

Equity Research—Americas

Industry: Value-Based Strategy
December 10, 1998

Michael J. Mauboussin	212/325-3108	michael.mauboussin@csfb.com
Bob Hiler	212/325-4341	bob.hiler@csfb.com



The Invisible Lead Steer

**New Answers to Old Questions
About the Stock Market**

Volume 7

Introduction

Investors often ask a legitimate question when presented with evidence that the stock market acts as if it follows an economic model: How does the market understand the value-based model when so few investors use it?¹ A corollary question also surfaces: If markets are so good, to whom should investors pay attention—others in the financial community or the market itself?

These are by no means trivial questions. In fact, the answers dictate how to deal with critical areas such as time allocation, financial reporting, executive compensation and an overall framework for decision making. Without a firm grasp of how stock prices are set, investors are at a competitive disadvantage in what is a highly competitive world.

Before attempting to address the question of how the market “understands” the value-based model, it is important to distinguish between two things. The first is how the market behaves, which is an empirical question. The second is how investors and companies talk about what they do—their individual decision rules. This distinction is central, because *aggregate* market behavior will imitate *individual* investor behavior only if the total equals the sum of the parts. In markets, as in nature, the complexity of interaction among agents almost always invalidates this cause-and-effect link.

This report broken into three parts. First, we look at potential explanations to explain the difference between individual and aggregate behavior in markets. Next, we explore complex adaptive systems as a way to understand markets. Finally, we suggest using market signal analysis as a practical outcome of our analysis.

The Birds and Bulls

There are two alternative approaches to answering the question of how the market “gets it.” The first is a *centralized* model, embodied by the “lead steer” metaphor. The second is a *decentralized* model, captured by the concept of complex adaptive systems. Leaving definitions aside for a moment, the distinction between centralized and decentralized approaches is important for how we organize our thoughts and actions.

The Centralized View: Is it Bull?

We start with the so-called lead steer metaphor, which is widely attributed to Joel Stern.² To paraphrase Stern, “If you want to know where a herd of cattle is heading, you need not interview every steer in the herd, just the lead steer.” The idea is that there is a group of super-smart investors that *do* understand the economic model. And it is these lead steers that are setting prices at the margin. Hence, you need not worry about the typical investor because the investor on the margin—the lead steer—is making sure that prices, on average, are set correctly.

This image of centralized knowledge is reminiscent of the pleasing simplicity of ancient myths: the Greek god Helios pulls the sun across the sky from east to west. Indeed, this centralized view is innately pleasing for the very reason that cause is directly linked to effect. However, given the vast number of securities traded globally and the admittedly limited number of lead steers, it is hard to see how this metaphor actually extends to the real world.³

We believe that the lead steer metaphor, for all of its intuitive attractiveness, is largely false.

The real answer is more elegant, more robust and, in some ways, magical. And it is not new. Adam Smith conveyed the idea as well as anyone, over 200 years ago, with his concept of the “invisible hand.”

The Decentralized View: Power in Numbers

Now we turn to the decentralized world. The first challenge to the centralized mindset comes from a delightful book by MIT Professor Mitchel Resnick, “Turtles, Termites, and Traffic Jams.” Resnick discusses perceptions about flocks of birds:

Most people assume that birds play a game of follow-the-leader: the bird at the front of the flock leads, and the others follow. But that’s not so. In fact, most bird flocks don’t have leaders at all. There is no special “leader bird.” Rather, the flock is an example of what some people call “self-organization.” Each bird in the flock follows a set of simple rules, reacting to the birds nearby it. Orderly flock patterns arise from these simple, local interactions. The bird in the front is not a leader in any meaningful sense—it just happens to end up there. The flock is organized without an organizer, coordinated without a coordinator.

Differences between mammalian and avian behavior aside, Resnick draws out a key point: order is not always the result of leadership. Order can also arise from the dynamic interaction of agents employing relatively simple decision rules. But does this apply to capital markets?

Two Professors at Carnegie Mellon University, Dhanajay Gode and Shyam Sunder addressed this issue in a revealing paper. While not a marketer’s dream, the title is descriptive: “Allocative Efficiency of Markets with Zero-Intelligence Traders: Market as a Partial Substitute for Individual Rationality.” Gode and Sunder created markets where the traders had *schlock* decision rules in an effort to see what happened to market efficiency. In fact, they found that markets were *still* remarkably efficient; in other words, even dumb agents achieve smart results. The authors write:

Allocative efficiency of a double auction market derives largely from its structure, independent of traders’ motivation, intelligence, or learning. Adam Smith’s invisible hand may be more powerful than some may have thought; it can generate aggregate rationality not only from individual rationality but also from individual irrationality.

Investors can take away two central messages. The first is that markets do not need leaders to function in a coordinated fashion. Second, it is the *structure* of the market, not the individuals that comprise it, that allow it to mimic the economic model—that is, a market that is generally “rational.”⁴ Accordingly, investor decision rules should not be based on what individuals do and say, but rather on aggregate market behavior.

Complex Adaptive Systems

Capital markets can be described more formally as complex adaptive systems (CAS). We develop this idea in three steps. First, we offer a simple, yet powerful example of how the aggregate estimates of many individuals lead to a very accurate consensus. Next, we describe a complex adaptive system in more detail. Here, we examine some of the inherent characteristics of CAS and how they ex-

plain actual market behavior. Finally, we provide thoughts on how to beat the market within this framework.

And the Winner is...Independent Errors

A number of years ago a colleague at Columbia Business School, Paul Johnson, created an exercise to demonstrate the exquisite capability of markets to discern value. The game is based on the Academy Awards—the highest accolades handed out in the film industry. The basics are very simple:

- Each student receives a single piece of paper with a listing of 12 Academy Award categories and the nominees for each. On the front of the page are relatively well known categories, such as best film, best actress and so on. The back page has more obscure categories—best adapted screenplay, best cinematography and such. The forms are distributed roughly three weeks in advance of the actual awards event.
- Students are asked to select the winners in each category. In order to play, students must contribute \$1 to a pot, with the student with the most correct answers winning the pot. Hence, there is a modest economic incentive to answer the questions right.
- About 125 students participated in 1998. All guesses were generated independently, as students were forbidden from consulting with one another.

The results were impressive in 1998. Similar results have been generated year-in and year-out:

- The “consensus”, defined as the most popular selection for a given category, correctly identified 11 of the 12 actual category winners. Remarkably, the only category the consensus missed, it missed by only one vote.
- The best individual accurately picked 9 of the 12 category winners.
- The average individual only picked 5 of the 12 winners—less than 50%.

The message from this exercise is that lots of agents and independent errors in their judgements lead to efficient results. The market tends to be much smarter than the average person. In fact, the standard error in equilibrium prices declines with roughly the square root of the number of investors.⁵ This observation is not particularly new—in fact Francis Galton made the same point in the late 19th century—but it is often overlooked. Further, this simple model does not incorporate meaningful economic incentives or learning. If incorporated, these elements would make the results even more robust.

CAS Described

Complex adaptive systems can be described in three parts. First, there are lots of agents, each operating with their own decision rules. Next, the interactions between the agents become the basis of “emergence”—the aggregate becomes more complicated than the sum of the parts. Finally, a “meta-system” is created that has distinct characteristics. Each part is described briefly:

- *Decision rules.* Agents within a complex adaptive system take information from the environment, combine it with their own interaction with the environment, and derive decision rules.⁶ Various decision rules compete with one another based on their utility, with the most effective rules surviving. This

process allows for adaptation, which explains the “adaptive” in “complex adaptive system.” Individual trading rules and investment rules of thumb are decision rules in the capital markets.

- *Emergence.* Emergence is the complex, large-scale behaviors that result from the aggregate interactions of many less complex agents. An ant colony is a good example of this phenomenon. If you were to interview any single ant about what it does, you would hear a narrowly defined task or set of tasks. However, because of the interaction of all the ants, a functional and adaptive colony emerges. In capital markets language, the behavior of the market “emerges” from the interaction of investors. This is Adam Smith’s “invisible hand.”⁷
- *Market as a “meta-system.”* We use the term meta-system to convey clearly the notion that the market has properties and characteristics distinct from the agents that comprise it. Two key characteristics of CAS include non-linearity and critical points. Non-linearity is the idea that the output of the system will not necessarily be proportionate with the input of the system. The familiar multiplier effect in economics is a good example. Critical points describe the fact that periodically, small-scale stimuli lead to large-scale effects—the proverbial straw that broke the camel’s back. In the realm of markets, this means booms and crashes.

In what appears to be an important contribution to our understanding of markets, CAS maintains the best of portfolio theory and incorporates much of the real life activity we see day-to-day.⁸

Beating the Market

How do portfolio managers outperform the market given this model? There are three ways:

- *Information.* Investors can get better information than the market reflects. This information can be captured through such pedestrian methods as channel checks and frequent management contact. But it is hard—and costly—to *systematically* get an information advantage. This is true even for the largest money management institutions.
- *Analysis.* It is possible to interpret information better than the consensus through better pattern recognition skills or more suitable mental models. Here, too, getting an edge is difficult because the competition is *not* other analysts but the overall market. Further, mental models are context dependent; investors must evolve their models to reflect market reality.
- *Emotion.* We noted earlier that efficiency tends to prevail when agent errors are independent. We can further the case by saying that inefficiencies can arise when errors are non-independent—when people are all thinking the same way. Non-independent errors are tough to exploit because of human nature: at critical junctures, your gut will pull you in the consensus (wrong) direction. Contrarian investing is possible, but it relies more on mental aptitude than on pure analytical aptitude.

Market Signals Analysis

Now we turn to the second of our two questions: To whom should companies and investors listen? The first alternative is market agents—financial analysts, the business press and other pundits. The second is the market itself, as expressed

in prices. Based on the prior discussion, we believe the answer is the market. While it is a little simplistic to assert that no one should listen to agents, the real point is that the value of the information conveyed in prices is generally underestimated.

In fact, most market observers have their priorities backwards: They assume that agents are smart and that markets are dumb. The CAS framework shows the opposite: agents can be dumb and markets can still be smart. The explanation for this misplaced emphasis can be found in behavioral psychology.⁹ Most people place the greatest weight on information that is accessible versus information that is most relevant. Since business press articles, analyst reports and investment banker pitches are ubiquitous, they are perceived to be most valuable sources to understand prices. Our theoretical and practical discussion of complex adaptive systems demonstrates that this perception is wrong.

If indeed there is so much value in reading the market, how should it be done? We believe there are three fundamental elements: mechanics, information flows and decision making.

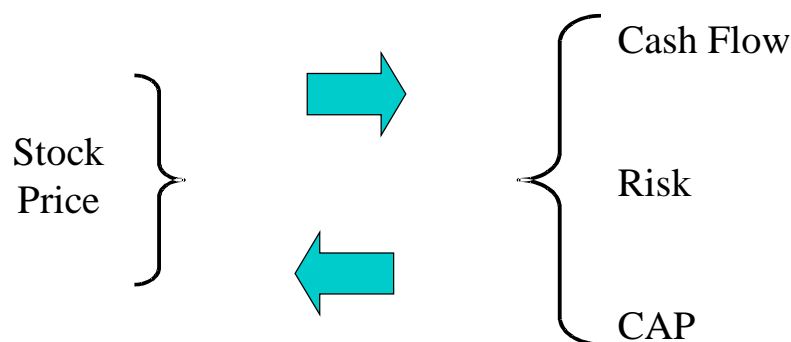
Mechanics

Mechanics are the guidelines for conducting market signals analysis.¹⁰ There are fundamentally two ways to quantify expectations. The first is a bottoms-up approach, where an analyst takes his or her view of key value drivers, plugs them into a model, and comes up with an estimate of intrinsic value. This value, in turn, can be compared with the market price in order to identify expectation gaps—differences between perception and reality. This is what most analysts ostensibly do in their valuation work.

Alternatively, one can go backwards. By taking the stock price as a given, the analyst can *infer* market expectations. The result is a set of value driver expectations that, when fortified by sensitivity analysis, provide a good sense of what performance is necessary in order to justify the price.

The spectrum of potential value driver outcomes of a business—dictated by category growth, market share shifts and changes in industry dynamics—is typically wider than analysts perceive. The key is to understand what financial reality is required to support the price and the likelihood that such an outcome will prevail.

Figure 1
Market Signals Analysis



Source: CSFBC Analysis

Information Flows

The mechanics of market signals analysis leads to an assessment of information flows. There are three steps to this process. The first is to determine whether or not your expectations are consistent with the consensus—as conveyed by the market price. This assessment can be done using the bottoms-up valuation approach.

The second step is to understand *where* the difference lies. It is important to pinpoint specific areas of non-consensus thinking. Examples include variant perceptions about sales or earnings growth, sustainability of competitive advantage or potential value-changing restructuring initiatives.

The final step is to act. From an investor's point of view, that means buying or selling a stock. From a company's perspective, it may mean changes in communication with the financial community or altered financial policy, such as share repurchase or share issuance.

Decision Making

How should all of this bear on decision making? The first point is that investors should shift their emphasis from paying attention to one another (or the financial community more broadly) to deciphering market prices. This is easier said than done. Humans much prefer dealing with one another than with an inanimate, intangible market.

Next, understanding market expectations should lead to periodic opportunities for investors to exploit inefficiencies that arise from perception-versus-reality incongruity—the result of information, analysis or emotion.

Finally, and most critical, it is important to avoid listening to the noise. Individuals only have “local” information, and cannot be expected to grasp the dynamics of the meta-system. Most of the day-to-day chatter in the investment business is noise, and should be dismissed.

Conclusion

Time is our most valuable commodity. A correct understanding of how capital markets operate allows for a more efficient allocation of time and energy.

One conclusion our analysis suggests is that investors and companies should embrace a value-based analytical framework, because the value-based model does the best job of reflecting the results of the “meta-system.”

In addition, we would underscore that while markets are generally smart and are good at reflecting expectations, they are not always right. There are exploitable opportunities. But the way most investors seek out those opportunities is far from optimal.

References

- Copeland, T., Koller, T., Murrin, J. *Valuation: Measuring and Managing the Value of Companies*, John Wiley & Sons, New York, 1996.
- Gell-Mann, M. *The Quark and the Jaguar*, New York: W.H. Freeman and Company, 1994.
- Gode, D., Sunder, S. “Allocative Efficiency of Markets with Zero-Intelligence Traders,” *Journal of Political Economy*, 101, 1993.
- Holland, J.H. *Hidden Order: How Adaptation Builds Complexity*, Reading, MA: Helix Books, 1995.
- Rappaport, A. *Creating Shareholder Value*, Free Press, New York, 1997.
- Resnick, M. *Turtles, Termites and Traffic Jams*, MIT Press, Cambridge, MA. 1994.
- Simon, H. *The Sciences of the Artificial*, MIT Press, Cambridge, MA. 1996.
- Stewart, G.B. *The Quest for Value*, HarperCollins, New York, 1991.
- Treynor, J. “Market Efficiency and the Bean Jar Experiment,” *Financial Analysts Journal*, May-June 1987.

¹ The vast majority of the empirical evidence suggests that the stock market acts as if it follows an economic framework. An economic framework—we use the phrase value-based model interchangeably—is based on first principles: prices are set based on anticipated cash flow streams, risk and associated reward, and a time horizon. The value-based model can be contrasted with more traditional and widely used rules of thumb, including earnings per share and price-to-earnings multiples.

For example, one might want to determine whether the market capitalizes accrual accounting earnings—still the predominate language of portfolio managers, companies and the financial press—or cash flow. The answer is cash flow. Likewise, there is good evidence that risk and reward are related in capital markets. See *Quest for Value*, G. Bennett Stewart (HarperCollins, New York, 1991), pp. 21-117. Also *Valuation: Measuring and Managing the Value of Companies*, Copeland, Koller, Murrin (John Wiley & Sons, New York, 1996), pp. 78-92. Also *Creating Shareholder Value*, Alfred Rappaport, (Free Press, New York, 1997), pp. 13-31.

² *Quest for Value*, G. Bennett Stewart (HarperCollins, New York, 1991). Stern’s views were significantly shaped by his economic training at the University of Chicago.

³ In addition, the lead steers themselves seem to disavow their role of price-setters in this paradigm. For example, Warren Buffett—the lead steer’s lead steer— agrees with the academics that “in the long run [the market] is a[n] [economic] weighing machine.” However, he also claims that “you should imagine [daily] market quotations as coming from a remarkably accommodating fellow named Mr. Market ... with incurable emotional problems.” It is clear that Buffett’s attitude towards the market is not the attitude of a lead steer who believes that he—or any other lead steer—is setting stock prices.

⁴ “Allocative Efficiency of Markets with Zero-Intelligence Traders”, Dhanajay K. Gode and Shyam Sunder, *Journal of Political Economy*, 101 (1993), pp. 119-127. Gode and Sunder first note that standard economic theory is built on two specific assumptions: utility maximizing behavior and institution of Walrasian tâtonnement—a tightly defined market structure. Next, they refer to the work of Gary Becker, who showed that market-level predictions of economic theory are consistent with individual behavior *more general* than utility maximization, as well as the work of Vernon Smith, who demonstrated that such predictions are consistent with trading mechanisms *more general* than Walrasian tâtonnement. Gode and Sunder synthesize these views and show that a double auction (non-Walrasian) market mechanism can sustain high levels of efficiency *even if* agents do not maximize or seek profits. According to the authors, in its “first-order” magnitude, allocative

efficiency seems to be a characteristic of the market structure and environment. Rationality of individual traders accounts for a relatively small fraction of the efficiency.

⁵ “Market Efficiency and the Bean Jar Experiment,” Jack L. Treynor, *Financial Analysts Journal*, May-June 1987.

⁶ *The Quark and The Jaguar*, Murray Gell-Mann, (New York, W.H. Freeman and Company, 1994).

⁷ “Every individual is continually exerting himself to find out the most advantageous employment for whatever capital he can command...By directing that industry in such a manner as its produce may be of the greatest value, he intends only his gain, and he is in this, as in many other cases, led by an *invisible hand* to promote an end which was no part of his intention.” *Wealth of Nations*, Adam Smith.

⁸ “Frontiers of Finance—Shift Happens”, Michael J. Mauboussin, *Credit Suisse First Boston Equity Research*, October 24, 1997.

⁹ “Frontiers of Finance—What Have *You* Learned in the Past 2 Seconds?” Michael J. Mauboussin, *Credit Suisse First Boston Equity Research*, March 14, 1997.

¹⁰ *Creating Shareholder Value*, Alfred Rappaport, (Free Press, New York, 1997), pp. 13-31.