The Rationality Struggle: Illustrations from Financial Markets

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For most economists it is an article of faith that financial markets reach rational aggregate outcomes, despite the irrational behavior of some participants, since sophisticated players stand ready to capitalize on the mistakes of the naive. (This process, which we call poaching, includes but is not limited to arbitrage.) Yet financial markets have been subject to speculative fads, from Dutch tulip mania to junk bonds, and to occasional dramatic losses in value, such as occurred in October 1987, that are hard to interpret as rational. Descriptive decision theory, especially psychology (see D. Kahneman et al., 1982), can help to explain such aberrant macrophenomena. Here we propose some behavioral explanations of overall market outcomes—specifically of financial flows, that are of considerable practical consequence to both policymakers and finance practitioners.

I. Behavioral Explanations of Market Macrophenomena

Investors play for significant stakes and have sustained opportunities for practice—both factors that should promote rational outcomes. C. Camerer (1987) shows that even in experimental markets, practice and significant payment do away with many anomalies. Moreover, since nonrational investors lose their funds, natural selection operates. Yet overall outcomes still may deviate from rationality, depending on two factors: the rationality of individual participants and the opportunities for poaching. Table 1 outlines the possibilities.

When participants are mostly rational and there are many opportunities for arbitrage (cell 1), we expect the efficient markets paradigm to triumph. In cells 2 and 3, results are best explained by a merger of behavioral considerations and economic analysis. In 2, we expect economic paradigms to succeed, albeit with behavioral residues associated with problems of information flows. Purchases of open-end mutual funds, that cannot be poached, might display some anomalies. In 3, barring new entrants, processes of natural selection reduce the role of nonrational players over time. In cell 4, behavioral models should provide important insights into inefficient outcomes. No one can benefit from (poach on) the misbalanced portfolio or poor retirement funding decisions of another. Mistakes are to be expected, though beyond a threshold they may provoke a corrective response. (A 1990 information campaign by Harvard led to a one-third increase in employees' use of highly tax-advantaged supplemental retirement annuities, which had long been available.)

Cell 4 offers other interesting possibilities when preferences focus on relative, not absolute, outcomes. Judging one's allocations relative to those of others (as in labor market contests) requires less information gathering. This approach may also be dictated by envy. Such relative valuations could lead

TABLE 1—MODELING OUTCOMES OF SOCIAL INTERACTIONS: POACHABILITY AND RATIONALITY

Rationality[a]	Poachability/Arbitrage Potential: High	Low
Full/Substantial; Individualistic	1) Efficient Markets	2) Anomalies Due to Incomplete Use and Flow of Information
Bounded/Low; Possibly Relativistic	3) Natural Selection Processes—pressures to restore efficiency	4) Grossly Inefficient Outcomes

Notes: Cell 2: For example, prices of open-end mutual funds fail to reflect management practices and skills; Cell 3: For example, commodity and gambling markets; Cell 4: For example, misallocated individual portfolios, over- and undershooting by groups.
[a]Nature/Proportion; Orientation.

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decision makers to distort their own decisions, say in a "keep up with the Joneses" effort, or an attempt to move with the herd as a mechanism of protection.

We introduce two behavioral hypotheses to help explain financial phenomena: *Barn Door Closing* for mutual fund purchases, and *Herd Migration Behavior* for debt-equity ratios. Barn door closing, in the horse protection sense, refers to undertaking behavior today that would have been profitable yesterday. Herd migrations in finance occur when market conditions change, so that individual decision makers wish to alter their holdings substantially. Their transition is slowed because they seek protection by traveling with the herd.

II. Barn Door Closing—Purchases of Mutual Funds

The Nobel Prize-winning contributions of Markowitz and Sharpe address the rational portfolio choice problem and its implications for market pricing and efficient portfolio decisions. Their models imply that any individual's optimal mix of asset holdings will comprise a market portfolio (with assets in proportion to their total market value weights) and a riskless fund. When combined with the efficient markets hypothesis, this view leads to a passive (i.e., nontrading) portfolio strategy. The recently introduced multifactor Arbitrage Pricing Theory has similar implications, though the implied universal fund components remain to be satisfactorily identified. If all investors behaved as the financial models predict, observed flows should be due entirely to liquidity/consumption needs or incremental savings and should be explained by portfolio balance considerations.

In contrast, our earlier 1990 paper finds that relative flows across *individual* open-end equity mutual funds reflect 1) status quo bias, 2) a performance effect (i.e., investors' belief that a managed fund with a superior past will perform better than they could as individuals, a view encouraged by financial professionals), and 3) framing/data packaging. In cross-sectional time-series regressions (for 96 funds over 1975–87), we explain 76 percent of the variance (R-squared) and highlight three interesting behavioral influences:

1) Persistence (Status quo bias). Other things equal, a one-dollar incremental flow induces a 75 cent flow in the following period. Although the avoidance of learning costs may justify some behavior persistence, we conjecture that investors (individuals more generally) shortchange important decisions by spreading their attention too evenly. Persistence may also spring from regret avoidance—an attempt to avoid a mistaken act of commission.

2) Past performance. A one-percentage-point return higher than the average fund's return implies a $200,000 increased flow in the next year (where the median fund's size is $80 million and the median flow is $21 million).

3) Framing and data packaging. Rank measures, which are widely reported, appear to be more relevant in explaining flow patterns than are cardinal risk-adjusted performance measures.

In explaining net flows of funds from individuals to the mutual fund sector, barn door closing behavior may be relevant. Mutual fund purchasers may exhibit it because they: 1) rely on trends/patterns (widely prescribed for and practiced in commodities trading but contrary to efficient markets theory and near-martingale asset prices); or 2) engage in personal window dressing (realigning their portfolio to a desirable composition for the sample period experienced).

The traditional struggle of the multiple selves (see Thomas Schelling, 1982, pp. 57–82) is to control one's present self on behalf of the future self. We add a backward-looking feature. Individuals, seeking to contain regret, may try to remove reminders of their past errors. To invoke the agency framework, investors engaged in personal window dressing are imperfectly monitoring principals deceiving themselves into thinking better of their agents, namely their earlier selves.

If the barn door closing hypothesis is germane, individuals will buy more mutual funds after the stock market goes up, and sell after it plunges. Further, if there is

some behavioral threshold effect, this reaction will manifest itself mainly for large changes. Consider the fraction, f, of the U.S. household sector's flow of financial purchases (composed of direct and intermediated net purchases of equities, bonds, and short-maturity or demand deposits) directed to mutual funds. Quarterly data on f is constructed from the Federal Flow of Funds for the 1952Q1–1990Q1 period and excludes households' indirect claims, such as pensions. The fraction f appears mean stationary over the sample period, though during the 1980's f is higher (0.11) than the overall mean (0.05).

In a regression of f on four of its own lags, changes in Treasury bill interest rates, and returns on the equity market (proxied by the value-weighted NYSE index), we observe an economically large and statistically significant positive coefficient on equity returns that is consistent with barn door closing. (Simultaneity problems are avoided since most mutual funds are open end, and hence their supply of shares is highly elastic.) When the market has done well, one wishes that one had invested there, rather than purchase short-term assets (that normally represent more than 50 percent of the households' flows) and fixed-interest assets (that represent about 21 percent), and vice versa. A regression that decomposes equity returns into large ($>|10$ percent$|$) and small changes suggests that barn door closing is most relevant when a threshold has been exceeded. The coefficient on large changes is 0.35 (t-statistic of 4.09), whereas the one on small changes is insignificant (0.06 with a t-statistic of 0.47). Thus a 1 percent change in equity returns beyond a threshold change of 10 percent induces a 6 percent change in the rate of investment in mutual funds by households. (The results are not driven by some subperiod; of the 25 large-change observations, 10 are from the 1950's and 1960's, and 15 are from the 1970's and 1980's.)

III. Financial Herd Migrations—Corporate Debt-Equity Ratios

Migrating birds and trekking wildebeest all know that traveling in a group offers protection. Financial players also may migrate in herds, as when firms increase their debt-equity, S&Ls invest in junk bonds, and banks increase their Third-World debt holdings. These transitions are not instantaneous for many reasons, including the superior information aggregation and mutually informed choices that result from movements in clusters. As with our animal friends, it may be dangerous to get too far out of line.

Each decision maker in a financial migration balances the benefits of more quickly approaching the optimum against the costs of moving away from the herd. As each takes small steps, the whole process ratchets along. Financial migrations, unlike periodic animal migrations, tend to chart unfamiliar territories, and the optimal destination often is not clear. This uncertainty, combined with the natural tendency of individuals to free ride on the information of others, provides the potential for overshooting; as we saw with Third-World debt, or proceeding a while along the wrong path (like the wildebeest who plunge one after another into a ravine, none having had sufficient incentive to worry about his own direction). Birds, scientists now believe, are guided to their distant destinations by the stars and magnetic fields, through navigational methods buried deep in their genes. Human decision makers are less blessed, and must call on their brains.

Even the most clear-sighted financial navigator may be deterred from steering his own course if there is herding on the other side of the market. Banks have delayed writing down doomed real estate loans because the market "would not understand." Corporations considering an increase in their debt-equity ratio had to be concerned about the perceptions of lenders and investors, who might be unfamiliar with the Modigliani-Miller theorem. Bankers hesitate to lend to a firm whose debt-equity ratio tops its industry.

We examined the annual ratios of debt (book value) to equity (market value) for the 200 largest firms (by sales) during the period 1971–89. On the COMPUSTAT database, 15 of these firms had some missing observations, and 3 clearly had outlier debt-equity ratios (in excess of 5): this left us with a

usable sample of 182 firms. We assigned firms to 10 industries based on a reasonable classification of two-digit SIC codes. Over the sample period, there was a persistent overall rise in debt-equity ratios, though considerable heterogeneity across industries and firms (R. Taggart, 1985).

This pattern might be explained by a cost-of-adjustment model. If benefits from movement are linear and costs of adjustment increasing, and if the parameters are constant for the period under study, then each firm would adjust a fixed amount per period; that is, exhibit a local trend regardless of the behavior of other firms.

Our simple herd migration model offers an alternative explanation with additional linkages. Suppose, for the period studied, there is a linear per unit benefit from moving the debt-equity ratio toward its optimum (that is possibly firm-specific and time-varying), but a quadratic penalty for deviations from the crowd (i.e., other firms in one's industry). Under this scenario, parallel to the solution for linear-quadratic models for inventory, the firm's ideal ratio will be a linear weighting of its own past ratio plus the industry's expected ratio. We investigate the herd migration explanation by regressing the firm's debt-equity ratio on two own lags and one lag of the industry ratio. (The expected industry ratio is proxied by its lagged value; its contemporaneous value may exhibit a positive relation simply because of common shocks that influence the market value of equity across firms in an industry.)

A herd migration tendency is indicated by a significant positive sign (a t-statistic above $+2$) on the industry ratio. For 3 of the 10 industries, less than 15 percent of the firms exhibit such tendencies significantly. The proportions were significantly higher for the other 7 industries: food & tobacco, 11/17; paper, lumber & printing, 8/24; oil & gas, 7/13; chemicals, 7/24; electrical products & machinery, 7/12; transportation & communication, 7/17; wholesale & retail trade, 6/26. The median coefficient on the industry ratio for all 182 firms was 0.2; 35 percent of all the coefficients had t-statistics greater than $+2$, 23 percent were between $+1$ and $+2$, and 22 percent were negative.

IV. Concluding Remarks

Looking at flows in financial markets, a relatively unexplored area, we have illustrated the role of such behavioral phenomena as status quo bias, barn door closing, and herd migrations in influencing market outcomes. (These ideas will be elaborated in a forthcoming article in *Theory and Decision*.) The mere survival of many financial markets needs explanation. What sustains their flows of new funds? Absent substantial hedging activity, a large proportion of the individual participants (speculators) in a financial market must have negative expectations. Markets must have certain characteristics to continually lure in losing investors (Zeckhauser and V. Niederhoffer, 1983).

Monday morning quarterbacking may provide part of the explanation. Fans of professional football often believe (with the unacknowledged benefit of hindsight) that they would have been better able than their team's coaches/quarterbacks to identify the strategy that would have won the weekend game. In financial markets, similarly, participants examine past movements and convince themselves they would have made the right choices had they been involved, implying they could do so in the future. To confirm the prevalence of Monday morning quarterbacking, the reader should ask finance-oriented friends whether they sensed that the stock market was "clearly" overpriced just before the October 1987 crash.

We conclude poetically:

In the players, not the market, may rational ways inhere.

(But also vice versa—received doctrine makes it clear.)

From the traders to the tickers, you should not expect to see

Either easy aggregation, or pat synecdoche.

REFERENCES

Camerer, C., "Do Biases in Probability Judgment Matter in Markets?," *American Economic Review*, December 1987, 77, 981–97.

Kahneman, D., Slovic, P. and Tversky, A.,

Judgement Under Uncertainty: Heuristics and Biases, Cambridge: Cambridge University Press, 1982.

Patel, J., Zeckhauser, R. and Hendricks, D., "Investment Flows and Performance: Evidence from Mutual Funds, Cross-Border Investments, and New Issues," (1990) in a volume by the Center of Japan-U.S. Business and Economic Studies, New York University, forthcoming.

Schelling, T., *Choice and Consequence*, Cambridge: Harvard University Press, 1982.

Taggart, R., Jr., "Secular Patterns in the Financing of U.S. Corporations," in B. Friedman, ed., *Corporate Capital Structures in the United States*, Chicago: University of Chicago Press, 1985, 13–80.

Zeckhauser, R. and Niederhoffer, V., "Futures Markets as Ecological Systems: Survival? Efficiency? Rational Participants?," presented at American Economic Association annual meeting, December 28, 1983.