Price and Quality Decisions by Self-Serving Managers*

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Abstract

We present a theory of price and quality decisions by a manager who is self-serving. In the theory, the firm emphasizes the price or quality of its product, but not both. Accounting for this choice of orientation, the self-serving manager credits success in the market to the dominant, "strategic" factor and blames failure on the other, as doing so is psychologically rewarding. However, biased attributions prompt biased responses, which damage future performance. The paper reports a series of experiments that support this logic and motivate our modeling effort. The model captures the phenomenon and clarifies the cost of the bias to the firm under different business conditions.

Keywords: Causal reasoning, self-serving bias, strategic orientation, managerial decision-making.

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1 Introduction

In many industries, firms anxious of getting "stuck in the middle" approach the market emphasizing the price or quality of their products, but not both (Bordalo, Gennaioli, and Shleifer 2015; Porter 2004). For example, the retailer Walmart claims "price leadership is core to who we are," while Wholefoods "considers quality the highest form of value."[1] In consumer electronics, Asus bets on "aggressive prices that make technology accessible to all," but Apple "creates the kind of wonder that revolutionizes entire industries." The fashion label H&M works to "ensure the best price for its customers," but DKNY "applies the highest standards of creativity and quality." In industrial equipment, Parker Hannifin warns "you are messing with a company DNA when you touch prices," while to SKF Group "cutting edge quality is our primary differentiator." EasyJet is the airline that wants to "make travel easy and affordable," but Emirates strives to "inspire travelers with excellence in service."

Accounting for this choice of orientation, managers may be tempted to explain the performance of their firms in the market in a manner that is self-serving, crediting favorable outcomes to the dominant, "strategic" factor and blaming unfavorable outcomes on the other. Indeed, the literature is clear that just as people see themselves—and almost anyone or anything associated with the self—readily as the origin of good effects and reluctantly as the origin of ill effects (Blaine and Crocker 1993; Zuckerman 1979), and that they see the firms that employ them readily as the origin of success and reluctantly as the origin of failure (Bettman and Weitz 1983; Bowman 1976; Curren, Folkes, and Steckel 1992; Salancik and Meindl 1984).

The problem with biased attributions is that they compromise behavior. A case in point is the link between self-serving explanations and overconfidence, which skews perceptions of market entry, acquisitions, and other risky prospects (Billett and Qian 2008; Camerer and Lovallo 1999; Malmendier and Tate 2008). Similarly, research shows that opportunistic disclosures of firm performance inflate earnings forecasts and valuations by the investing community (Baginski, Hassell, and Hillison 2000; Barton and Mercer 2005; Lewellen, Park, and Ro 1996). However, from a statistical standpoint a simpler but overlooked argument is that associating an effect with a particular cause dictates the

[1] This comparison may not stand the test of time. Amazon recently acquired Wholefoods, and it claims "offering low prices to our customers is fundamental to our future success."

attention paid to that cause (DeGroot and Schervish 2011).[2] That is, the manager interested in prolonging success and reversing failure is likely to repeat or correct the actions that, presumably, produced a given outcome. But if the causal claim is flawed, then so is the subsequent reply.

This paper has two objectives. First, we want to provide initial empirical evidence that managers explain and respond to (unexpected) firm performance as described. Second, we want to clarify the cost of the bias to the firm under different business conditions.

Accordingly, Section 2 below reports four experiments conducted with a total of 253 experienced professionals. Conceptually, the claim that price and quality serve the self-serving tendency of managers hinges on the likelihood that these factors are perceived differently on three dimensions of causal explanations (Weiner 1985, 1986): locus (whether a cause is internal or external), stability (whether it endures over time), and control (whether it is subject to volitional alteration). A candidate explanation that appears internal, stable, and controllable is typically linked to the self and, therefore, associated with success and dissociated from failure. An explanation that appears external, unstable, and uncontrollable has the opposite use. The experiments provide a full picture of the theory in the sense that they elicited these beliefs, attributions, and adjustments for price and quality. Importantly, the experiments motivate our modeling effort.

Section 3 describes a model in which the manager is uncertain about the cause of the market outcome—defined as the difference between realized and expected profit—because consumers form subjective valuations of price and quality that can deviate from the levels set by the firm. The presence of uncertainty forces the manager to rely on inference, but this is biased by the orientation of the firm toward price or quality. Conditional on strategic orientation, the manager attributes a surprisingly positive outcome to the dominant factor and a surprisingly negative outcome to the other.

Section 4 derives the (expected) price and quality levels, demand, and profit of a monopolist whose manager makes optimal attributions—the natural point of reference. In Section 5, the manager not only chooses explanations based on the valence of the market outcome and the strategic orientation of the firm, but also fails to anticipate doing so. The cost to the firm is the difference in the decisions and firm performance between this setting

[2] The argument is also a psychological one: the basic tenet of attribution theory as it applies to motivation is that a person's own explanations for success and failure determine the effort that person expends again on the same activities (Weiner 1986).

and the benchmark. Finally, Section 6 considers two changes to the business environment. First, we split decisions between headquarters and a division manager (à la Bernardo, Chai, and Luo 2001), where the former chooses price and quality in the first period and the latter makes adjustments in the second period. We find that delegation is a mitigating factor. Second, we introduce competition. Surprisingly, the results are mostly unaffected by this change.

While there is considerable research that maps the bounded rationality of individuals, the overwhelming majority of this work construes the individual as a consumer rather than as a manager (Goldfarb et al. 2011). We are interested in breaching this gap. In particular, we want more scholars to question how people's basic tendency to be self-serving impacts managerial decisions—a subject that in our opinion has clear applications to firms and markets but a poor track record in academia (Weiner 2000).

The literature in this area is scant, and it seldom pushes beyond the idea that actors credit success internally (to intent, competence, etc.) and blame failure externally (on states of nature, bad fortune, etc.) (Bettman and Weitz 1983). We extend the status quo in three ways. First, we study a setting where the possible causes of firm performance are all internal—they are all actions of the manager. Indeed, we show that perceptions, not reality, determine whether a cause is internal or external, stable or unstable, and controllable or uncontrollable. Second, we study actions that are concrete, routine, and consequential—decisions about the price and quality of a product are among the most common and significant in a firm. Third, we care not only about the presence of a bias, but also how it impacts future decisions and outcomes.

Finally, to the best of our knowledge we are the first to offer a formal model of the self-serving manager. The actor in our theory strays from optimal Bayesian updating and does not engage in backward induction—two known limitations of decision makers (Meyer and Hutchinson 2016). To address this and other behavioral phenomena, Goldfarb et al. (2011) recommend specifying alternative utility functions or adopting non-equilibrium concepts. However, in our work the manager chases the standard (profit-maximizing) objective function in a standard equilibrium structure. It is the way this manager interprets information that puts the firm at a disadvantage.

2 Initial Evidence

This section reports four experiments, conducted with samples of experienced professionals. These tests document the phenomenon and motivate our modeling effort. The goal was to establish two results. First, we wanted to show that attributions of firm performance to price and quality decisions are a function of the valence of the market outcome (relative to some expectation) and the orientation of the firm toward either product factor. Consistent with the literature, we operationalized the latter along the dimensions of locus, stability, and control (Weiner 1985, 1986). We made a clear prediction: managers tend to credit favorable outcomes to the factor that matches the orientation (i.e., the one that appears more internal, stable, and controllable) and blame unfavorable outcomes on the other. Second, we wanted to show that attributions influence responses (adjustments). The prediction here was that managers pay disproportionate attention to the factor that they deem responsible for the market outcome. For a given factor, this implies a positive effect of attribution on adjustment.

2.1 Experiment 1

Participants. The sample comprised 57 senior managers attending open-enrollment executive education programs at a business school in the United Kingdom. The average age and work experience in the sample at the time of the study was 40.9 years old and 17.6 years, respectively.

Instructions. Participants read a scenario that describes the launch of a new product in a competitive market. In the scenario, the manager learns from internal research and initial testing that the best (profit-maximizing) outcome in the first year is expected at a price of £25, with resulting demand of 10,000 units. Next, one group of participants was informed that the firm eventually sold 12,500 units in that period (25% above the estimate), while the other group saw a figure of 7,500 units (25% below the estimate). The difference between the realized and expected demand reflects the between-subjects manipulation of the market outcome (positive or negative, respectively).[3]

[3] In Section 3, we demonstrate that market outcomes are qualitatively equivalent irrespective of whether firm performance is measured by profit or demand.

Background Checks. Participants judged the realism of the scenario: "To what extent do you relate to the situation?" (1 = "Not at all, the situation mirrors reality poorly" to 7 = "Completely, the situation mirrors reality well"). A one-sample t-test comparing the mean score of responses to the midpoint of the scale suggests that the scenario was sufficiently realistic ($M = 4.79$, $t(56) = 4.39$, $p < .001$; with no statistical difference between experimental conditions, $p = .522$). They also indicated whether market outcomes of the type portrayed in the scenario are explained by differences in price and quality among competing products (1 = "Not at all, price and quality differences matter slightly" to 7 = "Completely, price and quality differences matter greatly"). Again, on average responses were significantly higher than the midpoint of the scale ($M = 4.79$, $t(56) = 4.39$, $p < .001$) and independent of the experimental condition ($p = .655$). Finally, participants assessed the gap in demand (-3 = "A really bad result for the firm" to 3 = "A really good result for the firm"). The data show a higher mean score in the context of a positive result than a negative one ($M_+ = 1.96$ vs. $M_- = -.93$; $F(1,55) = 70.63$, $p < .001$), and both values are significantly different from the midpoint of the scale ($t_+(29) = 8.80$, $p < .001$; $t_-(26) = -3.62$, $p = .001$).

Dependent Measures. The stimulus includes three types of measures, for a total of 10 questions (five each for price and quality). First, participants evaluated the two factors as explanations for the surplus or deficit in demand (-3 = "The price/quality of the product is a lot lower than that of competitors" to 3 = "The price/quality of the product is a lot higher than that of competitors"). Second, they expressed their intentions for the coming year (-3 = "Significantly decrease price/quality" to 3 = "Significantly increase price/quality"). Third, participants rated price and quality on locus ("Price/Quality is a fundamental and defining element of a product's value proposition;" 1 = "Strongly disagree" to 7 = "Strongly agree"), stability ("Price/Quality is easy to change;" 1 = "Very easy to change" to 7 = "Very hard to change"), and control ("Market forces such as strong competitors and demanding customers play a role in determining the prices/qualities of the products firms sell;" 1 = "A very small role" to 7 = "A very large role").

Results (Attributions). Table 1 reports the mean scores for the main dependent measures. We tested the first prediction—that managers tend to credit favorable outcomes to the factor that matches the strategic orientation of the firm and blame unfavorable outcomes on the other—by regressing Attribution on Orientation, Market Outcome, and

Table 1: Experiments 1–4: Mean scores for main dependent measures.

	Experiment 1 (n = 57)		Experiment 2 (n = 59)		Experiment 3 (n = 68)		Experiment 4 (n = 69)	
	P	Q	P	Q	P	Q	P	Q
Locus	4.74	6.00	4.80	5.58	5.31	5.75	4.81	5.45
Stability	3.21	5.18	83.05%	16.95%	3.50	5.04	2.90	5.10
Control	5.58	4.18	5.58	5.02	6.03	4.97	5.81	5.09
Attribution (+)	−0.22	1.63	37.50%	62.50%	−0.17	1.34	−0.44	1.24
Attribution (−)	0.97	0.03	66.67%	33.33%	1.18	−0.33	1.00	−0.26
Adjustment (+)	0.15	1.07			0.14	0.57	−0.29	0.94
Adjustment (−)	−0.87	0.23			−1.09	0.30	−1.06	0.26

Notes: P denotes price; Q denotes quality. Lower values for Stability (Experiment 2) and Control (all experiments) imply a stronger belief on that dimension. We denote a positive market outcome by + and a negative market outcome by −.

the interaction term. Attribution is the difference between the participants' valuation of quality as the explanation for the market outcome and the corresponding valuation of price (both expressed in absolute terms). Orientation is the mean-centered, composite difference between quality and price on locus, stability, and (the inverted scores of) control. Market Outcome is the contrast-coded indicator of the valence of the sales result. The regression shows a simple positive effect of Market Outcome ($\beta = .68$, $p < .001$) and, importantly, a significant interaction ($\beta = .45$, $p = .001$). Consistent with our argument, the slope of Orientation is significant and positive in the positive market outcome condition ($\beta = .44$, $p = .025$), and significant and negative in the negative market outcome condition ($\beta = -.46$, $p = .017$). This pattern implies that an increase in the firm's orientation toward quality relative to price increases the use of the former as the explanation for strong results and the latter for weak results.

An interesting observation is that participants expressed stronger beliefs for quality than they did for price on each of the criteria identified by Weiner (1985, 1986): on average, quality appeared more internal ($M_Q = 6.00$ vs. $M_P = 4.74$; $F(1,55) = 40.30$, $p < .001$), more enduring ($M_Q = 5.18$ vs. $M_P = 3.21$; $F(1,55) = 58.60$, $p < .001$), and more controllable ($M_Q = 4.18$ vs. $M_P = 5.58$; $F(1,55) = 28.83$, $p < .001$; where lower scores imply greater control). Accordingly, participants attributed the 25% surplus in demand more to quality than they did to price ($M_Q = 1.63$ vs. $M_P = -.22$; $F(1,26) = 17.71$, $p < .001$), and attributed the 25% deficit in demand more to price than they did to quality ($M_P = .97$ vs. $M_Q = .03$; $F(1,29) = 6.12$, $p = .019$).[4]

Results (Adjustments). The second prediction is a positive effect of Attribution on Adjustment. This is supported by separate regressions (where both variables are expressed in absolute terms) for price ($\beta = .315$, $p = .014$) and quality ($\beta = .373$, $p = .002$). Note that the effect of Attribution is independent of the market outcome. Participants confronted with demand above expectations indicated a stronger positive shift in quality ($M_Q = 1.07$ vs. $M_P = .15$; $F(1,26) = 11.18$, $p = .003$), and participants confronted with demand below expectations indicated a marginally stronger negative shift in price ($M_P = -.87$ vs. $M_Q = .23$; $F(1,29) = 2.89$, $p = .100$).[5]

2.2 Replications

We replicated the experiment to test several variations.[6] Specifically, in Experiment 2 (59 senior managers) participants chose price or quality as the most likely explanation for the market outcome; they did not evaluate each factor on a seven-point scale. The same applies to the measure of stability. Second, we did not survey adjustments. In Experiment 3 (68 senior managers), the price of the product was described as "revenue maximizing" rather than "profit maximizing," and the labels of the scales related to attributions made reference to an optimal point rather than to competition (-3 = "The price/quality of the product was lower than needed" to 3 = "The price/quality of the product was higher than needed." Finally, in Experiment 4 (69 senior managers) participants were instructed to reflect on their own firms and assume that the situation described in the stimulus affected them directly. They also answered two pairs of questions in lieu of the original background checks: they expressed their confidence in the attributions of and adjustments to the market

[4]Across market outcome conditions, only the dominant response was significantly different from the midpoint of the scale (positive market outcome: $t_Q(26) = 7.84$, $p < .001$, $p_P = .265$; negative market outcome: $t_P(29) = 3.99$, $p < .001$, $p_Q = .891$).

[5]Again, only the dominant response was significantly different from the midpoint of the scale (positive market outcome: $t_Q(26) = 4.89$, $p < .001$; $p_P = .404$; negative market outcome: $t_P(29) = 3.26$, $p = .003$; $p_Q = .387$).

[6]These replications are identical to Experiment 1 in all aspects other than those mentioned here. Information on the samples, stimuli, and statistical analyses are omitted for ease of exposition but available on request.

outcome (separate 1 = "Not at all" to 7 = "Completely" scales), and whether the scenario provided sufficient information to express these judgments (again, separate 1 = "Definitely not" to 7 = "Definitely yes" scales for attributions and adjustments). Third, we gauged how quickly (in days) participants expected to adjust price and quality.

Table 1 reports the mean scores for the main dependent measures. The results are consistent with those of Experiment 1 across all replications. With respect to Experiment 4, one-sample t-tests show that the confidence of participants in their attributions ($M = 4.71$) and adjustments ($M = 4.77$) is significantly higher than the midpoint of each scale ($t(68) = 24.59$, $p < .001$ and $t(68) = 23.55$, $p < .001$, respectively). The same is true for their impressions of the information provided in the stimulus (attributions: $M = 4.68$, $t(68) = 40.40$, $p < .001$; adjustments: $M = 4.98$, $t(68) = 34.50$, $p < .001$). The mean expected delay for adjustments is 36.92 days in the case of price and 42.05 days in the case of quality. The difference between these values is not statistically significant ($p = .231$), and in any case both are within the one-year time frame specified in the question.

2.3 Discussion

We conducted four experiments to provide suggestive evidence of our theory and motivate the modeling effort that follows. The conclusions that we draw are positive. First, the participants in our samples attributed the market outcome presented to them differently depending on the valence of that outcome and their orientation toward price or quality (measured by locus, stability and control). The influence of these two variables matches the one predicted by our argument. Second, the causal attributions of the participants influenced their responses—again, in the expected direction. The goal now is to study how this phenomenon impacts a firm.

3 The Model

This section introduces a stylized business environment in which the manager must rely on inference to explain the market outcome. We consider a profit-maximizing monopoly firm that offers a product (or service) to potential consumers over two periods, indexed by $t = 1,2$. In each period, the manager designs the product by choosing the price p_t and the quality q_t. The unit production cost is constant and normalized to zero. Providing quality

q_t requires an investment and costs $\kappa(q_t) = \frac{k}{2}q_t^2$, where $k > 0$. This specification means that providing quality is costly, and more so the higher quality is.

In line with standard arguments in behavioral research (e.g., Hoyer, MacInnis, and Pieters 2012), consumers form subjective valuations of price and quality that may vary from the actual levels set by the firm. We let ε_p and ε_q denote the corresponding deviations, which are drawn in the first period from independent normal distributions with mean zero and variances σ_p^2 and σ_q^2. Consumers have private information about ε_p and ε_q, but their respective distributions are common knowledge. The demand for the product in each period is given by

$$D_t(p_t, q_t) = \max\{\alpha + (q_t + \varepsilon_q) - (p_t + \varepsilon_p), 0\}, \tag{1}$$

where $\alpha > 0$ is an exogenous parameter that we view as a proxy for market size.[7] Therefore, the profit to the firm can be expressed as

$$\pi_t(p_t, q_t) = p_t D_t(p_t, q_t) - \frac{k}{2}q_t^2.$$

We impose the assumption that $k > \frac{1}{2}$ such that the profit function is concave and thus has a unique global maximizer.

At the beginning of the first period, the manager chooses p_1 and q_1 based on expected profit. Consumers in turn make purchase decisions based on their subjective valuations $p_1 + \hat{\varepsilon}_p$ and $q_1 + \hat{\varepsilon}_q$.[8] The resulting market outcome, expressed as the difference between realized and expected profit, is

$$\pi_1^r - \pi_1^e = p_1(\hat{\varepsilon}_q - \hat{\varepsilon}_p), \tag{2}$$

where $\hat{\varepsilon}_q - \hat{\varepsilon}_p$ is the discrepancy between realized and expected demand. Because the gap in profit is proportional to the gap in demand, we can capture the market outcome simply by $\hat{m} = \hat{\varepsilon}_q - \hat{\varepsilon}_p$. Using properties of the normal distribution, $\hat{m}$ is the realization of a normally-distributed random variable with mean zero and variance $\sigma_m^2 = \sigma_p^2 + \sigma_q^2$,

[7] Appendix A derives this demand function from model primitives.

[8] Realizations of random variables are denoted with a "hat."

where we require that $\sigma_m \leq \frac{\alpha}{4}$ to focus on the interesting case where the firm faces positive demand.[9]

The manager observes the market outcome $\hat{m}$ and knows that it is caused by the consumers' subjectivity toward price and quality, yet cannot identify $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$ separately to derive the corresponding valuations. One argument is that the manager commissions market research to estimate $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$. However, to the extent that research is a statistical exercise, the uncertainty about $\hat{m}$ cannot be eliminated and forces the manager to explain $\hat{m}$ by inference. In Section 4, the manager estimates $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$ using optimal attributions. In Section 5, the manager uses self-serving attributions.

4 Optimal Attributions

This section establishes the impact of optimal attributions of the market outcome on expected price and quality levels, demand, and profit—the natural point of reference. It also shows how these results relate to market size, uncertainty about the market outcome, and production and investment costs. We use backward induction.

4.1 Causal Inference

The standard rational assumption in statistical inference is that people use Bayes' rule to update beliefs in light of data (DeGroot and Schervish 2011). This implies that $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$ are estimated from $\hat{m}$ using

$$\varepsilon_p^o \equiv E[\varepsilon_p|\hat{m}] = E[\varepsilon_p] - \frac{\sigma_p^2}{\sigma_p^2+\sigma_q^2}\hat{m} \tag{3}$$

$$\varepsilon_q^o \equiv E[\varepsilon_q|\hat{m}] = E[\varepsilon_q] + \frac{\sigma_q^2}{\sigma_p^2+\sigma_q^2}\hat{m}. \tag{4}$$

These attributions of the market outcome to price and quality are intuitive.[10] First, if $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$ are equal to their respective means, then ε_p^o and ε_q^o are equal to zero (since $E[\varepsilon_p] = E[\varepsilon_q] = 0$). Second, in the event of a positive market outcome ($\hat{\varepsilon}_q - \hat{\varepsilon}_p > 0$), (3) and (4) imply that ε_p^o is below its mean and ε_q^o is above its mean. The opposite is true

[9] Appendix B shows that using the normal distribution rather than the truncated normal distribution does not qualitatively affect the results under this condition.

[10] Appendix C derives these rules using the properties of the bivariate normal distribution.

in the case of a negative market outcome ($\hat{\varepsilon}_q - \hat{\varepsilon}_p < 0$). Third, σ_p^2 and σ_q^2 determine any difference between $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$ and their respective means. In the extreme case where $\sigma_p^2 \to 0$ or $\sigma_q^2 \to 0$, the manager attributes the market outcome exclusively to quality ($\varepsilon_p^o = 0$ and $\varepsilon_q^o = \hat{m}$) or price ($\varepsilon_p^o = -\hat{m}$ and $\varepsilon_q^o = 0$), respectively.

4.2 Firm Behavior

The manager adjusts price and quality in the second period given the information learned from $\hat{m}$ according to (3) and (4). Specifically, the manager solves

$$\begin{aligned} \max_{p_2,q_2} \quad \pi_2(p_2,q_2;\hat{m}) &= p_2(\alpha + (q_2+\varepsilon_q^o) - (p_2+\varepsilon_p^o)) - \frac{k}{2}q_2^2. \\ &= p_2(\alpha + \hat{m} + q_2 - p_2) - \frac{k}{2}q_2^2, \end{aligned} \tag{5}$$

where $\varepsilon_q^o - \varepsilon_p^o = \hat{m}$ by construction. The profit-maximizing price and quality are denoted by $p_2^*(\hat{m})$ and $q_2^*(\hat{m})$, respectively. The optimized profit in the second period is $\pi_2^*(\hat{m})$.

In the first period, the manager sets price and quality to maximize the expected overall profit

$$\begin{aligned} \max_{p_1,q_1} \quad \Pi_1(p_1,q_1) &= p_1(\alpha + q_1 - p_1) - \frac{k}{2}q_1^2 \\ &\quad + \int_{-\infty}^{\infty} \pi_2^*(\hat{m}) f(\hat{m}) d\hat{m}, \end{aligned} \tag{6}$$

where the last summand is the expected second-period profit derived from adding $\pi_2^*(\hat{m})$ across all possible market outcomes. As price and quality do not carry over to the second period, this term is a constant that can be ignored when setting p_1 and q_1. We denote the profit-maximizing price and quality by p_1^* and q_1^*, and the optimized expected overall profit by Π_1^* (the expected first-period profit is denoted by π_1^*).

The analysis leads to the results shown in the first column of Table 2. The (expected) prices and qualities are constant across periods because the adjustments prompted by optimal attributions average out across market outcomes. Moreover, they have intuitive properties. First, prices and qualities increase in market size α: a larger market implies a higher average willingness to pay by consumers, which prompts the firm to increase price and quality. Second, a higher investment cost k decreases qualities and prices: the firm

Table 2: Comparison of optimal and self-serving attributions.

Expected Values	Optimal Attributions	Self-Serving Attributions (Price Orientation)	Deviation
First Period			
Price	$\frac{\alpha k}{2k-1}$	$\frac{\alpha k}{2k-1}$	0
Quality	$\frac{\alpha}{2k-1}$	$\frac{\alpha}{2k-1}$	0
Demand	$\frac{\alpha k}{2k-1}$	$\frac{\alpha k}{2k-1}$	0
Profit	$\frac{\alpha^2 k}{2(2k-1)}$	$\frac{\alpha^2 k}{2(2k-1)}$	0
Second Period			
Price	$\frac{\alpha k}{2k-1}$	$\frac{\alpha k}{2k-1}+\frac{\sigma_m}{2\sqrt{2\pi}}$	$-\frac{\sigma_m}{2\sqrt{2\pi}}$
Quality	$\frac{\alpha}{2k-1}$	$\frac{\alpha}{2k-1}$	0
Demand	$\frac{\alpha k}{2k-1}$	$\frac{\alpha k}{2k-1}-\frac{\sigma_m}{2\sqrt{2\pi}}$	$\frac{\sigma_m}{2\sqrt{2\pi}}$
Profit	$\frac{(\alpha^2+\sigma_m^2)k}{2(2k-1)}$	$\frac{4\alpha^2 k+(2k-1)\sigma_m^2}{8(2k-1)}$	$\frac{(2k+1)\sigma_m^2}{8(2k-1)}$
Overall Profit	$\frac{(2\alpha^2+\sigma_m^2)k}{2(2k-1)}$	$\frac{8\alpha^2 k+(2k-1)\sigma_m^2}{8(2k-1)}$	$\frac{(2k+1)\sigma_m^2}{8(2k-1)}$

maximizes profit by saving on quality and reducing price to counterbalance the drop in demand.

In turn, the profit impact is captured by the following proposition.

Proposition 1. *When the manager uses optimal attributions to explain firm performance, the optimized expected overall profit of a monopolist is*

$$\Pi_1^* = \frac{(2\alpha^2+\sigma_m^2)k}{2(2k-1)}.$$

Proof. The proof of this and all other results are provided in Appendix D. □

Proposition 1 shows how Π_1^* is driven by the model parameters. Not surprising, a larger market size or lower investment cost makes the firm better off. The impact of uncertainty is less intuitive but follows from the fact that, while the weighting function $f(\hat{m})$ is symmetric, the optimized profit in the second period $\pi_2^*(\hat{m})$ increases quadratically in $\hat{m}$. Since a (mean-preserving) spread of a probability density increases the expected value of a quadratic function, greater uncertainty increases expected overall profit.

5 Self-Serving Attributions

We establish now the impact of self-serving attributions on expected price and quality levels, demand, and profit. Importantly, we also quantify the cost of the bias by comparing this analysis to that of the benchmark case in Section 4. Recall that a self-serving manager chooses explanations based on the valence of the market outcome and the strategic orientation of the firm.

5.1 Causal Inference

The evidence reported in Section 2 suggests that managers update their beliefs about market outcomes in a manner that is inconsistent with Bayes' rule (for additional evidence, see Meyer and Hutchinson 2016). Based on this evidence, we derive the following result.

Proposition 2. *When the manager is self-serving, estimates of $\hat{\varepsilon}_p$ and $\hat{\varepsilon}_q$ are obtained from $\hat{m}$ using*

$$\varepsilon_p^s \equiv E[\varepsilon_p|\hat{m},\gamma] = \begin{cases} -\dfrac{(1-\gamma)\sigma_p^2}{(1-\gamma)\sigma_p^2+\gamma\sigma_q^2}\hat{m}, & \text{if } \hat{m}>0 \\ -\dfrac{\gamma\sigma_p^2}{\gamma\sigma_p^2+(1-\gamma)\sigma_q^2}\hat{m}, & \text{if } \hat{m}<0 \end{cases} \tag{7}$$

$$\varepsilon_q^s \equiv E[\varepsilon_q|\hat{m},\gamma] = \begin{cases} \dfrac{\gamma\sigma_q^2}{(1-\gamma)\sigma_p^2+\gamma\sigma_q^2}\hat{m}, & \text{if } \hat{m}>0 \\ \dfrac{(1-\gamma)\sigma_q^2}{\gamma\sigma_p^2+(1-\gamma)\sigma_q^2}\hat{m}, & \text{if } \hat{m}<0, \end{cases} \tag{8}$$

where $\gamma \in [0,1]$ reflects the strategic orientation of the firm: $\gamma < \frac{1}{2}$ denotes a "price orientation" and $\gamma > \frac{1}{2}$ a "quality orientation."

To understand this proposition, suppose that $\hat{m} > 0$. (The logic is the same when the firm experiences $\hat{m} < 0$, but leads to the opposite pattern of attributions.) Because the manager who is self-serving prefers to attribute a positive result to the product factor that matches the strategic orientation of the firm, the manager explains $\hat{m}$ proportionally more by price than quality when $\gamma < \frac{1}{2}$, and proportionally more by quality than price when $\gamma > \frac{1}{2}$. Note that price and quality are equally relevant when $\gamma = \frac{1}{2}$ (a "balanced orientation"), which implies that self-serving attributions are equivalent to optimal attributions. Indeed, the literature is clear that a self-serving motivation alone is not sufficient to produce self-serving attributions; it must be that candidate explanations differ in ways that the decision-maker can exploit (Weiner 1985, 1986).

5.2 Firm Behavior

A manager who is self-serving adjusts price and quality given the information learned from the market outcome $\hat{m}$ according to (7) and (8). Although we treated attributions as a continuous variable, we now focus on discrete adjustments.[11] Specifically, we assume that the manager attributes a positive result fully to price and a negative outcome fully to quality given a price orientation, and vice versa given a quality orientation. This approach improves tractability and provides a natural upper bound for the cost of the bias. We use the superscripts $-$ and $+$ to index variables according to the valence of $\hat{m}$.

Price Orientation. In the second period, the manager adjusts price (but not quality) in response to $\hat{m}^+$ and quality (but not price) in response to $\hat{m}^-$, solving the constrained optimization problems

$$\max_{p_2} \quad \pi_2(p_2; q_1|\hat{m}^+) = p_2(\alpha + \hat{m} + q_1 - p_2) - \frac{k}{2}q_1^2 \tag{9}$$

$$\max_{q_2} \quad \pi_2(q_2; p_1|\hat{m}^-) = p_1(\alpha + \hat{m} + q_2 - p_1) - \frac{k}{2}q_2^2. \tag{10}$$

The profit-maximizing price and quality are denoted by $p_2^+(q_1^*)$ and $q_2^-(p_1^*)$. The corresponding optimized profits are $\pi_2^+(q_1^*|\hat{m})$ and $\pi_2^-(p_1^*|\hat{m})$.

We assume that a self-serving manager does not anticipate making self-serving attributions or, for that matter, the adjustments prompted by these attributions. This is line with the repeated observation that people seldom engage in backward induction

[11] Allowing for continuous adjustments is an important topic for future research that is beyond the scope of this paper.

(Meyer and Hutchinson 2016). In fact, the argument in social psychology is that people's tendency to be self-serving leads them to think that they are not self-serving, or at least to think that they are less susceptible than the average peer—the bias "blind spot" (Pronin, Lin, and Ross 2002). Accordingly, in the first period the manager sets price and quality to maximize

$$\begin{aligned}\max_{p_1,q_1} \quad \Pi_1(p_1,q_1) &= p_1(\alpha+q_1-p_1)-\frac{k}{2}q_1^2 \\ &\quad +\int_{-\infty}^{\infty}\pi_2^*(\hat{m})f(\hat{m})d\hat{m}.\end{aligned}$$

This objective function is the same as (6) in the benchmark case, which implies that price and quality in the first period are also the same. Given that the manager makes self-serving attributions in the second period, the optimized expected overall profit is in effect given by

$$\Pi_1^s=\pi_1^*+\int_{-\infty}^{0}\pi_2^-(p_1^*|\hat{m})f(\hat{m})d\hat{m}+\int_{0}^{\infty}\pi_2^+(q_1^*|\hat{m})f(\hat{m})d\hat{m}. \tag{11}$$

The analysis leads to the results shown in the second column of Table 2. The (expected) prices and qualities are not constant across periods: unlike the benchmark case, the adjustments prompted by self-serving attributions do not average out across market outcomes. Overall, the manager sets a price that is excessive while quality is set at the optimal level. The price distortion is driven by the uncertainty about the market outcome: a higher variance increases the likelihood of larger positive market outcomes, which primes the manager to increase price to benefit from the expansion in demand. All other properties of prices and qualities are the same as in the benchmark case.

In turn, the profit impact is captured by Proposition 3.

Proposition 3. *When the manager uses self-serving attributions to explain firm performance, the optimized expected overall profit of a monopolist is*

$$\Pi_1^s=\frac{8\alpha^2k+(2k-1)\sigma_m^2}{8(2k-1)}.$$

This result shows that Π_1^s has the same properties as Π_1^* in the benchmark case.

Quality Orientation. In the second period, the manager adjusts quality (but not price) in response to $\hat{m}^+$ and price (but not quality) in response to $\hat{m}^-$, solving

$$\max_{q_2} \quad \pi_2(q_2; p_1|\hat{m}^+) = p_1(\alpha + \hat{m} + q_2 - p_1) - \frac{k}{2}q_2^2 \qquad (12)$$

$$\max_{p_2} \quad \pi_2(p_2; q_1|\hat{m}^-) = p_2(\alpha + \hat{m} + q_1 - p_2) - \frac{k}{2}q_1^2. \qquad (13)$$

The profit-maximizing quality and price are denoted by $q_2^+(p_1^*)$ and $p_2^-(q_1^*)$. The corresponding optimized profits are $\pi_2^+(p_1^*|\hat{m})$ and $\pi_2^-(q_1^*|\hat{m})$. In the first period, the manager sets the same price and quality as in the benchmark case. We show in Appendix D that the optimized expected overall profit is the same under a price or quality orientation.

5.3 The Cost of the Bias

This section quantifies the cost of the bias under a price orientation. In fact, Appendix D shows that the impact of self-serving adjustments on expected profit is the same irrespective of strategic orientation. Comparing price and quality decisions across the benchmark and self-serving cases leads to the results shown in the third column of Table 2. Because the manager does not foresee making self-serving adjustments following the market outcome, the price and quality chosen in the first period are the same across the two scenarios. Consequently, the cost of the managerial bias is caused by problems in the second period—excessive adjustments to price to maximize profit when demand is above expectations.

A comparison of the optimized expected overall profits derived above yields the following proposition.

Proposition 4. *The optimized expected overall profit of a monopolist is lower in the context of self-serving attributions than of optimal attributions, as*

$$\Pi_1^* - \Pi_1^s = \frac{(2k+1)\sigma_m^2}{8(2k-1)} > 0.$$

Proposition 4 illustrates how the effect of self-serving attributions is driven by the model parameters. First, higher uncertainty increases the cost of the bias: it reinforces excessive adjustments to price and, therefore, further distorts markup and demand. Second, a higher investment cost has the opposite effect: it discourages the manager from investing in quality in the first period, and, therefore, it reduces the distortions of price and quality in the second period.

6 Delegation and Competition

The situation of the firm may vary from what we describe in several ways. For example, it is often the case that decisions are split between actors, or that consumers enjoy a choice of products to purchase. An interesting question then is whether and how delegation and competition interact with the self-serving motivation of managers to impact firm performance. We study these questions in turn.

6.1 Delegation

We consider a principal-agent setting where headquarters (the principal) sets price and quality in the first period and a division manager (the agent) makes adjustments in the second period. This arrangement is common in multi-national or multi-brand firms, which tend to allocate strategy to a central office and implementation to a local or specialized team. It is also common in entrepreneurial ventures, where principal-owners are initially involved in questions of business entry or product launches but later empower a subordinate and exit.

We consider the following sequence of events: At the beginning of the first period, headquarters sets price and quality based on expected demand and communicates these decisions to the division manager. Next, consumers make purchase decisions and the market outcome is realized. In the second period, the division manager adjusts the two product factors given the information learned from $\hat{m}$ according to (7) and (8).

Importantly, we assume that headquarters anticipates the self-serving attributions and corresponding adjustments of the division manager—after all, the bias blind spot affects people's ability to introspect, not their ability to observe and counter the psychology of others (Pronin et al. 2002). For a firm with a price orientation, headquarters chooses the first-period price and quality to maximize expected overall profit

$$\max_{p_1,q_1} \quad \Pi_1(p_1,q_1) \quad = \quad p_1(\alpha+q_1-p_1)-\frac{k}{2}q_1^2 + \int_{-\infty}^{0} \pi_2^-(p_1|\hat{m})f(\hat{m})d\hat{m} + \int_{0}^{\infty} \pi_2^+(q_1|\hat{m})f(\hat{m})d\hat{m}, \tag{14}$$

where $\pi_2^-(p_1|\hat{m})$ and $\pi_2^+(q_1|\hat{m})$ relate to a negative and positive market outcome, respectively. The optimized expected overall profit is Π_1^d, which leads to our next result.

Proposition 5. *The optimized expected overall profit of a monopolist with forward-looking headquarters and a self-serving division manager is higher than that of a firm with a self-serving manager alone; that is*

$$\Pi_1^d - \Pi_1^s = \frac{(6k+1)\sigma_m^2}{4(18k-1)\pi} > 0.$$

The typical concern with delegation is that the need for coordination puts an addition strain on a business. However, Proposition 5 shows that delegation reduces the adverse effect of self-serving attributions on profit. Intuitively, this is the case because the foresight of headquarters leads to price and quality levels in the first period that soften the negative impact of the subsequent adjustments. However, note that profit is still lower in the presence of delegation than in the benchmark case ($\Pi_1^d < \Pi_1^*$).

Table 3 shows the expected differences in prices, qualities, demands, and profits for the two periods when delegation is present or not (price orientation and $k = 1$).[12] Headquarters chooses a lower price and higher quality in expectation than does a self-serving manager. While these levels lower profit in the first period, the optimized expected overall profit increases because headquarters anticipates and counteracts the adjustments of the division manager. Specifically, headquarters understands that the division manager raises price excessively, and as such chooses a lower level in the first period. Appendix D shows that the impact on expected profit is the same under a price or quality orientation.

[12]This normalization does not qualitatively affect the results. Appendix D provides the general case.

Table 3: The impact of delegation ($\gamma = 1$, $k = 1$).

Expected Values	No Delegation	Delegation	Deviation
First Period			
Price	α	$\alpha - \frac{3}{17}\sqrt{\frac{2\sigma_m^2}{\pi}}$	$\frac{3}{17}\sqrt{\frac{2\sigma_m^2}{\pi}}$
Quality	α	$\alpha + \frac{1}{17}\sqrt{\frac{2\sigma_m^2}{\pi}}$	$-\frac{1}{17}\sqrt{\frac{2\sigma_m^2}{\pi}}$
Demand	α	$\alpha + \frac{4}{17}\sqrt{\frac{2\sigma_m^2}{\pi}}$	$-\frac{4}{17}\sqrt{\frac{2\sigma_m^2}{\pi}}$
Profit	$\frac{\alpha^2}{2}$	$\frac{\alpha^2}{2} - \frac{25\sigma_m^2}{289\pi}$	$\frac{25\sigma_m^2}{289\pi}$
Second Period			
Price	$\alpha + \frac{1}{2}\sqrt{\frac{\sigma_m^2}{2\pi}}$	$\alpha + \frac{6}{17}\sqrt{\frac{\sigma_m^2}{2\pi}}$	$\frac{5}{34}\sqrt{\frac{\sigma_m^2}{2\pi}}$
Quality	α	$\alpha - \frac{2}{17}\sqrt{\frac{\sigma_m^2}{2\pi}}$	$\frac{2}{17}\sqrt{\frac{\sigma_m^2}{2\pi}}$
Demand	$\alpha - \frac{1}{2}\sqrt{\frac{\sigma_m^2}{2\pi}}$	$\alpha - \frac{8}{17}\sqrt{\frac{\sigma_m^2}{2\pi}}$	$-\frac{1}{34}\sqrt{\frac{\sigma_m^2}{2\pi}}$
Profit	$\frac{\alpha^2}{2} + \frac{\sigma_m^2}{8}$	$\frac{\alpha^2}{2} + \frac{\sigma_m^2}{8} + \frac{219\sigma_m^2}{1156\pi}$	$-\frac{219\sigma_m^2}{1156\pi}$
Overall Profit	$\alpha^2 + \frac{\sigma_m^2}{8}$	$\alpha^2 + \frac{\sigma_m^2}{8} + \frac{7\sigma_m^2}{68\pi}$	$-\frac{7\sigma_m^2}{68\pi}$

6.2 Competition

Assumptions. We consider now a market with two single-product firms $i = A, B$ that compete on price and quality over two periods. In each period, the managers choose the price p_{it} and quality q_{it} of the product sold by their respective firm. The investment to provide quality q_{it} is $\kappa(q_t) = \frac{k}{2}q_{it}^2$, where $k \geq \frac{1}{2}$.

The products are differentiated horizontally and vertically. Horizontal differentiation is à la Hotelling, with the firms located at the extremes of the characteristics space, or $x_A = 0$ and $x_B = 1$. Vertical differentiation reflects the notion that higher quality enhances the worth of the product in the minds of consumers. The market consists of a mass of consumers, which we normalize to unity. Each consumer purchases one unit of the preferred product in each period. Individual preferences are described by a conditional indirect utility function of the form

$$v_{it}(x) = q_{it} + \varepsilon_{iq} - (p_{it} + \varepsilon_{ip}) - \frac{1}{2}|x - x_i|, \tag{15}$$

where $x \in [0,1]$ is the consumer's preferred product characteristic and $|x - x_i|$ describes the horizontal mismatch of the consumer from purchasing the product of firm i. We assume that the preferred product characteristics are drawn identically and independently across consumers from a uniform distribution over the interval $[0,1]$. We let ε_{ip} and ε_{iq} denote the difference between the subjective valuations of price and quality by consumers and the corresponding levels set by firms. These deviations are drawn in the first period from independent normal distributions with mean zero and variances $\sigma_p^2/2$ and $\sigma_q^2/2$, respectively. Consumers have private information about x, ε_{ip}, and ε_{iq}, but their distributions are assumed to be common knowledge.

The demand for the product of firm i in period t as a function of prices $\mathbf{p}_t = (p_{At}, p_{Bt})$ and qualities $\theta_2 = (q_{At}, q_{Bt})$ is derived from the conditional indirect utility function in (15) as

$$D_{it}(\mathbf{p}_2, \theta_2) = \frac{1}{2} + (q_{it} - p_{it}) - (q_{jt} - p_{jt}) + \xi_{iq} - \xi_{ip},$$

where $\xi_{iq} \equiv \varepsilon_{iq} - \varepsilon_{jq}$ and $\xi_{ip} \equiv \varepsilon_{ip} - \varepsilon_{jp}$. The market outcome to firm i is defined as $\hat{m}_i = \hat{\xi}_{iq} - \hat{\xi}_{ip}$. Note that $\hat{m}_i = -\hat{m}_j$, which implies that the two firms experience opposite outcomes. The market outcome $\hat{m}_i$ is normally distributed with mean zero and variance $\sigma_m^2 \equiv \sigma_p^2 + \sigma_q^2$, where we require that $\sigma_m \leq \frac{3k-2}{8k}$.

Adjustments from Optimal Attributions. In the second period, the manager of firm i adjusts price and quality given the information learned from $\hat{m}_i$ according to (3) and (4).[13] Specifically, the manager solves

$$\max_{p_{i2}, \theta_{i2}} \quad \pi_{i2}(p_{i2}, \theta_{i2}|\hat{m}_i) = p_{i2} D_{i2}(\mathbf{p}_2, \theta_2|\hat{m}_i) - \frac{k}{2}\theta_{i2}^2. \tag{16}$$

The optimized profit in the second period is denoted by $\pi_{i2}^*(\hat{m}_i)$.

[13]In contrast to the monopoly case, the manager estimates $\hat{\xi}_{ip}^o$ and $\hat{\xi}_{iq}^o$ at the market level, not $\hat{\varepsilon}_{ip}^o$ and $\hat{\varepsilon}_{iq}^o$ at the firm level.

In the first period, the manager of firm i sets price and quality to maximize the expected overall profit

$$\max_{p_{i1},\theta_{i1}} \quad \Pi_{i1}(p_{i1},\theta_{i1}) = p_{i1}D^e_{i1}(\mathbf{p}_1,\theta_1) - \frac{k}{2}\theta^2_{i1} + \int_{-\infty}^{\infty} \pi^*_{i2}(\hat{m}_i)f(\hat{m}_i)d\hat{m}_i, \tag{17}$$

where D^e_{i1} is the expected demand. This analysis leads to the following proposition.

Proposition 6. *When managers use optimal attributions to explain firm performance, the optimized expected overall profit of firm i in a duopoly is*

$$\Pi^*_{i1} = \frac{2k-1}{4k}\left(1+\frac{2k^2\sigma^2_m}{(3k-2)^2}\right).$$

Proposition 6 mirrors the properties of the monopoly profit Π^*_1 in a competitive market environment. Finally, note that Π^*_{i1} increases with the mass of consumers if the size of the market is not normalized.

Adjustments from Self-Serving Attributions. Managers who are self-serving adjust price and quality given the information learned from $\hat{m}_i$ according to (7) and (8). We assume again that the choice of variable to adjust is discrete, and that managers do not anticipate making or acting on self-serving attributions. For brevity, we present only the case of a quality orientation.

In the second period, the manager of firm i adjusts quality (but not price) in response to $\hat{m}^+_i$ and price (but not quality) in response to $\hat{m}^-_i$. Following the definition of Nash equilibria, we assume that managers hold correct beliefs about the adjustments of their counterparts. Accordingly, the manager of firm i solves the constrained optimization problems

$$\max_{q_{i2}} \quad \pi_{i2}(p_{j2},q_{i2}|\hat{m}^+_i) = p_{i1}D_{i2}(p_{i1},p_{j2},q_{i2},\theta_{j1}) - \frac{k}{2}q^2_{i2} \tag{18}$$

$$\max_{p_{i2}} \quad \pi_{i2}(p_{i2},q_{j2}|\hat{m}^-_i) = p_{i2}D_{i2}(p_{i2},p_{j1},q_{i1},q_{j2}) - \frac{k}{2}q^2_{i1}. \tag{19}$$

The corresponding optimized profits are denoted by $\pi^+_{i2}(\hat{m}_i)$ and $\pi^-_{i2}(\hat{m}_i)$.

In the first period, the manager of firm i sets price and quality to maximize

$$\max_{p_{i1},\theta_{i1}} \quad \Pi_{i1}(p_{i1},\theta_{i1}) \quad = \quad p_{i1}D_{i1}^{e}(\mathbf{p}_1,\theta_1)-\frac{k}{2}\theta_{i1}^{2} \\ +\int_{-\infty}^{0}\pi_{i2}^{-}(\hat{m}_i)f(\hat{m}_i)d\hat{m}_i+\int_{0}^{\infty}\pi_{i2}^{+}(\hat{m}_i)f(\hat{m}_i)d\hat{m}_i. \qquad (20)$$

The optimized expected overall profit of firm i is Π_{i1}^{s}. We derive the following result.

Proposition 7. *The optimized expected overall profit of firm i in a duopoly is lower in the context of self-serving attributions than that of optimal attributions, as*

$$\Pi_{i1}^{*}-\Pi_{i1}^{s}=\frac{1}{8}\left(\sqrt{\frac{2\sigma_m^2}{\pi}}+\frac{((8-k)k-4)\sigma_m^2}{(3k-2)^2}\right).$$

This result shows that Proposition 4 generalizes to a competitive setting. The negative impact of self-serving attributions on the firm again increases with the uncertainty about the market outcome σ_m^2 and decreases with the investment cost parameter k. As is the case for a monopolist, the result is driven by an excessively large increase in expected price following a positive market outcome (the expected quality is the same in both cases). In fact, a comparison to the benchmark case indicates that self-serving attributions are of greater consequence in the presence of competition. It appears that competition intensifies the impact of distorted adjustments because the rival exploits the suboptimal decisions of the manager to steal business. Finally, note that delegation plays a similar mitigating role under competition as it does in the case of a monopolist.[14]

7 Conclusion

Managers like to think well of themselves and the firms that employ them. This motivation serves one's basic need to maintain and enhance self-esteem, but it also clouds perceptions of the past. In our research, the problem arises because firms have an orientation toward price or quality. If the performance of the firm in the market is surprisingly favorable, then the self-serving manager wants to credit the dominant, "strategic" factor. If the

[14] Proofs are available on request.

performance is surprisingly unfavorable, then the same manager blames the other, lesser factor. In both cases, the choice of orientation is vindicated, which protects the ego from threat and injury. However, these biased attributions carry a cost, as they skew future decisions about price and quality and, therefore, future outcomes.

Our first objective was to provide evidence of this logic. Four experiments, conducted with a total of 253 experienced professionals, elicited beliefs (about locus, stability, and control), attributions, and adjustments related to price and quality in the same stimuli. As predicted, we found that the attributions of participants are determined by the valence of the market outcome (positive or negative) and the strategic orientation of the firm (inferred from their beliefs). We also found the expected positive correlation between attributions and adjustments.

Our second objective was to clarify the impact on price and quality levels, demand, and profit. To that end, we developed a model in which the uncertainty necessary for managers to reveal their self-serving motivation stems from the fact that consumers perceive price and quality differently to the levels set by the firm. The manager must infer these deviations, but the estimates are skewed by the valence of the market outcome and the choice of orientation. The analysis centered on the case of a monopolist led by a single decision-maker. We also showed that the cost of self-serving attributions is alleviated by delegation but persists in the presence of competition.

As explained, the paper intends to make several contributions. While there is considerable research in management that maps the bounded rationality of individuals, the majority of this work studies the consumer rather than the manager (Goldfarb et al. 2011). We are interested in breaching the gap. Importantly, we want to push the literature on the self-serving bias beyond the basic idea that actors credit success internally and blame failure externally (Bettman and Weitz 1983). First, we examined a situation where all the causes of firm performance—be it negative or positive—are at the discretion of the manager (i.e., they are all internal). Second, these causes relate to actions that are concrete, routine, and consequential: decisions about price and quality are among the most common and significant in a firm. Third, we care as much about the presence of the bias as we do about its impact on a firm going forward. Fourth, we are the first to offer a formal model of the self-serving manager.

The first conclusion that we draw from the research is that the self-serving manager limits the range of decisions on price and quality, thereby putting the firm at a disadvantage. If possible, increasing awareness of the problem may help firms improve their performance without turning to complex and costly incentive schemes. Second, in contrast to the standard in the literature where a sophisticated firm benefits indirectly from the limitations of consumers, the self-serving nature of managers has an immediate effect on firm performance. In fact, the impact of self-serving attributions on decision-making is more pronounced when the firm incurs lower costs to provide quality—irrespective of the level of uncertainty about market outcomes. A firm that finds itself in this (usually enviable) predicament has to be more attentive to the psychology of its managers. Third, the firm cannot count on competition to rid the market of self-serving attributions as it does for other behavioral phenomena. In fact, there are conditions under which competition amplifies the problem.

The participants in our samples consistently rated quality as more internal, stable, and controllable than price. One explanation for this is that firms simply have many more opportunities to stand out on quality than they do on price, making the former more salient. In our research, however, we treated quality as a general construct. At the same time, there may be a belief among managers, justified or otherwise, that price is tantamount to "market conditions" (and, therefore, it must be external, unstable, and uncontrollable) while quality is a truer reflection of what the business is and stands for (and, therefore, it must be internal, stable, and controllable). An interesting avenue for future research is to test this premise and its possible implications.

The analytical results in the paper are to some extent driven by the assumption that the manager resolves to adjust price or quality, but not both. This assumption stems from the premise that the manager focuses on the factor that appears to have caused the market outcome. An alternative is to model adjustments as the outcome of a maximization problem where the manager derives utility not only from profit, but also from some non-monetary payoff. In our setting, the non-monetary payoff would reflect the psychological benefit or cost of adjusting a variable that, respectively, is or is not the one that best serves the self-serving motivation of the manager. A second approach is to assume that there are constraints on the decisions of managers such that they do not have complete freedom to make adjustments following a market outcome. This happens, for example, when firms tempt consumers with price or quality guarantees.

At a more conceptual level, some argue that market forces ultimately crowd out most psychological phenomena, including the type of positivism described in our research (Kaplan and Ruffle 2004). Yet the managers who took part in our experiments are clearly self-serving, despite their professional experience. One explanation for the apparent contradiction is that incentives are not always sufficient to remove a bias (Camerer 1987). A second explanation is that most real-world markets afford few opportunities to learn from mistakes and, when they occur, there is too much ambient noise to learn from them (Meyer and Hutchinson 2016). Third, questioning the resilience of a behavioral anomaly makes more sense when the effect is self-defeating, which is not the case here—it may be that biased attributions rob the manager of the opportunity to learn and improve. Bandura (1989) suggested that overstating one's role in successful outcomes facilitates goal accomplishment, as it increases motivation. Taylor and Brown (1988) similarly argued that the psychological benefits of self-enhancement, including lower anxiety and greater confidence, promote a state of well-being that prolongs the behavior.

Ideally, one settles this debate by checking whether the phenomenon replicates in the field. However, experiments that study managerial decisions outside of the laboratory usually present nontrivial challenges in logistics and tractability (Einhorn and Hogarth 1981). One solution is to study data from business simulation games such as Markstrat (Curren et al. 1992). This is a promising direction for future research, provided of course that the players in the game express their beliefs about the orientation of their fictional firms. On the contrary, the option of studying financial communications such as letters to shareholders or earnings reports is unlikely to provide great insight because they do not record the actions of managers following their attributions of strong or weak results.

Aside from addressing concerns about external validity, a different direction for additional studies is to test variables that are likely to play a moderating role. For example, although it is clear that self-serving attributions emerge when firm performance is either surprisingly favorable or unfavorable, prior beliefs about outcomes are shaped by experiences and intentions that, for the most part, are positive (Taylor 1991). This reflection not only bestows a certain robustness to the phenomenon, but also it suggests that perceived failure is more prevalent than perceived success, which presumably carries consequences for the attributions and adjustments that managers are willing to consider.

Likewise, there are probably several personality traits that make a difference. First, to the extent that managers hold a positive view of their abilities, the upshot is a stronger and more permanent asymmetry between price and quality in terms of attributions and adjustments. Second, a manager's tendency to be self-serving may depend on the capacity to exert self-control, as overriding the urge is cognitively taxing. Third, the degree to which managers are self-serving is probably affected by their acknowledgement and appreciation of the problem. We already pointed out that people struggle to spot their traits. In addition, motivated reasoning skews the search for information and the standards of proof in favor of hypotheses that reinforce past behaviors (Kunda 1990), which again weakens the ability to introspect. Our research addresses this issue by placing some of the decisions in the hands of headquarters. We show that firms need headquarters that are farsighted to reduce the adverse effect of self-serving attributions. It would be interesting to explore other mechanisms and institutions that play a similar role.

Appendix A Demand

Suppose that there are $\alpha + (q_t + \varepsilon_q)$ potential consumers whose willingness to pay for the product is uniformly distributed over the interval $[0, \frac{\alpha+(q_t+\varepsilon_q)}{\beta}]$. Given ε_p, the consumers' perceived price is $p_t + \varepsilon_p$ and demand is

$$D_t(p_t, q_t) = \max\{\alpha + (q_t + \varepsilon_q) - \beta(p_t + \varepsilon_p), 0\},$$

where the max function ensures that demand is non-negative. Setting β to unity yields the demand function in (1).

Appendix B Market Outcome

The market outcome can be viewed as a realization of a normally-distributed random variable if the realized demand is positive with probability one. Intuitively, this requires that the market outcome is not "too negative."

Using a standard result, the probability that a normally-distributed random variable with mean zero and variance σ_m^2 takes a value smaller than $n \geq 1$ standard deviations from the mean is

$$\Pr\{\hat{m} \leq -n\sigma_m\} = \frac{1}{2}(1 - Erf(\frac{n}{\sqrt{2}})), \tag{B.1}$$

where

$$Erf(x) := \frac{2}{\sqrt{\pi}} \int_0^x \exp(-t^2)dt$$

is the error function encountered in integrating the normal distribution (see, for instance, Greene 1995, p. 921). It is well known that the probability in (B.1) rapidly converges to zero as n increases. For example, if $n = 3$ the probability is already as low as 1.35×10^{-3}, meaning that, on average, less than two out of a 1,000 draws can be expected to be smaller than $-3\sigma_m$.

Throughout the paper, we make the conservative assumption that $n = 4$. In this case $\Pr\{\hat{m} \leq -4\sigma_m\} = 31.67 \times 10^{-6}$, which is essentially zero for our purpose. Therefore, by putting an upper bound on the variance of the market outcome, realized demand is positive with probability tending to one, and the market outcome can be viewed as a draw from an untruncated normal distribution.

Appendix C Optimal Attributions

Recall that, if X and Y are jointly normal random variables, then the conditional expectation of X given $Y = y$ is normal with

$$E[X|Y] = E[X] + \rho \frac{\sigma_X}{\sigma_Y}(y - E[Y]), \tag{C.2}$$

where $\rho = E[XY](\sigma_X \sigma_Y)^{-1}$ is the correlation coefficient of X and Y (Mood and Graybill 1963, Theorem 9.3, p. 202).

To establish (3), set $X \equiv \varepsilon_p$, $Y = \varepsilon_q - \varepsilon_p$, and $y = \hat{\varepsilon}_q - \hat{\varepsilon}_p$. The distributional assumptions imply $E[\varepsilon_p] = E[\varepsilon_q - \varepsilon_p] = 0$, $E[\varepsilon_p(\varepsilon_q - \varepsilon_p)] = -\sigma_p^2$ and $\sigma_Y^2 = \sigma_p^2 + \sigma_q^2$. Therefore, the conditional expectation in (C.2) can be expressed as

$$E[\varepsilon_p|\hat{m}] = E[\varepsilon_p] - \frac{\sigma_p^2}{\sigma_p^2 + \sigma_q^2}\hat{m},$$

where $\hat{m} = \hat{\varepsilon}_q - \hat{\varepsilon}_p$. The proof of (4) is similar and therefore omitted.

Appendix D Proofs

Proof of Proposition 1. In the second period, the optimal price and quality follow from the (necessary and sufficient) first-order conditions of profit maximization. Solving (5) yields the optimal price and quality

$$p_2^*(\hat{m}) = \frac{(\alpha+\hat{m})k}{2k-1} \tag{D.3}$$

$$q_2^*(\hat{m}) = \frac{\alpha+\hat{m}}{2k-1}. \tag{D.4}$$

By substitution, the second-period demand and the optimized profit are given by

$$D_2^*(\hat{m}) = \frac{(\alpha+\hat{m})k}{2k-1} \tag{D.5}$$

$$\pi_2^*(\hat{m}) = \frac{(\alpha+\hat{m})^2k}{2(2k-1)}. \tag{D.6}$$

Note that $D_2^*(\hat{m}) \geq 0$ if and only if $\hat{m} \geq -\alpha$. Using Appendix B and the assumption that $\sigma \leq \frac{\alpha}{4}$, demand is positive with probability one. Because the market outcome follows a normal distribution with mean zero and variance σ_m^2, the density of $\hat{m}$ is

$$f(\hat{m}) = \frac{1}{\sqrt{2\pi\sigma_m^2}} \exp\left(-\frac{\hat{m}^2}{2\sigma_m^2}\right) d\hat{m}.$$

Using $\pi_2^*(\hat{m})$ and $f(\hat{m})$, the expected second-period profit can be expressed as

$$\int_{-\infty}^{\infty} \pi_2^*(\hat{m}) f(\hat{m}) d\hat{m} = \frac{(\alpha^2+\sigma_m^2)k}{2(2k-1)}. \tag{D.7}$$

Given that price and quality do not carry over to the second period, the expected second-period profit in (D.7) is simply a constant that can be ignored when making first-period decisions. Solving (6) yields the optimal price and quality

$$p_1^* = \frac{\alpha k}{2k-1} \tag{D.8}$$

$$q_1^* = \frac{\alpha}{2k-1}. \tag{D.9}$$

By substitution, the expected first-period demand and profit are given by

$$D_1^* = \frac{\alpha k}{2k-1} \tag{D.10}$$

$$\pi_1^* = \frac{\alpha^2 k}{2(2k-1)}. \tag{D.11}$$

The expected overall profit follows by adding up the profits in (D.7) and (D.11), and is given by

$$\Pi_1^* = \frac{(2\alpha^2 + \sigma_m^2)k}{2(2k-1)}.$$

□

Proof of Proposition 2. When attributions are discrete, the manager attributes a positive market outcome to price if $\gamma = 0$ and to quality if $\gamma = 1$. Conversely, the manager attributes a negative market outcome to quality if $\gamma = 0$ and to price if $\gamma = 1$. Adapting (3) and (4) to account for the valence of the market outcome and the strategic orientation of the firm establishes the result. □

Proof of Proposition 3. In the event of a positive market outcome, the manager solves (9) to find the optimal price

$$p_2^+(q_1^*) = \frac{1}{2}(\alpha + \hat{m} + q_1^*). \tag{D.12}$$

By substitution,

$$\pi_2^+(q_1^*|\hat{m}) = \frac{1}{4}\left((\alpha + \hat{m} + q_1^*)^2 - 2k(q_1^*)^2\right). \tag{D.13}$$

Substituting q_1^* given in (D.9) into (D.13) and averaging across positive market outcomes yields

$$\int_0^\infty \pi_2^+(q_1^*|\hat{m})f(\hat{m})d\hat{m} = \frac{2\alpha^2 k + 4\sqrt{\frac{2}{\pi}}\alpha k \sigma_m + (2k-1)\sigma_m^2}{8(2k-1)}. \tag{D.14}$$

In the event of a negative market outcome, the manager solves (10) to find the optimal quality

$$q_2^-(p_1^*) = \frac{p_1^*}{k}.$$

By substitution,

$$\pi_2^-(p_1^*|\hat{m}) = \frac{p_1^*(p_1^* + 2(\alpha + \hat{m} - p_1^*)k)}{2k}. \tag{D.15}$$

Substituting p_1^* given in (D.8) into (D.15) and averaging across negative market outcomes yields

$$\int_{-\infty}^0 \pi_2^-(p_1^*|\hat{m})f(\hat{m})d\hat{m} = \frac{\alpha\left(\sqrt{2\pi}\alpha - 4\sigma_m\right)k}{4\sqrt{2\pi}(2k-1)}. \tag{D.16}$$

The expected second-period profit that results from self-serving attributions follows from adding up (D.14) and (D.16) as follows

$$\int_{-\infty}^0 \pi_2^-(p_1^*|\hat{m})f(\hat{m})d\hat{m} + \int_0^\infty \pi_2^+(q_1^*|\hat{m})f(\hat{m})d\hat{m} = \frac{4\alpha^2 k + (2k-1)\sigma_m^2}{8(2k-1)}. \tag{D.17}$$

The optimized expected overall profit in (11) can be derived as

$$\Pi_1^s = \frac{8\alpha^2 k + (2k-1)\sigma_m^2}{8(2k-1)}, \tag{D.18}$$

from adding up (D.11) and (D.17). □

Next, we calculate the expected overall profit under a price orientation. We have the following result.

Lemma A1. *The expected overall profit under a price or quality orientation are the same.*

Proof. In the event of a positive market outcome, the manager solves (12) to find the optimal quality

$$q_2^+(p_1^*) = \frac{p_1^*}{k}.$$

By substitution,

$$\pi_2^+(p_1^*|\hat{m}) = \frac{p_1^*(p_1^* + 2(\alpha + \hat{m} - p_1^*)k)}{2k}. \tag{D.19}$$

Substituting p_1^* given in (D.8) into (D.19) and averaging across positive market outcomes yields

$$\int_0^\infty \pi_2^+(q_1^*|\hat{m}) f(\hat{m}) d\hat{m} = \frac{\alpha\left(\sqrt{2\pi}\alpha + 4\sigma_m\right)k}{4\sqrt{2\pi}(2k-1)}. \tag{D.20}$$

In the event of a negative market outcome, the manager solves (13) to find the optimal price

$$p_2^-(q_1^*) = \frac{1}{2}(\alpha + \hat{m} + q_1^*).$$

By substitution,

$$\pi_2^-(q_1^*|\hat{m}) = \frac{1}{4}\left((\alpha + \hat{m} + q_1^*)^2 - 2k(q_1^*)^2\right). \tag{D.21}$$

Substituting q_1^* given in (D.9) into (D.21) and averaging across negative market outcomes yields

$$\int_{-\infty}^0 \pi_2^-(q_1^*|\hat{m}) f(\hat{m}) d\hat{m} = \frac{2\alpha^2 k - 4\sqrt{\frac{2}{\pi}}\alpha k \sigma_m + (2k-1)\sigma_m^2}{8(2k-1)}. \tag{D.22}$$

The expected second-period profit that results from self-serving attributions follows by adding up (D.20) and (D.22) as follows

$$\int_{-\infty}^0 \pi_2^-(q_1^*|\hat{m}) f(\hat{m}) d\hat{m} + \int_0^\infty \pi_2^+(q_1^*|\hat{m}) f(\hat{m}) d\hat{m} = \frac{4\alpha^2 k + (2k-1)\sigma_m^2}{8(2k-1)}. \tag{D.23}$$

Since the expected second-period profit under a price orientation in (D.23) coincides with the corresponding profit under a price orientation in (D.17), the optimized expected overall profit under a quality orientation is the same as Π_1^s in (D.18). □

Proof of Proposition 4. The proof of Proposition A1 shows that the expected overall profit under a price or quality orientation are the same. Therefore, it suffices to compare Π_1^* (given in Proposition 1) to Π_1^s (given in Proposition 3) to calculate the profit impact of self-serving attributions to the firm, which is given by

$$\Pi_1^* - \Pi_1^s = \frac{(2k+1)\sigma_m^2}{8(2k-1)}.$$

The cost of the managerial bias to the firm is positive as $\sigma_m^2 > 0$ and $k > \frac{1}{2}$ by assumption. $\square$

Deriving the Entries in Table 2. We illustrate the steps to calculate the expected second-period prices. With adjustments from optimal attributions,

$$p_2^* = \int_{-\infty}^{\infty} p_2^*(\hat{m}) f(\hat{m}) d\hat{m} = \frac{\alpha k}{2k-1},$$

where p_2^* is given in (D.3). With adjustments from self-serving attributions,

$$\begin{aligned} p_2^s &= \int_{-\infty}^{0} p_1^* f(\hat{m}) d\hat{m} + \int_{0}^{\infty} p_2^+(q_1^*) f(\hat{m}) d\hat{m} \\ &= \frac{\alpha k}{2k-1} + \frac{\sigma_m}{2\sqrt{2\pi}}, \end{aligned}$$

where p_1^* and $p_2^+(q_1^*)$ are given in (D.8) and (D.12), respectively. The first-period quality to compute $p_2^+(q_1^*)$ is given in (D.9). $\square$

Proof of Proposition 5. Substituting the expressions for $\pi_2^-(p_1|\hat{m})$ and $\pi_2^+(q_1|\hat{m})$ from (D.21) and (D.19) into (14), and maximizing the objective function with respect to price and quality, yields the optimal first-period decisions

$$\begin{aligned} p_1^d &= \frac{((18k-1)\alpha - 3(2k-1)\sqrt{\frac{2\sigma_m^2}{\pi}})k}{1+4k(9k-5)} \\ q_1^d &= \frac{\alpha}{2k-1} + \frac{\sqrt{\frac{2\sigma_m^2}{\pi}}}{18k-1}. \end{aligned}$$

By substitution, the expected demand and overall profit are given by:

$$\begin{aligned} D_1^d &= \frac{k(18k-1)\alpha + (2k-1)(3k+1)\sqrt{\frac{2\sigma_m^2}{\pi}}}{1+4k(9k-5)} \\ \Pi_1^d &= \frac{\alpha^2 k}{2k-1} + \frac{(6k(2+3\pi)+2-\pi)\sigma_m^2}{8(18k-1)\pi}. \end{aligned} \qquad \text{(D.24)}$$

These expressions lead to the values in Table 3, for $k = 1$.

Subtracting Π_1^s given in Proposition 3 from Π_1^d in (D.24) yields

$$\Pi_1^d - \Pi_1^s = \frac{(6k+1)\sigma_m^2}{4(18k-1)\pi},$$

which is positive as $\sigma_m^2 > 0$ and $k > \frac{1}{2}$ by assumption. Finally, the second-period values can be derived by following the same steps as in the proof of Proposition 3. □

Proof of Proposition 6. In the second period, the manager of firm i solves (16) to determine the optimal adjustments to price and quality as a function of the market outcome. The optimal price and quality are

$$\begin{aligned} p_{i2}^*(\hat{m}_i) &= \frac{1}{2} + \frac{k\hat{m}_i}{3k-2} \\ q_{i2}^*(\hat{m}_i) &= \frac{1}{2k} + \frac{\hat{m}_i}{3k-2}. \end{aligned}$$

By substitution, the demands and profits can be derived as

$$\begin{aligned} D_{i2}^*(\hat{m}_i) &= \frac{1}{2} + \frac{k\hat{m}_i}{3k-2} \\ \pi_{i2}^*(\hat{m}_i) &= \frac{(2k-1)((3+2\hat{m}_i)k-2)^2}{8(3k-2)^2k}. \end{aligned}$$

The expected second-period profit can be found by adding up the profits across market outcomes, that is

$$\int_{-\infty}^{\infty} \pi_{i2}^*(\hat{m}_i) f(\hat{m}_i) d\hat{m}_i = \frac{(2k-1)((3k-2)^2 + 4k^2\sigma_m^2)}{8(3k-2)^2k}.$$

The prices, qualities, and demands are positive if $|\hat{m}_i| \leq \frac{3k-2}{2k}$; a condition that holds with probability tending to one as $\sigma_m \leq \frac{3k-2}{8k}$ (see Appendix B). Specifically, note that $\Pr\{|\hat{m}_i| \geq 4\sigma_m\} = 63.34 \times 10^{-6}$, which is essentially zero.

In the first period, the managers solve (17) to determine the optimal price and quality. Noting that the expected second-period profit is simply a constant, it follows that $p_{i1}^* = p_{i2}^*(0)$ and $q_{i1}^* = q_{i2}^*(0)$. The optimized expected overall profit Π_{i1}^* follows by substitution. □

Proof of Proposition 7. In the event of a positive market outcome, the manager of firm i solves (18) to find the optimal quality

$$q^{+}_{i2}(p^{*}_{i1}) = \frac{p^{*}_{i1}}{k}.$$

The manager of firm j chooses the price according to

$$p^{-}_{j2}(q^{*}_{j1}) = \frac{1}{4}(1 - 2\hat{m}_j + 2p_{i1} + 2q_{j1} - 2q_{i2}).$$

By substitution,

$$\pi^{+}_{i2}(\hat{m}_i) = \frac{2k(1+\hat{m}_i) - 1}{8k}. \tag{D.25}$$

In the event of a negative market outcome, the manager of firm i solves (19) to find the optimal price

$$p^{-}_{i2}(q^{*}_{i1}) = \frac{1}{4}(1 + 2\hat{m}_i + 2p_{j1} + 2q_{i1} - 2q_{j2}).$$

The manager of firm j chooses its quality according to

$$q^{+}_{j2}(p^{*}_{j1}) = \frac{p^{*}_{j1}}{k}.$$

By substitution,

$$\pi^{-}_{i2}(\hat{m}_i) = \frac{2k(1+\hat{m}_i)^2 - 1}{8k}. \tag{D.26}$$

The expected second-period profit follows by adding up (D.25) and (D.26) as follows

$$\int_{-\infty}^{0} \pi^{-}_{i2}(\hat{m}_i) f(\hat{m}_i) d\hat{m}_i + \int_{0}^{\infty} \pi^{+}_{i2}(\hat{m}_i) f(\hat{m}_i) d\hat{m}_i = \frac{1}{8}\left(2 - \frac{1}{k} - \sqrt{\frac{2\sigma_m^2}{\pi}} + \sigma_m^2\right).$$

In the first period, the manager of firm i solves (20) to determine the optimal price and quality. Noting that the expected second-period profit is simply a constant, the optimized expected overall profit can be derived as

$$\Pi^{s}_{i1} = \frac{1}{8}\left(4 - \frac{2}{k} - \sqrt{\frac{2\sigma_m^2}{\pi}} + \sigma_m^2\right).$$

Comparing Π_{i1}^{s} to the corresponding profit Π_{i1}^{*} in the benchmark case yields

$$\Pi_{i1}^{*} - \Pi_{i1}^{s} = \frac{1}{8}\left(\sqrt{\frac{2\sigma_m^2}{\pi}} + \frac{((8-k)k-4)\sigma_m^2}{(3k-2)^2}\right).$$

This difference is positive under our assumption that $\sigma_m \leq \frac{3k-2}{8k}$. □

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