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ARTICLES

"What Goes Up Must Come Down"—How Charts Influence Decisions to Buy and Sell Stocks

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Five experiments examine how charts depicting past stock prices influence investing decisions. We expected investors to use extreme past prices depicted in charts as comparison standards to which expectations about future prices are assimilated. Investors should thus expect stocks depicted in a chart with a salient high to perform better than stocks depicted in a chart with a salient low. And as a consequence, investors should be more likely to buy and less likely to sell stocks depicted in a chart with a salient high than a low. Results of five experiments support this reasoning. Whether investors are private or professional and whether background information about the stock was limited or abundant, expectations about future prices assimilated to extreme past prices. Consequently, investors buy more and sell less when the critical chart is characterized by a salient high than a low. The implications of these findings for the core role comparison processes play in investing decisions are discussed.

"The Dow Jones Industrial Average was down 75 points today. It is now approaching its five-year low and is almost 35% below its all-time high."

"Microsoft stocks were hit by a major sell-out on Friday and currently trade at less than half their all-time high."

Statements like these are made virtually every day in all the media that cover Wall Street. Such brief summaries of what happened on the trading floor are typically accompanied by charts depicting how stock prices and indexes have developed over a given period of time. The wide use of such charts indicates that investors seem to view them as a valuable source of information and have a keen interest in the information they convey, namely how current prices relate to past ones.

Standard economic theory, on the other hand, assigns little informative value to such charts (Brealey, Myers, and Marcus [1999]). Prices have no memory, as the theory of efficient markets proclaims (Fama [1965, 1998]), and they develop at random. Thus, information about a stock's past valuation does not help predict its future development. This basic assumption of efficient market theory, however, stands in marked contrast to the content of financial news, and also to the basic principles of psychological research on human judgment and decision-making. One of the hallmarks of this research is that every judgment is comparative in nature (Eiser [1990]; Kahneman and Miller [1986]; Mussweiler [2003]). Whether people evaluate the luxury of their home, the speed of their car, or the taste of their favorite ice cream, they tend to rely on salient standards of comparison. Decisions as trivial as the choice between two chocolate bars and as essential as the choice between two career paths depend on how the critical alternatives compare to relevant standards.

Because investing decisions are above all decisions, they are unlikely to be an exception to this well established principle of the relativity of human judgment. Past stock prices provide particularly salient comparison standards that could be used as a basis for investing decisions. But why should investors use such prices if they are merely the product of a "random walk down Wall Street" (Malkiel [1973])?

Part of the answer may involve the complexity of investing decisions. When trying to decide what to do with their money, investors face a myriad of decisions. Should they invest in mutual funds, stocks, or bonds? How should they weigh these different investment types? Which particular fund, stock, or bond should they put in their portfolio? These decisions are

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painstakingly complex, not only because of the number of potential options but also because of the endless stream of information that comes with each one. Furthermore, investors also must decide when to invest. Markets fluctuate immensely, and investment success depends very much on timing—as any investor who bought an Internet stock in the spring of 2000 can confirm. In short, investing decisions are overwhelmingly complex.

Because of this complexity, investors cannot find the "best" possible investment. As in many domains of human judgment and decision-making, investors must "satisfice" (Simon [1956]), and be content with decisions that seem reasonably good. Judgmental heuristics—mental shortcuts that turn complex decisions into simple judgment tasks—are a major tool for satisficing (Tversky and Kahneman [1974]). In fact, the use of judgmental heuristics appears to prevail in virtually every domain of human judgment and decision-making (Gilovich, Griffin, and Kahneman [2002]): medical; juridical (Arkes [1991], Englich and Mussweiler [2001], Hogarth [1971]); and economic (Bazerman [2002], Thaler [1991]).

One particularly efficient and ubiquitous heuristic relies on the simplifying power of comparisons (Mussweiler [2003]; Mussweiler and Epstude [2003]). Judges often simplify a complex absolute judgment task by turning it into a simple comparative task. When asked to estimate the percentage of African nations in the UN, for example, judges may simplify their task by comparing the critical quantity to a previously provided standard (Tversky and Kahneman [1974]). In fact, abundant psychological research attests that comparisons are used as a simplifying judgmental device in a variety of domains (for overviews, see Mussweiler [2003] and Mussweiler and Strack [1999a]). These include price estimates (Mussweiler, Strack, and Pfeiffer [2000]; Northcraft and Neale [1987]), probability assessment (Plous [1989]), gambling and lottery evaluations (Chapman and Johnson [1994], legal judgment (Chapman and Bornstein [1996]; Englich and Mussweiler [2001]), and negotiation (Galinsky and Mussweiler [2001]).

For example, Mussweiler, Strack, and Pfeiffer [2000] asked experienced car mechanics to estimate the price of a used car. The mechanics were told that a friend of the seller had suggested the car might sell for about 5,000 German marks. All the mechanics ended up using this suggested price as a starting point for their estimates, even though the car was right in front of them and therefore they had all the relevant information at hand.

Comparisons with salient standards thus appear to influence price estimates even if relevant information is readily available. And in a situation of high uncertainty, in which relevant information is difficult to obtain or too abundant to process, comparisons with salient standards are likely to become even more influential (Jacowitz and Kahneman [1995]). Such a situation is clearly characteristic of investing decisions.

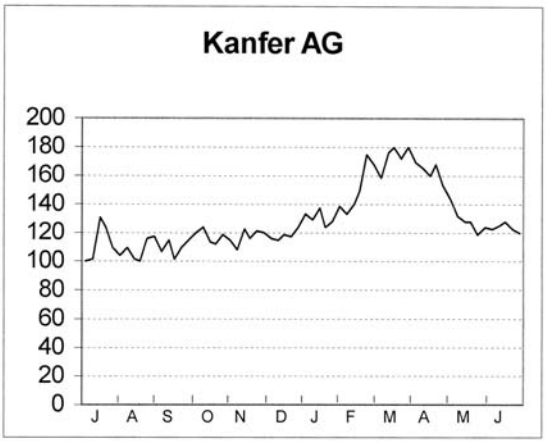
Just like human judgment in other domains, investing decisions are likely to be comparative in nature (Mussweiler [2003]). For example, in deciding whether to buy a particular stock, investors are likely to be influenced not only by the specific company but also by the current state of the economy. So comparisons with salient standards are also likely to have an effect. But which standards can be used for a comparative assessment of a potential investment? Where can investors find information about potentially relevant comparison standards that may simplify their investment decisions?

Charts constitute a particularly condensed source of standard information for what is arguably the core estimate for investment decisions—future share prices. In trying to arrive at this critical estimate, judges may consult the relevant economic data. The abundance and uncertainty of this data, however, make this a daunting task.

Alternatively, judges may use prior share prices—often depicted in charts—as comparison standards to estimate a target price. But when consulting such charts, investors may be confronted with a larger number of potential standards that could all be used as a judgmental basis for this estimate. Psychological research suggests there is one class of potential standards that is particularly likely to become influential: extreme points on the chart. In evaluating a particular event, people tend to rely primarily on their most extreme reactions (Kahneman [1999]). In much the same way, the most extreme values in a given chart are particularly likely to be used as comparison standards in estimating future share prices.

In a chart that includes a clear high (see Figure 1a), for example, this high is likely to be used as a compari-

FIGURE 1a
Examples of Charts with a Salient High Used in Experiements 1 to 5



son standard. In a chart that includes a clear low (see Figure 1b), on the other hand, the low is likely to be used as the standard. As is true for other domains of human judgment, the use of these comparison standards is likely to influence judges' estimates of future share prices and, as a consequence, their investing behavior.

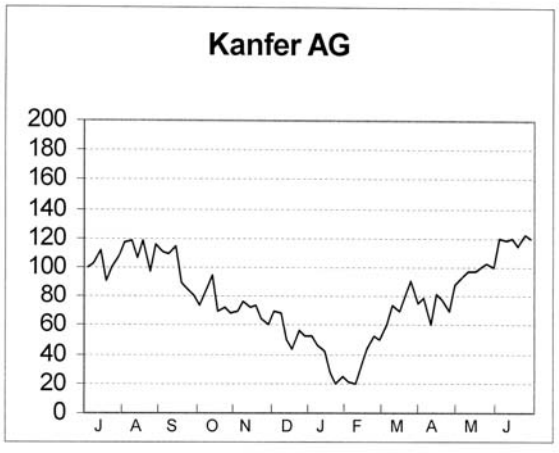
So in light of the psychological literature on the ubiquity and potency of comparison processes in human judgment (Mussweiler [2003]; Tversky and Kahneman [1974]), investing decisions are likely to be influenced by past prices as depicted in charts. This prediction is in clear contrast to the implications of efficient market theory (Fama [1965, 1998]). From this perspective, share prices reflect all relevant available information, so future prices follow a random walk and are thus independent of past prices.

But although prices may have no memory, as this perspective implies, investors do. In fact, it has been demonstrated that past stock prices do influence forecasts of stock prices (De Bondt [1993]), as well as buying and selling behavior (Andreassen [1988]; Schachter et al. [1987]). The direction of this influence, however, remains unclear. Some findings suggest that investors tend to go with the trend in their investing decisions. De Bondt [1993] has demonstrated that non-expert investors tend to expect recent trends in the stock market to continue, so they forecast higher stock prices in a rising bull market than in a falling bear market. This suggests that investors would be more likely to invest in the stock depicted in Figure 1b because there is a strong upward trend. Figure 1a is characterized by a strong downward trend, so in this case investors might expect lower prices for the future, which might keep them from investing.

Other findings, however, imply that investors tend to go against the trend. Andreassen [1988] shows that by default investors tend to sell when prices are high and buy when they are low. This suggests that investors would be more likely to invest in the stock depicted in Figure 1a than in Figure 1b.

So how does a salient comparison standard influence investor decisions to buy stocks? When are investors more likely to buy, if a chart is characterized by a high, or if it is characterized by a low? To answer these questions, we need to closely examine the psychological mechanisms that underlie comparative investing decisions.

FIGURE 1b
Examples of Charts with a Salient Low Used in Experiements 1 to 5



Comparison Processes and Consequences

Recent psychological research has demonstrated that the consequences of a given comparison depend on what knowledge about the judgmental target is sought, used, and rendered accessible during the comparison process (Mussweiler [2003]). Judges appear to compare a target to a given standard by selectively searching for and retrieving information indicating that the target value is similar to the standard (Mussweiler and Strack [1999b]). A judge who estimates the average price of a new car in comparison to a high standard of $30,000, for example, selectively searches for and activates information indicating that the average price is close to $30,000 (Mussweiler and Strack [2000]). He may bring to mind the prices of expensive German cars or SUVs, rendering such standard-consistent knowledge at the forefront of his mind. Ultimately, a judge who has considered a fairly high standard will provide a high estimate.

Conversely, a judge who uses a low standard of $10,000 will search for and activate information implying a low price, such as the costs of small Korean vehicles. As a consequence, such standard-consistent information will become easily accessible, and may result in a fairly low estimate. Because judges selectively search for and activate information that is standard-consistent, this selective accessibility mechanism (Mussweiler [2003]; Mussweiler and Strack [1999b]) leads to an assimilation effect—judgments are moved toward the comparison standard. Such assimilative consequences have been demonstrated across many domains of human judgment (for an overview, see Mussweiler [2003]).

Applying this selective accessibility mechanism to comparative investment decisions suggests that investors may equally assimilate their future share price estimates to the salient comparison standard. In particular, an investor who is confronted with a high past price when estimating the future price of a share may selectively search for and activate information implying a fairly good performance of the stock. Again, this renders the standard-consistent knowledge accessible, building the basis for the investor's estimate of the future share price. And if an investor expects good performance from the stock, this may increase the likelihood that he will invest.

An investor who is confronted with a salient low comparison standard when evaluating the potential of the exact same stock, however, will tend to selectively focus on information implying a poor performance, and guide his investment decision accordingly. In a nutshell, this assimilative influence on comparative investment decisions follows the rule that what was up must go up, and what was down must come further down.

The Present Research

We examined this assumed influence that salient comparison standards provided by charts have on investing behavior. We use a simplified experimental stock market to directly manipulate the critical comparison standards suggested by the chart and control for other influences. Such laboratory markets are an important complement to field data (see Caginalp, Porter, and Smith [2001]), and allow for a more direct test of causal influences.

Participants were provided with real information about stocks pertaining to the general economic situation and specific companies. The information was taken from one of the leading German online brokers. The background information was held constant for all participants, but we varied the nature of the chart that depicted the ostensible development of the share price within the last twelve months.

About half the participants received a chart characterized by a high (see Figure 1a); the other half received a chart characterized by a low (see Figure 1b). After inspecting the chart and the background information, participants were asked to make an investing decision. In particular, they were asked to estimate the twelve-month target price for the stock, and decide whether they would like to buy or sell it and by how much. If our reasoning is correct, participants should use the salient high or low as a comparison standard, and assimilate their future stock price estimate toward it.

Five experiments tested for this dependency. Experiments 1 through 4 used experienced private investors as participants. In Experiments 1 through 3, the investors received only basic information about the stocks. In Experiment 4, they received the complete information that could be obtained from a leading online broker. Experiment 5 then uses professional investors that again received complete information.

Experiment 1 examines how charts influence investor estimates of stock target prices. If the chart of the critical stock is characterized by a high, we expect the estimates to be higher. We also expect investors to be less likely to sell the stocks when confronted with a high chart. We examine this possibility in Experiment 2. Experiments 3 through 5 then examine how the charts influenced investor decisions to buy stocks. We expect investors to invest more if the chart is characterized by a high than a low.

In addition to these effects on investment behavior, we also examine its underlying mechanism. In Experiment 5, we examine whether considering charts with highs versus lows increases the accessibility of a specific subset of information about the stock.

Experiment 1

Method

We recruited thirty-four business and economics students at the University of Würzburg as participants. Each had at least one year of experience in investing ($M = 4.49$, $SD = 3.63$). They were approached while working in individual cubicles in the library and were asked to participate in a brief study on investing behavior. Upon agreement to participate they were handed the experimental materials and asked to read the instructions carefully.

Participants were told to imagine the following scenario. A close friend was planning to invest in two stocks that the participants had been following for a long time. Before making an investing decision, the friend asked for their best estimate of the stock's target price in twelve months. Participants were further informed that we would provide them with some information about the current situation of the stock market as well as about the two companies.

The general information consisted of four brief statements with mixed implications. The information about the companies consisted of half a page of written text as well as a graph depicting the development of the share prices over the last twelve months. In the written text, the field, products, and clients of the company as well as its basic economic figures (net income and increase) were introduced. The chart involved either a clear high or a clear low (see Figure 1). The stocks depicted in both charts had the same start and end values so that both had provided identical profits (20%) over the last twelve months. The order of presentation, company description, and charts were counterbalanced, so that all charts were presented in both positions and with both company descriptions across participants. At the bottom of each of the two pages introducing the stocks, participants were reminded to provide their best estimate of the stock's price in twelve months. Subsequent to the two investment decisions, participants were asked a series of questions about their demographic background and investing experiences.

In sum, Experiment 1 is based on a one-factorial (Chart: High versus Low) within-subjects design.

Results and Discussion

The results confirm our hypothesis. Participants provided higher target prices if the chart was characterized by a high ($M = 132.27$, $SD = 29.96$) than a low (M

= 112.41, *SD* = 35.37), $t(33) = 2.6$, $p < 0.02$. These findings indicate that investor expectations about future stock prices are influenced by the nature of the chart depicting past prices. Note that the critical information about the two target stocks was counterbalanced across participants, so that on average the two stocks were identical. However, participants still estimated the future price to be higher if past prices were shown in a chart with a high rather than with a low. Thus, participants assimilated their expectations about the future performance of the stock toward the salient comparison standards. Participants' different expectations should further influence their investing decisions.

Experiment 2

Method

In our second experiment, we examined whether investor decisions to sell are influenced by the nature of the chart depicting *past* stock prices.

We recruited twenty-two business and economics students at the University of Würzburg. They had an average of 3.1 years (*SD* = 2.47) of experience with the stock market. They were approached while working in individual cubicles in the library and asked to participate in a brief study on investing behavior. Upon agreement to participate they were handed the experimental materials and asked to read the instructions carefully.

In the instructions, participants were told to imagine the following scenario. One year ago, they had invested in two stocks and were now reevaluating whether they should keep them. As in Experiment 1, participants were informed that we would provide them with some information about the current situation of the stock market and about the two companies. The information and the two critical charts were identical to those used in our first experiment. Again, the order, company description, and charts were counterbalanced, so that all charts were presented in both positions and with both company descriptions across participants. At the bottom of each of the two pages introducing the critical stocks, participants were informed that they possessed a total of 100 shares of the two stocks and were asked to indicate whether and how much they would like to sell. After making their investment decisions, participants were asked the same questions concerning their demographic and investing background as in Experiment 1.

In sum, Experiment 2 is based on a one-factorial (Chart: High versus Low) within-subjects design.

Results and Discussion

Our results again confirmed our hypothesis. Participants sold more shares if the chart was characterized by a low (*M* = 52.46, *SD* = 41.99) than a high (*M* = 22.05, *SD* = 30.03), $t(21) = 2.4$, $p < 0.03$.

These findings indicate that investor decisions to sell stocks are influenced by the nature of the chart depicting past stock prices. Thus the influence of charts is not limited to expectations and target prices; it is also apparent in selling behavior. Our next experiment examines whether buying behavior is also influenced in this way.

Experiment 3

Method

We recruited fourteen business and economics students at the University of Würzburg. Each had at least three years of experience in investing (*M* = 5.57, *SD* = 1.60). They were again approached while working in individual cubicles in the library and asked to participate in a brief study on investing behavior. Upon agreement to participate they were handed the experimental materials and asked to read the instructions carefully.

Participants were told to imagine the following scenario. They were planning to invest in the stock market and had followed the prices of two particular stocks for a long time. They could invest a maximum of 12,000 German marks in each stock (about U.S. $5,000 at the time), but they had to decide whether to buy. Participants were further provided with the same background information and charts used in the previous studies. At the bottom of each of the two pages introducing the critical stocks, participants were reminded that they could invest up to 12,000 marks in each stock, and asked to indicate how much they would like to invest now. Subsequent to the two investment decisions, participants were again asked questions about their demographic and investing background.

In sum, Experiment 3 is based on a one-factorial (Chart: High versus Low) within-subjects design.

Results and Discussion

Our results are again consistent with our hypothesis. Participants invested more in the stock if its chart was characterized by a high (*M* = 6,571, *SD* = 3,524) than a low (*M* = 2,143, *SD* = 3,697), $t(13) = 3.13$, $p < 0.01$.

Together with Experiments 1 and 2, these results indicate that investing behavior is influenced by charts in important ways. Investors have higher expectations of future stock prices if past prices are depicted in a chart with a salient high. As a result, they are less likely to sell and more likely to buy.

Note also that the size of these effects is quite substantial. In Experiment 2, investors sold more than twice as much stock if the chart they were given was characterized by a low. In Experiment 3, participants

invested more than three times as much in the stock if the chart was characterized by a high.

These experiments provide converging support for the assumption that charts are an important determinant of investing behavior. One criticism, however, pertains to the richness of the provided information. It has been suggested that judgmental biases are primarily apparent in environments where relevant information is scarce (e.g., Hogarth [1981]). Notably, participants received considerable relevant information about the critical stocks in Experiments 1 through 3. Still, one could argue that they had less information than they would have in real life.

To demonstrate that the effects of charts on investing behavior are not limited to situations of restricted information, we provided judges with even more information in our subsequent studies. In particular, participants received all the information about a critical stock that is provided by one of the leading German online brokers. Participants in our last two studies are thus in the same situation in which online investors typically make their investment decisions.

Experiment 4

Method

We recruited thirty-two business and economics students at the University of Würzburg as participants. Each had at least one year of experience investing in stocks or mutual funds (M = 3.27, SD = 2.11). They were approached while working in individual cubicles in the library and asked to participate in a brief study on investing behavior. Upon agreement to participate they were handed the experimental materials and asked to read the instructions carefully.

The materials were similar to those used in Experiment 3, with two exceptions. First, participants only invested in one stock. Second, they were provided with much richer information about the stock. The general scenario was similar to Experiment 3. Participants were again asked to imagine that they had 12,000 German marks to invest and that they had followed the critical share price for a long time. This time, they were provided with all the information about an actual German stock available from the Internet resources of a major German online broker. Only the name of the company and any references that could identify it were eliminated. This information included about one and a half pages of written text about the field, the products, the subsidiaries, and the customers of the company. In addition, the key economic figures for the past four years (e.g., earnings per share, operating profit, net income, total revenues) as well as analyst expectations for the future (e.g., cash flow) were provided on two pages. The information included one of the two charts used in the previous studies.

Half the participants were given the chart including a high, and the other half received the chart including a low. Again, participants were reminded that they could invest a maximum of 12,000 marks in the stock and asked to indicate how much they would like to invest. Subsequent to their investment decisions, participants answered the questions about their demographic background and investing experience.

In sum, Experiment 4 is based on a one-factorial (Chart: High versus Low) between-subjects design.

Results and Discussion

Our results were again consistent with our expectations. Participants invested more if the chart was characterized by a high (M = 6,250, SD = 3,825) than a low (M = 3,755, SD = 2,721), $t(30) = 2.13$, $p < 0.05$.

These findings replicate those of Experiment 3 under conditions of richer information. They seem to suggest that even if investors are provided with all the information typically available to online investors, their decisions to buy stocks depend on the nature of the chart. The amount of available information does not seem to influence investing decisions as much as whether charts involve a high or a low.

Experiment 5

Method

The preceding experiments used private investors as participants. All four studies demonstrate that the investing decisions of these private investors were reliably and substantially influenced by charts. The effect of salient highs and lows is akin to the so-called anchoring effect, in that investor estimates of stock target prices are assimilated toward the salient comparison standard (i.e., the high or the low). Such anchoring effects have been found to influence the judgments and decisions of novices and experts alike (e.g., Englich and Mussweiler [2001]; Northcraft and Neale [1987]). But is this also the case for professional investors? Although the participants of Experiments 1 through 4 were all students of economics or business and had substantial experience with the stock market, one could argue that they are too naïve and inexperienced to base their investing decisions on information other than such normatively irrelevant information in the charts. In our final experiment, we examined whether the investing decisions of professional investors are also influenced by charts.

Experiment 5 was also designed to shed some light on the mechanisms that underlie the effects charts have on investing decisions. Our analysis suggests that the assimilative influence of chart highs and lows on buying and selling behavior are produced by changes in the informational basis used to make the investing de-

cision. In considering a high as a comparison standard when making an investment decision, investors primarily think of standard-consistent information, information that implies a good performance of the stock. And in considering a low as a comparison standard, they primarily consider information that implies poor performance. From a selective accessibility perspective (Mussweiler [forthcoming]), this selectivity in the activation and use of information is responsible for the resulting differences in investing decisions.

To examine the role informational selectivity may play in the genesis of these effects, we examined what information investors had about the stock at the forefront of their mind after making the investing decision. If our reasoning is correct, then investors who had been confronted with a high should primarily be considering information implying good performance. Investors given a low, however, should be thinking of negative aspects.

We recruited twenty investment professionals as participants. All worked for a major German bank, mostly advising clients in investment decisions. Participants had an average of 9.2 years of experience in the stock market ($SD = 5.38$). They were recruited while attending a vocational training seminar on investing-related topics.

Participants received the same materials as in Experiment 4. They were again provided with rich information about one company and told they could invest a maximum of 12,000 marks in the stock. Half the participants were given the chart including a high, the other half were given the chart including a low.

After participants had made their decisions, we asked them to justify their investments. In particular, they were instructed to list those characteristics of the stock that had led them to invest the amount they had. Subsequently, participants were asked a series of questions about their demographic background and their investing experiences.

In sum, Experiment 5 is based on a one-factorial (Chart: Peak versus Low) between-subjects design.

Results and Discussion

Once again, our findings exactly matched our expectations. The investment decisions of the professional investors seemed to be strongly influenced by the charts. Participants invested more if the critical stock was depicted in a chart characterized by a high ($M = 4{,}500$, $SD = 2{,}759$) rather than a low ($M = 1{,}200$, $SD = 2{,}699$), $t(18) = 2.7$, $p < 0.02$.

To examine whether this effect on investing decisions might be produced by mechanisms of selective accessibility, we further analyzed participants' justifications of their investment decisions. If the investing effect is produced by a selective increase in the accessibility of critical information about the stock, then participants confronted with the high chart should list more positive and less negative aspects of the stock, and vice versa.

An independent rater who was blind to experimental conditions counted the number of positive and negative aspects listed by each participant. These aspects were combined into a single measure by subtracting the number of negative from the number of positive aspects. The higher the value of this difference score, the relatively more positive aspects were mentioned.

Participants who received the high chart mentioned more positive aspects ($M = 0.3$, $SD = 2.21$) than participants who received the low chart ($M = –2.4$, $SD = 2.5$), $t(18) = 2.55$, $p < 0.02$. This suggests that participants selectively focused on those aspects of the stock that were consistent with the salient high. For participants who received the high chart, knowledge indicating that the stock may be a good investment was more accessible. For participants who received the low chart, knowledge indicating that it might be a bad investment was more accessible.

We further examined whether this selective accessibility effect mediates the effect on investing behavior. Baron and Kenny [1986] recommend a series of three regression analyses to establish mediation. First, the mediator (the implications of accessible knowledge about the stock) is regressed on the independent variable (the chart). Second, the dependent variable (the amount invested) is regressed on the independent variable. And, finally, the dependent variable is regressed on both the independent variable and the mediator.

The first regression analysis reveals that the chart (the independent variable) affected the implications of accessible knowledge about the stock (the mediator), $\beta = –0.52$, $p < 0.02$. The second regression analysis demonstrated that the chart affected how much participants were willing to invest (the dependent variable), $\beta = –0.54$, $p < 0.02$. The third revealed that if the dependent variable is regressed on both the moderator and the independent variable, the amount invested is only significantly affected by the implications of accessible knowledge, $\beta = 0.72$, $p < 0.001$, not the chart, $\beta = –0.16$, $p < 0.4$. Thus, when controlling for the implications of accessible knowledge, the influence of the chart on investing decisions is reduced to non-significance.

Moreover, a Sobel [1982] test demonstrated that the effect the chart had on participants' willingness to invest was significantly reduced when controlling for the effect of the implications of accessible knowledge about the stock, $Z = –2.21$, $p < 0.03$. This pattern suggests that the effects of the chart on investing decisions are partially mediated by its effects on the implications of accessible knowledge about the stock.

These findings demonstrate that the charts influence more than just the investing decisions of private investors. The investing decisions of professional investors are assimilated toward the salient highs and lows of the charts in much the same way as those of

their amateur counterparts. Furthermore, these findings provide initial insight into the mechanisms that may be responsible for these effects. Consistent with our theoretical analysis as well as abundant evidence on the mechanisms underlying comparison effects in other domains (Mussweiler [2003]), mechanisms of selective accessibility may contribute to the obtained effects. Clearly, however, our measure of selective accessibility does not provide for a stringent test and may be open to additional influences. For example, there may have been a tendency for participants to report information consistent with their investing decision. To rule out such alternative mechanisms, a more direct measure of accessibility, such as the lexical decision tasks in our previous research must be applied (e.g., Mussweiler and Strack [2000]). Still, these findings are quite consistent with a selective accessibility perspective on comparative investing, and suggest that informational selectivity may play an important role in this context.

General Discussion

We have examined how charts influence investing decisions. Starting from a social cognitive perspective on human judgment, we expect investing decisions, just like decisions in other domains (Mussweiler [2003]), to depend on comparisons with relevant standards. One particularly rich source of standard information is provided by charts depicting the past development of share prices. Recent psychological research allows us to identify which points in the chart are likely to be used as comparison standards, and in what direction the comparison will influence investing decisions.

First, extreme points in the charts are especially likely to be used as a comparison standard (Kahneman [1999]). Second, such a standard is likely to influence investing decisions in an assimilative way (Mussweiler [2003]; Mussweiler and Strack [1999b]; Tversky and Kahneman [1974]). Our results support this reasoning. They suggest that investor expectations about future stock prices are assimilated to a salient high or low in the chart, so that investors given a chart with a high expect the stock depicted to perform better, and vice versa. As a consequence, investors are more likely to buy and less likely to sell if the critical charts are characterized by a high than by a low. This is true for situations with limited as well as abundant background information about the stock and for private and professional investors.

Furthermore, our data provide some initial evidence about the mechanism that might be responsible for this assimilative influence. Consistent with abundant evidence on the mechanisms underlying comparison effects in other domains (Mussweiler [2003]), salient highs and lows may influence investing decisions via mechanisms of selective accessibility. Investors may assimilate their estimates of future stock prices toward the salient high or low because they selectively focus on information suggesting that future stock prices will approach past standards. The exact mechanisms that underlie this assimilative investment effect, however, need to be further examined in future research.

These findings are related to previous work on the effects of time series data on investing decisions. De Bondt [1993], for example, demonstrated that non-expert investors tend to expect recent trends in the stock market to continue, so they forecast higher stock prices in a rising bull market than in a falling bear market. Aside from this trend, our data suggest that salient comparison standards in a chart constitute an additional influence in the opposite direction. In our studies, participants expected future stock prices to assimilate to the past extreme rather than to develop with the trend. Because the charts we used also included clear trend information, we believe the effects of salient comparison standards of a chart are stronger than those of its trend.

Although the generality of this finding remains to be examined, the results of Andreassen [1988] point in a similar direction. He demonstrated that by default investors tend to sell when prices are high and buy when they are low. Rather than expecting a trend to hold, investors thus expected stock prices to return to their previous levels, much as our participants expected future stock prices to return to previous extremes. In contrast to our experimental setup, the paradigm of Andreassen [1988] did not provide investors with extended information about past prices, however. Andreassen [1988] established a "trading game" in which participants were confronted with the current price of the stock as well as the current price change. Consistent with our findings, this research demonstrated that past prices exert a stronger influence on investing decisions than trends.

In this respect, both bodies of evidence demonstrate that past prices influence decisions to buy and sell stocks when the time frame is relatively narrow and involves only a few trades, and when it is relatively wide and involves long periods of time (e.g., one year as depicted in our charts). Comparisons with salient past prices may thus constitute a ubiquitous influence on investing decisions.

But which potential standard is likely to have the strongest effect on investing decisions? For example, will the recent prices examined by Andreassen, or the past extreme prices examined here, primarily influence whether investors buy or sell stocks? Although research on comparison processes implicitly assumes that judges select one single standard for comparison, more recent evidence suggests this is not typical (Rüter and Mussweiler [2003]). In particular, judges appear to engage in a series of comparisons with different standards when evaluating a given target. Judges evaluat-

ing a specific luxury car, for example, appear to activate comparison information about a series of different standards (Mercedes, BMW, Porsche) rather than a single standard. In much the same way, they may also use different past prices to evaluate a given stock.

The psychological literature suggests at least three kinds of past prices that are likely to have an effect. The extreme prices we focused on here are the first. Similarly to pain evaluation, which Kahneman [1999] has shown is influenced primarily by the most extreme pain experience, stock evaluation appears to be influenced by the most extreme past prices. And recent prices, such as those examined by Andreassen [1988], are likely to be influential, because they are particularly accessible in investors' minds (Higgins [1996]).

Finally, prospect theory (Kahneman and Tversky [1979]) suggests that the buying price of a stock is likely to be another influential standard of comparison. Because people are motivated to prevent losses, they are likely to compare the current price of a stock they own with the price at which they bought it. Although psychological research thus allows us to determine multiple types of standards that may be used as a basis for investing decisions, the exact interplay remains to be examined.

Past stock prices, however, are not the only salient comparison standard to evaluate a stock. It has been shown that people do not rely exclusively on temporal comparisons when evaluating themselves (Ross and Wilson [2002]); they also tend to use information about other people by engaging in social comparison (Festinger [1954]). And investors may also use information about other stocks to evaluate a target stock. An investor considering buying Daimler Chrysler, for example, may examine how it has developed in the past, how its current price compares to salient past prices, and also information about other stocks related to it, such as Ford or General Motors.

Investing decisions may thus be essentially comparative in nature, as future research will need to investigate further.

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