CONFOUNDING CHANGES IN AVERAGES WITH MARGINAL EFFECTS: HOW ANCHORING CAN DESTROY ECONOMIC VALUE IN STRATEGIC INVESTMENT ASSESSMENTS

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Profit maximization requires that decision makers assess marginal profits. We demonstrate that decision makers often confound marginal profits with changes in average profits (e.g., changes in return-on-investment). This results in systematic deviations from profit maximization where decision makers forgo profit-enhancing investments that reduce average profits or engage in loss-enhancing investments that decrease average losses. In other words, average profit becomes an anchor by which new investments are assessed. We conduct two decision-making experiments that show this bias and demonstrate it is pronounced when average profit data are accessible or task-relevant. Moreover, we find within-subject effects across experiments, which helps demonstrate the mechanism that invokes the bias.

INTRODUCTION

Making strategic investment decisions is not a task that should be taken haphazardly. Managers and MBA students spend time studying appropriate decision criteria such as net present value (NPV) to aid in making profit-maximizing decisions. However, in discussing investment decisions with practicing managers over the years, we sensed that managers often systematically deviated from profit maximization. In particular, we noticed that managers often equate changes in scaled profit measures (e.g., changes in return on investment [ROI]) with changes in total profits (i.e., marginal profits). This causes them to deviate systematically from profit maximization with respect to strategic investment decisions (e.g., research and development [R&D] investments, capital investments, acquisitions) by avoiding investments that increase total profits yet are less profitable than their average current investment.1 In other words, current levels of average profit create an anchor by which investments are assessed.

In illustration this phenomenon, we asked managers enrolled in an Executive Master of Business Administration (EMBA) class the following question:

Assume that you work for a company that currently, after accounting for the cost of capital, has a current return of 10 percent systematically from profit maximization with respect to strategic investment decisions (e.g., research and development [R&D] investments, capital investments, acquisitions) by avoiding investments that increase total profits yet are less profitable than their average current investment.1 In parallel, this can lead to decisions to make investments that increase total losses yet decrease average losses. Namely, investments that are loss-generating but relatively less loss-generating than the average current investments.

Keywords: decision making; biases; investments; ROI; profit maximization

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on $10 million of invested capital. You are asked to make a recommendation whether the company should invest in Project A, in Project B, in both or in neither.

Project A, which after accounting for the cost of capital, has an expected discounted return of 10 percent on a $1 million investment. Project B, which after accounting for the cost of capital, has an expected discounted return of five percent on a $1 million investment.

Many of the managers who responded to the above choice question recommended investing in Project A but not in B. It is clear that Project A dominates Project B; however, the positive [albeit lower] return is a sufficient reason to invest also in B, and profit-maximizing decision makers should make the investment. Although managers might shy away from recommending B for many “good” reasons, such as holding the money for better alternatives or investing the money in riskless alternatives, the experiments we report in this paper controlled for such reasons, but the phenomenon did not go away.

Moreover, we noticed prominent examples of this effect in the business press. For example, in 2004 the Coca Cola Company decided to forgo several investments and focus on Coke’s core business despite the company’s declining market share. Then-CEO Isdel justified focusing on their core business because “there just aren’t many businesses for sale that produce the lush margins—around 30 percent, some analysts estimate that Coke makes from selling its proprietary concentrate to bottlers.” (Foust and Byrnes, 2004). This statement suggests that Coke’s current performance provided a strong anchor that affected investment decisions. Namely, one can imagine that investments with returns below 30 percent would be profitable to Coke; however they appeared not to want to make such investments.

Likewise, such an affect presents a way to reconcile the discussion of why managers state that they are unwilling to make acquisitions that dilute earnings per share (Lynch, 1971 as cited in Matsusaka, 1993), even though there is no evidence that doing so leads to superior market reactions on announcement (Matsusaka, 1993). Earnings per share is an average performance measure and by acquiring a target with lower earnings per share, a firm lowers earnings per share of the combined entity. Nevertheless, total profits can often be increased under this situation. Therefore, the decision bias would be reflected in the managerial statement and not in the market reaction [if markets are efficient].

Our goal in this paper is twofold: first, to demonstrate deviations from profit maximization where decision makers anchor on current average profit; second, to examine under what conditions such anchors are more likely to be pronounced. We do so by conducting two decision-making experiments with MBA students.

We find that many of our respondents demonstrate the decision making bias central to our arguments. Moreover, we find the likelihood of such bias increases when average performance data are available or when they are task-relevant [i.e., when subjects have multiple investments to compare].

Before proceeding, we wish to note that we are not stating that average performance data are meaningless or should be avoided. Average return data are beneficial because they facilitate comparisons of investment choices. For example, the preference of two investments that result in $10 million profit likely differs if one requires an investment of $1 million and the other an investment of $100 million—and average return data make this comparison transparent. Our point, however, is that average performance data can invoke an anchor in the decision-making process that may lead to nonoptimal choices.

**Anchoring in decision making**

The mechanisms that underlie the behavior we study are described in the judgment under uncertainty literature. Edwards (1954) did some of the pioneering work in this area by showing that the way people process probabilistic information departs from Bayes rule. His major finding was that people do not update their prior probabilities sufficiently when they get additional information in the way prescribed by Bayes rule; he coined the term “conservatism” to describe such behavior. Tversky and Kahneman (1974) followed Edwards’s work and described the **representativeness** heuristic to show that when making inferences in situations where prior probabilities are given and then additional information is provided, people do not use Bayes rule and tend to focus on the information elements that represent to them the problem in a clearer manner. They proposed another heuristic called **anchoring and**
adjustment to describe a situation in which an unrelated numerical figure is mentioned to people and may affect their estimate of the frequency or probability of another uncertain event. They showed that the original numerical stimulus operates as a strong anchor from which people do not adjust enough even though the original stimulus is unrelated to the question at hand. The metaphor they used is an anchor, which sailors use to stabilize the position of a boat so that it doesn’t move. Accordingly, Tversky and Kahneman hypothesized that once anchored on a specific estimate people find it hard to adjust it when given new information. Note, however, that while Tversky and Kahneman (1974) showed that an anchor can affect people’s estimates of another unrelated event, other researchers used a substantial event to demonstrate the anchoring effect. This has been demonstrated often in negotiation research. For example, Northcraft and Neale (1987) provided real estate agents and students with information on list prices for properties and the subjects anchored on those prices when estimating the value of these properties. The effect was clear even though the real estate agents denied that this affected their estimates. Galinsky and Mussweiler (2001) also show how meaningful anchors affect subsequent judgments by manipulating who makes the first offer within a negotiation. Galinsky et al. (2002) go further and examine the effects of the extremity of first offers as meaningful anchors.

Following Tversky and Kahneman (1974) many researchers studied the effect of unrelated anchors on judgment under uncertainty, where unrelated anchors operate as a priming mechanism. We believe that a clear and meaningful anchor such as firm’s average profits provides an even stronger anchor from which managers find it hard to deviate. The effect can be stronger and last longer than what Tversky and Kahneman observed.

Anchor accessibility

Epley and Gilovich (2006) argued that anchors that come easily to mind tend to develop resistance to adjustment due to new data, as compared with anchors that require some effort to come by. Furthermore, the ease with which people can come up with an initial estimate is inversely related to the degree to which they would engage in adjustment, which is usually effortful. For instance, Epley and Gilovich (2006) argue that when asked to estimate the year when Washington became president, people can easily generate an anchor, 1776, which seems plausible, and therefore their inclination to make an adjustment is smaller compared with other cases where generating an anchor is effortful, or when an anchor is provided by an experimenter not easily accessible to the subject. In this respect, the context of our study is a natural candidate for such an effect since a company’s average profits are very accessible to managers. Marginal expected profits, even if their expected NPV is positive, may be less accessible since they may change often. Average profits are usually stated for a certain period, such as in annual reports and thus are more accessible. Consequently, we argue that managers anchor on average performance figures and tend to equate changes in average performance as marginal effects leading them to make suboptimal decisions.

We argue that average performance figures are both relevant and accessible, and these combined features are likely to affect managers to anchor on these averages and not adjust them for better estimates when they make investment decisions.

In the domain that we study, we expect that the degree to which average profit measures are accessible or task relevant will affect the likelihood that decision makers anchor on the current level of average performance and fail to assess marginal performance. When faced with a single decision, we predict that decision makers will more likely anchor on current average performance when we present profit data as averages (e.g., ROI) versus totals. Namely, accessibility to average profit data invokes the bias.

We also predict that task benefits of using averages will invoke the bias. In particular, we predict that decision makers will be more likely to anchor on average current performance when they have multiple investments to compare. The reason is that average performance measures facilitate the comparison of investments and this heightens the task relevance of using average performance—and hence the likelihood of observing the bias. Therefore, under either of these conditions we predict that average performance will loom much larger in the decision maker’s mind and she will be more likely to assess the new project based on changes in average performance versus marginal performance.
METHOD

Pilot study

With the general topic in mind, we went through a process of piloting the experiments we wished to perform. The focus of the pilot study was to see if we could document the bias and ensure that subjects were not misled in our description of the investment. We provided subjects with an investment decision and a set of additional information to aid their assessment. We asked them to make the decision and explain what they did. We also asked them if they had to make assumptions or required additional data to make their assessment. We wanted them to find the material clear, unambiguous, and complete.

We went through four waves to refine and hone the instrument. Three of these waves involved classes of full-time MBA students and the fourth was a class of executive MBA students. Through these iterations we altered the instrument so that by the end of the process subjects indicated little evidence of ambiguity or need for additional information. Moreover, the effectiveness of the pilot tests provided us confidence that we could conduct the experiments in a classroom setting because the instructions were clear and unambiguous to the subjects and because the experimental manipulations were effective. An advantage of using a classroom setting is that it allowed us to sample a large number of MBA students—many of whom were working professionals—rather than having to rely on a small sample and subjects with less business experience such as undergraduate students.

Experiment overview

To assess the existence of this bias we designed two decision-making experiments. The goal of the experiments was to assess if the predicted conditions in which decision makers would likely anchor on existing average performance, systematically led to decisions based on changes in average profits, rather than marginal profits. Due to the nature of these experiments, it was possible to have subjects take both experiments at one time. Having subjects take two experiments allows us to assess within-subject effects. Namely, we are able to assess if subjects are sensitive to the manipulations across the experiments. This aids in ruling out alternative explanations to our findings, as we demonstrate below.

One experiment [what we subsequently refer to as the single-decision experiment] has only one manipulation. We present the profile of an investment and a description of the firm’s current performance. In one condition subjects see the performance data presented as averages [i.e., return on investment]. In the other condition, subjects see the performance data presented as totals [i.e., profits or loss]. Appendix 1 presents the instrument. Our expectation is that subjects who see the data as averages will more likely anchor on changes in average performance than those who see the data presented as totals.

As mentioned previously, averages are an important decision aid when decision makers have to compare investments. As a result, the other experiment presents subjects with two investments to make [we subsequently refer to this as the multidecision experiment]. We design this experiment such that both investments increase firm profits. With the complexity of two investments from which to decide, we can introduce more manipulations and produce a $2 \times 2 \times 2$ design. Appendix 2 presents this instrument.

The key manipulation we use is how the two investments relate in average performance (i.e., ROI) to the firm’s current performance. Keeping in mind that both investments increase profits, in one manipulation (1) one of the investments equals the firm’s current ROI and the other exceeds the current ROI; and in the other manipulation (2) one of the investments equals the current ROI but the other is lower than current ROI. Our expectation is that because subjects have two investments to compare, they will tend to scale the investments [namely, use averages]. Therefore, we expect subjects will tend to make both investments when the investments equal and exceed current ROI and will be less likely to make both investments when the investments have equal and lower ROI.

The other two manipulations in the $2 \times 2 \times 2$ design provide conditions that will magnify the anchor in the event that subjects are not sensitive to the focal manipulation. These additional

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2 We recognize that there are plausible alternative interpretations for the results we discuss (e.g., presenting averages leads subjects to believe this is how they would personally be evaluated). The subsection entitled, alternative explanations in the discussion section, discusses why we do not believe such factors drive the results across studies.
two manipulations (1) present the data as ROI versus profit levels and (2) present investments of equal versus different magnitude. The rationale for manipulating the presentation in terms of ROI, or profit levels—as in the single-decision experiment—to induce was the consideration of averages. The rationale of varying the magnitudes of the investments was that investments of different magnitude would be more difficult to compare, subjects would be more inclined to calculate averages to compare the investments, and calculating the averages would induce the anchor.

**Experiment**

**Subjects**

The experiment included 218 MBA students from five MBA classes at a Midwestern university: 81 full-time MBA students and 137 evening MBA students. The average age of students in these programs was approximately 28 years. Participants had an average of 5.27 years of experience in their last two full-time positions.

**Procedure**

The experiment took place at the beginning of a class session. Prior to the experiment it was verified that no student was in multiple classes in which the experiment was run. Students were introduced to the experiment by a standardized script prepared for Institutional Review Board (IRB) approval of the experiment and were assured that this was not a graded element of their class and that their responses would be anonymous. Students were able to opt out by simply not completing the experiment. The instructor of the class was not in the room at the time the experiment was run. Once all students had finished the experiments—approximately 15 minutes—the packets were collected and the students were debriefed.

We assembled packets that contained the two experiments. The conditions for the single-decision experiment and for the multidecision experiment were randomly matched—namely, the manipulation of the single-decision experiment that a subject received was not related to the manipulation of the multidecision experiment the same subject received. Likewise, the order of presentation was randomly assigned—some saw the single-decision experiment first in the packet, others the multidecision experiment. Due to the nature of data collection, participation in each cell of each design is not equal. However, it is relatively balanced, which reinforces the randomization underlying the distribution of the instrument.

**Single-decision experiment**

Of the 218 subjects, 216 responded to this question. Table 1 summarizes their responses. Here, subjects evaluated whether or not to make an investment that would decrease total profit to $-1.08M from $-1.00M. Clearly, the profit-maximizing decision is to forgo this investment. However, this investment increases ROI to −9 percent from −10 percent. Our hypothesis is that subjects who were presented with investment performance as averages (i.e., ROI data) would be more likely to recommend the investment than those who were presented with the profit data. The results in Table 1 confirm our expectation. When presented with data on total profits 93 of the 114 subjects [81.6%] forgo the investment; whereas 71 of 102 [69.6%] forgo the investment when presented with ROI data. This difference is statistically significant [Fisher exact test, p < 0.02].

<table>
<thead>
<tr>
<th>Presented as total profit. Total profit becomes $-1.08M from $-1.00M</th>
<th>Presented as average profit (i.e., ROI). ROI becomes −9% from −10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend not to make the investment [percentage]</td>
<td>Recommend making the investment [percentage]</td>
</tr>
<tr>
<td>93 [81.6]</td>
<td>71 [69.6]</td>
</tr>
<tr>
<td>21a [18.4]</td>
<td>31 [30.4]</td>
</tr>
</tbody>
</table>

a Of the 21 subjects who chose to make the investment and were presented the data as total profits, 14 explicitly showed that they calculated average profit (i.e., ROI) before making the nonprofit-maximizing decision.
although 31 subjects [30.4%] in the ROI condition made the nonprofit-maximizing choice, the majority of subjects did make the profit-maximizing choice. What we want to emphasize is that subjects in this condition were about twice as likely to make the nonprofit-maximizing decision compared to those presented the profit data.

Second, 21 of the 114 subjects [18.4%] who were presented with the profit data made the nonprofit-maximizing decision. To understand why they would have made an investment that clearly decreased profits, we examined these subjects’ written responses. We found that 14 of the 21 subjects calculated the average return on the page and subsequently decided to make the investment because it increased average profit! In essence, we observed that calculating averages and using them as the decision criteria was an important source of nonprofit-maximizing answers in the condition where we did not present the ROI data. It appears that the subjects introduced the experimental mechanism upon themselves and subsequently made the nonprofit-maximizing decision.

In summary, when we presented subjects with data in the form of average profit (i.e., ROI) versus total profits, they were more likely to make an investment that decreased total profits, yet increased average profits. This is consistent with subjects evaluating changes in average profits rather than marginal effects and anchoring on past average performance.

Multidecision experiment

Of the 218 subjects, 217 responded to this question. Again, our expectation for the multidecision experiment was that multiple comparisons would invoke the calculation of averages, because it aids comparability of the two investments. This, in turn, would enhance the bias and strengthen reliance on the anchor of past average performance.

Recall that in the multidecision experiment subjects were presented with two investments. In all conditions, both investments increased firm profits. Moreover, in all conditions one of the investments had the same average return as the firm’s existing investments. However, one of the experimental manipulations was that the other investment had (1) lower average profits (i.e., ROI) than the firm’s existing investments or (2) higher average profits (i.e., ROI) than the firm’s existing investments.

In this experiment, the profit-maximizing decision is to make both investments. Our hypothesis was that subjects with one investment that had lower average profits would be less inclined to make both investments than subjects presented with one investment that had higher average profits. Panel A of Table 2 presents the results.

As expected, we found that 52 of the 105 subjects [49.5%] in the condition where one of the investments had lower ROI than existing investments made both investments. In contrast, 79 of 112 subjects [70.5%] recommended both investments in the condition where one of the investments had higher ROI than existing investments. This difference is statistically significant [Fisher exact test, p < 0.001].

It is also noteworthy that in the multidecision experiment—in which comparisons were likely to invoke the use of averages—the degree to which subjects focused on changes in averages appears more pronounced than in the single-decision experiment. In the single-decision experiment, in the condition in which we expected the bias, 31 of 102 subjects [30.4%] made a nonprofit-maximizing choice (Table 1, second column). In the multidecision experiment, in the condition in which we expected the bias, 53 of 105 subjects [50.5%] made a nonprofit-maximizing choice (Table 2, Panel A, first column).

Returning to the results in panel A of Table 2, we examined the justifications provided by the 53 subjects who did not make both investments in the condition where one investment decreased average profits and the other equaled average profits [Panel A—lower left cell]. Of the 53 subjects, 47 chose to make only the investment with the same ROI as existing operations. Of these 47 subjects, 8 explicitly stated that only this investment hit the company’s average return; 37 stated that they choose the highest return but did not expand further; and 2 gave no justification. We also examined the justifications of the 33 subjects who did not make both investments in the maximizing decision in the condition where one investment increased average profits and the other equaled average profits [Panel A—lower...
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Table 2. Multidecision experiment

A. Comparison of the condition where the investments equal and increase average profits versus equal and decrease average profits

<table>
<thead>
<tr>
<th></th>
<th>One investment decreased average profits, the other equaled average profits</th>
<th>One investment increased average profits, the other equaled average profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend making both investments [percentage]</td>
<td>52 [49.5]</td>
<td>79 [70.5]</td>
</tr>
<tr>
<td>Recommend not to make both investments [percentage]</td>
<td>53 [50.5]</td>
<td>33 [29.5]</td>
</tr>
</tbody>
</table>

B. Of the investments where one investment decreased average profits and the other equaled average profits—analysis based on whether the investments were of equal size

<table>
<thead>
<tr>
<th></th>
<th>Presented as total profits</th>
<th>Presented as average profit (i.e. ROI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend making both investments [percentage]</td>
<td>28 [52.8]</td>
<td>24 [46.2]</td>
</tr>
<tr>
<td>Recommend not to make both investments [percentage]</td>
<td>25 [47.2]</td>
<td>28 [53.9]</td>
</tr>
</tbody>
</table>

C. Of the investments where one investment decreased average profits and the other equaled average profits—analysis based on whether the investments were of equal size

<table>
<thead>
<tr>
<th></th>
<th>Investment sizes the same across investments</th>
<th>Investment sizes differed across investments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommend making both investments [percentage]</td>
<td>26 [48.2]</td>
<td>26 [51.0]</td>
</tr>
<tr>
<td>Recommend not to make both investments [percentage]</td>
<td>28 [51.8]</td>
<td>25 [49.0]</td>
</tr>
</tbody>
</table>

\( a n = 217, p < 0.001, \) one-tailed Fisher exact test.

\( b n = 105, p < 0.46, \) one-tailed Fisher exact test.

\( c n = 105, p < 0.32, \) one-tailed Fisher exact test.

The profit-maximizing decision under all conditions is to make both investments because every investment increases total profits.

right cell].\(^4\) Twenty eight of the 33 subjects chose only the investment with ROI greater than current investments. Of these 28 subjects, 8 explicitly stated that they chose the higher ROI investment because it exceeded the company’s average return; 18 stated that they choose the highest return but did not provide further explanation; and 2 gave no justification. Again, we saw many instances where the subjects made explicit comparisons to the current ROI when making their decisions.

Our reasoning for employing the other manipulations in the multidecision experiment was to try to invoke stronger inducements for subjects to assess changes in averages versus marginal effects. Because we find the effects in the multidecision structure overall, we do not necessarily expect to find further effects based on the other manipulations. Panel B of Table 2 breaks down the investments where we expect the bias [one of the investments has a lower ROI] by whether or not the data are presented as averages (i.e., ROI) or profits.

The data show a slightly higher incidence of bias among subjects who had the data presented as averages. Here 28 of 52 subjects [53.9%] did not make both investments. This is in contrast to 25 of 53 subjects [47.2%] not making both investments when having the data presented as profits. This slight difference is not statistically significant [Fisher exact test, \( p < 0.32 \)].

Panel C of Table 2 breaks down the investments where we expect the bias [one of the investments has a lower ROI] by whether or not the investment magnitudes were equal versus different. Here we find no discernable difference in whether the subjects made both investments. Of 54 subjects, 28 [51.8%] did not make both investments when the investment magnitudes were the same, and 25 of 51 subjects [49.0%] did not make both

\(^4\) Of the other five subjects, two choose to make no investment stating they wanted higher returns. The other three subjects chose the investment that equaled past ROI (two stating that they did so because it equaled past ROI, the other proving an explanation of why the investment that exceeded average profits would have been chosen).
Table 3. Within-subject accuracy across experiments: frequencies of profit-maximizing decisions across both experiments [conditioned on the multidecision experiment being in the condition subject to bias]

<table>
<thead>
<tr>
<th>Made profit-maximizing decision in the multidecision experiment</th>
<th>Did not make profit-maximizing decision in the multidecision experiment</th>
<th>Total</th>
</tr>
</thead>
</table>
| Made profit-maximizing decision in the single-decision experiment | 42 [40.4]
| Did not make profit-maximizing decision in the single-decision experiment | 36 [34.6] |
| Total | 78 |
| | 10 [9.6] |
| | 16 [15.4] |
| | 52 |
| | 26 |
| | 104 |

p < 0.001, of the test that subjects made either (1) both profit maximizing decisions or (2) did not make either profit-maximizing decision [i.e., that the count in the off-diagonal cells equals 0].

a Number in brackets is the percentage of all 104 observations.

investments the investment magnitudes differed [Fisher exact test, p < 0.46].

**Within-subject analyses**

A possible concern about interpreting our results is that subjects might differ in their ability to assess investments or in their susceptibility to focus on changes in averages versus marginal effects [e.g., they believe that they should maximize ROI versus profits]. Although the experimental conditions were randomized among subjects, there exists the possibility that less adept subjects fall into the conditions where we expect the bias to be invoked and more adept subjects fall into the other conditions.

An advantage of our design is that most subjects [215 of 218] completed both the single-decision experiment and the multidecision experiment. Therefore, it is possible to assess if the results we previously report hold within subjects across the two experiments.

The data presented in Table 3 do not support the interpretation that subject differences drive the results because there appears to be significant within-subject variation in showing the bias. Columns of the table reflect whether an individual made the profit-maximizing decision in the single-decision experiment. The rows of the table reflect whether an individual made the profit-maximizing decision in the multidecision experiment—provided the subject was in a condition that would subject to the bias.

If the results were driven by subject differences and not anchoring [e.g., subjects did not maximize profit because they thought they should maximize ROI], then we would expect subjects either to provide the profit-maximizing or the nonprofit-maximizing answer to both questions. We would not expect a subject to profit maximize in one instance and not in the other. In other words, we would expect no observations in the off-diagonal [top-right and lower-left cells]. A binomial test that the count in the off-diagonal cells is zero rejects this null-hypothesis [p < 0.001].

A further examination of the within subject effect is to assess if subjects are sensitive to the experimental manipulations designed to invoke the bias regardless of how they answered the other question. Table 4 presents data that are consistent with the conclusion that subjects remain sensitive to the manipulation regardless of how they answered the other question. In all four instances [2 questions × profit-maximizing or nonprofit maximizing answers], the pattern of results is consistent with what we presented previously—there is a greater likelihood of nonprofit-maximizing answers in the condition subject to the bias. In three of the four cases, the difference is statistically significant at p < 0.10 level.

More specifically, in panel A of Table 4 we see that subjects who did not profit maximize in the single-decision experiment were subject to the manipulation of the multidecision experiment. Ten of 26 subjects [38.5%] made both investments in the condition where we expected the anchor to be stronger, and 16 of 26 subjects [61.5%] made both investments in the condition where we expected the anchor to be weaker [p < 0.10, Fisher exact test].

Likewise, in panel B of Table 4 we see that subjects who profit maximized in the single-decision experiment were also subject to the manipulation.
Table 4. Within-subject accuracy across experiments

<table>
<thead>
<tr>
<th>A. Responses to the multidecision experiment of the subjects who made the profit-maximizing decision for the single-decision experiment</th>
<th>One investment decreased average profits, the other equaled average profits</th>
<th>One investment increased average profits, the other equaled average profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made profit-maximizing decision for multidecision experiment [percentage]</td>
<td>10 [38.5]</td>
<td>16 [61.5]</td>
</tr>
<tr>
<td>Did not make profit-maximizing decision for multidecision experiment [percentage]</td>
<td>16 [61.5]</td>
<td>10 [38.5]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Responses to the multidecision experiment of the subjects who did not make the profit-maximizing decision for the single-decision experiment</th>
<th>One investment decreased average profits, the other equaled average profits</th>
<th>One investment increased average profits, the other equaled average profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made profit-maximizing decision for multidecision experiment [percentage]</td>
<td>42 [53.9]</td>
<td>62 [72.9]</td>
</tr>
<tr>
<td>Did not make profit-maximizing decision for multidecision experiment [percentage]</td>
<td>36 [46.2]</td>
<td>23 [27.1]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Responses to the single-decision experiment of the subjects who made the profit-maximizing decision for the multidecision experiment</th>
<th>Presented as total profits</th>
<th>Presented as average profit (i.e., ROI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made profit-maximizing decision for single-decision experiment [percentage]</td>
<td>33 [78.6]</td>
<td>26 [60.5]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D. Responses to the single-decision experiment of the subjects who did not make the profit-maximizing decision for the multidecision experiment</th>
<th>Presented as total profits</th>
<th>Presented as average profit (i.e., ROI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made profit-maximizing decision for single-decision experiment [percentage]</td>
<td>59 [83.1]</td>
<td>45 [76.3]</td>
</tr>
<tr>
<td>Did not make profit-maximizing decision for single-decision experiment [percentage]</td>
<td>12 [16.9]</td>
<td>14 [23.7]</td>
</tr>
</tbody>
</table>

\[ a n = 52, p = 0.082, \text{ one-tailed Fisher exact test.} \]
\[ b n = 163, p = 0.009, \text{ one-tailed Fisher exact test.} \]
\[ c n = 85, p = 0.057, \text{ one-tailed Fisher exact test.} \]
\[ d n = 130, p = 0.227, \text{ one-tailed Fisher exact test.} \]

of the multidecision experiment. Forty-two of 78 subjects [53.9\%] made both investments in the condition where we expected the anchor to be stronger and 62 of 85 subjects [72.9\%] made both investments in the condition where we expected the anchor to be weaker [\( p < 0.01, \text{ Fisher exact test}. \)]

In panel C of Table 4, we find that subjects who did not profit maximize in the multidecision experiment were subject to the manipulation in the single-decision experiment. Of 41 subjects, 33 [78.6\%] forwent the investment when presented the investment data as profits and 26 of 43 subjects [60.5\%] forwent the investment when presented the investment data as averages (ROI) [\( p < 0.06, \text{ Fisher exact test}. \)]

Finally, in panel D of Table 4, we find that subjects who profit maximized in the multidecision
experiment were subject to the manipulation in the single-decision experiment. Of 71 subjects 59 [83.1%] forwent the investment when presented the investment data as profits, and 45 of 59 subjects [76.3%] forwent the investment when presented the investment data as averages (ROI). Although the difference is in the predicted direction and of meaningful magnitude, it does not test significant \[ p < 0.227, \text{Fisher exact test} \].

**Summary**

With two paper and pencil decision-making experiments, we find supportive evidence that many subjects anchor investment decisions on the past average performance of investments. In a single decision experiment, as expected, we find that the bias is pronounced when subjects are presented with performance data as averages (ROI) versus totals [profits]. We also find that the bias appears when subjects are presented with two investment decisions. This is consistent with our expectation that subjects use averages to make comparisons, and this invokes the anchor.

An advantage of our research design is that we can assess within-subject effects. We find that our results are not driven by astute/naïve subjects because there is sensitivity to the experimental manipulations within individuals. Moreover, it appears that individuals were sensitive to the manipulations that invoked the bias in one experiment, regardless of how they answered the other experiment.

**DISCUSSION**

We set out to analyze the possible reasons for the tendency of managers to make decisions on investment in new projects based on changes in ROI [i.e., change in average performance] rather than on NPV [i.e., marginal profits]. Several earlier studies documented the tendency to focus on ROI or internal rate of return (IRR) rather than on NPV without providing a mechanism to explain it [see, e.g., Aggarwal and Gibson, 1989; Ferraro and Taylor, 2005; Hermes, Smid and Yao, 2007; Mao, 1970; and Petty, Scott and Bird, 1975]. We argue that the anchoring heuristic is at work here. Practicing managers are anchored on their firms’ average profits so strongly that they tend to ignore the fact that positive NPV projects can increase total profits.

Support for this argument comes from our conversations with the Chairman and CEO of a Standard and Poor’s (S&P) midcap company. He mentioned that “no-brainer” decisions were the high-return investments. However, they were often small investments that would only marginally affect his firm’s overall profits. The difficult investment decisions were large-dollar investments that returned close to the cost of capital. These investments had the ability to have large profit impacts. However, they had to be managed carefully.

Finally, an example of the prevalence of the effect we demonstrate was reflected in the comments of two Executive MBA students who participated in the pilot study. In that study, we also asked subjects, to describe further if there would be other considerations in selling their decision to the board of directors or their senior management. Interestingly, two subjects mentioned that, although they would want to make the investment that increased total profits yet decreased average profits, they would not recommend the project to senior management because they didn’t think they could convince senior management that this was the correct thing to do. Apparently, they had experiences similar to the Coke example, brought in the introduction, where there was a focus on only considering projects that enhanced average profits.

**Alternative explanations**

Before concluding, we wish to highlight two alternative explanations for why managers would avoid making investments that increased profits, yet decreased average profits. Although these reasons are valid and consistent with profit maximization, we also discuss why we do not expect them to hold in our experimental setting.

First, managers might face investment constraints, such as limited capital or managerial resources to oversee projects. Here, optimizing managers would rank investments on their contribution to profitability and forgo profitable investments once constraints became binding. We do not believe this effect drives our results for the following reasons: (1) We are explicit in the instructions that such a constraint is not binding. (2) To the extent that subjects did not read or believe that constraints were not binding, we find that subjects equate the constraint with current average profits.
This reflects the anchoring mechanism central to our arguments; however, there is no reason to believe that this would necessarily be the point where the constraint binds.\(^7\) (3) Experiment 1 reflects a loss condition where the investment constraint would not be an alternative mechanism. With the loss-making investment in Experiment 1, it would not make sense to make this investment whether the firm was constrained or not.

Second, firms might have better noninvestment alternatives than low-profit investments. Here, firms would forgo profitable investments to find other uses for the capital. We do not believe this effect drives our results because we were explicit in the noninvestment alternatives. Moreover, to the extent this trade-off occurred, it again would appear to occur at the level of current average profits. There is no reason to believe that this would necessarily be the point where the alternative becomes more attractive and is consistent with the anchor of using changes in average profits.

Another alternative explanation is that subjects might believe that maximizing average profits is what the company assesses or rewards. As we previously noted, if a subject holds this belief then we should not observe the within-subject effects that we find. Nevertheless, there is the possibility that our experimental manipulations might suggest that average profits are assessed in some cases and not in others. For example, when we present average profits in the single-decision experiment, this could prime subjects into thinking that average profits are what the company assesses or rewards. Therefore, making investments based on average profits reflects that decision makers believe they would be assessed on this metric. There are two reasons why we do not believe this is the primary determinant for the results that we find. First, in the multidecision experiment, subjects were not more likely to make the nonprofit-maximizing assessment when presented with average versus total profit figures (Table 2B). Here it appeared the task advantages to using averages drove the result. If presenting averages lead subjects to believe that average profits are the performance metric they should assess, then we would expect to see this across experiments—and we do not. Second, in the single-decision experiment we observed that some subjects calculated averages when presented total profit figures and subsequently make the nonprofit-maximizing decision. Apparently it was the use of averages—but not being primed to use averages—that drove the outcome.

**CONCLUSION**

“Average” profitability measures such as ROI play an important and legitimate role in managerial decision making because they facilitate the comparison of investment alternatives. However, changes in average profit measures are not marginal effects, and attention to changes in averages can lead to systematic deviations from profit maximization. We demonstrate how focusing on changes in averages causes managers to anchor investment decisions on current performance.

We provide experimental evidence that MBA students—many of whom were practicing managers—were susceptible to this anchoring heuristic when asked to make a strategic investment decision. In the case of making an isolated decision, we find the bias more pronounced when decision makers have average performance metrics presented to them. We also find that the bias is pronounced when decision makers have to compare investment alternatives. Moreover, we find evidence that our experimental manipulations showed within-subject effects. This aids in ruling out alternative explanations based on subject skill as the driver of the results that we find.

Our findings suggest that the ways in which managers process investment decisions can lead to systematic biases in the outcomes. Anchoring has been demonstrated in many studies of managerial decision making. For example, Lant and Shapira (2008) show that the term expectation is a major organizing concept for professional economists; whereas, managers tend to focus on targets and aspirations. Targets are often set in a relative manner where a company’s performance is evaluated in relation to historical profitability (Baum et al., 2005; Greve, 2002). Recognizing that random fluctuations in the environment can lead to variations in performance over time, average performance is perceived as a much more stable and valid indicator of performance. Indeed, many companies

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\(^7\) Average profits would reflect the cutoff for current investments only if all investments have the same average return. Consider a situation where the average payoff was 11 percent. Unless all investments pay 11 percent return, then at least some investments have a return less than 11 percent. For example, if the firm has three investments with an average 11 percent return and one returns 12 percent; then at least one of the other investments must return less than 11 percent.


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advertize their average performance over different periods of time to help investors evaluate their value. This information is very accessible to managers and potentially enhances its role as an anchor when evaluating future projects.

As we show, anchoring on average performance is very powerful due to its accessibility and relevance. Anchoring has been recently shown to affect the way consumers pay their credit card debt (Stewart, 2009) and the way consumers and professional insurance agents evaluate the value of alternative insurance policies (Shapira and Venezia, 2008). Our study suggests that anchoring affects strategic decision investments as well.

One could argue that within corporations, if some decision makers are prone to the anchoring bias yet others are not, then we would not observe the effect central to our study. While this is possible, we believe it can still manifest or be organizationally important for the following reasons. The aggregate decision of a group of managers, where part of them are inclined to anchor on ROI and other are not, does not guarantee that in the aggregate the anchoring on ROI disappears. Not all decision makers have equal influence or power. Likewise, other biases have been shown to affect investor behavior and the market as a whole (e.g., De Bondt and Thaler, 1985). Thus, firms might have external pressure to anchor on average performance lending power to decision makers that anchor on ROI. Finally, even if these factors do not prevail, if some decision makers are subject to the bias, we expect that it prolongs the decision-making process and this is costly to organization—especially in terms of occupying managerial resources.

To conclude, we believe that better understanding the psychological processes underlying the ways managers make decisions within their job context can help explain strategy choices. This has benefits beyond enhancing our understanding of the strategic decision-making process. Understanding systematic determinants of strategy choice is also important to discern accurately how firm strategies affect performance (e.g., Shaver, 1998).

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REFERENCES


Foust D, Byrnes N. 2004. Gone flat: the good old days weren’t as good as you thought. That’s one more reason Coke’s latest CEO needs a bold new formula. Business Week 20 December: 76–82.


APPENDIX 1

Single-decision

Two conditions: (A) Data presented as totals, (B) Data presented as averages.

The following is a decision that we would like you to assess:

You work for a company that currently, after accounting for the cost of capital, has ([A] total losses of $1 million/[B] a return of −10%) on $10 million of invested capital.

You are asked for your opinion about the following project that is being considered.

The project will require $2 million of capital investment. After making this investment and accounting for the cost of capital, the expected performance of the firm will be ([A] losses of $1.08 million/[B] a return of −9%) on $12 million of invested capital.

You are recommended if the company should invest in this project.

The following information might aid your assessment.

- The risk profile of this project does not materially differ from the risk profile of your existing business.
- This is the only project that you have to consider at this time.
- Any decision that you make is not expected to aid or hinder your ability to make further investments should the opportunity arise.
- Any cash that the company does not use to make investments will be invested in liquid assets that have returns of about one percent [and experts do not think that the return for such instruments will materially change in the future].

Explain your decision [feel free to add any qualifications to your answer].

APPENDIX 2

Multidecision experiment

For presentational clarity, we present only one condition of the $2 \times 2 \times 2$ design. The condition is (a) one investment equals current ROI, one investment is greater than current ROI, (b) data presented as totals, (c) investments are of different size. The complete instrument is available upon request.

The following is a strategic investment decision that we would like you to assess:

You work for a company that currently, after accounting for the cost of capital, has total profits of $1 million on $10 million of invested capital.

You are asked for your opinion about the following two projects that are being considered.

Project A, which after accounting for the cost of capital, has an expected discounted return of $150,000 on a $1 million investment.

Project B, which after accounting for the cost of capital, has an expected discounted return of $100,000 on a $1 million investment.

Please recommend if the company should do Project A, Project B, both, or neither.

The following information might aid your assessment.

- Making either of these investments does not affect your ability to make the other.
- The risk profiles of these projects do not materially differ from each other or from the risk profile of your existing business.
- These are the only projects that you have to consider at this time.
- Any decision that you make is not expected to aid or hinder your ability to make further investments should the opportunity arise.
- Making either of these investments is not expected to affect the profitability of your existing operations.
- Any cash that the company does not use to make investments will be invested in liquid assets that have returns of about one percent [and experts do not think that the return for such instruments will materially change in the future].

Explain your decision [feel free to add any qualifications to your answer].