

HERDING: AN INTERDISCIPLINARY INTEGRATIVE REVIEW FROM A SOCIONOMIC PERSPECTIVE

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Abstract

Herding is one of the most important concepts in cognitive economics, especially as applied to financial markets. This paper presents an interdisciplinary integrative literature review of the herding concept, discusses the salient differences between different ways of conceptualizing herding, and argues for the advantages of the socionomic perspective on herding, a new theory that sees herding as a process having evolutionary, prerational and predictable aspects. The paper first summarizes the literature regarding diverse theoretical approaches to the concept of herding: social psychological approaches; information theory and cybernetic approaches; ethological and biological approaches; econophysics approaches; medical model approaches; and the socionomic model.

The paper categorizes these theories according to several theoretical distinctions:

- Evolutionary component or not;
- Assumes context of uncertainty or not;
- Model of agents as homogeneous or heterogeneous;
- Herding dynamics seen as endogenous or exogenous;
- Conscious or unconscious processes;
- Rational or other-than-fully-rational processes;
- Assumes equilibrium theory or not;
- Assumes utility-maximizing or not.

Finally, the paper offers the socionomic model of herding in contrast to other models. Socionomic theory incorporates a type of quantified structuralism, taking free choice seriously at the individual level yet finding probabilistic constraints on herding at the aggregate level due to a structure-determined dynamic in the herding process. The socionomic model of herding has a repetitive fractal form, is self-affine to an intermediate degree, is governed by Fibonacci relationships, and is unique in being probabilistically predictable at the aggregate level.

There has been an explosion of studies regarding herding in recent years. There have been several excellent summaries of the growing herding literature (Devenow and Welch [1996], Bikhchandani and Sharma [2000], and Sornette [2003b, 27-36]). Most reviewers, however, limit themselves to rather narrow theoretical confines. For instance, some reviewers seem to assume that herding theories without a commitment to the rational choice model are not worth considering: "In this review, we do not discuss models of herd behavior by individuals who are not fully rational...." (Bikhchandani and Sharma [2000, 5]). This paper, in contrast, attempts to analyze a wider diversity of models of herding so that we can see the differences between socionomic theory and more traditional

theories in this area. The literature reveals many theoretical approaches to herding:

- 1) Social psychological approaches: imitation processes, fads and fashions
- 2) Information theory and cybernetic approaches: information cascades, positive feedback, etc.
- 3) Ethological approaches: flocking, migrating birds, ant recruitment, etc.
- 4) Econophysics approaches: catastrophe theory, sandpile analogies, self-organized criticality, etc.
- 5) Medical model approaches – disease and infection analogies: contagion, etc.
- 6) The socionomic approach

We categorize these theories in Table 1 according to eight salient dimensions. We have scored a theoretical model as “Yes/No” on theoretical dimensions on which the model takes both sides of the issue, and “?” on those dimensions on which the model does not express a discernible stance. To facilitate comparisons, we have bolded the theoretical positions held in common with the positions taken by socionomics.

Social psychological theory of herding.

Shiller [1984, 1990, 2000, 2001] is perhaps the best representative of this model of herding. Shiller has devoted much of his career to challenging economic theorists’ assumption of the full rationality of investors. Socionomics

goes further, seeing financial behavior as prerational and unconscious.

Many of Shiller’s ideas overlap with socionomic theory, especially his focus on waves of excessive optimism and pessimism in market “fads” (similar to the waves of “social mood” in socionomic theory). Shiller describes the social dynamics of a stock market bubble as a combination of social enthusiasm, excessive optimism, and selective attention: “The high demand for the asset is generated by the public memory of high past returns, and the optimism those high returns generate for the future.” His “fads and fashions” model posits that “...investors have over-confidence in a complex culture of intuitive judgments about expected future price changes, and an excessive willingness to act on these judgments” (Shiller [2001, 3-4]).

Though often lumped in with the information cascade theories of herding, papers about “reputational herding” (e.g., Hong, Kubik, and Solomon [1998]) are also categorized here as social psychological theories of herding, since they similarly rely on a simple process of “imitation for social advantage” as their explanation for herding. Many of these theorists also cite social psychological research, such as Asch’s early studies of conformity (cited, e.g., by Scharfstein and Stein [1990]).

Table 1: Summary of Positions of Theories of Herding on Eight Theoretical Dimensions

	1 Evolu- tionary	2 Un- cert.	3 Homo- geneous	4 Endoge- nous	5 Con- scious	6 Ration- al	7 Equili- brium	8 Util- Max.
Social psych.	No	Yes	Yes	Yes/No	Yes/No	Yes/No	?	Yes
Info. Theory	Yes/No	Yes	Yes/No	No	Yes	Yes	Yes	Yes
Ethological	Yes	Yes	Yes	Yes	No	No	?	Yes
Econophysics	?	Yes	No	Yes/No	Yes/No	Yes	Yes	Yes
Medical	Yes	Yes	No	Yes	No	No	Yes/No	Yes
Socionomics	Yes	Yes	Yes	Yes	No	No	No	No

Other reputational herding papers include Zwiebel [1995] and Prendergast and Stole [1996]. Reputational herding is exogenous, conscious, rational, and utility-maximizing. Most of these theories do not comment on equilibrium theory, and they typically do not assume an evolutionary source of the herding behavior, seeing it rather as a rational choice. Reputational herding is usually a model of heterogeneous agents in interaction, with younger, inexperienced agents competing for a good reputation in society against older, more experienced agents who are assumed to have superior knowledge or skill – Scharfstein and Stein [1990] call their two groups “smart managers” and “dumb managers.”

Information theory of herding. The most frequently cited representatives of this model of herding, and perhaps the herding theorists most cited by economists, are Banerjee [1992] and Bikhchandani, Hirshleifer and Welch [1992] (referred to here as BHW). Banerjee [1992, 801] takes pains to distinguish his informational model of herding from the reputational models such as that of Scharfstein and Stein [1990]. BHW (p. 994) define the essence of their model of herding: “An informational cascade occurs when it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information.” The word “optimal” helps us see that this model assumes utility-maximizing, and the model also makes an assumption that neoclassical equilibrium theory is correct. It describes a rational, conscious process where causality is exogenous. Some studies using models related to Banerjee’s or BHW’s approach model homogeneous agents in interaction, while others model heterogeneous groups of agents. We also include in the information theory category the models of herding based on game theory. Some papers in this category mention evolutionary functions of herding behavior, while others do

not. What they all share is a model of herding more closely aligned with neoclassical economics than any of the other five models we cover in this paper; thus, this model is the most influential among traditional economists. See Hirshleifer and Teoh [2001] for a useful review of other papers using this model. Herding models invoking a “positive feedback” process in their explanation are a subtype of the information theory model.

Ethological theory of herding. Ethology, the study of animal behavior, is the source of metaphors and analogies for this model of herding. The studies in this category are less unified theoretically than those in the other categories presented in this paper, since their primary commonality is a focus on animal behavior and its analogues in human herding behavior, rather than a focus on a single set of theoretical assumptions about the dynamics of herding. Kirman [1993] is a representative of this category. He bases his model of herding on the process of “recruitment” seen in ant behavior. He claims that his model of “stochastic recruitment... explains the ‘herding’ and ‘epidemics’ described in the literature on financial markets as corresponding to the equilibrium distribution of a stochastic process rather than to switching between multiple equilibria” (p. 137). Kirman approvingly cites studies in which herding behavior is seen as “a source of endogenous fluctuations in the price level in asset markets” and feels that this “explanation is particularly appealing when... it does not rely on exogenous shocks to the system” (p. 138). Kirman’s model does not endorse the equilibrium theory of neoclassical economics, since “there is no convergence to any particular state” (p. 147). Kirman also explains that while traditional models involving exogenous shocks cannot “detect the presence of periodically collapsing bubbles in asset prices,” his ant recruitment model “will generate such bubbles” (p. 153).

Examples of the diverse ethological theories of herding include those related to the work of Danchin et al. [2004], Okubo [1986], Saffre and Deneubourg [2002], and Viscido, Miller and Wethey [2002].

Econophysics theory of herding. UCLA geophysics professor Didier Sornette [2003a, 2003b] and his colleagues (Sornette and Andersen [2002], Lux and Sornette [2002]) are exemplars of a model of herding that is even more mechanistic in its assumptions than the information theory model, since it models human herding behavior by comparing it to that of nonliving systems. The ethologists compare human systems to nonhuman systems, but not to nonliving systems.

The econophysics models have much in common with the information theory models of herding, which they often quote approvingly (e.g., Sornette and Andersen [2002, 172-173]). The most significant difference is that most (not all) econophysics models of herding attempt to model endogenously the dynamics of “rational bubbles” created by herding, while the information theory models involve exogenous causality exclusively. Various versions of econophysics models describe homogeneous agents as well as heterogeneous agents, and the econophysics papers vary as to whether the processes involved are conscious or not.

The econophysics models of herding include those based on catastrophe theory, self-organized criticality, and sandpile models. While these variants on physics-based theory have important theoretical differences, they share the features outlined in the econophysics model.

Medical model theory of herding. This model of herding has a long history, going back to classical economist David Ricardo ([1815-1823/1951, as cited in Kelly and O’Grada [2000]). He first described market panics in terms of “social contagion” (p. 68), ascribing the panic of 1797 to “the contagion of the unfounded fears of the timid part of the community.” Thus,

Ricardo sees such contagions as irrational, endogenous and heterogeneous.

A unique study that serves as an exemplar of the medical model of herding is that conducted by Kelly and O’Grada [2000], using an analysis of historical banking data. In this study, factors such as size of bank account and years since immigration to the U.S. predict some of the variance as to whether investors panicked and withdrew all their money during two bank runs in the 1850s, but by far the greatest part of the variance is predicted by an aspect of their “social network,” namely their county of origin in Ireland. This social contagion study makes sophisticated use of social network theory, often used by medical epidemiologists.

Another body of literature describing herding as social contagion draws heavily on the social psychological literature. (See Levy and Nail’s [1993] review.) These contagion studies are distinguished from the social psychological studies mentioned earlier by the fact that they draw their explanatory power from primarily unconscious processes, often involving the “infectiousness” of social mood, whereas the social psychology section above concern primarily consciously imitative processes.

Though we are focusing in this paper primarily on herding behavior within one nation’s financial markets, many studies invoking the medical model define “financial contagion” as “the rapid spread from one market to another of declining prices, declining liquidity, increased volatility, and increased correlation associated with the financial intermediaries’ own effect on the markets in which they trade” (Kyle and Xiong [2001]).

Socionomic theory of herding. A more than cursory comparison of the preceding models of herding must await a future, lengthier publication. We will discuss in a bit more depth a new theory of herding, that of socionomics. The socionomic theory of herding (Prechter [1979, 1999, 2001, 2003]) is unique in

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describing a model of *unconscious, prerational* herding behavior that posits *endogenous* dynamics that have *evolved* in *homogeneous* groups of humans in contexts of *uncertainty*, while eschewing the traditional economic assumptions of *equilibrium* and *utility-maximization*.

The unique causal model of socionomic theory utilizes a quantified structuralism, taking free choice seriously at the individual level yet finding probabilistic constraints on behavior at the aggregate level due to a structure-determined dynamic in the herding process. The socionomic model of herding – called the Wave Principle – has a repetitive fractal form that is self-affine to an intermediate degree. Neoclassical economic theory takes its model of causality from nineteenth century physics (Mirowski [1989]). Socionomics, in contrast, addresses the complex reality of financial behavior from the perspective of a modern integration of the organicist and contextualist worldviews (see Prechter and Parker [2004]). Socionomic theory captures the process of decision-making under uncertainty in a manner that reflects the psychological reality of the individual's behavior while offering probabilistic prediction of the form-determined path of development of the social whole.

We present this new theory of herding in the context of a new paradigm, that of socionomics (Prechter [1999, 2003]), which is the study of the laws of human social behavior in the aggregate. The socionomic paradigm challenges the rational choice model of human behavior that underlies much of the current theory in the social sciences. The main theoretical principles of socionomics are that in human, self-organized complex systems:

- Shared unconscious impulses to herd in contexts of uncertainty lead to the emergence of mass psychological dynamics that manifest as social mood trends.
- These social mood trends are patterned and therefore are probabilistically predictable,

being governed by principles of fractal geometry and Fibonacci mathematics.

- These patterns of human aggregate behavior are form-determined due to endogenous processes rather than mechanistically determined due to exogenous causes.
- Social mood trends are the underlying cause of social actions. (This statement is the converse of an assumption implicit in conventional social theories, which is that social actions are the cause of changes in social mood.)

Putting these elements together, we can say that the socionomic theory of finance is that endogenous patterns of aggregated unconscious herding impulses under conditions of uncertainty produce a probabilistically predictable pattern of social mood, which in turn impels social actions, one of which is buying and selling in financial markets, records of which manifest as a hierarchical fractal described by the Wave Principle (Elliott [1938, 1946] and Frost and Prechter [1978/2005]).

Context of uncertainty – According to socionomic theory, when people are uncertain, they default to a herding impulse developed through evolution. When humans do not know, they are impelled to act as if others do, and because sometimes others actually do know, herding increases the overall chance of survival.

In contrast to current proponents of the Efficient Market Hypothesis (EMH), earlier economists such as Keynes [1921, 1936/1997] and Knight [1921] took uncertainty in the financial markets seriously. Keynes spoke of “fundamental uncertainty,” suggesting that he saw uncertainty as an ineluctable aspect of reality itself (Prechter and Parker [2004], Winslow [1989] and Davis [1989]). Bischoff-Grethe, Martin, et al. [2001] have provided neurophysiological evidence that the brain processes information differently in contexts of uncertainty vs. contexts of certainty, as socionomic theory postulates. In contrast to

Keynesian theory, the possibility of prediction in socioeconomic theory does not rely upon knowledge of a mechanistic determinism. On the contrary, in the social aggregate, herding affords form-determined predictability despite fundamental unpredictability at the level of individual agents. In socioeconomics, predictability is an emergent property of the form-determined system at the aggregate level.

In contrast to socioeconomic theory's attention to conditions of uncertainty, EMH postulates that investors are never uncertain about current values. According to EMH (see Fama [1970]), investors simply revalue markets rationally as new information becomes available. But as Alan Greenspan [2003] said about central banking, "Uncertainty is not just an important feature of the monetary policy landscape; it is the defining characteristic of that landscape." This is at least as true for most investors as it is for the Fed. The vast majority of investors are uninformed, ignorant, and most definitely uncertain, so they look to the herd for guidance, not realizing that most others in the herd are just as uncertain as they are.

Prerational processes – Because herds are ruled by the majority, not the wise, financial market trends are based on little more than the shared mood of investors – how they feel – which is the province of the prerational areas of the brain mediating emotional responses, not rational ones (see Prechter [2001]).

The areas of the brain mediating rational thought do play a role in the herding process. They provide rationalization, generating for the investor plausible-sounding reasons for his own unconscious behavior. Without this service, the herding impulse would encounter resistance from the dictates of reason. Most economists know the Italian economist Vilfredo Pareto for his early contributions to neoclassical equilibrium theory, but Pareto is less well known for his later sociological theory concerning the basic motivations of human behavior. His theory

features a distinction between underlying prerational drives and the conscious rationalizations given by men for their own behavior *a posteriori*. He posited six non-rational instincts, or "residues" as he called them (of which one, the instinct toward "sociability," is similar to the herding impulse of socioeconomic theory), along with a number of *post hoc* logical rationalizations people offer for their behavior, which he called "derivations." (See Zetterberg [1993] for a brief summary of Pareto's sociological theory.) In this regard, Pareto's sociological ideas are an early theoretical precursor to socioeconomics, though the two theories were created independently.

Unconscious processes – Some people are surprised to learn that one portion of the brain could generate prerational herding behavior, while a more rational portion of the brain might be unconscious of this herding dynamic. Shiller's [1990] survey-based study of the stock market crash of 1987 is a good example of the discrepancy between what investors say is the reason for a large price movement and what they actually did as they sold their stock in droves. The survey revealed that the most frequent reasons given for the crash was that the market was "overpriced" and that large institutional investors were selling when the market hit "stop-loss" points. These ideas sound rational and at least roughly related to fundamental analysis or rational trading techniques. Shiller's research found, however, that on the day of the big crash, an astounding 43% of his random sample of institutional investors were experiencing "unusual symptoms of anxiety (difficulty concentrating, sweaty palms..., or rapid pulse) regarding the stock market" (p. 58). In contrast to the calm reasoning process of selling they reported in the survey, these investors were actually found to be "...people reacting to each other with heightened attention and emotion, trying to fathom what other investors were likely to do, and falling back on intuitive models..."

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Endogenous causality – Shiller also concluded that his survey data revealed “...no recognizable exogenous trigger for the crash.” Data from several socioeconomic studies (Prechter [1999, 2003]) allow us to dismiss every supposed reason so far offered for adopting an opinion on the stock market that relies on causes outside the market itself. The irrelevance of exogenous forces applies to economic reports, wars and peace treaties, terrorism, elections, corporate earnings, scandals, Fed actions and the movements of other markets. None of these things has a consistent relationship to stock price movement, and to the extent that any relationship may exist, it is a lagging one (due to social mood’s inducing social actions), making it useless for stock-market forecasting.

Socioeconomics resolves the conflict between endogenous and exogenous causal models of human social behavior. The Wave Principle suggests that shared social mood is endogenous and form-governed. Neoclassical economics sees exogenous shocks as impacting prices, which in turn govern behavior via the Law of Supply and Demand. In the socioeconomic model that operates in financial markets, prices are simply a record of the endogenous herding dynamic and do not regulate it. Mirowski [1990, 296] has explained how, following Mandelbrot’s observation that “empirical [financial] time series of prices are not continuous functions,” it is inevitable that the “Marshallian ‘law’ of supply and demand is most certainly the primary victim of this reconceptualization.” Socioeconomics postulates that financial prices are simply an epiphenomenon of an unconscious, subjective valuation process. Waxing optimism produces rising prices, and waxing pessimism produces falling prices. In economics, prices are powerful; in finance, they are (in the aggregate) irrelevant. They are merely a gauge of investor psychology, which derives from social mood.

Homogeneous agents – Socioeconomics can explain why professional money managers, in

the aggregate, fail to beat the market (Olsen [1996]). It is not because the market is random; it is because in the aggregate, professionals are herding, just like most other investors. See Sias [2004], Welch [2000], Graham [1999], Trueman [1994], and Scharfstein and Stein [1990] for evidence of herding by institutions, investment newsletter writers, brokers, financial analysts, and money managers. Table 1 indicates that socioeconomic is among the minority of theories that argue for a homogeneous agent model of herding. This is because amateurs and professionals alike are part of the herd in the financial markets. When it comes to herding, there are no significant differences in action between the traditional classes of “smart money” and “dumb money.”

While Shiller’s [1984, 482] model allows the distinction between “smart money” and “ordinary investors,” he also acknowledges that “...managers, like the public, are forecasting earnings and may become overly optimistic or pessimistic.” Socioeconomics’ Wave Principle models these waves of optimism and pessimism.

Evolutionary – Socioeconomics incorporates the idea that herding developed via evolution to enhance survival (see Prechter [1999] and earlier comments). By coherently integrating theories of economics governing decision-making where knowledge is relatively certain with a theory of finance where knowledge is intrinsically uncertain, socioeconomic may represent the next step in the evolution of broader and more powerful theoretical models of human social behavior. Socioeconomic theory recognizes the need for both an accommodation to mechanistic causality in certain economic contexts and an assimilation of man’s active, endogenous causal processes in social contexts of uncertainty, where herding is the rule, not the exception. These Piagetian processes of assimilation and accommodation at the level of social behavior need not be in opposition conceptually if each is understood in its proper context.

Conclusion

The endogenous causal model posited by the socio-economic theory of herding clearly differs on one or more theoretical dimensions from all the other theories of herding covered in this paper. As a theory of finance it is especially at odds with any model of financial behavior that shares the prevailing neoclassical economic assumption of mechanistic causality and “exogenous shocks.” Neoclassical economic theory is useful; it is just that finance is not the proper context for its application. We need an historical perspective on the conflict between these two radically different theoretical views. As Noelle-Neumann [1993, 116] has documented,

In the nineteenth and twentieth centuries, two views have repeatedly clashed – the view that stresses instinctual behavior and sees man as determined by herd instincts; and the view that assumes man reacts rationally to the experience of reality.... From one historical perspective it can be said that behaviorism has supplanted two different instinct theories, the one by the British biologist Wilfred Trotter [whose 1916 book first popularized the term “herd instinct”]... and the other one by McDougall [whose 1920 *The Group Mind* was about social behavior in the aggregate].... The schools of thought that emphasized the rationality of man regarded imitation as a purposeful [conscious, rational] learning strategy. Because these schools clearly prevailed over the instinct theories, the subject of imitation [as instinctual herding]... fell into neglect.

In the evolution of social theory, the pendulum of history is beginning to swing back in the other direction. Thanks to the economic experiments of behavioral finance, and to the anomalies for EMH discussed by researchers such as Shiller [1984] and Lo and MacKinlay [1999], some economists are beginning to

recognize the importance of the non-rational and instinctual aspects of human behavior. As this new wave of science examining the nature-nurture question comes into focus, we are moving past simplistic questions such as “Is man’s behavior instinctive or rationally determined?” to a more sophisticated and more useful question: “How do the dynamics of rational social behavior relate to the dynamics of instinctive social behavior?” Socio-economic theory has an answer: the context of uncertainty is the boundary between instinctive and rational behavior, as it is the boundary between financial and economic behavior. The social dynamic generating financial behavior is unconscious herding as conceptualized in socio-economic theory.

REFERENCES

Note: Some of the material in this paper was presented earlier in a somewhat different form in Prechter and Parker [2004].

- Banerjee, Abhijit V. (Aug. 1992). “A simple model of herd behavior,” *Quarterly Journal of Economics*, **107** (3), 797-817.
- Bikhchandani, Hirshleifer and Welch (Oct. 1992). “A theory of fads, fashion, custom, and cultural change as informational cascades,” *Journal of Political Economy*, **100** (5), 992-1026.
- Bikhchandani, Sushil, and Sunil Sharma. (2000). “Herd Behavior in Financial Markets: A Review,” (March 2000). IMF Working Paper No. 00/48. <http://ssrn.com/abstract=228343>.
- Bischoff-Grethe, A., M. Martin, H. Mao, and G.S. Berns. (2001). “The context of uncertainty modulates the subcortical response to predictability,” *Journal of Cognitive Neuroscience*, **13** (7), 986-993.
- Danchin, Etienne, Luc-Alain Giraldeau, Thomas J. Valone, and Richard H. Wagner (July 23, 2004). “Public information: From nosy

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- neighbors to cultural evolution,” *Science*, **305**, 487-491.
- Davis, John B. (Dec. 1989). “Keynes on atomism and organicism.” *Economic Journal*, **99**, 1159-1172.
- Devenow, Andrea, and Ivo Welch (1996). “Rational herding in financial economics,” *European Economic Review*, **40**, 603-615.
- Elliott, R.N., *The Wave Principle* (1938) and *Nature’s Law* (1946), reprinted in Prechter (Ed.), *R.N. Elliott’s Masterworks* (1993), New Classics Library.
- Fama, Eugene F. (1970). “Efficient capital markets: A review of theory and empirical work,” *Journal of Finance*, **25** (2), 383-417.
- Frost, Alfred John, and Robert R. Prechter, Jr. (1978/2005). *Elliott wave principle — key to market behavior*. Gainesville, GA: New Classics Library.
- Greenspan, Alan (August 29, 2003). Remarks at a symposium in Jackson Hole, WY, <http://federalreserve.gov/boarddocs/speeches/2003/20030829/default.htm>.
- Graham, John R. (Feb. 1999), “Herding among investment newsletters: Theory and evidence,” *Journal of Finance*, **54**(1), 237-268.
- Hirshleifer, David A. and Siew Hong Teoh. (Dec. 19, 2001). “Herd Behavior and Cascading in Capital Markets: A Review and Synthesis.” Dice Center Working Paper No. 2001-20, <http://ssrn.com/abstract=296081>.
- Hong, Harrison, Jeffrey D. Kubik, and Amit Solomon (July 1998). “Security analysts’ career concerns and herding of earnings forecasts,” <http://ssrn.com/abstract=142895>
- Kelly, Morgan, and Cormac O’Grada (Dec. 2000). “Market contagion: Evidence from the panics of 1854 and 1857,” *American Economic Review*, **90** (5), 1110-1124.
- Keynes, John M. (1921). *The Treatise on Probability*. London: Macmillan.
- Keynes, John M. (1936/1997). *The General Theory of Employment, Interest Rates, and Money*. New York: Prometheus Books.
- Kirman, Alan (Feb. 1993). “Ants, rationality, and recruitment.” *Quarterly Journal of Economics*, **108** (1), 137-156.
- Knight, Frank H. (1921). *Risk, Uncertainty, and Profit*. New York: Houghton Mifflin.
- Kyle, Albert S., and Wei Xiong (Aug. 2001). “Contagion as a wealth effect,” *Journal of Finance*, **56** (4), 1401-1440.
- Levy, David A., and Paul R. Nail (May 1993). “Contagion: A theoretical and empirical review and reconceptualization,” *Genetic, Social & General Psychology Monographs*, **119** (2), 235-284.
- Lo, Andrew W., and A. Craig MacKinlay. (1999). *A Non-Random Walk Down Wall Street*. Princeton, New Jersey: Princeton University Press.
- Lux, Thomas, and Didier Sornette. (Aug. 2002). “On rational bubbles and fat tails,” *Journal of Money, Credit, and Banking*, **34** (3), 589-610.
- Mirowski, Philip. (1989). *More Heat than Light: Economics as Social Physics, Physics as Nature’s Economics*. Cambridge: Cambridge University Press.
- Mirowski, Philip. (Oct 1990). “From Mandelbrot to chaos in economic theory.” *Southern Economic Journal*, **57** (2), 289-307.
- Noelle-Neumann, Elisabeth. (1993). *The Spiral of Silence: Public Opinion – Our Social Skin*, 2nd ed. Chicago: University of Chicago Press.
- Okubo, Akira (1986). “Dynamical aspects of animal grouping: Swarms, schools, flocks, and herds,” *Adv. in Biophysics*, **22**, 1-94.
- Olsen, R. (July/Aug. 1996). “Implications of herding behavior...” *Financial Analysts Journal*, **52** (4), 37-41.
- Prechter, Jr., Robert R. (1979). “What’s going on?” *Elliott Wave Theorist*, August 3, 1979. Reprinted in Prechter (2003), p. 1.

- Prechter, Jr., Robert R. (1999). *The Wave Principle of Human Social Behavior and the New Science of Socionomics*. Gainesville, GA: New Classics Library.
- Prechter, Jr., Robert R. (2001). "Unconscious herding behavior as the psychological basis of financial market trends and patterns," *Journal of Psychology and Financial Markets* [now *Journal of Behavioral Finance*], **2** (3), 120-125.
- Prechter, Jr., Robert R. (2003). *Pioneering Studies in Socionomics*. Gainesville, GA: New Classics Library.
- Prechter, Robert R., Jr., and Wayne D. Parker (2004). "The financial/economic dichotomy," in Heping Pan, Didier Sornette, and Kenneth Kortanek, Eds., *Intelligent Finance - A Convergence of Mathematical Finance with Technical and Fundamental Analysis*. Melbourne, Australia: International Workshop on Intelligent Finance (University of Ballarat).
- Prendergast, Canice, and Lars Stole (1996). "Impetuous youngsters and jaded old-timers: Acquiring a reputation for learning," *Journal of Political Economy*, **104** (6), 1105-1134.
- Saffre, F., and J.L. Deneubourg (2002). "Swarming strategies for cooperative species," *Journal of Theoretical Biology*, **214**, 441-451.
- Scharfstein, David S., and Jeremy C. Stein. (June 1990). "Herd behavior and investment," *American Economic Review*, **80** (3), 465-479.
- Shiller, Robert J., Stanley Fischer, and Benjamin M. Friedman (1984). "Stock prices and social dynamics," *Brookings Papers on Economic Activity*, **1984** (2), 457-510.
- Shiller, Robert J. (Spring 1990). "Speculative prices and popular models," *Journal of Economic Perspectives*, **4** (2), 55-65.
- Shiller, Robert J. (2000). *Irrational Exuberance*. Princeton, New Jersey: Princeton University Press.
- Shiller, Robert J. (May 2001). "Bubbles, human judgment, and expert opinion," Cowles Foundation Discussion Paper No. 1303, http://papers.ssrn.com/abstract_id=275515.
- Sias, Richard W. (Spring 2004). "Institutional herding," *The Review of Financial Studies*, **17**(1), 165-206.
- Sornette, D. (2003a). *Why Stock Markets Crash: Critical Events in Complex Financial Systems*, Princeton University Press.
- Sornette, D. (2003b). "Critical market crashes," *Physics Reports* **378** (1), 1-98.
- Sornette, D., and J.V. Andersen (2002). "A nonlinear super-exponential rational model of speculative financial bubbles," *International Journal of Modern Physics C*, **13** (2), 171-187.
- Trueman, Brett. (Spring 1994). "Analyst Forecasts and Herding Behavior," *The Review of Financial Studies*, **7** (1), 97-124.
- Viscido, Steven V., Matthew Miller, and David S. Wethey (2002). "The dilemma of the selfish herd: The search for a realistic movement rule," *Journal of Theoretical Biology*, **217**, 183-194.
- Welch, Ivo. (2000). "Herding among security analysts," *Journal of Financial Economics*, **58** (3), 369-396.
- Winslow, E.G. (Dec. 1989). "Organic interdependence, uncertainty and economic analysis," *Economic Journal*, **99**, 1173-1182.
- Zetterberg, Hans L. (1993). "Elites: Vilfredo Pareto," ch. 3 in *European Proponents of Sociology Prior to WW I*. http://zetterberg.org/Books/b93e_Soc/b93eCh4.htm.
- Zwiebel, Jeffrey (1995). "Corporate conservatism and relative compensation," *Journal of Political Economy*, **103** (1), 1-25.

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