Because people are irrational in systematic and predictable ways, decision-making processes can be an important driver of investing success if they mitigate biases and enhance objectivity. However, there is little consensus on the best approach to making investment decisions. Many investors rely on informal intuitive decision making guided by unreliable mental narratives, which are automatically generated stories that seemingly explain the immediately available data points. Our perception of evidence is naturally distorted to be artificially coherent with these narratives, so this approach often leads to biased, overconfident choices. At the other end of the spectrum, “black box” quantitative, factor-based investing, driven by statistical inputs and purely algorithmic processes, typically forgoes the benefit of differentiated forward-looking views based on fundamental research and expertise.

In this research paper, we advocate the use of investment frameworks that adopt a hybrid approach, taking inputs based on forward-looking expert insight, and mechanically combining them to drive investment decisions. We believe such an approach should reduce the influence of pernicious biases without relinquishing the potential added value from proprietary forward-looking expertise. We also argue that investment frameworks are potentially much more effective if they decompose the problem into several small steps and their forward-looking inputs incorporate multiple scenarios, which should further mitigate biases and overconfidence.
Summary

Because people are irrational in systematic and predictable ways, decision-making processes can be an important driver of investing success if they mitigate biases and enhance objectivity. In fact, we believe that superior decision making may be a more powerful asset than an information advantage in equity investing, particularly with the advent of electronic dissemination of information and regulations intended to control differential access to information. However, there is little consensus on the best approach to making investment decisions.

Many equity investors rely on relatively unstructured, intuitive decision-making approaches that are largely guided by mental narratives, which are quickly and automatically generated stories that seemingly explain the immediately available evidence. Some investors embrace the intuitive nature of their decisions, believing their intuitions represent a competitive advantage, while other investors believe that they can overcome the potential pitfalls of intuitive biases by conducting thorough, objective analyses of the evidence before arriving at their conclusions. However, scientific research suggests that both camps are operating on questionable premises.

As we shall explain, intuition alone is unlikely to produce consistently sound judgments in the field of investing, which rarely offers the reliable cues or clear, timely feedback necessary for the development of expert intuition. What’s more, we generally cannot detect, let alone correct, the influence of biases on our decisions. Without intent or even awareness, we tend to automatically distort our perception of evidence to be artificially coherent with our dispositions, enabling us to rationalize mistakes. As a result, we often overconfidently reach and stick with decisions that are consistent with misleading mental narratives, so informal intuitive decision-making does not reliably lead to optimal choices, no matter how hard we try to be objective.

At the other end of the spectrum, some equity investors strive to avoid the influence of cognitive biases by eliminating all subjectivity from their processes. “Black box” quantitative factor-based investing is typically driven by statistical inputs and purely algorithmic processes. Such approaches may mitigate the impact of intuitive biases, but they may do so at a great cost, forgoing the benefit of any differentiated forward-looking views based on fundamental research and expertise. Because the value of a stock is a function of future cash flows, we believe forward-looking fundamental views are crucial to adding value in equity investing, even if they are inherently subjective, so purely quantitative automated approaches also have drawbacks.

In this report, we advocate the use of investment frameworks that adopt a hybrid approach—using forward-looking expert insights and mechanically combining them to drive investment decisions. Scientific research suggests that the primary weakness of unstructured intuitive decision making is that humans are unable to make consistently good decisions when informally combining and weighing multiple data points. On the other hand, an objective combination of inputs by a formalized model has a much stronger track record.

An investment framework that mechanically combines and weighs expert-driven inputs should reduce the impact of biases to more consistently produce objective decisions and make it more difficult to rationalize poor choices, without relinquishing the value of expert insights and out-of-consensus views. We also hold that investment frameworks are likely to be much more effective if they decompose the problem into several smaller steps and their forward-looking inputs incorporate multiple scenarios, which should further mitigate biases and overconfidence.

Despite our enthusiasm, we recognize that a framework by itself is not a panacea, nor does it diminish the investor’s importance as a valuable source of expert insight. Rather, it is a tool for handling certain types of mechanical processing, much like a calculator or spreadsheet. No matter how well we design a framework, the quality of the decisions it produces can be only as good as the quality of the inputs provided. A framework is unable to remedy faulty inputs reflecting inadequate research or expertise.
The Importance of Decision-Making Processes in Investing

What do we believe is the key to outperformance in equity investing? If we assume that all investors are able to make rational investment decisions based on the information at their disposal, then we can infer that superior information is the key to outperformance. Certainly, investors operating at a disadvantage in terms of information and expertise will find it difficult to compete. But let’s revisit the assumption that investors are able to make rational decisions. Studies from the field of judgment and decision making have demonstrated conclusively that people are actually irrational in systematic and predictable ways. It is not that they lack the desire or intelligence to make good decisions; it is that human nature prevents them from doing so.

Led by the pioneering work of Nobel laureate Daniel Kahneman and the late Amos Tversky, researchers have identified a litany of innate biases that can lead to severe errors and irrational decisions. Many biases arise from our reliance on potentially misleading cognitive heuristics, which are simplifying “rules of thumb” that serve as mental shortcuts. Other sources of irrationality include our preference for consistency, our susceptibility to emotions and wishful thinking, and the influence of framing effects and social factors. An exhaustive catalog of different types of biases is beyond the scope of this paper, but the key point is that they can compromise our objectivity on virtually any issue while we remain blissfully unaware. As observed in the Harvard Business Review, “What makes all these traps so dangerous is their invisibility. Because they are all hardwired into our thinking processes, we fail to recognize them—even as we fall right into them” (Hammond et al. 1998). Once biased in the direction of a particular choice, the rest of the decision-making process becomes largely an exercise in rationalizing and building overconfidence in that choice.

We often cannot detect, let alone correct, the impact of biases on our decisions because so much of the mental processing supporting our perceptions and judgments is performed outside of our awareness by an efficient autopilot-like system. As researcher Timothy Wilson explains, “The mind operates most efficiently by delegating a good deal of high-level, sophisticated thinking to the unconscious, just as a modern jumbo jetliner is able to fly on automatic pilot with little or no input from the human, ‘conscious’ pilot” (Wilson 2002). The nonconscious processes handle much of the on-the-fly heavy lifting, which would overwhelm our slow, deliberate, conscious thinking. In other words, “a lot of the interesting stuff about the human mind—judgments, feelings, motives—occur outside of awareness for reasons of efficiency,” observes Wilson. However, “That is not to say that nonconscious thinking always leads to accurate judgments,” he cautions. Just as an autopilot system is not appropriate for all flying conditions, our unconscious thinking is not reliable for all types of judgments. Problems arise because, even when it is not up to the task, it still influences our decision, potentially pushing us away from the optimal choice, without our awareness.

There is a tendency to erroneously attribute our decisions solely to our conscious, deliberate thought processes because they command our attention and effort. It makes perfect sense that our mental processes seem largely conscious because the conscious portion typically is all that we notice, but clearly we are missing much of the picture. The influence of nonconscious thinking is invisible, but it is very real and unavoidable. As a result, according to Wilson, “we know less than we think we do about our own minds, and exert less control over our minds than we think” (Wilson 2002). It seems as though we can make unbiased choices based purely on our analytical reasoning, but in reality our judgments are shaped by both conscious and nonconscious mental processes.

A Story of Two Systems

Daniel Kahneman explains these two contrasting modes of thought in detail in his book Thinking, Fast and Slow. He refers to the unconscious, automatic system as System 1, while he refers to our conscious, deliberate thinking as System 2. In Exhibit 1, we summarize some of the key characteristics of these two systems. System 1’s properties indicate that it tends to achieve a high degree of efficiency at the expense of consistent accuracy, so its influence may lead our conscious judgments and decisions astray. Specifically, according to Kahneman, System 1 operates by spontaneously constructing stories that, based on the evidence at hand, are as coherent as possible. Because System 1 does not account for information that it does not have and is not prone to doubt, System 1 tends to suppress ambiguity. As a result, Kahneman refers to System 1 as a “machine for jumping to conclusions,” especially if those conclusions are consistent with our preexisting expectations and desires. Indeed, it “runs ahead of the facts in constructing a rich image on the basis of scraps of evidence” and “will produce a representation of reality that makes too much sense” (Kahneman 2011).

System 1’s artificially coherent narrative can be problematic because, unless there is overwhelming evidence to the contrary, System 2 tends to endorse or rationalize this narrative as the basis for our judgments and decisions. In other words, in the absence of clear-cut evidence, System 1 is often the de facto decision maker. In such situations, System 2 generally will be confident that it has arrived at an unbiased, analytical decision, but in reality, it has merely rubber-stamped an

<table>
<thead>
<tr>
<th>Exhibit 1</th>
<th>Dual-System Model of Mental Processing</th>
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<tbody>
<tr>
<td><strong>System 1</strong></td>
<td><strong>System 2</strong></td>
</tr>
<tr>
<td>Fast</td>
<td>Slower</td>
</tr>
<tr>
<td>Automatic</td>
<td>Controlled</td>
</tr>
<tr>
<td>Effortless</td>
<td>Requires effort</td>
</tr>
<tr>
<td>Autopilot</td>
<td>Requires attention</td>
</tr>
<tr>
<td>Unconscious (invisible to us)</td>
<td>Conscious (who we think we are)</td>
</tr>
<tr>
<td>Influences System 2</td>
<td>Often unaware of System 1’s influence</td>
</tr>
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</table>

This information is for illustrative purposes only.
intuitive response. The evidence is rarely one-sided in stock picking, so investors are particularly susceptible to decisions guided by System 1’s unreliable stories rather than an objective analysis of risk and reward.

Any doubts that System 1’s intuitions can exert such influence over our decisions may be dispelled by the results of an intriguing experiment, highlighted by Kahneman, in which researchers showed subjects “pictures of men’s faces, sometimes for as little as one-tenth of a second, and asked them to rate the faces on various attributes, including likeability and competence.” The subjects did not know this, but the pictures happened to be the campaign portraits of politicians. It turns out that, in 70% of electoral races, the winner was the candidate whose face had received a higher competency score, which happened to correlate with a strong chin and a slight smile. This type of study has been replicated in numerous countries, so the result was neither a fluke nor driven by culture-specific factors.

In this experiment, the face ratings were reflexive snap judgments, clearly the domain of System 1, but they were significantly predictive of actual voting choices, presumably analytical decisions controlled by System 2. It seems that, in this context, System 1 quickly jumps to a conclusion about a candidate’s competency based simply on facial appearance, and, more often than not, System 2 endorses that view of the candidate, unaware that the voting decision actually was guided by the candidate’s facial structure. Because System 1 operates outside of our consciousness, we cannot tell when its intuitions drive our decisions, but they often do.

Pre-decisional Distortion

At this point, you may be thinking that System 1’s intuitions may mislead us if our decision making is careless, but that we can overcome such specious influences if we simply take our time and conduct a thorough, objective analysis before settling on a choice. However, that is not nearly as easy as it sounds due to a phenomenon called pre-decisional distortion. As Cornell University’s Edward Russo explains, “After a tentative disposition emerges based on the initial information, new information is biased or ‘distorted’ to support it. That is, the new information is interpreted and evaluated as more supportive of the emerging, tentative disposition than it should be” (Russo and Yong 2011). In other words, if System 1 already has us leaning in one direction, it is no longer possible to be truly objective during System 2’s subsequent deliberate analysis, as illustrated in Exhibit 2.

Russo demonstrated such pre-decisional distortion in a study which involved the subjects choosing between pairs of restaurants. He was able to “show that participants can be induced to select a self-identified inferior alternative merely by using information order to establish a leader and then allowing pre-decisional distortion to build support for it” (Russo et al. 2006). The experiment required two sessions, with the first used to determine each subject’s true preferences. Then, in the second session, researchers altered the order in which the attributes were presented. When they targeted the inferior restaurant to become the early leader by presenting the attributes most favorable to that option first, it was usually chosen as the tentative leader. Measurements confirmed that subsequent attributes were in fact distorted to support this early leader, and the majority of subjects actually selected it. Russo concludes that “Thus, participants were manipulated into selecting the targeted inferior restaurant over one that they had preferred two weeks earlier.” Clearly, pre-decisional distortion can lead to suboptimal decisions favoring whatever choice has emerged as the early leader.

This was also demonstrated, in a more serious setting, by a study of diagnostic judgments by physicians. The subjects were presented with “patient scenarios, each with 2 competing diagnoses. Physicians first read information that favored 1 of the 2 diagnoses (the ‘steer’),” before receiving a series of additional evidence cues. (Kostopoulou et al. 2012). The researchers examined whether, by installing one of the two potential diagnoses as the initial leader, physicians’ perceptions of subsequent information would be distorted to favor it. Potential patients might be concerned that the answer was yes. “Having developed an initial diagnostic leaning consistent with the steer, 56% of physicians remained committed to it after receiving the conflicting cues. Distortion was strongly associated with commitment to the steer.”

Pre-decisional distortion, according to Edward Russo, “seems to be nearly ubiquitous. It has been found in decisions made by professionals and in the evaluations of single options as well as in choices between options. Further, it is material, and not some curiosity of the decision-
making process that has no impact on the decision itself.” In fact, it has proven nearly impossible to eliminate. Individuals remain unaware of pre-decisional distortion as it automatically occurs, so they are “likely to be just as unaware that the resulting confidence in their final position is unjustified. Indeed, one can almost describe them as having talked themselves into that final confidence,” he elaborates. In the world of equities, an investor is likely to find both bullish and bearish evidence about a company, so there is a risk that the ultimate investment decision is determined not by the relative merits of those conflicting data points, but by favoring those that happened to be encountered first. As a result, the investor may act confidently on a judgment that seems well-supported but, in reality, was essentially random.

We already noted System 1’s tendency to quickly generate coherent stories based on whatever little evidence it can access. Pre-decisional distortion of our perception of evidence can be viewed as an innate tendency to maintain the coherence of those stories framing our decisions, which biases System 2’s deliberate analysis. One scientific study notes, “Research has shown that decisions unfold in a series of coherence shifts, by which decision makers transform both new information and prior beliefs to align with each other and the emerging choice” (Bond, et al. 2007). Similarly, the findings of another study “support the view that decisions are determined by constructions of representations rather than by the ‘raw evidence’, that the emerging story serves to direct interpretation of the evidence, and that confidence in the decision is a function of the coherence of the reconstruction” (Simon et al. 2004). Research indicates that, without intent or even awareness, we distort evidence to be coherent with our mental narrative, abandoning our story only when it becomes impossible to reconcile with clearly conflicting evidence.

**Confirmation Bias**

This natural preference to maintain cognitive coherence as we make decisions continues even after we have chosen, biasing our perception of new data points to be consonant with the choice we already made. According to noted psychologists Carol Tavris and Elliot Aronson, “So powerful is the need for consonance that when people are forced to look at disconfirming evidence, they will find a way to criticize, distort, or dismiss it so that they can maintain or even strengthen their existing belief. This mental contortion is called the ‘confirmation bias’” (Tavris and Aronson 2007). We readily accept confirming evidence as obviously true and compelling, but we tend to convince ourselves that disconfirming evidence is in some way flawed so that we can minimize its meaning, all without recognizing the inherent bias.

Such confirmation bias has been demonstrated repeatedly by a range of studies. For example, Tavris and Aronson write: “In one experiment, researchers selected people who either favored or opposed capital punishment and asked them to read two scholarly, well-documented articles on the emotionally charged issue of whether the death penalty deters violent crimes. One article concluded that it did; the other that it did not. If the readers were processing information rationally, they would at least realize that the issue is more complex than they had previously believed and would therefore move a bit closer to each other in their beliefs about capital punishment as a deterrence.” As one might guess, that is not what happened. Instead, after both groups read the exact same articles, they actually moved in opposite directions, with the favoring group becoming more in favor and the opposing group becoming more opposed. It seems that the old adage has it backwards—actually, believing is seeing. Interestingly, scientists have gained insights into the brain mechanisms that may underlie confirmation bias. Tavris and Aronson describe one study in which the subjects “were monitored by magnetic resonance imaging (MRI) while they were trying to process dissonant or consonant information about George Bush or John Kerry.” The researchers, they continue, “found that the reasoning areas of the brain virtually shut down when participants were confronted with dissonant information, and the emotion circuits of the brain lit up happily when consonance was restored.” Once we make a choice, our reasoning goes on strike in the face of disconfirming evidence, and emotions step in to overemphasize confirming data points. This allows us to maintain the coherence of our mental story, even if that coherence is artificial. Tavris and Aronson conclude, “These mechanisms provide a neurological basis for the observation that once our minds are made up, it is hard to challenge them.” Indeed, it is far too hard, assuming our goal is to consistently make rational investment decisions.

The extent to which confirmation bias can compromise our objectivity makes it perhaps the most dangerous form of irrationality in investing. Because it allows us to cling to incorrect judgments in the face of evidence that we are wrong, by the time we are forced to admit our mistake, our investment performance likely has suffered already. In fact, when contradictory developments finally force us to abandon our bullish mental narrative about a stock that has performed poorly, other bullish investors are likely rejecting their own investment theses and capitulating at the same time. As such, there is a risk that we will be selling at overly punitive prices, when, in reality, buying may finally be the more rational course of action. In such cases, not only is the buy decision wrong, but, adding insult to injury, the sell decision is as well.

**Overconfidence**

Not only can pre-decisional distortion and confirmation bias lead to suboptimal decisions, but they also contribute to overconfidence in those decisions. Overconfidence arises because, as Daniel Kahneman explains, “The subjective confidence we have in our opinions reflects the coherence of the story that System 1 and System 2 have constructed. The amount of evidence and its quality do not count for much, because poor evidence can make a very good story” (Kahneman 2011). As a result of this overconfidence supported by distortion-fueled artificial coherence, we are stubbornly slow to realize that we have made poor decisions, as illustrated in Exhibit 3.

Indeed, research has consistently demonstrated that people are overconfident in their own judgments in a wide range of fields. In a study of spelling, for instance, “subjects were asked to spell a word and then to indicate their confidence that they were correct as a probability
Biased consideration of new evidence

Another twist of the old adage, it seems that committing is believing. In much of a stretch to infer that the act of buying a stock would make an investor even more overconfident that it will perform well. In other cases this belief is strongly supported by commitments, make narrative thinking particularly dangerous in equity investing, where virtually any decision can be rationalized. The value of a stock is highly sensitive to assumptions regarding future growth, profitability, and capital intensity, so it is nearly always possible to justify a valuation that is significantly higher or lower than the current market price. Even when it is difficult to justify substantial further downside, or upside, to a stock’s price, investors can typically create narrative rationalizations unrelated to intrinsic value, such as an overhang or lack of catalysts that, as the story goes, will prevent a re-rating by the market, at least in the near term. In other words, equity investors can usually talk themselves into a narrative related to almost any course of action.

In fact, it does not even take much of a commitment to compromise our objectivity. In one study of pre-decisional distortion, participants who had developed a currently preferred alternative were required “to indicate their preference either by circling or by darkening a sizable box” (Polman and Russo 2012). This seemingly modest commitment, merely an indication of which way they were leaning early in the decision process, “substantially increased predecisional distortion.” A more significant commitment, such as having invested substantial amounts of capital, seems even more likely to encourage information distortion in favor of mental coherence.

This elevated level of evidence distortion, as well as overconfidence, that accompanies commitment to a decision contributes to our tendency toward “escalation of commitment.” As researchers note, “Decision makers who commit themselves to a particular course of action have a tendency to make subsequent decisions that continue that commitment beyond the level suggested by rationality. As a consequence, they often allocate resources in a way that justifies previous commitments, whether or not those initial commitments now appear valid” (Bazerman and Moore 2009). In the context of stock markets, there is a real risk that investors’ decisions may be driven by a preference for consistency with prior actions rather than forward-looking evaluations of risk and reward that ignore “sunk costs.”

Escalation of Commitment

Not only are we overconfident in our judgments, but when we act on them our confidence level increases even further, as demonstrated by a study of horse bettors at a racetrack in Canada. Researchers asked “72 people who had just finished placing a $2.00 bet within the past thirty seconds, and 69 people who were about to place a $2.00 bet in the next thirty seconds” to rate their horse’s chances of winning on a 7-point scale. “What they found was that people who were about to place a bet rated the chance that their horse would win at an average of 3.48 (which corresponded to a ‘fair chance of winning’), whereas people who had just finished betting gave an average rating of 4.81 (which corresponded to a ‘good chance of winning’)” (Plous 1993). The act of betting obviously did not increase their probability of winning, but it did increase their confidence that they would win. From there, it is not much of a stretch to infer that the act of buying a stock would make an equity investor even more overconfident that it will perform well. In another twist of the old adage, it seems that committing is believing.

Exhibit 3
Post-decisional Distortion

<table>
<thead>
<tr>
<th>Myth</th>
<th>Objective decision with appropriate confidence level</th>
<th>Objective consideration of new evidence</th>
<th>Objective adjustment to viewpoint and confidence level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reality</td>
<td>Biased decision with overconfidence</td>
<td>Biased consideration of new evidence (confirmation bias)</td>
<td>Maintain original viewpoint and overconfidence as long as possible</td>
</tr>
</tbody>
</table>

This information is for illustrative purposes only.
Because investors can rationalize just about any mental narrative regarding a stock’s prospects, it would seem dangerous to use those unreliable stories to frame their decisions. Nonetheless, it seems that many investors use exactly that approach. Nobel laureate Robert Shiller has noted that “much of the human thinking that results in action is not quantitative, but instead takes the form of storytelling and justification” (Shiller 2009). He continues, “Such reasoning is not well described by the usual kinds of economic theory, but there is a large amount of evidence in support of the assertion that investor reasoning does take this form.”

In fact, this was confirmed by an analysis of fifty-two money managers, nearly all dealing in equities (mostly stock pickers), that was conducted by David Tuckett of University College London. Each manager had spent at least ten years in their role, and controlled at least $1 billion in assets. Tuckett’s rigorous analysis suggested that these investors tended to use stories to frame their decisions. He noted that they told him “stories about their decisions they had made because narrative is the framework within which they thought” (Tuckett 2011). Furthermore, it appears that the coherence of their narratives, which is not a reliable indicator of accuracy, was a key driver of the investors’ confidence. According to Tuckett, “One of the essential properties of narrative is that it allows diverse elements of fact and interpretation to be woven together in scripts so that they coalesce meaningfully and feel right. Narrative provides a sense of conviction and truth. Their stories thus made manager decision making sensible and coherent, underpinning their conviction about their choices.” The problem with this type of decision making is that, when evidence may be distorted to enhance coherence, basing convictions on that artificial coherence is a recipe for overconfidence in choices of questionable quality.

This flawed approach is certainly not unique to stock pickers. In fact, the “story model” of decision making was largely developed by studying the behavior of jurors in the context of legal trials, where the cognitive challenges are fairly similar to those faced by investors. As indicated by such research, “There seems to be little question that jurors’ decisions are driven primarily by the stories they construct to comprehend and remember the evidence presented to them at trial.” Studies suggest “that story the juror constructs, often quite deliberately to ‘piece together the puzzle of historical truth,’ determines the juror’s verdict. Ask any juror why he or she decided on a particular verdict, and you will more likely than not get an answer that begins, ‘Let me tell you what happened…”’ (Hastie and Dawes 2010). Just as Tuckett found that investors used narratives to explain their decisions to him, jurors reply to questions about their verdicts with stories of their own. In both contexts, problems may arise because imposing a narrative on the evidence tends to promote distorted perceptions favoring coherence.

Indeed, researchers have found that story-based decision making by jurors leads to a perception of stronger evidence, more extreme judgments, and higher confidence in those more extreme judgments. In one experiment, researchers conducted mock trials borrowing the evidence from an actual trial, and they presented this evidence either in Witness Order (the same order it was presented by witnesses in the actual trial) or, to make it easier for the subjects to construct narratives, in Story Order (the temporal sequence of the original events). Even though it was the exact same evidence (just presented in a different sequence), organization by Story Order had a dramatic impact on verdicts. “As predicted, jurors were likeliest to convict the defendant when the prosecution evidence was presented in Story Order and the defense evidence was presented in Witness Order (78% of the jurors judged the defendant guilty), and they were least likely to convict when the prosecution evidence was in Witness Order and the defense was in Story Order (31% said guilty). The difference in conviction rates is huge, over 40 percentage points” (Hastie and Dawes 2010). It seems that, by encouraging narrative thinking, Story Order made the evidence seem more coherent and, therefore, much more compelling. Based on such findings, researchers advise that “the attorney should set up the story in his or her opening statement to the jury. The chance of obtaining a verdict consistent with a story is increased when the story is primed in advance and is ready in the juror’s mind to interpret the evidence” (Hastie and Dawes 2010). In other words, by planting a story in the minds of jurors, a lawyer can exploit the jurors’ propensity for distorted evidence perception favoring coherence with their mental narratives, making the lawyer’s case seem more compelling than it would otherwise. While attorneys have a clear interest in manipulating jurors in such a manner, investors should not similarly facilitate the distortion of their own perceptions by using stories to frame their decisions.

Frameworks to the Rescue

How can investors avoid these pitfalls associated with the narrative framing of decisions to reach better judgments? One obvious potential solution might be deliberate, diligent self-monitoring of one’s decision making to identify and correct any biases that contribute to distorted perception of evidence. However, we do not believe such vigilance is likely to prove particularly effective. “Knowing that one may be subject to bias is one thing; being able to correct it is another,” notes Jon Elster of Columbia University (Elster 2007). It is simply too difficult to determine exactly how we have been influenced by unconscious mental processes, which we cannot observe. An investor typically can concoct a “just so” story that seemingly explains how a judgment has been biased in a certain way, but the plausibility of a post hoc explanation by no means guarantees its accuracy. By misdiagnosing the influence of invisible biases, “one easily falls into the traps of insufficient correction, unnecessary correction, or overcorrection,” according to Elster.

Instead, researchers suggest that “what is needed is some kind of alternative way of making these judgments, a method that ‘affirmatively’ diverts us from relying on intuitions and associations and heuristics” (Hastie and Dawes 2010). Along similar lines, according to Warren Buffett, the legendary Chairman and CEO of Berkshire Hathaway, “What’s needed is a sound intellectual framework for making decisions and the ability to keep emotions from corroding that framework” (Graham 2003). Combining these two prescriptions, we
endorse the disciplined adherence to a sound investment framework that supplants intuitive narratives in framing and guiding our judgments and decisions.

In our view, a well-designed investment framework is a formalized, structured, numerically based method that serves as a decision-support tool by decomposing the problem, focusing attention on the relevant factors, hiding irrelevant factors, and more objectively weighing the evidence. Such a structured framework offers less room for narratives shaped by emotions, expectations, desires, and the earliest data points to distort our perceptions and bias our choices. Thus, a sound, formalized investment framework can make it more difficult to rationalize and remain overconfident in poor decisions.

**Mechanical Decisions are Better**

Importantly, an investment framework is not something one should use to simply organize one’s thoughts before making an intuitive decision. To be effective, the framework must offer a formal mechanism for translating inputs into actionable decision recommendations, as scientific research has clearly demonstrated that decisions produced by mechanical formulas or models are generally superior to those based on “clinical” evaluations, meaning those in which we informally weigh all of the evidence in our minds. A meta-analysis of 136 research studies, from a wide variety of fields, “identified no systemic exceptions to the general superiority (or at least material equivalence) of mechanical prediction” over informal clinical approaches (Grove et al. 2000). In fact, less than five percent of those 136 studies showed clinical evaluations to be more accurate.

Such research, according to Kahneman, has suggested that “informal clinical evaluations should not be trusted and that statistical summaries of separately evaluated attributes would achieve higher validity” (Kahneman 2011). He attributes the inferiority of clinical predictions to their inconsistency, noting “Unreliable judgments cannot be valid predictors of anything…Because you have little direct knowledge of what goes on in your mind, you will never know that you might have made a different judgment or reached a different conclusion under very slightly different circumstances. Formulas do not suffer such problems. Given the same inputs, they always return the same answer.” Critics of mechanical procedures might suggest that, although they may be consistent, in some cases they cannot match the complexity of human judgment. However, as Edward Russo and the Wharton School’s Paul Schoemaker observe, “Study after study—in a wide range of fields—has come to the same conclusion: the benefits of consistency provided by a model usually exceed any losses of human complexity (applied unreliably)” (Russo and Schoemaker 2002).

Complex judgments are not reliable when they are overly swayed by intuitive responses and emerging dispositions, so we should avoid making decisions by informally weighing the evidence in our minds. That being said, there are specific fields where highly experienced individuals may develop the ability to make sound intuitive judgments. Expert intuition fares better in high-validity environments, meaning those that offer reliable cues and clear, timely feedback because they are stable and predictable. In such highly regular environments, intuitive expertise requires “adequate opportunities for learning the environment (prolonged practice and feedback that is both rapid and unequivocal). If an environment provides valid cues and good feedback, skill and expert intuition will develop in individuals of sufficient talent” (Kahneman and Klein 2009).

To illustrate an example of such a high-validity environment, we shall consider the game of chess. The basic structure of chess, which includes the board, pieces, and rules, never changes, thus offering a highly regular environment. As a result, the current positions of the pieces represent a valid clue as to which move should be made next. Because chess players are able to practice repeatedly within that regular environment and learn from reliable feedback, they can gain intuitive expertise. Researchers have “described the performance of chess experts as a form of perceptual skill in which complex patterns are recognized. They estimated that chess masters acquire a repertoire of 50,000 to 100,000 immediately recognizable patterns, and that this repertoire enables them to identify a good move without having to calculate all possible contingencies” (Kahneman and Klein 2009). Chess masters can read situations at a glance and intuitively know how to proceed because they have learned from repeated feedback in a high-validity environment.

In contrast, equity investing is clearly a low-validity environment, with little certainty or stability. The stock market rarely offers reliable cues or clear, timely feedback, so it is not conducive to the development of expert intuition, even after substantial experience. As such, this environment favors mechanical decisions over intuitive clinical judgments. Noisy, irregular problems such as investing are typically too complicated to be solved by System 1, but it is an automatic process that cannot be turned off, so its intuitions may guide our clinical judgments anyway. An informal clinical evaluation is susceptible to System 1’s unreliable influences, and its only hurdle to acceptance, the ability to rationalize it, is a rather modest one. Therefore, in a low-validity environment such as equity markets, it is especially important to consider a mechanical procedure for reaching decisions rather than an unstructured intuitive approach. As Kahneman observes, “The research suggests a surprising conclusion: to maximize predictive accuracy, final decisions should be left to formulas, especially in low-validity environments” (Kahneman 2011).

**A Hybrid Approach**

However, to be clear, we are not suggesting that investors should necessarily move to the opposite end of the spectrum and embrace purely algorithmic, automated investing based on statistical inputs. Such an approach may minimize the impact of intuitive biases, but it typically does so at the expense of benefiting from differentiated, forward-looking views based on fundamental research and expertise. Forward-looking views are inherently subjective, but we believe they are also crucial to adding value in equity investing, so eliminating all subjectivity from our decision drivers is not the goal.
Instead, we prefer a hybrid approach to investment frameworks, which involves a mechanical combination of inputs that reflect forward-looking views, informed by research and expertise, rather than backward-looking statistical factors. A mechanical combination of an expert’s subjective forward-looking inputs should weigh those inputs more objectively to produce more consistent, better decisions and make it more difficult to rationalize poor choices, without relinquishing the potential added value from proprietary expertise and out-of-consensus views. Such investment frameworks do not diminish the importance of expert insights; instead, they help us reach decisions that better reflect those insights. In other words, subjective inputs are not necessarily the problem and could in fact add significant value, but it is important that we weigh those inputs in a more consistent, objective manner to improve decision making.

This approach of relying on expert judgment to estimate inputs and then mechanically combining those subjective inputs to generate decisions is not a new concept. A 1972 study by the late Hillel Einhorn of the University of Chicago “was the first to demonstrate the advantage of expert measurement followed by mechanical combination. He found that expert pathologists’ predictions of cancer survival were improved when their component judgments of nine histological characteristics were mechanically combined into a global prediction of cancer survival. Subsequent studies have replicated this finding in contexts such as performance evaluation and auditing. This decision aid approach works because it capitalizes on a decision maker’s strength (cue measurement), while compensating for a weakness (cue combination)” (Whitecotton et al. 1998). As such, the pairing of an expert’s insights with a model’s objective treatment is an important aspect of sound investment frameworks. We believe this hybrid framework has the potential to produce better decisions than either an informal intuitive approach or a purely statistical procedure.

Incorporating such an investment framework would require a significant adjustment for many experienced investors. As noted by David Hardman of London Metropolitan University, “Of course, professionals in any domain may be reluctant to cede decision making to a formula because this seems to be calling into question their expertise. However, it must be remembered that their expertise is required to select and code the variables of interest. On other hand, ceding the final decision to a formula is merely to recognize that we have limitations in our ability to process information” (Hardman 2009).

It is important to keep in mind that the investment framework, as a decision aid, does not at all diminish the investor’s importance as the source of value-added expert insight. The investment framework is merely a tool for handling certain types of mechanical processing, much like a calculator or spreadsheet. Without the investor’s expert inputs, it is useless. At the same time, no matter how well we design a framework, the quality of the decisions it produces can be only as good as the quality of inputs provided. A framework can do nothing to remedy faulty inputs reflecting inadequate research or expertise.

How to Choose Inputs

So, how do we implement an investment framework? The first step is to choose the factors that will serve as inputs. In general, these factors will leverage the investor’s forward-looking research and expertise to reach better decisions. If we introduce a framework to augment an existing investment strategy, the inputs will likely be the factors that are already considered key decision drivers. Our goal is not to alter the strategy but to improve execution by considering those factors in a more consistent, objective manner.

Nonetheless, there may be certain factors that we want to prevent from influencing our decisions. For example, we may consider the price that we paid for a stock in the past as irrelevant to our decision. However, we may still find it difficult to avoid being influenced by it, despite our best efforts, when using an informal clinical decision-making approach. An advantage of using a framework is that we can eliminate the influence of potentially misleading factors by excluding them from the decision-making model.

Given the broad diversity of investment styles and mandates, there is no one correct answer for exactly which inputs should be included in an investment framework. However, in general, the inputs of any well-designed framework should have a forward-looking focus, given that equity values are a function of future cash flows. In turn, we believe that forward-looking views should be enhanced by explicitly considering multiple scenarios.

The Importance of Multiple Scenarios

We believe that using a multi-scenario lens for forecasting is crucial for a couple reasons. First, a multi-scenario approach better reflects the probabilistic nature of a problem involving uncertainty. When projecting an uncertain future, there is always a probability distribution of potential outcomes and our job as analysts is to approximate that distribution as best we can. In our view, assigning relative probabilities to multiple scenarios is an effective method for modeling the relevant probability distribution. In contrast, an intuitive story approach focused on a single narrative describes only one potential outcome, and it tells little about the potential risks and rewards if that scenario is wrong, which it almost certainly will be in some respect. Virtually every company has key drivers that cannot be reliably forecasted with precision, so it is important to understand the sensitivities to those variables.

Second, forecasting multiple scenarios forces an individual to intellectually contemplate different narratives as being potentially correct. We believe that this actively engages the reasoning areas of the brain in the face of disconfirming evidence, when they would normally tend to shut down, as discussed earlier. This may help to overcome the pre-decisional distortion, confirmation bias, and overconfidence associated with coherence shifts that distort perceptions to fit a single narrative. For example, due to confirmation bias, the interpretation of a new piece of evidence by an investor who is focused on a single-scenario narrative would tend to be biased toward coherence with that
narrative. However, Paul Schoemaker suggests that a multi-scenario approach allows us to “use each scenario as a lens for examining the implications of each piece of new information.” More specifically, “the same piece of information can have very different meanings depending on the scenario considered. By examining significant new pieces of information through multiple lenses, managers can gain a deeper understanding of their implications,” he continues (Schoemaker 2002). This should provide a more balanced, accurate view than interpreting information through a single distortion-prone lens. Thus, analyzing multiple scenarios in reaching investment decisions should mitigate biases to facilitate more objective consideration of evidence and more accurate calibration of confidence, resulting in better choices.

However, the goal here is not to forecast every conceivable scenario, no matter how unlikely. That approach may be helpful in scenario exercises for contingency-planning purposes, but it is not ideal for investors striving for predictive accuracy. University of Pennsylvania’s Philip Tetlock studied the impact of such scenario exercises on expert predictions and found that they had, on average, a negative net effect on the empirical accuracy and logical coherence of forecasts. Tetlock notes that, “it is easy to overdo it when we start imagining ‘possible worlds.’ Taking too many scenarios too seriously ties us into self-contradictory knots…Imagination-driven thinking sensitizes us to possible worlds but exacts a price in confusion and even incoherence” (Tetlock 2005). The confusion arising from too many scenarios may be worse than the distortion and overconfidence associated with single-scenario thinking. In order to avoid such confusion, we prefer to focus on a limited number of scenarios judged as likely given the investor’s expertise. Based on practical experience, we believe that either three scenarios (base, pessimistic, and optimistic cases) or five (adding a more extreme scenario to each tail) is ideal.

Choosing a few carefully selected scenarios, rather than a host of marginally plausible ones, is analogous to the de-biasing strategy of considering the opposite, which induces decision makers to explicitly consider the diametric opposite of their currently held view. Two related experiments, one focused on the assimilation of new evidence and the other on hypothesis testing, demonstrated that “the cognitive strategy of considering opposite possibilities promoted impartiality” and had a “corrective effect” on judgments (Lord et al. 1984). Along the same lines, in another study, subjects wrote an explanation of the hypothetical relationship between two variables as suggested by case history data, and some subjects also wrote explanations of the opposite potential relationship. The result was that subjects who had considered both possible relationships were significantly less biased than those who had considered only one. Interestingly, this de-biasing technique was effective whether the subjects considered both possibilities prior to seeing the case study data or considered them both after seeing the data. The researcher concluded that subjects who had considered the opposite theory produced “more flexible and appropriate responses to challenges to those theories,” as they “displayed significantly less reluctance to abandon their theories than did subjects who only considered the relationship suggested by their case history data” (Anderson 1982).

Based on such results, we believe that investors with a strongly positive or negative opinion of a stock can mitigate their biases by more thoroughly analyzing the case for the opposite view.

In addition to promoting impartiality, a “consider the opposite” strategy can also help reduce overconfidence. As Philip Tetlock notes, experimental psychologists “have had some success in correcting overconfidence by asking people to look for reasons that cut against the grain of their current expectations” (Tetlock 2005). For example, one study found that compelling participants to list contradicting reasons for an answer greatly improved their confidence calibration, and even requiring just one contradicting reason was enough to significantly reduce overconfidence. These results “are consistent with the idea that overconfidence derives in part from the tendency to neglect contradicting evidence and that calibration may be improved by making such evidence more salient” (Koriat et al. 1980). Overconfidence is driven by the coherence of mental narratives, and “considering the opposite” mitigates it presumably by attenuating artificial coherence.

**Problem Decomposition**

Beyond incorporating multiple scenarios, another principle of well-designed investment frameworks is decomposing the problem at hand into several smaller questions. If you start by focusing on potential conclusions, such as whether to buy or sell a stock, your System 1 will automatically pick a side and bias the rest of the decision-making process in that direction. Instead, we should try to keep System 1 at bay by decomposing the problem and addressing the components piece by piece, deferring consideration of actionable decisions as much as possible. Indeed, the field of decision analysis suggests “the decomposition of a decision problem into a set of smaller (and, hopefully, easier to handle) problems. After each smaller problem has been dealt with separately, decisions analysis provides a formal mechanism for integrating the results so that a course of action can be provisionally selected” (Goodwin and Wright 2009).

In Exhibit 4, we illustrate the steps in an example of a framework designed to decompose equity investment decisions. This particular framework starts with fundamental analysis and valuation, incorporating scenarios to estimate the stocks’ values in base, bear, and bull cases. In the second step, relative probabilities are assigned to the appraisal scenarios to calculate probability-weighted expected returns for each stock. Next, a baseline hurdle rate is determined based on the return potential of the overall opportunity set, and then company-specific hurdle rates are adjusted relative to that baseline based on how the stocks’ correlations affect total portfolio risk. Finally, excess expected returns, net of company-specific hurdle rates, are used to derive target position sizes, which imply recommended actions.

Because there are many different investment styles and mandates, there is no single correct way to decompose investment decisions, but we believe breaking the process into a series of smaller steps should produce better decisions that are more representative of forward-looking views. If the investor starts with a much broader question (such as whether to
buy or sell a stock), this unleashes a clinical evaluation, which bundles all the steps together in an informal mental process, making it easier to rationalize suboptimal decisions swayed by narrative intuitions.

**Conclusion**

In summary, a well-designed investment framework, incorporating both multiple scenarios and problem decomposition, offers several benefits that, in combination with expertise, help us reach better decisions, in our view. For example, with respect to inputs, the framework can filter potentially misleading influences by excluding irrelevant factors from the decision process that would be hard to eliminate by mental effort alone. Also, it replaces informal clinical evaluations with a model that should better match our decisions with the selected inputs. This combination of improved inputs and decisions that better reflect them should promote better choices and make it much more difficult to rationalize mistakes.

Of course, the implementation of an investment decision framework does not guarantee success. However, it does encourage consistency and objectivity in a field in which just about any decision can be rationalized. If a well-designed investment framework can help us enough to improve our decisions even on the margin, preventing us from rationalizing mistakes even occasionally, we believe it is well worth the effort. Clearly, a wealth of research seems to suggest that we could use the help. Indeed, “Perhaps the most consistent finding in more than 30 years of judgment and decision-making research is that humans have difficulty drawing inferences from multiple sources of information” (Libby and Libby 1989). As such, it is hard to disagree with the assertion, “Shooting from the hip when many data points are involved is simply unprofessional” (Russo and Schoemaker 2002). Equity investors routinely make decisions based on an incomplete but complex and often conflicting body of evidence. In such situations, we believe that a structured framework can mitigate the biasing influence of intuitive narratives and help investors make decisions that better reflect their forward-looking views, which should be informed by fundamental research and expertise.

### Exhibit 4

**Example of Investment Decision Decomposition**

<table>
<thead>
<tr>
<th>Decision Component</th>
<th>Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamentals</strong></td>
<td>Scenarios of a stock’s value (base, bearish, and bullish):</td>
</tr>
<tr>
<td></td>
<td>• Financial projections</td>
</tr>
<tr>
<td></td>
<td>• Corresponding valuations</td>
</tr>
<tr>
<td><strong>Expected Returns</strong></td>
<td>Risk-adjusted expected returns calculated by applying relative probabilities to scenarios</td>
</tr>
<tr>
<td><strong>Cost of Capital</strong></td>
<td>Hurdle rate, reflecting:</td>
</tr>
<tr>
<td></td>
<td>• Return potential of opportunity set</td>
</tr>
<tr>
<td></td>
<td>• Company-specific impact on portfolio-level risk exposures (correlations)</td>
</tr>
<tr>
<td><strong>Sizing Position</strong></td>
<td>Target position size:</td>
</tr>
<tr>
<td></td>
<td>• Reflecting excess expected returns (net of hurdle rate)</td>
</tr>
<tr>
<td></td>
<td>• Either absolute or active (relative to benchmark), depending on mandate</td>
</tr>
<tr>
<td><strong>Action</strong> (Buy/Hold/Sell)</td>
<td>Driven by difference between target and actual position sizes</td>
</tr>
</tbody>
</table>

This information is for illustrative purposes only.
Important Information
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