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Anomalies
The Winner's Curse

Richard H. Thaler

Economics is distinguished from other social sciences by the belief that most (all?) behavior can be explained by assuming that agents have stable, well-defined preferences and make rational choices consistent with those preferences in markets that (eventually) clear. An empirical result qualifies as an anomaly if it is difficult to "rationalize," or if implausible assumptions are necessary to explain it within the paradigm. This column will present a series of such anomalies. Of course, "difficult" and "implausible" are judgments, and others might disagree with my assessment. Therefore, I invite readers to submit *brief* explanations (within the paradigm or otherwise) for any of the anomalies I report. To be considered for publication, however, proposed explanations must be falsifiable, at least in principle. Future topics for this column will come from as many fields of empirical economics as possible. Readers are invited to suggest topics by sending a note with some references to (or better yet copies of) the relevant research. My address is: Richard Thaler, c/o *Journal of Economic Perspectives*, Johnson Graduate School of Management, Malott Hall, Cornell University, Ithaca, NY 14853.

Introduction

Next time that you find yourself a little short of cash for lunch, try the following experiment in your class. Take a jar and fill it with coins, noting the total value of the

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coins. Now auction off the jar to your class (offering to pay the winning bidder in bills to control for penny aversion). Chances are very high that the following results will be obtained: (1) the average bid will be significantly less than the value of the coins (bidders are risk averse); (2) the winning bid will exceed the value of the jar. Therefore, you will have money for lunch, and your students will have learned first-hand about the "winner's curse."

The winner's curse is a concept that was first discussed in the literature by three Atlantic Richfield engineers, Capen, Clapp, and Campbell (1971). The idea is simple. Suppose many oil companies are interested in purchasing the drilling rights to a particular parcel of land. Let's assume that the rights are worth the same amount to all bidders, that is, the auction is what is called a *common value* auction. Further, suppose that each bidding firm obtains an estimate of the value of the rights from its experts. Assume that the estimates are unbiased, so the mean of the estimates is equal to the common value of the tract. What is likely to happen in the auction? Given the difficulty of estimating the amount of oil in a given location, the estimates of the experts will vary substantially, some far too high and some too low. Even if companies bid somewhat less than the estimate their expert provided, the firms whose experts provided high estimates will tend to bid more than the firms whose experts guessed lower. Indeed, it may occur that the firm that wins the auction will be the one whose experts provided the highest estimates. If this happens, the winner of the auction is likely to be a loser. The winner can be said to be "cursed" in one of two ways: (1) the winning bid exceeds the value of the tract, so the firm loses money; or (2) the value of the tract is less than the expert's estimate so the winning firm is disappointed. Call these winner's curse versions 1 and 2 respectively. Notice that the milder version 2 can apply even if the winning bidder makes a profit, as long as the profit is less than expected at the time the bid was made. In either version the winner is unhappy about the outcome, so both definitions seem appropriate.

The winner's curse cannot occur if all the bidders are rational (see Cox and Isaac, 1984), so evidence of a winner's curse in market settings would constitute an anomaly. However, acting rationally in a common value auction can be difficult. Rational bidding requires first distinguishing between the expected value of the object for sale, conditioned only on the prior information available, and the expected value conditioned on winning the auction. Even if a bidder grasps this basic concept, version 2 of the winner's curse can occur if the bidder underestimates the magnitude of the adjustment necessary to compensate for the presence of other bidders.

In a first price auction there are two factors to consider, and they work in opposite directions. An increase in the number of other bidders implies that to win the auction you must bid more aggressively, but their presence also increases the chance that if you win, you will have overestimated the value of the object for sale—suggesting that you should bid less aggressively.[1] Solving for the optimal bid is not trivial. Thus, it is an empirical question whether bidders in various contexts get it right or are

[1]As Capen, Clapp and Campbell state (p. 645): "If one wins a tract against two or three others he may feel fine about his good fortune. But how should he feel if he won against 50 others?" "Ill."

cursed. I will present some evidence, both from experimental and field studies, suggesting that the winner's curse may be a common phenomenon.

Experimental Evidence

The jar of coins example cited above has, in fact, been conducted under experimental conditions by Max Bazerman and William Samuelson (1983). Their subjects were M.B.A. students taking microeconomics classes at Boston University. The objects auctioned off were jars of coins or other objects such as paper clips valued at four cents each. Unknown to the subjects, each jar had a value of $8. Subjects submitted sealed bids and were told that the highest bidder would receive the defined value of the object less his or her bid. A total of 48 auctions were conducted, 4 in each of 12 classes. No feedback was provided until the entire experiment was completed. Subjects were also asked to estimate the value of each jar (point estimates and 90 percent confidence limits), and a $2 prize was offered for the best guess in each class.

The estimates of the actual values turned out to be biased downward. The mean estimate of the value of the jars was $5.13, well below the true value of $8.00. This bias, plus risk aversion, would tend to work against observing a winner's curse. Nevertheless, the mean winning bid was $10.01, producing an average loss to the winning bidder of $2.01. Clearly these experiments do not require large NSF grants!

Samuelson and Bazerman (1985) have run another series of experiments about the winner's curse in a different context. Try this problem yourself before continuing.

> In the following exercise, you will represent Company A (the acquirer) which is currently considering acquiring Company T (the target) by means of a tender offer. You plan to tender in cash for 100% of Company T's shares but are unsure how high a price to offer. The main complication is this: the value of the company depends directly on the outcome of a major oil exploration project it is currently undertaking.
>
> The very viability of Company T depends on the exploration outcome. In the worst case (if the exploration fails completely), the company under current management will be worth nothing—$0/share. In the best case (a complete success), the value under current management could be as high as $100/share. Given the range of exploration outcomes, all share values between $0 and $100 per share are considered equally likely. By all estimates the company will be worth considerably more in the hands of Company A than under current management. In fact, whatever the value under current management, the company will be worth 50 percent more under the management of Company A than under Company T.
>
> The board of directors of Company A has asked you to determine the price they should offer for Company T's shares. This offer must be made now, before the outcome of the drilling project is known.

> Thus, you (Company A) will not know the results of the exploration project when submitting your offer, but Company T will know the results when deciding whether or not to accept your offer. In addition, Company T is expected to accept any offer by Company A that is greater than or equal to the (per share) value of the company under its own management.
>
> As the representative of Company A, you are deliberating over price offers in the range \$0/share to \$150/share. What offer per share would you tender? (pp. 131–33).

The typical subject thinks about this problem roughly as follows: The firm has an expected value of \$50 to Company T, which makes it worth \$75 to Company A. Therefore if I suggest a bid somewhere between \$50 and \$75, Company A should make some money. This analysis fails to take into consideration the asymmetric information that is built into the problem. A correct analysis must calculate the expected value of the firm conditioned on the bid being accepted. If a bid B is accepted, then the company must be worth no more than B under current management for an average of $B/2$. Under new management, the average is 150 percent of this, or $3B/4$, which is still less than B, so it is best not to bid at all. Thus, this problem produces an extreme form of the winner's curse in which any positive bid yields an expected loss to the bidder.

This experiment was run in two conditions, one with monetary incentives and one without. The results, as shown in Table 1, are quite similar for the two conditions, with the bids in the condition with monetary incentives somewhat lower. In both conditions over 90 percent of the subjects make positive bids, and a majority are in the range between \$50 and \$75.

Economists often respond to examples like this by hypothesizing that although people can be fooled once or twice by such a problem, they will figure out the trap with experience. Sheryl Weiner, Max Bazerman, and John Carroll (1987) have investigated this hypothesis by giving the "buy-a-firm" problem to 69 Northwestern M.B.A. students via a microcomputer. All subjects repeated the experiment 20 times with financial incentives and feedback after each trial. The feedback included the "true" value of the company, whether their bid was accepted, and how much money they made or lost. Of the 69 subjects, 5 learned to bid one dollar or less by the end of the experiment. For these 5 subjects, the average trial in which they began to bid \$1.00 or less was trial 8. There was no sign of any learning among the others; in fact the average bid drifted up over the last few trials. It may be possible to learn to avoid the winner's curse in this problem, but the learning is neither easy nor fast.

Another series of experiments has been conducted by John Kagel and his colleagues at the University of Houston. Many of the experiments have the following structure. An object is to be sold using a sealed bid auction. The value of the object, X^*, is drawn from a uniform distribution over the interval X_L to X_H. Each bidder is then given a single-valued draw, X_i, from the uniform distribution $X^* \pm \varepsilon$, with ε varying from trial to trial. Subjects thus know X_L, X_H, and ε, and their own draw, X_i, which corresponds to the expert estimate in the oil bidding example. An auction is

Table 1
Distribution of bids in Samuelson and Bazerman experiment

Bids	*No Incentives* ($N = 123$)	*Monetary incentives* ($N = 66$)
0	9%	8%
1–49	16	29
50–59	37	26
60–69	15	13
70–79	22	20
80 +	1	4

Source: Samuelson and Bazerman, 1985.

then conducted, the bids are posted, and the winner has a profit or loss credited to his or her account. (Bidders were given some capital to start with, usually about $10. Once their account reached zero they were no longer permitted to bid.) The experimental manipulations included varying ε, N (the number of bidders), and the type of auction (first price, second price, and low price[2]). Typically subjects first participated in small groups of 3–5 bidders and then in "large" groups of 6 or 7. A nice feature of all the experiments is that for each trial the authors compute the outcome that would be predicted by a bidding model using a noncooperative Nash equilibrium concept and risk neutral bidders. They call this the risk neutral Nash equilibrium or RNNE model.[3]

In Kagel and Levin (1986), which used first price auctions, the results varied with group size. In the small groups, there were typically profits which were, on average, 65.1 percent of the RNNE profits. However, in the large groups, losses of $.88 per auction period were observed, in contrast to the $4.68 profit predicted by the RNNE. The winner's curse emerged in the larger groups because the subjects bid more aggressively in the larger groups, while the RNNE bid function requires bidding more conservatively as N increases. These results have been replicated in Kagel, Levin and Harstad (1987) using a second price auction method. Again there were profits in the small group experiments, here 52.8 percent of RNNE profits, and losses of $2.15 per period in the large groups, compared to the RNNE prediction of $3.95 in profits.

Finally, Dyer, Kagel and Levin (1987) report on a series of low price auctions. In these auctions there were losses in both the small groups and the larger groups. However, the most interesting and innovative feature of the paper is that they included an experiment with a group of construction firm managers. A common

[2]In a first price auction, the item is awarded to the highest bidder who pays whatever he bid. In a second price auction, the item is given to the highest bidder, but he pays whatever was the second highest bid. In a low price auction, such as construction contract bidding, the winner is the one who submits the lowest bid. Low price auctions can use either first or second price rules.

[3]That is, each risk neutral bidder has a strategy that he would not want to change even if he knew all the other bidders' strategies.

criticism of experimental economics, especially if the results of the experiment do not accord with economic theory, is that the subjects are "only college students working on toy problems, and in the real world, experts wouldn't make these silly mistakes." So how did the construction managers do? While the experimenters worried that the experts might take them to the cleaners, in fact the experts did no better or worse than the students. This is surprising, given that construction firms participate in low bid auctions all the time, and would soon go bankrupt if they fell prey to the winner's curse. Dyer, Kagel and Levin believe the result occurs because the managers have learned situation specific rules of thumb rather than the relevant theory:

> We believe that in the field the executives have learned a set of situation specific rules of thumb which permit them to avoid the winner's curse in the field but could not be applied in the laboratory.... However, these rules of thumb do not translate into a structurally similar, but different environment which lacks a familiar references. When placed in a new environment which does not contain the usual stimuli, the learning process must take place anew, since without theory absorption there is nothing to be carried over from previous experience (pp. 23–24).

Field Data

The laboratory evidence demonstrates that avoiding the winner's curse is not easy. Even experienced subjects who are given significant learning opportunities fail to solve the buy-a-firm problem and fail to understand the need to become more conservative when the number of bidders increases. Do bidders in large stakes auctions in the "real world" make the same mistakes? There are numerous studies that claim to have found evidence of the winner's curse in market contexts. For example, in the field of book publishing, Dessauer (1981, p. 33) reports that: "The problem is, simply, that most of the auctioned books are not earning their advances. In fact, very often such books have turned out to be dismal failures whose value was more perceived than real."[4] Cassing and Douglas (1980) looked at the market for free agents in baseball and concluded that free agents were overpaid. The owners of major league baseball teams seem to have come to the same conclusion, and appear to have responded with the effective tactic of collusion.[5] The fact that during the 1986–87 off-season, no team, including George Steinbrenner's pitching-weak Yankees, even bid for Jack Morris, perhaps the American League's best pitcher in the 1980s, is reasonably strong evidence of collusion. Here I will review the evidence in two other contexts: offshore oil and gas leases, and corporate takeovers.

[4]Of course, the quoted statement could be true but not be evidence of a winner's curse if the sales distribution is sufficiently skewed.

[5]It has also been suggested that the construction managers in Dyer, *et al.*'s experiments would have done better in an experiment emphasizing cartel skills rather than optimal bidding strategy.

It is appropriate to start with the evidence on bidding for oil and gas drilling rights, since that is the domain which prompted the marvelous article by Capen, Clapp and Campbell that first mentioned the concept of a winner's curse. They began their discussion by noting (p. 641):

> In recent years, several major companies have taken a rather careful look at their record and those of the industry in areas where sealed competitive bidding is the method of acquiring leases. The most notable of these areas, and perhaps the most interesting, is the Gulf of Mexico. Most analysts turn up with the rather shocking result that, while there seems to be a lot of oil and gas in the region, the industry is not making as much return on its investments as it intended. In fact, if one ignores the era before 1950, when land was a good deal cheaper, he finds that the Gulf has paid off at something less than the local credit union.

The authors cite several studies to document their claims, and report some interesting data of their own regarding the dispersion of bids. They report that the ratio between the highest and lowest bids by what they call "serious competitors" is commonly as high as 5 to 10 and can be as high as 100. While this result might be explained by some firms submitting low bids in the hope that there will be no other bidders (as was true for 15 tracts in the sample they analyzed), the authors report some other interesting data. In the 1969 Alaska North Slope sale the sum of the winning bids was $900 million, while the sum of the second highest bids was only $370 million. The winning bid exceeded the second bid by a factor of 4 or more in 26 percent of the tracts, and by a factor of at least 2 for 77 percent of the tracts. While these figures do not actually prove that anyone was behaving irrationally, they certainly seem consistent with a winner's curse scenario.

The Capen, Clapp and Campbell article was published in 1971, before all the information was in on the Gulf of Mexico leases they discuss. However, Walter Mead, Asbjorn Moseidjord, and Philip Sorensen (1983) have examined how those leases turned out. They calculate before-tax rates of return on 1,223 leases issued in the Gulf of Mexico between 1954 and 1969, the period directly preceding the publication of Capen, Clapp and Campbell. They report (p. 42):

> [F]or all 1223 leases, firms suffered an average present value loss of $192,128 per lease using a 12.5% discount rate.[6] ... 62% of all leases in our data base were dry. Consequently, the lessees had no revenues whatsoever to offset their bonus and rent payments, or their exploration costs. Another 16% of the leases were unprofitable (on an after-tax basis) although some production occurred. Only 22% of the leases were profitable, and these leases earned only 18.74% in aggregate on the after-tax basis.

These results seem consistent at least with version 2 of the winner's curse; that is, they are surely lower than the bidders anticipated when they bid on the property. In

[6] They use nominal values for costs and selling prices; thus this rate seems reasonable.

addition, these returns are helped by the fact that nominal crude oil prices increased from $3 to $35 a barrel between 1970 and 1981, something that could not have been anticipated when the leases were purchased. As to why the returns were so low, the authors venture this (p. 45): "The low and negative rates of return for the initial five lease sales (from 10/13/54 through 8/11/59) appear to reflect excessive enthusiasm for the amount of oil likely to be found."

Another analysis of the same lease sales was conducted by Hendricks, Porter, and Boudreau (1987). They use a 5 percent real discount rate and real price sequences that did not assume that the oil companies could anticipate the OPEC price shocks. They also make several other assumptions that differ from those used by Mead, Moseidjord and Sorenson. Their results, in contrast, indicate that firms would have made profits even if oil prices had remained constant in real terms. Nevertheless, their data does provide some support for the winner's curse. For the 18 individual firms or consortiums of firms that made a significant number of bids (the average number of bids was 225), Hendricks, *et al.* calculated the profit each firm would have made ex post if it had multiplied all of its bids by a constant, θ, assuming all other firms had kept their bids the same. They then determined θ^*, the value of θ that would have maximized profits. If all firms chose their bids according to risk neutral Nash equilibrium behavior, then θ^* would be equal to one. However, for 12 of the 18 firms θ^* was less than one, with the median value being .68. For Texaco, which seems to have been particularly cursed, θ^* was .15, indicating that they should have reduced their bids by a factor of nearly 7! For many of the firms, the difference between the actual profits earned and those that would have been earned with optimal bidding amounted to hundreds of millions of dollars. The authors conclude (p. 529): "This result suggests that some firms may have systematically overvalued the tracts and/or failed to fully anticipate the impact of the 'winner's curse'."

Richard Roll (1986) applies the concept of the winner's curse to the puzzling phenomenon of corporate takeovers. The puzzle is to explain why firms are willing to pay substantial premiums above the market price to acquire another firm. The empirical evidence suggests that while stockholders of target firms make significant profits when their firms are purchased, there is little or no gain to the buyer. Why then do takeovers occur? Roll offers what he calls the hubris hypothesis as one plausible answer. According to this view, bidding firms, typically flush with cash[7] identify potential target firms, estimate the value of the target, then bid for the target if and only if the estimated value exceeds the market value. Since Roll takes the efficient market hypothesis seriously, he believes that (in the absence of synergy or

[7]Asquith (1983) reports that successful bidders earned 14.3 percent above the market over the 460-day period ending 20 days before the merger. In light of this fact, I think that the hubris hypothesis may be partially a "hot hand" phenomenon. Most basketball players and fans believe that there is strong positive serial correlation in the shooting of basketball players; that is, the probability of making a shot increases after making the previous shot and vice versa. In contrast to this perception, psychologists Gilovich, Vallone, and Tversky (1985) have found no serial correlation using actual NBA data. So according to the hot-hand-hubris hypothesis, firms that have been doing well lately, perhaps because of a run of good luck, mistakenly think that they are "hot" (i.e., good managers) and will be able to perform miracles with any firm they purchase.

insider information) the belief by acquirers that they can estimate true value better than the market is likely to be mistaken. As Roll points out (p. 201):

> Most other explanations of the takeover phenomenon rely on strong-form market inefficiency of at least a temporary duration. Either financial markets are ignorant of the relevant information possessed by bidding firms, or product markets are inefficiently organized so that potential synergies, monopolies, or tax savings are being ineffectively exploited (at least temporarily), or labor markets are inefficient because gains could be obtained by replacement of inferior managers.

To test the hubris hypothesis Roll reviews the data on stock prices of bidders and targets around the announcement date. The hubris hypothesis predicts that the combined value of the bidder and the target should fall slightly, representing transactions costs; the value of the target firm should increase; and the value of the bidder should fall.[8] He interprets the evidence as consistent with these predictions and concludes as follows (p. 213):

> The final impression one is obliged to draw from the currently available results is that they provide no really convincing evidence against even the extreme (hubris) hypothesis that all markets are operating perfectly efficiently and that individual bidders occasionally make mistakes. Bidders may indicate by their actions a belief in the existence of takeover gains, but systematic studies have provided little to show that such beliefs are well founded.

While Roll is careful to explain how difficult it is to evaluate these studies, it seems clear that bidding firms are making very little money (if any) through takeovers. Again, version 2 of the winner's curse seems consistent with these data.[9]

Commentary

If my reading of the literature on oil leases and takeovers is correct, namely that the winner's curse is present in these markets, how surprised should economists be? What challenge does the existence of the winner's curse pose to the economists' paradigm? McAfee and McMillan (1987, p. 721) in their survey of auctions and

[8]Of course, it is an article of faith that the stock prices are rational. Indeed, Miller (1977) argues that stock prices in general are afflicted by the winner's curse because the investors most optimistic about a stock will be the ones who own it. Thus, in the case of mergers, the investors most optimistic about the prospects of the merger will end up owning the shares of the acquiring firm. This argument must be tempered by the possibility that pessimists can sell the acquiring firm short. Nevertheless, it is true that many investors, both individual and institutional, do not sell short, and it remains an empirical question whether the existing quantity of short selling is sufficient to prevent a winner's curse from emerging.

[9]For additional information on takeovers see the papers in this issue's symposium.

bidding say: "Statements about the winner's curse [such as the quote by Dessauer about book publishing that appears above] come close to asserting that bidders are repeatedly surprised by the outcomes of auctions, which would violate basic notions of rationality." I think that what they are saying can be paraphrased as follows: "These statements about the winner's curse suggest that bidders make systematic errors. Economic theory precludes such errors. Therefore, the statements must be wrong." The internal consistency of this position is questionable. I think it is important to keep in mind that rationality is an assumption in economics, not a demonstrated fact. Given the results of the experimental studies, isn't it possible that some bidders make mistakes in these auctions?

It is also interesting to note a peculiar tendency among many economic theorists. A theorist will sweat long and hard on a problem, finally achieving a new insight previously unknown to economists. The theorist then assumes that the agents in a theoretical model act as if they also understood this new insight. In assuming that the agents in the economy intuitively grasp what it took so long to work out, the theorist is either showing uncharacteristic modesty and generosity, or is guilty of ascribing too much rationality to the agents in his model. As Kenneth Arrow (1986, p. 391) has said: "We have the curious situation that scientific analysis imputes scientific behavior to its subjects. This need not be a contradiction, but it does seem to lead to an infinite regress."

The possibility of suboptimal behavior by other participants in an auction raises an issue rarely discussed in economic theory, namely what to do when you realize that your competitors are making mistakes. Theoretical treatments of bidding typically assume that bidders are rational and that the rationality of other bidders is common knowledge.[10] Suppose you are Capen and his colleagues and you have figured out the winner's curse. You now have an advantage over other oil firms. How can you exploit your new competitive advantage? If you react by optimally reducing your bids, then you will avoid paying too much for leases, but you will also win very few auctions. In fact, you may decide not to bid at all! Unless you want to switch businesses, this solution is obviously unsatisfactory. You could let your competitors win all the auctions and try to make money by selling their shares short, but this strategy can be risky. In the oil drilling case, for instance, the price of oil skyrocketed, and the price of oil stocks went up too. A better solution may be to share your new knowledge with your competitors, urging them to reduce their bids as well.[11] If they believe your analysis, then the game can be profitable for the bidders. This, of course, is exactly what Capen, Clapp and Campbell did. More generally, the study of optimal strategy for games in which one's opponents are less than fully rational deserves greater attention from economists.

Even once one is aware of the winner's curse, it is easy to fail to appreciate some of the subtle ways in which it can operate. For example, Harrison and March (1984)

[10]Bidding theory is explored in Wilson (1977), Milgrom and Weber (1982) and the recent survey by McAfee and McMillan (1987).

[11]Thanks to Julia Grant for making this point.

discuss the concept of postdecision surprise, a situation similar to the second version of the winner's curse in which decision makers systematically observe outcomes which are worse than expected. They show that postdecision surprise will occur for any decision with great uncertainty and/or many alternatives. Thus, the following should be true: for a department recruiting a new assistant professor, the more candidates it interviews at the annual meetings, the better will be the candidate it hires, and the more likely that candidate will be to fail to live up to the department's expectations. Similarly, Brown (1974) discusses the case of capital investment projects within a firm. If many such projects are considered, and only a few are selected, then actual net revenues will tend to be less than projected, even if the projections are unbiased for the complete set of projects considered.

The winner's curse in a prototype for the type of problem that is amenable to investigation using modern behavioral economics, a combination of cognitive psychology and microeconomics. The key ingredient is the existence of a cognitive illusion, a mental task that induces a substantial majority of subjects to make a systematic error. The existence of the cognitive illusion was recognized by Capen, Clapp and Campbell and demonstrated by Bazerman and Samuelson, and by Kagel and Levin. Whenever such an illusion can be demonstrated, the possibility that market outcomes will diverge from the predictions of economic theory is present.

I will close with a fortune cookie provided by Capen, *et. al.* "He who bids on a parcel what he thinks it is worth, will, in the long run, be taken for a cleaning."

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[Footnotes]

[8] **Risk, Uncertainty, and Divergence of Opinion**
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