they will have the defense that they did everything they could. We thus predict:

H5: Players will advertise at a high level (compete) more often when their objectives cannot be met than when they can.

Market share. Market share is often related to advertising budgets (cf. Jones 1990; Lunch and Hooley 1990). Our players were informed that they had the funds to spend at either level, so share did not constrain their resources. In this study, since players are provided with explicit information on the profits they and their competitors will receive with each combination of strategies, information on relative market share is not necessary for prediction of profits. However, if players assume larger share firms will advertise at higher levels, either because these firms can afford to (advertising as a percent of sales logic) or to defend their position, players are likely respond to this anticipated competition by competing. Similarly, players may also feel that they should advertise at higher levels when their own firm has the larger share, as

suggested by Low and Mohr (1992) and Sethuraman and Tellis (1991). We predict that:

H6: Players will advertise at a high level (compete) more often when their firms have larger shares of the market than when they have smaller shares.

Opponent's expected action. The outcome of the prisoner's dilemma rests heavily on what the opponent decides to do. Even though the high budget is the dominant strategy and should, theoretically, be chosen regardless of what the opponent is expected to do, we expect the manager's judgment of which strategy the opponent is likely to choose to play an important role in his or her own decision. We expect that managers will be more inclined to compete when they expect their opponents to be competitive and if they are ever going to cooperate it will **not** be when their opponents are expected to compete. Hence, in addition to the general tendency to compete, we predict that managers will be sensitive to the anticipated behavior of the opponent:

H7: Players will advertise at a high level (compete) more often when they expect their opponents to advertise at a high level than when they expect them to advertise at a low level.

Just as we surmise that a player will be generally competitive and advertise at a high level even more often when the relationship is short-term, the player might use this kind of logic in predicting an opponent's behavior. In other words, managers are likely to assume others will behave as they do. Thus,

H8: Players will expect their opponents to advertise at a high level (compete) more often than they advertise at a low level (cooperate).

H9: Players will expect their opponents to advertise at a high level (compete) more often in short-term than in long-term relationships.

American Airlines' introduction of a simplified pricing strategy in the summer of 1992 was clearly a cooperative move, as the industry stood to benefit. Consistent with H9, AA's Chairman, Robert Crandall, hoped that its long-term competitors would recognize the benefits of cooperating and follow their strategy. In this case, his hope was not fulfilled. Both the short-term focus of competitors operating in or near bankruptcy and the general tendency to be competitive overcame any inclination to cooperate.

We also expect players to react to their opponents' past behavior. Employment of a tit-for-tat strategy requires that managers respond to their opponents' last action by being *retaliatory* following competition, *nice* following cooperation, and *forgiving* when cooperation follows competition. Managers may also use past behavior as a signal of future behavior. Market signals have been studied by many economists and strategy researchers (e.g., Burke 1988; Montgomery and Weinberg 1979; Porter 1980; Schelling 1960). A good example of a *behavioral* signal is information on what an opponent did in similar situations in the past:

H10: Players will expect their opponents to advertise at a high level (compete) more often when the opponents have advertised at high levels in the past.

Finally, we anticipate that the lack of personal information about the opponent, which is typical of many strategic decision-making situations, will lead players to project their own typical responses onto the opponent. For example, a number of studies have found a strong relationship between a player's likelihood of cooperating and his or her attribution of cooperative intent to others (Burke 1988; Dawes, McTavish and Shaklee 1977; Lindskold, Walters and Koutsourais 1983).

H11: Players who tend to advertise at high levels will expect their opponents also to advertise a high levels more often.

The Individual

The following characteristics are examined for their effects on a manager's tendency to cooperate or compete: competitiveness, empathy, integrity, self-esteem, attitude toward risk, importance of religion, age, and gender. These were chosen because of their impact on competitive decisions in other contexts. We expect that players who are cooperators (Kelley and Stahelski 1970; Lindskold, Walters, and Koutsourais 1983), have greater self-esteem (Cohen 1964), and are more empathetic and religious (Corfman and Lehmann 1991) will be more cooperative and tend to advertise at low levels. Prior studies' findings for the remaining variables are either mixed or are not directly applicable to the focus of this study (e.g., Greenhalgh, Neslin and Gilkey 1984; Rohrbaugh, McClelland and Quinn 1980; Terhune 1970). Thus, we have no strong expectations about the impact of these variables and include them on an exploratory basis.

Players' beliefs about the effectiveness of advertising are examined as a manipulation check. As we give players the specific profits that they and their

competitor will earn depending on the combination of moves they make, players should not let their general beliefs about advertising effectiveness influence their strategy selection. However, players who have strong beliefs about advertising effectiveness may discount the profit information provided. If our method is sufficiently convincing, this variable will not be significant.

Method

Pilot Study

A pilot study was conducted to refine the instrument and examine the appropriateness of using student subjects. Data were collected from 43 marketing managers enrolled in an executive program and 57 marketing students. Data analysis indicated that parameter estimates were very similar and there was no significant difference in the amount of variance explained by the model when it was estimated separately on the student and manager samples. These results and the relative convenience of using students led us to use them in the subsequent study. Indicating that the task was sufficiently realistic, the managers said that they had responded as they would have in their real jobs.

Subjects

Data for this study were collected from a new sample of 57 business students who participated in the study as part of a course requirement, using a self-administered interactive computer program. They were told that they would be making advertising spending decisions as marketing managers of a medium-sized manufacturer selling in mature markets, and that they were committed to remaining with the company for at least five years.

Design

Five two-level factors were combined to form 16 competitive situations using an orthogonal design (Hahn and Shapiro 1966). These factors were (1) time the opponent is expected to remain in the market (*Future*), (2) size of the opponent's last budget (*Past*), (3) relative market share (*Share*), (4) target profit framing—impossible vs. guaranteed (*Profit Framing*). The fifth factor was the profit matrix (*Game*). To provide some variation in the task, two different games were used. The cell entries represent profits to the player and opponent in millions of dollars:

	Cooperate	Compete
Cooperate	28, 28	2, 52
Compete	52, 2	16, 16

	Cooperate	Compete
Cooperate	38, 38	2, 52
Compete	52, 2	26, 26

Assuming the opponent is equally likely to advertise at high or low levels, in both games the difference between the expected values of the strategies is 19. However, in the game on the left, cooperation has the smaller variance, while in the game on the right the variance of competing is smaller. Though we do not expect this difference to have an effect, we control for the possibility in the analyses.

Procedure

Subjects were responsible for setting the advertising budgets (a low $5 million or a high $15 million budget) for four regional brands of a product (with only one major competitor per region) that are quite similar to each other, but have different margins since their prices and production costs differ substantially. Subjects in the group with the short-term profit objective were told that the company rewards its managers based on the annual profit performance of the brands for which they are responsible and that they would receive .01% of any profits they earned for their brands that exceeded the targets. Those who received the long-term objective were told that the company rewards its managers based on the long-term (5-year) profit performance of the brands for which they are responsible. (See Exhibit 2 for a summary of the information provided.)

In both the short and long-term objective groups, each subject received four randomly selected situations (from the 16 orthogonally designed situations) in random order. The players' task for each game was (1) to indicate the likelihood that they would choose each budget (100-point constant sum scale), (2) to choose either the high or the low budget, and (3) to estimate the likelihood that the opponent would choose each budget (100-point constant sum scale). Once subjects had set budgets for all four products for the first year, for each opponent firm subjects were given feedback on the opponent's strategy choice, their own and their opponent's profits, and their bonus (if they had the short-term profit objective and they had earned

Exhibit 2
Summary of Instructions for Computer Simulation

You recently accepted the position of division manager for a medium-sized company that produces a number of products. You have made a commitment to remain with the company for at least five years and plan to honor it.

Your company began with one regional brand of the product for which you are responsible and later developed brands of the product for three other regions of the country. Market analysts estimate that the four regions have approximately equal market potential. All four markets are mature and change little from year to year. The four regional brands differ minimally from each other, but since their prices and production costs differ substantially they have different margins. Your company's code names for these brands are: TNX (Region 1), DAC4 (Region 2), AF20 (Region 3), and NRZ (Region 4). You have only one major competitor in each region. These competitors are four different companies: Alpha, Beta, Gamma, and Delta.

One of your new responsibilities is to set the annual advertising budget for each of your brands. As we continue, you will be given information that may help you decide whether to set high or low budgets. Using this information you will choose either a low or a high advertising budget for each product. The better your decisions are, the higher your brands' profits will be. Each time you set an advertising budget for one of your products, a computer program designed by strategy experts to simulate your competitor's actions will set the advertising level for the competing product at the same time.

Once you have set your [year 1] budgets for all four products, you will be told how profitable you and your competition were as a result of the budgets set by both firms. Then you will have the opportunity to try again by setting your [year 2] budgets.

one), and they were asked to repeat the budget-setting process for the following year. Only data from the second year were used in the analysis. Thus, the budgets the opponents set in the first round of decisions became the *Past* variables. Information on whether the opponent was likely to remain in the market was not given until the beginning of the second budget year. On average it took subjects 12 minutes to complete the eight sets of ratings.

Once the second year budgets were set, subjects provided information on individual traits. (See Exhibit 3 for items.) Most of these items were drawn from Corfman and Lehmann (1987, 1991). Self-esteem items and additional empathy and self-centeredness items were motivated by self-rated personality characteristics found by Groesbeck (1958) to be most associated with a high need for achievement and affiliation. An additional self-esteem item was developed by Cheek and Buss (1981). These measures were refined in pilot studies.

Subjects reported that they found the task interesting and took it seriously. Debriefings revealed no indication of "hypothesis guessing" or associated demand effects (Shimp, Hyatt and Snyder 1991).

Analysis and Results

Variable Coding

The five manipulated game factors (*Future, Past, Share, Profit Framing,* and *Game*) and the profit objective (*Objective*) were effect coded. The number of points the player allocated to the competitive strategy (high advertising budget) is the dependent variable of the model used to test *H1-H7*, $P_S(Ad\ High)$. Similarly, the dependent variable of the model used to test *H8-H11*, $P'_O(Ad\ High)$, is the proportion of points the subject allocated to the likelihood that the opponent would choose the high advertising budget.

The 19 non-demographic items relating to player traits were factor analyzed. Six factors have eigenvalues greater than one and are easily identified. Two of the items intended for the self-centeredness construct loaded with the competitiveness items and two loaded with the empathy items. As this made intuitive sense the self-centeredness items were incorporated in the other two indices. (See Exhibit 3.) Indices were created by calculating the mean of the items that load at .5 or greater on each factor. The

Exhibit 3
Items for Individual Characteristic Indices[1]

Competitiveness
- Winning is important to me.
- I dislike losing.
- Sometimes it is necessary to hurt others to get what you need.[2]

Self-centeredness
- I am selfish.[3]
- I am self-centered.[3]
- I am considerate of others.[4]
- I am a generous person.[4]
- I think of others before I think of myself.[2]

Empathy
- I am interested in the way people think and feel.
- I understand other people's feelings.

Integrity
- I believe it is important to play fair in business.
- I am honest.

Self-esteem
- I am basically worthwhile.
- I know myself well.
- I am fairly sure of myself.

Risk aversion
- I would rather stick with a sure thing than take a chance for greater gain.
- I enjoy taking risks.

Religion
- I am religious.
- Religion is not a strong force in my life.

[1]Measured on four-point Likert-type scales.
[2]Loaded below .5 on all factors; omitted from index.
[3]Loaded on *Competitiveness* factor and incorporated in that index.
[4]Loaded on *Empathy* factor and incorporated in that index.

four indices that have more than two items and their Cronbach alpha's are: *Competitiveness* (.74), *Empathy* (.77), *Risk Aversion* (.60), and *Self-esteem* (.55). *Integrity* and *Religion* are two-item indices whose items are correlated at .52 and .70, respectively. (Two items loaded at only moderate levels on the factors that they were designed to measure and were omitted.) These correlations are marginally below desired levels (Nunnally 1978). Hence, while the measures are useful for exploratory work, the results based on them are likely to be somewhat weaker than those that would be obtained using stronger measures. Belief in the effectiveness of advertising was measured with a single item.

The variable *Average Strategy* was created to test *H11*, which predicts that players expect their opponents' to be more competitive when they are themselves. This variable is the average number of points a subject allocated to the competitive strategy (high budget) across the four games played in the second budget year.

Manager's Strategy

Subjects chose the high advertising budget 78.4% of the time, supporting *H1*. However, they advertised at the higher level in 72.5% of decisions when opponents were about to leave the market and 84.0% of decisions when a long-term competitive relationship was expected ($p<.05$), the opposite of the prediction in *H2*. Debriefing interviews with subjects indicate that they were more likely to advertise at the higher level in long-term relationships for three classes of reasons: (1) if the opponent is planning to leave the market they are not likely to spend much on advertising, so why should the player's firm, 2) why bother competing with an opponent who is planning to leave the market, they will be gone soon anyway, and 3) it is important to establish dominance at the beginning of an ongoing competitive relationship. The first reason is somewhat illogical because there is every reason to compete in a one-shot prisoner's dilemma when you feel certain that the opponent will cooperate. The second and third reasons suggest that subjects had a long-term (greater than one year) orientation.

When the relationship was expected to continue, players chose the high budget in 84.6% of decisions which followed high spending by their opponents, but chose the low budget in only 16.7% of decisions which followed low spending by the opponent. Thus, they were only slightly (and not significantly) more competitive when the opponent had competed last time. This suggests that subjects were neither retaliatory (as recommended by the tit-for-tat strategy), nor "nice"—i.e. they competed without provocation. When the relationship was short-term, players advertised at the higher level in 76.5% of decisions that followed high spending by the opponent and in 68.6% of decisions that followed low spending ($p<.10$). Thus, they were somewhat sensitive to the opponent's last action.

A strategy choice model was estimated using weighted least squares regression (Neter, Wasserman and Kunter 1983) on the 227 observations produced by having 57 subjects make four decisions each. (One observation was dropped due to missing data.) The

Table 2
Probability of Choosing the High Advertising Budget: P_s'(*Ad High*)

Independent variables	Full sample* (*n*=227)	Profit objective: Short-term (*n*=115)	Profit objective: Long-term (*n*=112)
Manipulated:			
Future	-.03	.18[b]	-.18[c]
Past	.15[b]	.21[a]	.09
Objective	-.01	....	....
Profit framing	.02	.04	.00
Share	.13[b]	.21[a]	.04
Game	-.04	-.09	.00
Measured:			
P'_O(Ad High)	.29[a]	.22[b]	.30[a]
Competitiveness	-.06	.15	-.19[c]
Empathy	-.10	.15	-.43[a]
Integrity	.23[a]	.42[a]	.20[c]
Self-esteem	-.12[c]	-.14	.00
Risk aversion	.10	-.04	.19[c]
Religion	-.13[b]	-.05	-.12
Age	.07	-.21[a]	.11
Gender (female)	-.23[a]	-.24[a]	-.30[b]
Advertising effectiveness	.08	.04	.15
R^2	.22[a]	.40[a]	.32[a]

* Standardized regression coefficients.
[a] $p \leq 0.01$; [b] $p \leq 0.05$; [c] $p \leq 0.10$.

model was estimated both as proposed (with the individual traits) and with a subject dummy variable for each subject (minus one) in place of the individual characteristics, as a control for the incomplete repeated measures design (Kerlinger and Pedhauzer 1973). As the parameter estimates of the treatment variables are virtually identical in these two analyses, the results of the model with the individual traits are reported here (Table 2). (The model was also estimated using logistic regression on the strategy selected to determine whether there were differences between the information contained in the strategy selected and the points allocated to each strategy. Results were very similar to those reported in Table 2.)

The model R^2 is .22, which is fairly typical of survey-based experiments. Three situation factors are significant. *Past* and *Share* are significant ($p<.05$), indicating that subjects tended to echo their opponent's last move (*H3*) and that they chose the high budget more often when their relative market share was greater (*H6*). The coefficient of P'_O(*Ad High*) is also significant ($p<.01$), supporting *H7* and indicating that subjects tended to choose the strategy they expected their opponents to choose. *Profit Framing* and the *Objective* were not significant, leading to rejection of *H4* and *H5*. Though framing was a significant factor in the simpler paper-and-pencil pilot study, the complexity of the computer simulation may have rendered it unimportant relative to the additional information available. The insignificance of *Objective* indicates that the term of the profit objective did not have a main effect on budget setting. An analysis reported later in this section reveals that it did have an important higher order effect. As expected, which profit matrix was provided (*Game*) did not significantly affect strategy selection.

Four individual characteristics had significant effects on the subjects' strategy choices. Those who had more integrity, lower self-esteem, were less religious,

and were men tended to be more competitive, choosing the higher advertising budget. The *Self-esteem* and *Religion* effects are consistent with our hypotheses. Why integrity (honesty and fairness) is positively related to competitiveness is unclear and may be a fruitful topic for further research. (Perhaps those are more straightforward individuals with a short-term orientation to whom the obviously dominant solution appeals. In any event, there is no evidence that competitive individuals have less integrity.) The result for *Gender*, indicating that women were less competitive than men, may be added to the pool of mixed results for the behavior of men and women in competitive games.

To determine whether subjects with different profit objectives made their decisions differently, we split the sample into long and short-term objective groups, and estimated the model separately on the two subsamples (Table 2). A Chow test indicates that significantly more variance is explained than when the sample is not pooled ($p<.01$). R^2's are .40 and .32 for the short and long-term regressions, respectively, and P'_O*(Ad High)* has a large effect in both. Subjects who were given the short-term objective were more likely to advertise at the higher level when their own product had a larger share of the market, when their opponent had competed in the preceding year, and when they expected to compete with the opponent again in the future. The latter finding is consistent with the overall result that subjects were more competitive in long-term relationships. Subjects who had long-term objectives were more likely to advertise at the higher level when they **did not** expect to compete with the opponent again in the future. It makes sense that players who have long-term objectives would be more motivated to make a long-term competitive relationship pay by being more cooperative.

There are four notable differences in the individual characteristics between the short- and long-term objective groups. Younger subjects were more likely to advertise at the higher level than older subjects when both had short-term objectives. When subjects had long-term objectives, those who were less competitive, less empathetic and more risk averse, were more likely to advertise at the higher level. The *Competitiveness* finding runs counter to our expectations. A possible explanation for this is that those who are more competitive and self-centered are more concerned with and, thus, more attuned to the benefits to themselves of cooperation in a long-term relationship. An alternative explanation is that this marginally significant coefficient is a chance finding. Our hypothesis concerning *Empathy* appears to hold when objectives are long-term, supporting the notion that concern for others is recognized as an important part of a long-term strategy. Concerning the *Risk Aversion* result, although choosing the high advertising budget was the less risky strategy (had lower variance) only half the time, its dominance as a solution may make it appear more *conservative* and this may be why it was more appealing to risk averse subjects. Perhaps when the competitive relationship is expected to be short-term it is easier to justify a decision not to compete than it is in a long-term relationship. In anticipation of having to explain the choice of an advertising strategy to a boss, the higher budget may be perceived as being less *risky*.

Opponent's Expected Strategy

Players assumed their opponents would be competitive (advertise at the higher level), supporting *H8*, but less competitive overall than they were themselves ($p<.01$). Players expected their opponents to advertise at the higher level in 58.1% of the decisions. Contrary to *H9*, but consistent with their own strategies, players also projected that their opponents would be much more competitive in long-term than in short-term situations (advertising at the higher level in 82.5% and 32.3%, respectively, $p<.01$).

Estimation of the opponent's strategy model produced an R^2 of .24 ($p<.01$) and two significant effects: *Future* ($\beta=.43$, $p<.01$) and the subject's own *Average Strategy* ($\beta=.23$, $p<.01$). Subjects had a higher expectation that their opponents would advertise at the higher level in long-term than in short-term relationships, as they did themselves, and subjects who tended to advertise at the higher level expected their opponents to do the same, supporting *H11*. The result for *Future* is consistent with the first reason subjects gave for being more competitive in long-term relationships; opponents were expected to choose the low budget when they were planning to leave the market. The insignificance of *Past* ($\beta=-.05$) is contrary to *H10* and is surprising, as the strategy the opponent selected last time would seem a useful indicator of subsequent behavior. It appears that players felt the opponent's behavior was much better predicted by the expected duration of the competitive relationship; opponents were expected to spend little on advertising when they were leaving the market, regardless of their past behavior. *Share* had no effect on the opponent's expected strategy ($\beta=.02$) and, again, *Game* was insignificant ($\beta=-.02$).

A split-half analysis based on the subject's profit motive was also performed for this model. No significant difference was found in how the opponent's strategy was predicted. This result is logical, since no information was given on the opponent's profit motive.

Summary and Conclusions

The study reported here demonstrates that players in an advertising spending prisoner's dilemma game were generally competitive, choosing the dominant high advertising budget the large majority of the time, and expected their opponents to be competitive as well, although less so. Subjects were somewhat more likely to advertise at a high level in long-term than in short-term relationships, but this appears to have been because they based their strategy selections primarily on what they expected their opponents to do and they expected their opponents to spend more when remaining in the market. Subjects also expected their opponents to advertise at a high level when they advertised at a high level themselves. Also influencing strategy choice were the opponent's past advertising spending and which firm's market share was larger. Empathy, integrity, risk attitude, age, and gender also contributed to choice of strategy.

Subjects who were given a long-term profit objective were more likely to advertise at a low level when their opponents were expected to remain in the market, while those who had a short-term objective were more likely to advertise at a high level in long-term relationships, and focussed on market share and the opponent's past strategy. The behavior of those with the long-term objective is more consistent with normative prescription. Despite this, subjects generally expected their opponents to advertise at a high level more often in long-term relationships, perhaps due to commitment to the market, and advertise at a low level more often in short-term relationships, perhaps because they were expected to stop putting money into a product they were harvesting. Individual characteristics also played different roles depending on whether the profit objective as short- or long-term. While gender influenced choice in both contexts, age and integrity influenced choice only in short-term relationships, and empathy only in long-term relationships.

This study has several limitations which suggest directions for future research. First, the experiment dealt with one kind of competitive situation: a mature duopoly. When there are more than two competitors or when the market is growing (making share goals more appropriate) the pressure to advertise at a high level may be greater. It would also be helpful to examine competitive histories longer than one period. Thus, examination of competitive decisions in more volatile and complex markets is clearly needed. Second, the subject dummy variables accounted for a much larger amount of variance than was explained by the player traits specified in the model. (R^2 rose to .49 when the subject dummy variables were used in place of the player traits.) Future studies might concentrate on trying to identify the sources of this heterogeneity. Finally, there is the question of the realism of the task. Were subjects able to report the actions they would actually have taken in the situations described? Although most subjects reported feeling that the computer simulation was realistic and their answers were the ones they would have given had they actually been making these decisions, there is no guarantee they would have behaved the same way if the decisions had been real—a limitation of all experimental research.

This study has a number of implications for the advertising budget setting process. First, we found that there is a tendency to choose higher rather than lower advertising budgets, at least among business students (remembering that graduates of business programs make up a substantial fraction of product managers). This is consistent with recent criticism of MBAs as being overly competitive and illustrates a danger of this predisposition, especially as our future managers tended to be competitive (setting higher advertising budgets) even when cooperation was more profitable. Further, they appear to have anchored their expectations of their competitors' advertising aggressiveness on their own typical budgeting behavior. Managers should take care to separate their expectations of their opponents' behavior that are based on how the competitor will respond to the manager's past actions, from mere projection of the manager's own tendencies onto the opponent. Despite this apparent projection technique for anticipating competitive action, subjects expected their competitors to be less aggressive advertisers than they were themselves. It is clear that this will not always be true and has obvious implications for the quality of strategic choices based on the assumption. Another area of concern comes from the result that subjects tended to advertise at higher levels when their shares of the market were greater. This may indicate that some managers continue to use relatively unsophisticated approaches to setting advertising spending levels (Lynch and

Hooley 1990).

Our results imply that individual characteristics also play an important role in advertising budgeting decisions. Awareness of the effects of personality, age, and gender on competitiveness in advertising may also be useful in analyzing how managers are making this choice. Further, it may be possible to influence the effects of individual characteristics on decisions through guidance and, in the cases of integrity and empathy, through hiring and promotion decisions.

This study is part of a growing body of research that is contributing to our understanding of how managers make decisions. We have found that, in this context, players often do not follow the normative recommendation to compete in one shot games and use a more cooperative strategy in ongoing games. The experimental game method appears to be a useful approach for the investigation of advertising decision-making. However, the prisoner's dilemma is not a sufficient descriptive model because players incorporate more complex predictions about future competitive behavior into their decisions and individual differences play a role in determining their strategy choices. Helping managers become aware of the factors that influence their decisions should aid in the improvement of managerial decision-making in general and advertising budgeting in particular.

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