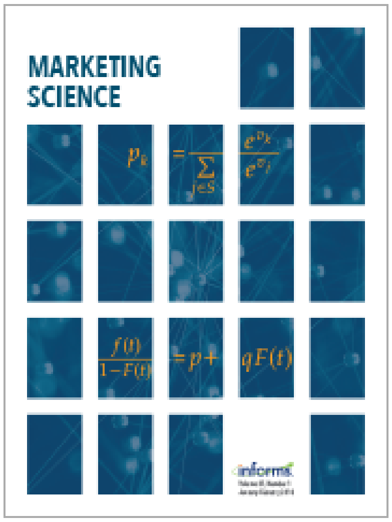

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Competitor Orientation and the Evolution of Business Markets

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Competitor orientation, i.e., the focus on beating the competition rather than maximizing profits, seems to thrive in business situations despite being, by definition, suboptimal for profit-maximizing firms. Our research explains how a competitor orientation can persist and even thrive in equilibrium in markets that reward only profits. We apply evolutionary game theory to business markets where reputation matters. We use three games that represent classic interactions in business marketing: Chicken (to illustrate competition for product adoption), the Battle of the Sexes (channel negotiations), and the Prisoners' Dilemma (pricing battles).

Initial populations are assumed to have both profit-maximizing managers and competitor-oriented managers (i.e., those who gain additional utility from beating others). We demonstrate that a competitor orientation can survive in equilibrium despite selection that is based solely on profits. Using Chicken, we show that a competitor orientation thrives and can even overrun the population. We use the Battle of the Sexes to show that a competitor orientation will overrun one population in a two-sided negotiation (e.g., all retailers in a retailer/manufacturer dyad). Last, using the Prisoners' Dilemma, we show that competitor orientation is not selected against. We conclude that evolutionary profit-driven selection pressures cannot be assumed to eliminate nonprofit-maximizing behavior even when selection is based purely on profitability.

Keywords: evolutionary game theory; competitor orientation; chicken; prisoners' dilemma; battle of the sexes; behavioral economics; analytical model
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1. Introduction

Jack Welch instructs us that business is all about *Winning* (Welch and Welch 2005). Managers revere such brutal murderers as Alexander the Great (Martino 2008), Attila the Hun (Roberts 1990), and Genghis Khan (Man 2010). Cardone (2010) suggests that *If You're Not First, You're Last*, while both Zichermann and Linder (2013) and Newman (2013) advocate strategies to crush the competition. Despite research indicating that a focus on beating competitors (i.e., gaining market share) tends to reduce profitability (Armstrong and Collopy 1996, Armstrong and Green 2007), it is not difficult to find advocates for beating the competition instead of, or as a poorly theorized route toward, profit maximization.

In a market-based system, many suggest that profit maximization should be the manager's primary focus (Friedman 1970). Indeed, Alchian (1950) used an evolutionary logic to show that markets can induce profit-maximizing behavior, regardless of the participants' inability to maximize profit. Why then do markets not discipline those who focus on competitors rather than profits?

To address this question, we develop a series of evolutionary game theory models to study the market-level implications of a successive series of individual interactions. In markets that reward only profitability, we compare profit-maximizing managers with competitor-oriented managers, i.e., those who gain utility from defeating others (Armstrong and Collopy 1996). We show that in markets that select solely on the basis of profitability, a supposedly suboptimal strategy oriented toward beating competitors persists and thrives. Furthermore, our results imply that the notion of finding an optimal strategy can be illusory, as the best strategy at any point in time depends on the market's competitive composition.

Although a manager in any firm can hold a competitor orientation, we apply our evolutionary models in business markets as opposed to consumer markets. We study three types of competitive situations that cover a broad range of marketing interactions. Two of these, Chicken and Battle of the Sexes, have no dominant strategies, and one, Prisoner's Dilemma, has a single dominant strategy.

In the game of Chicken, two players compete for a prize that only one can win outright. The most straightforward example is market entry (e.g., Selten and Güth 1982), where a single player entering gains a major payoff but more entrants cause disaster for all. Players can coordinate to achieve profitable outcomes

(Sundali et al. 1995, Rapoport et al. 1998) but empirical research shows that most new firms fail after a few years (Dunne et al. 1989), suggesting an issue with over entry (Camerer and Lovallo 1999). Chicken games are widespread in business marketing situations. For example, in the competition for shelf space, powerful retailers may demand offers of investments from suppliers, such as slotting fees and trade deals (Chu 1992, Lariviere and Padmanabhan 1997, Bloom et al. 2000).

In the Battle of the Sexes, both players value working together but disagree on how to share the benefits of such an approach. This set-up can result in many channel coordination problems, including double marginalization (Moorthy 1987, Gerstner and Hess 1995) and the provision of quality service (Chu and Desai 1995). For example, a retailer and manufacturer may each want to offer a low price to the end consumer, yet each also wants the other's margin cut.

Finally, in the Prisoners' Dilemma (Rao et al. 1995), players are collectively better off if they do not compete but incentives drive vigorous competition; this situation commonly creates pricing challenges (Rao et al. 2000) and promotion wars.

The remainder of this paper is structured as follows. In the next section, we discuss the related literature. We delve into the details of evolutionary game theory and compare it with more traditional game theory methods. We then develop the three models in detail, determine the nature of the possible equilibria, and discuss the routes to these solutions. We conclude with a discussion and implications for future research.

2. Related Literature

Competitor Orientation

A manager with a competitor orientation wants to beat others even at the expense of profitability (Armstrong and Collopy 1996, Griffith and Rust 1997, Graf et al. 2012). If a firm aims to maximize profits, a focus on beating the competition is an error; it is not profit-maximizing behavior. For this reason, some researchers refer to such behavior as *competitive irrationality* (Arnett and Hunt 2002, Brouthers et al. 2008). We suggest, however, that, although a focus on beating others may often be unpleasant, it need not be erroneous when a manager personally values winning over profit. As such, we prefer the term *nonstandard preference*. Managers may maximize profits or willingly sacrifice them to defeat others, but to aim for both, as some managerial folklore advises, is incoherent.

Competitor orientation is widespread. Leeflang and Wittink (1996), Brodie et al. (1996), and Keil et al. (2001) showed that managers tend to overreact to their competitor's actions. Arnett and Hunt (2002) link a competitor orientation to underdeveloped moral reasoning, while Brouthers et al. (2008) suggest that it is increasing in transitional economies. Kalra and Soberman (2008) even suggest that training and advice can spread the curse of competitiveness.

Evolutionary Game Theory

Evolutionary game theory, a branch of theoretical biology, seeks to apply the precision of mathematical techniques to describe how strategies (broadly defined) work in a population. Early work in this area focused on competitive topics (Maynard Smith 1982), but the focus has recently moved toward the evolution of social preferences (Dreber et al. 2008, Bowles and Gintis 2011) and even the advantages of nonstandard decision making, such as self-deception (Trivers 2011). Evolutionary game theory has become a mainstay of economic analysis (Samuelson 1997, Gintis 2000). In marketing, Palmer (2000) and Ding (2007) use evolutionary ideas; Homburg et al. (2013) use evolutionary game theory to examine strategy. Our research contributes by raising the profile of evolutionary thinking in marketing.

Evolutionary game theory examines long-run outcomes given numerous interacting players, making it ideal for studying *markets*, rather than the skirmishes at which traditional game theory excels. The evolutionary process is governed by the inclusion of a selection criterion that enables the transition of populations toward relatively successful strategies. Over many iterations, stable mixes of player types emerge.

Table 1 provides an outline of the steps in an evolutionary game theory process. Because the analysis is at the market level, we are concerned with the evolution of different groups in the population. In each period, players randomly meet and compete following the rules of a single-period, game-theoretic interaction. In our models, reputations are known and incorporated into competitive strategies. Selection is the key evolutionary game theory addition. After the payoffs from the interactions are calculated, the selection criterion (in our case, profitability) is applied, and the groups' sizes transition. The transition process we use, the replicator dynamic, is very general and could describe transitions driven by managers changing their orientations to mimic currently successful competitors. That said, we see transition as the churn in the market. The profitable are less likely to quit, and those with similar orientations to profitable managers secure start-up investment more easily.

Although evolution is a dynamic process, researchers use static equilibrium concepts to describe the direction toward which populations evolve. Equilibrium occurs when the market has no internal impetus to change; any orientation that exists in equilibrium will persist indefinitely. The key solution concept of evolutionary game theory, developed by Maynard Smith (1982), is an evolutionarily stable strategy (ESS), which is a subset of Nash equilibrium under which, when all play the ESS,

Table 1 A Basic Evolutionary Game Theory Process

Steps	Description	
1. State of population at time t	We assume two groups in the population, but n are possible. At $t = 0$, a non-zero share of the population is allocated to each group.	Group 1 Group 2
2. Interaction	Randomly paired players meet and play a "traditional" game theory interaction.	Payoffs calculated by dyad, weighted by share in the population
3. Selection	Successful strategies, based on the selection criterion, rewarded with a greater share of players in the population. Profits are our only selection criterion.	*Replicator dynamic* used to reward profits alone
4. State of population at time $t+1$	After the selection criteria is applied, shares of the groups in the population are recalculated. Numbers of players with successful strategies increase.	Group 1 Group 2
5. Repetition	Using this new state of the population, the steps are repeated until population shares remain stable.	Population shares eventually reach equilibrium.

the population cannot be invaded by any other strategy. When multiple equilibria exist, evolutionary research generally focuses on the mixed strategies as these are often the only evolutionarily stable strategies. Random (mixed) strategies can seem counterintuitive, but are often exhibited at the market level we are interested in. A move may seem random to researchers, though no individual need randomize. For example, consider 10 managers, six aggressive and four who compromise. Although the managers may have (unobserved) reasons for their decision, the researcher views the population as having adopted a mixed strategy of 60% aggression.

Aggression is often successful when it intimidates the peaceful. However, when two aggressors meet, the ensuing fight can be disastrous for both. This *frequency-dependence* of success is central to evolutionary game theory. Success depends on the behavior of others in the population. Business markets present marketers with similarly varied challenges. Thus, evolutionary logic suggests that effective strategies will vary substantially between markets.

Evolutionary models build on traditional game theory, but consider *market* outcomes rather than focusing on individual competitive skirmishes. The evolutionary approach requires weaker assumptions, as superhuman knowledge and infinite depth of reasoning are not assumed. Actors often need only understand their own preferences. Selection pressure weeds out unsuccessful strategies. Table 2 clarifies the differences between the two approaches and highlights the advantages of the evolutionary approach to address questions about markets.

3. Games Without a Dominant Strategy

3.1. Modeling Conflict: The Game of Chicken

In Chicken, there is no dominant strategy: A player's best choice depends on the other player's choice but the two players' incentives conflict. This ubiquitous game is analogous to numerous non–zero sum, conflicting-motive encounters (e.g., struggles between firms and nature's "red in tooth and claw" elements). It describes strutting young men in muscle cars and, not unconnectedly, political negotiators hoping the opposition will chicken out. In Table 3, arrows indicate that the row player favors aggression if the column player will compromise, but favors compromise when faced with aggression. Winning big involves aggression but can lead to a clash and mutual disaster.

To be Chicken, the payoffs must rank Clash < Lose < Draw < Win Prize.

The marketing applications are widespread:

- Rival business-to-business firms competing to induce retailers with offers they cannot refuse;
- Multinationals entering new markets that can support only one firm;
- Partners at advertising agencies displaying their best ideas to attract clients.

Table 2 Comparing Traditional and Evolutionary Game Theory Models

Feature	Traditional game theory	Evolutionary game theory
Ability to analyze markets	Considers only single games between a limited number of players. Does not map to market.	Shows the strategies that persist in a market. After specifying preferences, selection pressure, and a game describing the market, an entire market is analyzed.
Interactions between individuals	N rounds in a single encounter. Allows complex interactions to be modeled.	Each round is a separate event. (But evolutionary models can be built onto traditional game theory models.)
Number of interactions	Often single, typically finitely repeated but can be infinitely repeated.	Allows for infinite interactions. Equilibrium, where it exists, is reached.
Population	Exogenous.	Endogenous, changed by selection.
Transition process	None.	More successful strategies increase representation in population.
Forward thinking	Often assumes calculation of all possible future payoffs.	Not required. Players can be myopic or forward looking.
Player preferences	Often assumed to be similar but can be varied.	Comparing different preferences allows for mixtures of preferences in market.
Players know what others will do	Players typically use their reason to predict what the other players will do.	Needs no such assumption. We assume reputations are known but this knowledge is not required to apply evolutionary models.
Common knowledge	Often assumed, but models can vary information.	Most evolutionary models use players with minimal knowledge.
Selection pressures	None. Choose highest utility option, but no consequence if their choice would harm them in a market.	Selection pressure rewards some behavior. In our model, the market punishes the less profitable (i.e., reduces their representation in a market).

Model Details

Competing risk-neutral managers have one of two preferences (later we add reciprocators):

Profit-Maximizing Managers: These managers, per economic theory, value only profit.

Competitor-Oriented Managers: These managers value profits *and* success relative to those they meet. They therefore value beating others independently of the profit it brings.

The state of the population at time t, q_t, is defined as the proportion of managers with each preference. C_t is the proportion of competitor-oriented managers, and $1-C_t$ is the proportion of profit-maximizers in the population at time t. (For mathematical convenience, the population size is assumed to be infinite.) In any period, managers are randomly paired for a single competitive interaction. Thus, the proportion of dyads where two competitor-oriented managers face off is C_t^2.

Imagine two managers competing. Each has one of two generic choices: (1) Throw full force behind winning the big prize at any cost, which involves expensive preparatory work and aggressive terms. We refer to such active competition as *aggression*. (2) Alternatively, the manager can seek *compromise*, which will not win the big prize but will gain some business, providing the other manager also compromises. The choice is *aggression* or *compromise*. Managers behave aggressively if the expected utility from aggression is greater than the expected utility from compromise. Note, as detailed below, utility may differ from profit.

The manager chooses a strategy based on his or her preference (competitor orientation or profit maximization). This chosen strategy is the probability of being aggressive, given the manager's belief about the likely actions of the manager he or she faces. Managers may choose a pure or mixed strategy. The potential pure strategies are aggression 100% of the time or compromise 100% of the time. A mixed strategy is being aggressive randomly with probability α.

Utility and Profits

When both managers compete aggressively, a costly struggle ensues resulting in a negative average payoff. The weighted average of aggression, fight, and win plus aggression, fight, and lose is $-\kappa$. If only one manager is aggressive, he or she wins the prize, gaining p (calculated as cost to serve). The payoff to compromise when the other manager is aggressive is equal to the outside option, normalized to 0. When neither manager is aggressive, both win some business, γ. We define α_i as the probability that a focal (row) manager is aggressive and α_{-i} as the probability that the other manager is aggressive. Table 4 shows the profit matrix for the row manager.

The outcomes are rank ordered. Winning the big prize (i.e., the row manager is aggressive and the other

Table 3 Game of Chicken (Payoffs Described for Row Player)

	Aggression	Compromise
Aggression	Clash	Win prize
	↓	↑
Compromise	Lose	Draw

Table 4 Profit Matrix for Row Manager (Utility of a Profit-Maximizing Manager)

	Other manager	
Focal manager	Aggressive	Compromise
Aggression	$-\kappa$	p
Compromise	0	γ

compromises) represents the best possible outcome, p. The outside option (i.e., when only the other manager is aggressive) is worse than the payoff when both compromise. The expected utility to aggression if the other manager is aggressive, $-\kappa$, must be less than zero (otherwise aggression dominates, and this is not Chicken). The payoff ranking is: $p > \gamma > 0 > -\kappa$.

Profits depend on both managers' choices and are weighted by the chance of any outcome occurring. For example, the chance of both managers being aggressive equals the chance of the focal manager being aggressive, α_i, multiplied by the chance that the other manager is aggressive, α_{-i}.

$$\text{Profit} = -\kappa\alpha_i\alpha_{-i} + p\alpha_i(1-\alpha_{-i}) + \gamma(1-\alpha_i)(1-\alpha_{-i}). \quad (1)$$

Profit maximizers care only about profits, but, for a competitor-oriented manager, utility differs from profits. The joy of the big win is not just about the profit but also about gaining more than a rival. Denote the additional utility from winning ε, where $\varepsilon > 0$. Competitor-oriented managers hate losing and receive negative utility from having a lower profit than their rival. The outside option feels worse merely because the other manager won the big prize. Thus, the utility for compromise when the other manager is aggressive is $-E$ where $E > 0$. Whenever the managers receive the same profit, $-\kappa$ and γ, utility comes only from profit, given no relative difference in ranking. The competitor-oriented manager's utility is shown in Table 5. In Chicken, the rank ordering must be $p + \varepsilon > \gamma > -E > -\kappa$; thus, the pain of being beaten remains less than the pain of a clash.

The expected profit for a manager has two key determinants: (1) whether the manager predicts that his or her rival will be aggressive, $\hat{\alpha}_{-i}$; and (2) the utility from any outcome.

$$\begin{aligned}\text{Expected Profit} = {} & -\kappa\alpha_i\hat{\alpha}_{-i} + p\alpha_i(1-\hat{\alpha}_{-i}) \\ & + \gamma(1-\alpha_i)(1-\hat{\alpha}_{-i}). \end{aligned} \quad (2)$$

The utility payoffs for the competitor-oriented manager, Equation (3), differ, as the competitor-oriented manager holds a different view of utility from a profit-maximizer.

$$\begin{aligned}&\text{Competitor-Oriented Expected Utility} \\ &\quad = -\kappa\alpha_i\hat{\alpha}_{-i} + (p+\varepsilon)\alpha_i(1-\hat{\alpha}_{-i}) \\ &\qquad + \gamma(1-\alpha_i)(1-\hat{\alpha}_{-i}) - E(1-\alpha_i)\hat{\alpha}_{-i}. \end{aligned} \quad (3)$$

See Table 6 for the notation used.

Table 5 Utility Matrix for Competitor-Oriented Managers

	Other manager	
Focal manager	Aggressive	Compromise
Aggression	$-\kappa$	$p+\varepsilon$
Compromise	$-E$	γ

Table 6 Summary of Notation

$i/-i$	Focal manager/other manager (i.e., a rival or a competitor)
$C_t(R_t)$	Proportion of competitor-oriented (reciprocators) in population at time t
q_t	State of the population at time t
$\alpha(\hat{\alpha})$	Probability $\widehat{\text{(predicted)}}$ of choosing aggression rather than compromise
ε, $-E$	Competitor-orientation's utility from relative ranking (upper case when losing)
π_j^{-j}	Profit of preference j, i.e., profit-maximizing, competitor-oriented or reciprocator, given competitor of preference $-j$
$\pi_j \mid q_t$	Profit of preference j given state of the population
p	Profit from winning prize
γ	Profit from compromise
$-\kappa$	Loss when both are aggressive

What Is the Probability of Being Aggressive?

A manager's best response depends on the response of the other manager. An optimal probability of aggressiveness can be calculated depending on the manager's expected utility, which depends on the predicted likelihood of the rival's aggression. As a rival seems increasingly likely to be aggressive, $\hat{\alpha}_{-i} \to 1$, aggression is less appealing. A point may exist where the rival's likelihood of aggression makes the manager indifferent (i.e., when the expected utilities of aggression and compromise are equal). For a profit-maximizing manager, Equation (2), indifference occurs when $-\kappa\hat{\alpha}_{-i} + p(1-\hat{\alpha}_{-i}) = \gamma(1-\hat{\alpha}_{-i})$. Rearranging isolates the rival's entry probability:

Profit-maximizing managers are aggressive until

$$\hat{\alpha}_{-i} = \alpha^M = \frac{p-\gamma}{p-\gamma+\kappa}. \quad (4)$$

Rearranging Equation (3) for competitor-oriented managers gives us:

Competitor-Oriented Managers are aggressive until

$$\hat{\alpha}_{-i} = \alpha^C = \frac{p+\varepsilon-\gamma}{p+\varepsilon-\gamma+\kappa-E}. \quad (5)$$

If both managers share the same probability of aggression, equilibrium is possible.

Comparing Equation (4) with Equation (5) shows that the mixed-strategy aggressiveness probability for the competitor-oriented manager is higher, $\alpha^C > \alpha^M$, as ε and E are both positive.

Reputation Matters

Because managers usually know who their competitors are, we consider a world where reputation matters. Each manager wants to convince his or her rival that he or she will be aggressive (Schelling 1980). However, credibly committing to aggressive behavior is difficult, given the pressure to chicken out. We therefore make the critical, but reasonable, assumption that it is

Table 7 Probability of a Manager (Row) Being Aggressive Given Competitor (Column)

	Profit-maximizer	Competitor-oriented	Reciprocator
Profit-maximizer	α^M (i.e., mixed strategy)	0 (i.e., compromises)	α^M (i.e., mixed strategy)
Competitor-oriented	1 (i.e., aggressive)	α^C (i.e., mixed strategy)	α^C (i.e., mixed strategy)
Reciprocator	α^M (i.e., mixed strategy)	α^C (i.e., mixed strategy)	α^M (i.e., mixed strategy)

easier to convince rivals of something true (i.e., that a competitor-oriented manager will be more aggressive) than something untrue (i.e., that a profit-maximizer will be more aggressive).

A manager's decision depends on whether he or she thinks the rival will be aggressive. If the rival is expected to adopt a lower probability of aggression than the manager's mixed strategy, α^M or α^C, the focal manager thinks the rival compromises too much, leading the focal manager to select the best response to compromise, i.e., aggression. If the rival is predicted to be too aggressive, the focal manager responds with compromise. Rivals who have the same preference both see their rival's aggressiveness as correct, thus generating the mixed-strategy equilibrium. Given $\alpha^C > \alpha^M$, when facing competitor-orientation, the profit-maximizing manager always compromises. The competitor-oriented manager is aggressive at a strictly greater probability than the profit-maximizing manager will respond to with aggression. The reverse also holds: When facing a profit-maximizer, a competitor-oriented manager is always aggressive, seeing too much compromise. Profit-maximizers think competitor-oriented managers are too aggressive, but responding aggressively themselves is untenable. The competitor-oriented manager wins the prize without a challenge. Mixed-strategy solutions exist only when managers with the same preferences compete. Table 7 details strategies when facing a specific rival. (For now consider only cells for profit-maximizers or the competitor-oriented. Reciprocators are discussed later.)

The profits using these aggressiveness probabilities and the profits from Equation (2) are shown in Table 8.

We next weigh the expected profit of a manager meeting a rival with a specific preference by the chance of a manager facing a rival with that preference. Given random matching, the meeting probabilities derive from the state of the population, q_t. Bishop-Cannings Theorem (Maynard Smith 1982) shows that the profits of all supported preferences are equal in equilibrium; when the $\pi_M \mid q_t = \pi_C \mid q_t$, i.e., when Equations (6) and (7) are equal.

Table 9 Ranking of Preferences

	Against profit maximization	Against competitor orientation	
		When $\pi_C^{-C} < 0$	When $\pi_C^{-C} > 0$
Profit maximization	2	1	2
Competitor orientation	1	2	1

Profit of Profit-maximizer Given State of the Population

$$\pi_M \mid q_t = \frac{(1-C_t)\gamma\kappa}{p-\gamma+\kappa}. \tag{6}$$

Profit of Competitor-oriented Given State of the Population

$$\pi_C \mid q_t = p(1-C_t) + \frac{1}{(p-\gamma+\varepsilon+\kappa-E)^2} \cdot \big[C_t\big(-p^2E+\gamma E^2-((\gamma-\varepsilon)^2+2\gamma E)\kappa + \gamma\kappa^2+p(\gamma-\varepsilon)(E+\kappa)\big)\big]. \tag{7}$$

We can analyze what happens given the parameters and managers' preferences. The rankings of the preferences are shown in Table 9 (for details, see the appendix: Ranking of Preferences in Chicken). To understand the ranking in this table, read down the column, e.g., against a profit-maximizer being competitor-oriented is ranked first and being a profit-maximizer is ranked second. As the impact of a competitor orientation

Table 8 Profit Given Manager Preferences

	Profit maximization	Competitor orientation	Reciprocator
Profit maximization	$\pi_M^{-M} = \dfrac{\gamma\kappa}{p-\gamma+\kappa}$	$\pi_M^{-C} = 0$	$\pi_M^{-R} = \dfrac{\gamma\kappa}{p-\gamma+\kappa}$
Competitor orientation	$\pi_C^{-M} = \text{p}$	$\pi_C^{-C} = \dfrac{-p^2E+\gamma E^2- ((\gamma-\varepsilon)^2+2\gamma E)\kappa +\gamma\kappa^2+p(\gamma-\varepsilon)(E+\kappa)}{(p-\gamma+\varepsilon+\kappa-E)^2}$	$\pi_C^{-R} = \dfrac{-p^2E+\gamma E^2- ((\gamma-\varepsilon)^2+2\gamma E)\kappa +\gamma\kappa^2+p(\gamma-\varepsilon)(E+\kappa)}{(p-\gamma+\varepsilon+\kappa-E)^2}$
Reciprocator	$\pi_R^{-M} = \dfrac{\gamma\kappa}{p-\gamma+\kappa}$	$\pi_R^{-C} = \dfrac{-p^2E+\gamma E^2- ((\gamma-\varepsilon)^2+2\gamma E)\kappa +\gamma\kappa^2+p(\gamma-\varepsilon)(E+\kappa)}{(p-\gamma+\varepsilon+\kappa-E)^2}$	$\pi_R^{-R} = \dfrac{\gamma\kappa}{p-\gamma+\kappa}$

depends on whether the competitor-oriented manager's profits when competing against another competitor-oriented manager are greater or less than zero ($\pi_C^{-C} > 0$ or < 0), we examine these cases separately (ignoring the point $\pi_C^{-C} = 0$).

Weakly dominated preferences do not survive. A preference that never makes more, and sometimes less, profit against the preferences featured in equilibrium is driven from the population. If a preference is more profitable against any preference present in equilibrium, it survives.

First, note that a competitor orientation outperforms profit maximization when facing a profit-maximizer. Thus, if any profit-maximizing managers feature in equilibrium, a competitor orientation must also feature. The intuition is that a mutant whose preference is competitor-oriented will invade a market of all profit-maximizers. Note as $C_t \to 0$, competitor orientation becomes rarer in the populace, and those with competitor-oriented preferences perform better, restoring their numbers. Competitor orientation is never driven out of this population.

Proposition 1. *In Chicken, competitor-oriented managers are never driven from the market by profit-maximizers.*

Proof. Competitor-oriented managers outperform profit-maximizers when competing against profit-maximizers, i.e., $\pi_C^{-M} > \pi_M^{-M}$, as $p > \gamma\kappa/(p-\gamma+\kappa)$ given $p > \gamma$ and $\{p, \gamma, \kappa\} > 0$.

The most intuitive outcome is where $\pi_C^{-C} < 0$. This occurs when a competitor orientation induces relatively more aggression. Thus, competitor-oriented managers hurt each other enough to allow the compromising profit-maximizers to maintain a presence in equilibrium.

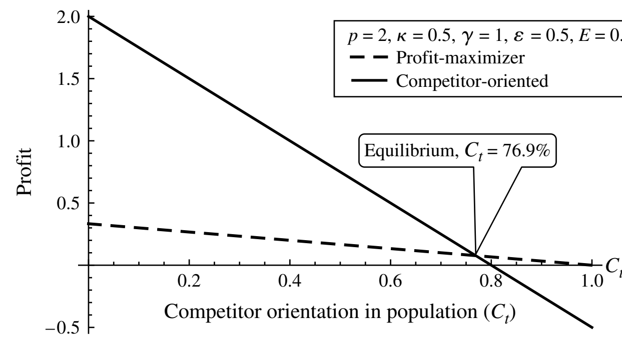
Proposition 2A. *In Chicken, where $\pi_C^{-C} < 0$, competitor-oriented and profit-maximizing managers each form part of the population in equilibrium.*

Proof. Compared with profit-maximizers, the competitor-oriented perform better against profit-maximizers but worse against the competitor-oriented, i.e., $\pi_C^{-M} > \pi_M^{-M}$ (see Proposition 1) and $\pi_C^{-C} < \pi_M^{-C}$ given $\pi_M^{-C} = 0$.

We can go further in the nonintuitive case when $\pi_C^{-C} > 0$. When a competitor-oriented manager performs better against another competitor-oriented manager than a profit-maximizer does against a competitor-oriented manager, then competitor orientation performs better against both preferences. Thus, the competitor-oriented managers are more profitable, and drive profit-maximizers from the population.

Proposition 2B. *In Chicken, where $\pi_C^{-C} > 0$, competitor-oriented managers overrun a population.*

Figure 1 Profitability of Preferences Given State of Population



Proof. Competitor-oriented managers perform better than profit-maximizers against all rivals, i.e., $\pi_C^{-M} > \pi_M^{-M}$ see Proposition 1 and $\pi_C^{-C} > \pi_M^{-C}$ given π_M^{-C} is 0.

To illustrate in a numerical example, we assume that the cooperative payoff (γ) is 1 and the loss from a clash $(\kappa) = 0.5$. Furthermore, we assume that the pain from being beaten equals the joy from winning, $\varepsilon = E = 0.5$. We set the value of a big win (p) equal to 4κ. Figure 1 shows the profit each preference gains given the state of the population. Note that profits fall for all as the level of competitor orientation (C_t) in the population rises. The competitor-oriented gain higher profits than profit-maximizers where the black line is higher. An equilibrium, all equally profitable, exists where the lines cross.

Figure 2 plots the change in the equilibrium level of competitor orientation in the population as the payoff to winning (p) changes relative to the loss from a clash. Note that when p is close to κ, the rewards to aggression are limited, but as p increases relative to κ, the profit gained by those with a competitor orientation through intimidating the profit-maximizers, π_C^{-M}, become so high that a smaller and smaller number of profit-maximizers persist in the population.

Adding Reciprocators

Market theory often assumes that markets self-police. Using this assumption as inspiration, we add reciprocators who punish aggression with an "eye for an

Figure 2 Equilibrium Level of Competitor Orientation

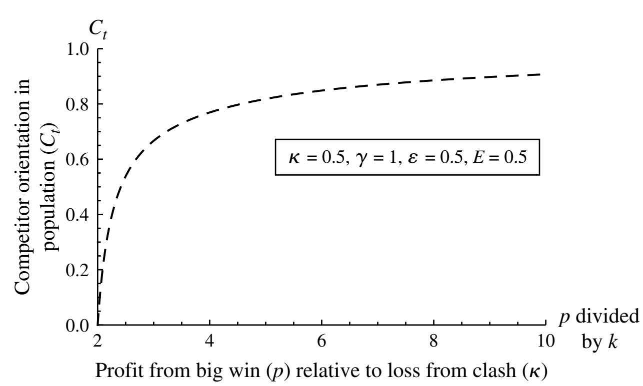


Table 10 Profit of the Three Preferences Given the State of Population

Profit maximization $\pi_M \mid q_t$	$\dfrac{(1-C_t)\gamma\kappa}{p-\gamma+\kappa}$
Competitor orientation $\pi_C \mid q_t$	$p(1-R_t-C_t)-\dfrac{(C_t+R_t)(p^2E+\gamma^2\kappa+\varepsilon^2\kappa-p(\gamma-\varepsilon)(E+\kappa)-\gamma((E-\kappa)^2+2\varepsilon\kappa)}{(p-\gamma+\varepsilon+\kappa-E)^2}$
Reciprocator $\pi_R \mid q_t$	$\dfrac{\gamma\kappa(p-\gamma+\varepsilon-E+\kappa)^2-C_t(E(p-\gamma)+\varepsilon\kappa)(p^2-\gamma E+\varepsilon\kappa+p(-\gamma+\varepsilon+\kappa))}{(p-\gamma+\kappa)(p-\gamma+\varepsilon-E+\kappa)^2}$

eye" strategy, using a simple decision rule: Mirror the rival you encounter; when facing a reciprocator, maximize profits. All know the reciprocator's rule and respond with their own best response, i.e., the mixed strategy. Table 7 shows the entry probabilities; Table 8, the profits from pairings; and Table 10, the profit of each preference, given the state of the population.

Table 11 shows the ranking of the preferences. Again read down the columns to understand the ranking. Note that profit-maximizers weakly dominate the reciprocators where $\pi_C^{-C} < 0$. Reciprocators act as profit-maximizers except against the competitor-oriented, when profit-maximizers simply compromise, which is more profitable than reciprocating at the competitor-oriented level of aggression given $\pi_C^{-C} < 0$.

Transition Process

To see how populations change, we must specify a transition process. We use Taylor and Jonker's (1978) replicator dynamic (Fudenberg and Levine 1998) to model population transition. Each round, the population transitions through selection pressure toward preferences proving to be profitable in the market. When competitor-oriented managers are more profitable, their swashbuckling approach attracts investors, and vice versa.

The transition formula we use is: $j_t(\pi_j \mid q_t - \overline{\pi_j \mid q_t})$. At time t, j_t is the proportion of managers adopting preference j in the population; $\pi_j \mid q_t$ is the profit of preference j, given the state of the population; and $\overline{\pi_j \mid q_t}$ is the average profit across the entire population. Note that a preference's representation increases with greater relative profits; managerial utility/happiness is nice but does not affect the transition. Equilibrium exists when profits are equal across all preferences.

Modeling Transition

Dynamo, a Mathematica program (Sandholm et al. 2012), shows the impact of adding reciprocators. The vertices of the triangle represent a population of one preference; thus, the apex occurs where all managers are profit-maximizers. The arrows show movement using the replicator dynamic. For example, an arrow toward Reciprocator (bottom right) means that, starting at the base of the arrow, reciprocators are relatively profitable and are increasing in numbers. Warmer colors show faster change. The initial population does not affect the equilibrium reached if all preferences are represented. In Figure 3, we choose an arbitrary starting point. Reciprocators initially reduce competitor orientation (label 1), but as reciprocators perform relatively poorly against the competitor-oriented, the profit-maximizers displace the reciprocators (label 2). With no reciprocators to punish them, the competitor-oriented return to the equilibrium level (label 3).

In summary, where $\pi_C^{-C} < 0$, reciprocators cannot exist in equilibrium with the competitor- and profit-maximizers since the profit-maximizing approach weakly dominates reciprocating.

Figure 3 Population Movement with Three Initial Preferences

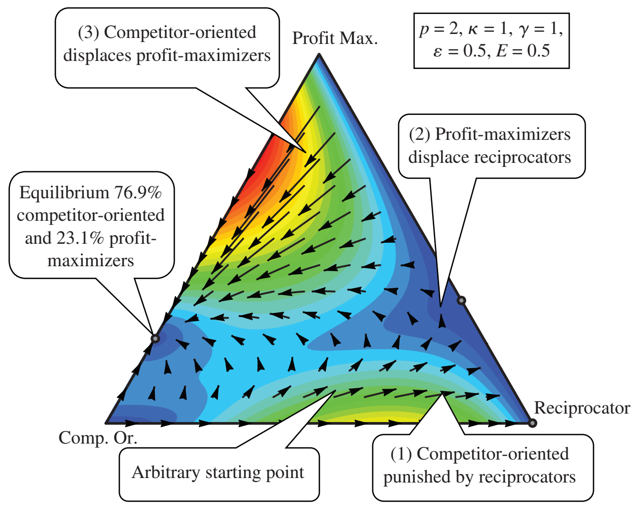


Table 11 Ranking of Profits of the Three Preferences

	Against profit maximization	Against competitor orientation $\pi_C^{-C} < 0$	Against competitor orientation $\pi_C^{-C} > 0$	Against reciprocator
Profit maximization	2	1	2	1
Competitor orientation	1	2	1	2
Reciprocator	2	2	1	1

Where $\pi_C^{-C} > 0$, reciprocators can take over, as they weakly dominate profit-maximizers when all three groups are present, and the competitor-oriented when only reciprocators and the competitor-oriented are present. Reciprocation succeeds only when those with a competitor orientation would overrun the market in the reciprocators' absence. The reciprocator's advantage emerges only after the (weakly dominated) profit-maximizers are removed from the population. The reciprocators can then leverage their greater ability to cooperate with their fellow reciprocators compared to the competitor-oriented.

In Chicken, a competitor orientation can persist in a market in equilibrium even when the selection pressure is based on profit maximization. Critically, profit-maximizing managers can never rid the market of the competitor-oriented managers.

3.2. Modeling Bargaining: The Battle of the Sexes

Our second game without a dominant strategy, the Battle of the Sexes, though less studied than Chicken, is exceptionally well suited to explain bargaining in marketing channels. The analogy is to a married couple in the 1950s. The husband wants to have a manly evening, attending a boxing match or gambling; the wife prefers the opera, but neither wants to go alone (Gintis 2000). For the husband, his wife compromising while he stands firm (i.e., is aggressive) is a big win. His compromise while his wife is aggressive is a small win, but better than the worst outcome of both going out alone. Table 12 shows the outcomes of the Battle of the Sexes, the requirement being that payoffs are arranged: Big Win > Small Win > Lose.

This basic structure applies to many situations in marketing channels; a surplus is gained by cooperation, but the players differ on who deserves the lion's share of the surplus.

- An equipment manufacturer and a system integrator want to offer a high-quality implemented system to the customer but both want the other to bear the majority of the costs.
- A manufacturer and a retailer try to set a price. Each wants to offer a low price to the consumer (i.e., to solve the problem of double marginalization), but each wants the other's margin to be cut.

Model Details

The Battle of the Sexes is a coordination game where the best results come from taking the same action. (In contrast, Chicken is an anticoordination game, as the best results come from taking different actions.) As before, we create the profit and utility matrices (Table 13), given that each manager knows the other's reputation. In the Battle of the Sexes, the off-diagonal payoffs can differ but that possibility is unnecessary; thus, we denote all coordination failures as 0. The focal manager wants the other manager to compromise but prefers to compromise rather than face a coordination failure. Thus profits are: $p > \gamma > 0$. The competitor-oriented manager gains extra utility from the other manager agreeing to his or her demands and is distressed when the other manager performs relatively better than him or her. Thus, the utility matrix for the competitor-oriented manager is shown in parentheses, where $\varepsilon > 0$ and $E > 0$.

Table 12 Battle of the Sexes Game (Payoffs Described for Row Player)

	Aggression	Compromise
Aggression	Lose	Big win
	↓	↑
Compromise	Small win	Lose

Table 13 Battle of the Sexes: Profit of the Row Manager (Utility for Competitor-Oriented)

	Other manager	
Focal manager	Compromise	Aggression
Aggression	$p(p+\varepsilon)$	0
Compromise	0	$\gamma(\gamma-E)$

We work out the entry probabilities forming the mixed-strategy Nash equilibrium for a manager of a given preference by setting utility as equal regardless of the manager's choice. Note that a competitor-oriented manager is more likely to be aggressive, $\alpha^C > \alpha^M$, given $\varepsilon > 0$ and $E > 0$ and $\alpha^M = p/(p+\gamma)$ and $\alpha^C = (p+\varepsilon)/(p+\gamma+\varepsilon-E)$.

Table 14 shows the probability of aggression and profit when managers of each preference meet. The rankings of profitability are shown in parentheses and should be read down the column. Note that, when facing profit-maximizers, the competitor-oriented make the most profit; when facing the competitor-oriented, the profit-maximizers make the most profit. Neither preference dominates, so both will exist in equilibrium.

We establish the expected profit, given the state of the population.

Profit Given State of the Population:

$$\text{Profit Maximization } \pi_M \mid q_t = \frac{(1-C_t)p\gamma}{p+\gamma} + C_t\gamma. \quad (8)$$

Profit Given State of the Population:

Competitor Orientation

$$\pi_C \mid q_t = (1-C_t)p + \frac{C_t(p+\gamma)(p+\varepsilon)(\gamma-E)}{(p+\gamma+\varepsilon-E)^2}. \quad (9)$$

Solution with One Population

We first apply a single-population model, i.e., all managers perform a similar role. This situation could

Table 14 Probability of Aggression and Expected Profit Given Managers' Preferences

	Against profit maximization	Against competitor orientation
Profit maximization Strategy profit (ranking)	α^M Mixed strategy $\pi_M^{-M} = \dfrac{p\gamma}{p+\gamma}$ (2)	0 Always compromise $\pi_M^{-C} = \gamma$ (1)
Competitor orientation Strategy profit (ranking)	1 Always aggression $\pi_C^{-M} = p$ (1)	α^C Mixed strategy $\pi_C^{-C} = \dfrac{(p+\gamma)(p+\varepsilon)(\gamma-E)}{(p+\gamma+\varepsilon-E)^2}$ (2)

be represented by members of a firm's selling team where their efforts and/or rewards may vary depending on their strategy choices. When paired with a competitor-oriented manager, the profit-maximizing manager performs best, and vice versa. Thus, neither preference dominates the other, and so neither is removed from the population. Equilibrium must exist when profits are equal for each preference, given the state of the population.

Proposition 3. *In a single population Battle of the Sexes, competitor-oriented managers are never driven from the market by profit-maximizers.*

Proof. Compared with profit-maximizers, the competitor-oriented perform better against profit-maximizers but worse against the competitor-oriented.

$\pi_C^{-M} > \pi_M^{-M}$ as $p > (p\gamma)/(p+\gamma)$ given $p > \gamma$ and $\{p, \gamma\} > 0$;

$\pi_C^{-C} < \pi_M^{-C}$ *given*

(i) $\pi_C^{-C} < \pi_M^{-M}$ as $\pi_M^{-M} - \pi_C^{-C} = (\alpha^C - \alpha^M)(p+\gamma)(\alpha^C + \alpha^M - 1)$. All terms are positive as $\alpha^C > \alpha^M$, $\{p, \gamma\} > 0$ and $\alpha^M > 0.5$ as $p > \gamma$ so $\alpha^C + \alpha^M - 1 > 0$,

(ii) $\pi_M^{-M} < \pi_M^{-C}$ as $\gamma - (p\gamma)/(p+\gamma) = \gamma^2/(p+\gamma) > 0$ given $\{p, \gamma\} > 0$.

Solution with Two Populations

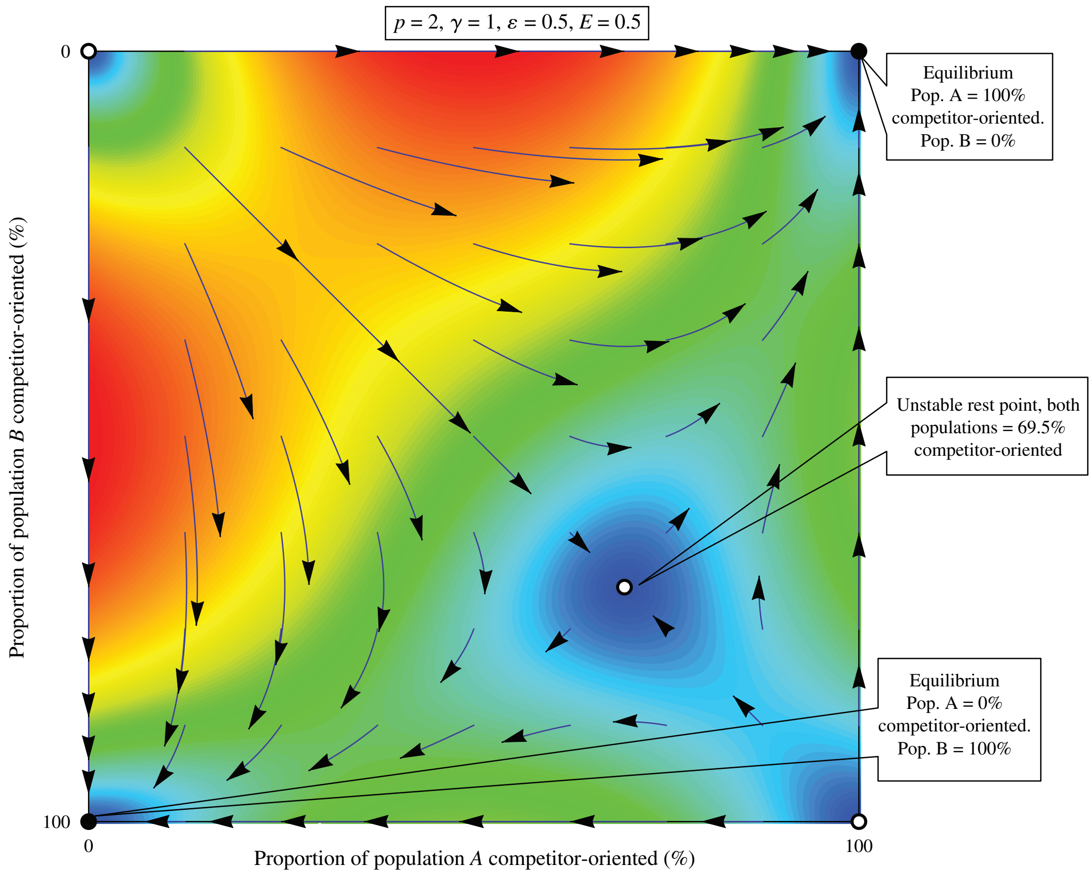
Although in some circumstances, a single population model might apply (e.g., team-selling), the Battle of the Sexes intuitively uses two distinct populations (i.e., sexes), e.g., retailers and manufacturers. Indeed, how retailers perform relative to other retailers is probably a more interesting question than how a retailer compares with a manufacturer. The single population model provides a useful point of comparison: A single population has a mixed-population equilibrium. For example, with parameters $p = 2$, $\gamma = 1$, $\varepsilon = 0.5$, and $E = 0.5$, equilibrium exists when 69.5% of the managers are competitor-oriented. A similar result might be expected with two populations, and indeed a rest point exists where both populations have an equal proportion of competitor-oriented groups, e.g., 69.5%. However, this mixture is an unstable rest point; when both populations are at that point, there is no endogenous impetus for change; any random change, however small, will throw the populations out of balance, and they will not return to the unstable rest point. This failure to return to the unstable rest point occurs because, in two populations, movement to homogeneous populations is driven by the preferences of those faced. When facing a population with more than the equilibrium level of competitor orientation, the managers in the other population are more profitable when they are profit-maximizers. If one population for whatever reason (e.g., even by mistake) deviates from the equilibrium mix, the populations begin self-reinforcing movements toward homogeneity. A population facing slightly more competitor-oriented managers than equilibrium, will select for, and move toward, profit maximization. The more competitor-oriented population thus faces more profit-maximizers than in equilibrium, and the proportion of competitor-oriented managers similarly increases. These processes reinforce each other, leading to the competitor-oriented dominating one population and profit-maximizers the other. Figure 4 plots the level of competitor orientation in one population on the X-axis and in the other on the Y-axis. As before, arrows represent the direction of movement, and warmer colors represent faster movement. Open dots indicate unstable rest points; filled dots indicate stable rest points, i.e., equilibria that the market moves toward and returns to after a disruption. Note that the stable equilibrium points are 100% of one population and 0% of the other population competitor-oriented and vice versa.

Proposition 4. *In a two-population Battle of the Sexes, if the population ever moves from the unstable population mix, competitor-oriented managers overrun one population and profit-maximizers the other.*

Proof. Let $\dot{q}_t$ be the unstable rest point where both populations are mixed between the competitor-oriented at $\dot{C}_t$ and profit-maximizing managers. If the level of competitor-orientation in the population that is being faced is greater than $\dot{C}_t$, then $\pi_M \mid q_t > \pi_C \mid q_t$ and C_t decreases to 0. If the level of profit-maximization in the population that is being faced is greater than $\dot{C}_t$, then $\pi_M \mid q_t < \pi_C \mid q_t$ and C_t increases to 1.

We can also determine who makes more profit. Given that the populations in equilibrium are homogenous and adopt pure strategies, we can compare the profit from Table 14 with the profit of the reverse match-up. The competitor-oriented managers are always aggressive while the profit-maximizing always compromise, and, as $p > \gamma$, the competitor-oriented earn more.

Figure 4 Population Movement in Two Populations in a Battle of the Sexes



4. A Single Dominant Strategy: The Prisoners' Dilemma

Finally, we turn to another common marketing scenario, the Prisoners' Dilemma. Such dilemmas are most obviously seen in pricing, but also represent many advertising and promotional decisions. In stable markets where rivals compete for a relatively fixed number of consumers, all competitors are collectively better off when they cooperate, i.e., when they avoid cutting their price but each have an incentive to defect, e.g., to cut price. (Note that the customers may get a better deal through price-cutting; so, although the Prisoners' Dilemma hurts firms, the consequences are not necessarily universally negative.) The utility matrix for a profit-maximizing (competitor-oriented) manager is given in Table 15, where s is the sucker's payoff. Given $p > 1 > 0 > s$, all firms should always defect.

In a sense, adding competitor orientation has little effect. The competitor-oriented manager merely enjoys defecting, when the other manager cooperates more, $p + \varepsilon > p$, and suffers more when cooperating with defection, $s - E < s$. All will still always defect, so the behaviors of the competitor-oriented and profit-maximizers are identical; they cannot be distinguished from each other through their actions, so selection cannot favor one preference over the other.

The Prisoners' Dilemma is an interesting game because it has a clear predicted outcome (i.e., all defect), leading to scholars attempting to explain why, in practice, defection is not universal. Kreps et al. (1982) alter the assumption of common knowledge to some degree to assess how this alteration affects managers' decisions. Their game changes to a near Prisoners' Dilemma situation by enabling players to have uncertainty about the actions of others even where there is a finite end point. With this change, they show that a range of situations exist wherein a cooperative outcome occurs, often mirroring the results observed in experimental settings.

Building on the notion that changing the Prisoner's Dilemma slightly changes the insights, we investigate

Table 15 Prisoners' Dilemma: Profit of Row Manager (Utility for Competitor-Oriented)

	Other manager	
Focal manager	Cooperate	Defect
Cooperate	1	$s(s - E)$
Defect	$p(p + \varepsilon)$	0

the boundaries of our results. We maintain all of our behavioral assumptions and basic market structure while changing the payoff structure. Defect remains the dominant solution for the competitor-oriented but a profit-maximizer may not see defect as the dominant solution. The two options we examine lead to diametrically opposed outcomes.

First, imagine that one manager cooperating while the other manager defects is less adverse in terms of profit, such that the parameter valuation changes to $1 > s > 0 > s - E$. Perhaps a segment of customers are willing to pay high prices to signal their high status. Thus, cooperating (i.e., pricing high) is more profitable than defecting (i.e., cutting prices) if the rival defects (cuts prices). A competitor-oriented manager cannot bear being undercut and thus cuts prices at the expense of profit so as not to be beaten. The competitor-oriented manager defects while the profit-maximizer responds with cooperation. When two profit-maximizers meet, each would prefer to cut prices but will not do so if the rival cuts. Two pure strategy solutions exist but, given no exogenous way to determine who will cut prices, we use the mixed-strategy solution process used above. See Table 16 for all of the expected profit from all dyads.

Note that the rankings of expected profits (shown in parentheses in Table 16), as before, should be read down the column. Compared with profit-maximizers, the competitor-oriented gains more profit against a profit-maximizer but less against a competitor-oriented rival. Thus, no preference dominates; both approaches will survive in equilibrium. This game resembles Chicken, and a competitor orientation persists despite selection that favors profits.

Second, we change the game so that the profit-maximizing manager does not want to defect if the other manager cooperates. We move away from the Prisoners' Dilemma by relaxing the stipulation that $p > 1$ and instead examine a game where $p + \varepsilon > 1 > p > 0 > s$. Imagine a situation where customers have relatively high switching costs. Many customers will not switch to the firm with the lowest price, which makes cutting prices less profitable. The competitor-oriented manager will have a dominant solution of defect, as, in addition to profits, he or she values beating, and not being beaten by, the other manager. The profit-maximizer's approach is more complex.

Table 16 **Profit: Changing from Prisoners' Dilemma** ($p + \varepsilon > p > 1 > s > 0 > s - E$)

	Against profit maximization	Against competitor orientation
Profit maximization (ranking)	$\pi_M^{-M} = \dfrac{p - S}{1 - p + S}$ (2)	$\pi_M^{-C} = s$ (1)
Competitor orientation (ranking)	$\pi_C^{-M} = p$ (1)	$\pi_C^{-C} = 0$ (2)

Table 17 **Profit: Changing from Prisoners' Dilemma** ($p + \varepsilon > 1 > p > 0 > s > s - E$)

	Against	
	Profit maximization	Competitor orientation
Profit maximization	$\pi_M^{-M} = 1$ or 0 (both equilibria)	$\pi_M^{-C} = 0$
Competitor orientation	$\pi_C^{-M} = 0$	$\pi_C^{-C} = 0$

He or she will always defect against a competitor-oriented manager, given that the rival will always defect. Thus any dyad involving a competitor-oriented manager will lead to all competitors defecting. The profit-maximizing managers *may*, however, cooperate if they meet a fellow profit-maximizer, thus gaining (1), i.e., the expected profit matrix as shown in Table 17.

The challenge is that although a profit-maximizer *may* cooperate with another profit-maximizer, cooperation is not necessarily the outcome. Cooperation will occur only if the profit maximizer believes the other manager will also cooperate, which is not certain, as cooperation risks getting s, if the rival does not reciprocate. As Cooperate/Cooperate is intuitively preferable to Defect/Defect, this game resembles a Stag Hunt (Samuelson 1997). Mathematically, two equilibria exist but one is superior. Any solution depends on whether the profit-maximizers can develop a mutually beneficial coordinating mechanism. Assuming some possibility exists that they will cooperate, then profit-maximization will do no worse than a competitor-orientation and could do better. Without formally proving this outcome, we think it is reasonable to believe that cooperation will be achieved by profit-maximizers given that cooperation leads to the highest payoff for everyone. We, therefore, see this outcome as a boundary of our findings and conclude that the competitor-oriented firm will be driven from this market.

Of course, these modified games are not true Prisoners' Dilemmas but they illustrate important points: First, in competitive interaction, the precise game matters. Second, competitor orientation will not always persist. We instead conclude that in games that cover a wide range of marketing interactions, the market will not remove competitor orientation despite selection on profitability. Profit-maximizers may still, in certain circumstances, drive the competitor-oriented from markets.

Assuming any market is full of profit-maximizing managers is not necessarily false. We instead suggest this assumption is not necessarily true and should be examined given the game being played, the selection pressures in the game, and the managers playing the game.

5. Discussion

Given that competitor orientation exists in business (Armstrong and Green 2007), the implication is that the market fails to weed out those who violate the normative economic advice. The question is: Why? This research demonstrates a thought experiment. If sufficient time were allowed for equilibrium to emerge, could a competitor orientation persist in business markets that reward only profits? Our results are definitive: Selection on profitability will often not weed out the competitor-oriented.

Our analysis spans both games with a dominant strategy and those with no dominant strategy, and our three common games represent many business marketing situations. Chicken and the Battle of the Sexes, where managers must balance cooperation and conflict, often show a thriving competitor orientation. In the basic Prisoners' Dilemma, competitor orientation is not selected against; it is irrelevant. However, by varying the game to promote cooperation, more profitable, long-run outcomes can often be achieved (Axelrod 1984). It is in this spirit that we show that competitor orientation can be damaging because it discourages cooperation.

Our research should not be interpreted as suggesting that a competitor orientation will persist in all markets. The game being played affects the result. To this end, note that there are many games we did not study. Some, like patent races (Fudenberg et al. 1983), make the distinction between profit maximization and competitor orientation seem less relevant; whereas others, like common value auctions, are left to future research.

Our research contributes to the literature by promoting the use of evolutionary game theory in marketing research. We break new ground by allying evolutionary modeling (Maynard Smith 1982, Gintis 2000) with behavioral economics (Camerer 1992, 2003; Ho et al. 2006). Beyond our specific findings, we offer a method to examine which nonstandard behaviors might persist in marketplaces.

We establish a useful tool kit for investigating numerous marketing questions, especially those related to analyzing entire markets. Theories that apply to financial markets, where numerous anonymous players have little strategic interaction, may not apply to common marketing situations, where small numbers of players often conduct face-to-face negotiations.

More widely, our approach also has implications for behavioral research. One of the impediments to the wider acceptance of behavioral research is the belief that markets in equilibrium eliminate behavioral effects. For instance, despite numerous examples (Odean 1999, Fehr and Gächter 2002, Camerer et al. 2004), many scholars remain unconvinced that behavioral considerations matter in markets (Fama 1998, Schwert 2003). Our results contribute in several ways. On one hand, our work shows that nonstandard behavior can persist. On the other hand, our work implies that documenting violations of normative advice is insufficient to demonstrate market failure. Together, these findings provide an opportunity to consider how violations of normative advice interact with market structures. We suggest that scholars can hope to develop precise descriptions of which nonstandard behaviors will survive, and in which markets.

Our research highlights the problem of providing decision-making advice independent of the environment (Gigerenzer 2008). In one sense, all approaches in equilibrium are equally good but only in that specific situation. If an approach's success is frequency-dependent, i.e., depends on population, giving normative advice becomes impossible without the details of the population competing and the game being played. The implication, then, is that abandoning constructivist (i.e., deliberative) rationality in favor of ecological rationality (Smith 2008) (i.e., actions fitted to the environment) should not be seen simply as arriving at the same destination but by a different route. Selection pressures may drive different outcomes from those recommended by traditional decision making. *Homo economicus* himself may not survive the selection pressure of business markets. Future research might consider how pro-social tendencies survive.

Note that despite demonstrating that a competitor orientation is supported in equilibrium, we do not advocate it. A competitor orientation can lead to serious problems because managers may become belligerent. Sometimes they are simply too brave. Fortune can favor the brave but can also kick the brave in the teeth. In our model, a competitor orientation is an unfortunate fact of life, not our recommendation.

In essence, searching for a perfect method of management remains a fundamentally flawed notion in a frequency-dependent marketplace. Understanding the marketplace and players is a vital first step in providing advice or developing marketing theory.

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Appendix. Ranking of Preferences in Chicken

Ranking When Facing a Profit—Maximizing Manager. π_C^{-M} versus π_M^{-M}, competitor-oriented earns more, as $p > \gamma\kappa/(p-\gamma+\kappa)$ given $p > \gamma$ and all terms > 0. The reciprocator acts as a profit-maximizer, and so the rank order is: $\pi_C^{-M} > \pi_M^{-M} = \pi_R^{-M}$.

Ranking When Facing a Competitor-Oriented Manager If $\pi_C^{-C} < 0$. π_C^{-C} versus π_M^{-C}, the profit-maximizer earns more, given $\pi_C^{-C} < 0$. Reciprocators act as competitor-oriented managers, and so the rank order is: $\pi_M^{-C} > \pi_R^{-C} = \pi_C^{-C}$.

Ranking When Facing a Competitor-Oriented Manager If $\pi_C^{-C} > 0$. π_C^{-C} versus π_M^{-C}, the competitor-oriented manager earns more, given $\pi_C^{-C} > 0$. Reciprocators act as competitor-oriented managers, and so the rank order is: $\pi_C^{-C} = \pi_R^{-C} > \pi_M^{-C}$.

Ranking When Facing a Reciprocator. π_C^{-R} versus π_M^{-R}, the profit-maximizer earns the most, as the reciprocator mimics the rival and $\pi_M^{-M} > \pi_C^{-C}$. Why is $\pi_M^{-M} > \pi_C^{-C}$? $\pi_M^{-M} - \pi_C^{-C} = (\alpha^C - \alpha^M)[-p + 2\gamma + (\alpha^C + \alpha^M)(p - \gamma + \kappa)]$ $\alpha^C > \alpha^M$, so $\alpha^C - \alpha^M > 0$.

As $\alpha^M = (p-\gamma)/(p-\gamma+\kappa)$ we know $2\alpha^M(p-\gamma+\kappa) = 2(p-\gamma)$ so if $\alpha^C = \alpha^M$ then $-p+2\gamma+(\alpha^C+\alpha^M)(p-\gamma+\kappa) = p$ which is > 0.

As $\alpha^C > \alpha^M$ and $p-\gamma+\kappa > 0$ then $-p+2\gamma+(\alpha^C+\alpha^M)(p-\gamma+\kappa) > p$ which must be > 0.

$\alpha^C - \alpha^M$ and $-p+2\gamma+(\alpha^C+\alpha^M)(p-\gamma+\kappa)$ are both > 0 so their product, $\pi_M^{-M} - \pi_C^{-C}$, must be positive.

The reciprocator acts as a profit-maximizer, and the rank order is: $\pi_M^{-R} = \pi_R^{-R} > \pi_C^{-R}$.

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