SUPPLEMENT TO MSASI - HF LLC SPRING 2010 NEWSLETTER

Strategy and Epistemology: Strategic Decisions Enhancing Outcomes Epistemologically[1]

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Preface

This Hoyt Group Wikimedia site[3] provides a bio-economic lens as an application of the principles of human biology to economics under the basic proposition of consilience, the concept that there is a commonality of principles among the disciplines. The focus is on dealing with the instabilities that are inherent in the emergent properties of markets ranging from real estate to capital markets, including the derivatives and other innovative instruments.

The site is organized under a hierarchical structure that permits discussion to flow along a variety of lines designed to flesh out a mosaic that provides a gestalt of the system. The intent is to foster research on components of the mosaic so that the linkages among the components and the energy with which they interrelate are understood with a comprehension that enables constructive intervention of public policy.

This particular entry, "Strategy and Epistemology," as one of a number of opening items, is set in a context of philosophy of science. It is a background piece for a potential research roundtable that may have as the spine of discussion the use of agent-based models to provide insights to the process of emergence in real estate and capital markets. The research agenda expected to emerge from the roundtable should focus on an array of research projects, most of which will use standard economics research methodology, but would collectively present a vision of the system as a whole so as to provide the basis for better forecasts of outcomes.

Introduction

The traditional view of social science research to enhance knowledge relevant to public policy is deficient!

Forecasting outcomes can be enhanced by recognizing insights gained through research producing lesser qualities of knowledge than that achieved through the traditional view of science. The traditional view of science relies on inductive reasoning, which may be in error, but which is produced by rigorous research obtaining greater reliability than achieved by other methodologies. Advancements through new disciplines offer the opportunity to conduct research not doable by prevailing methodology.

Academia would do well to apply new methodologies that recognize alternative scenarios arising out of emergent activities and strategically select options not simply based on the most likely outcome.

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[1] This essay was initially developed for a combination of two interest groups at ASPEC (Academy of Senior Professionals at Eckerd College), the Seminar on Improving Decisions through Strategy and 21st Century Science; but, it has evolved to serve as a background paper for a new Wikimedia section of the Hoyt Group website and the related section of that site called *Maury Seldin on Strategy Matters*.

[2] Dr. Seldin, a chaired professor emeritus of the American University, is Chairman of the Board of Directors of the Homer Hoyt Institute (HHI), an independent not-for-profit organization dedicated to improving the quality of real estate related decisions through the development and dissemination of relevant research. The views expressed are those of Dr. Seldin and may not represent the views of HHI.

[3] **Www.wiki.hoyt.org** is opening soon.

Reliance on the invisible hand of the free market, a case of emergence in a complex adaptive system, is a case in point. It contributed to the creation of the *Great Recession* that is deteriorating the quality of life in our society. Society would have been better served had guidance of the invisible hand been taken applying the principles used by some individuals in managing their own health care. For example, monitoring the flow of funds along with such policies as would permit markets to perform their functions, but would avoid excessive volatility is an example.[i] That bio-economic approach utilizes three levels of meeting problems and in a strategic context is a case of minimax.[ii]

The discussion that follows identifies some advances in science through the creation of new disciplines and the application of the resulting knowledge in an interdisciplinary approach to interdisciplinary issues. It endorses a philosophy of science that would broaden the concept of scientific research and, by application in academia, produce knowledge that would facilitate policies resulting in better societal outcomes.

The Deficiency of the Traditional View of Science

The traditional view of science is rooted in the work of Francis Bacon (circa 1620) that became the basics of the modern scientific method, hypotheses derived from observation, tested by replicable experiments, and adding to knowledge by induction.[iii] Rene Descartes, his contemporary, raised the question of how we know that it is true.[iv] That has been called the "epistemological turn." Epistemology, what we know and how we know it, is one of the five classical fields of philosophy.[v]

The evolution of the traditional view continued with Isaac Newton's *Principles of Natural Philosophy* (1687) that became the model of the physical sciences and that social sciences later sought to emulate (a case of physics envy). The accumulation of knowledge derived by repeated observations with tests of hypotheses is known as being achieved by inductive reasoning. A half-century later, David Hume produced his three volume *Treatise of Human Nature* (1739-40) followed by revisions titled *Inquiry Concerning Human Understanding* (1748) and *Inquiry Concerning the Principles of Morals* (1751).

Hume, an empiricist (knowledge derives from experience), subscribed to the phenomenologist version, the idea that it is one's perception of the experience that provides the knowledge, but that the reality may be different. A major leap in the evolution of the traditional view came in 1781 when Immanuel Kant, in his *Critique of Pure Reason*, blended empirical and rational knowledge. "That all our knowledge begins with experience there can be no doubt…But although all our knowledge begins with experience, it does not follow that it arises from experience" is a combination of the opening sentences of the first two paragraphs.[vi]

A variation of a combination of the opening sentences of the first two paragraphs of Kant's, *Critique of Pure Reason* is provided by Brian Magee in his *Confessions of a Philosopher*, in the chapter titled "The Discovery of Kant." It is "The attempt leads him [Kant] into the most radical reconstruction of the theory of knowledge that anyone has ever carried out. At the end of it he pronounces that the whole nature of the world *as we experience it* is dependent on the nature of our apparatus for experiencing, with the inevitable consequence that things as they appear to us are not the same as the thing as they are in themselves." [page 143.]

The Kantian view, as discussed by Magee, includes the following. "All the ways we have of perceiving objects - sight, sound, touch, taste, smell, - are such as cannot exist independently of sensory and nervous systems; and all the ways of thinking about objects are precisely that, namely ways of thinking, and can no more take place without brains than seeing can take place without eyes… Science, in other words, consisted entirely of immediate observation plus logic, and these were two processes which, if carefully executed, yielded the highest level of certainty that there could be." [pages 141-2.]

Magee continues the discussion noting that Kant drew from Hume's contribution; "Hume taught him that causal connection is something whose existence is not only unobservable but impossible to derive logically from anything that is observable..." [page 142.] Magee goes on to develop the idea that **"Therefore observation and logical derivation cannot be the only bases for reliable knowledge."** [Emphasis added.] [page 143.] The next concept relevant here is a quote from page 146 of the chapter, "Kant left us with three as against two components of possible knowledge about this world: empirical observation, logical derivation, and the forms in which all these are mediated by our mental and sensory apparatus."

This situation leaves us with a problem in that with induction we cannot really be sure, although the belief can be strengthened. Karl Popper's approach is to use science in efforts at falsification, the idea that one cannot prove the validity of the knowledge, but by attempting to refute the proposition some false propositions can be identified. Knowledge is advanced by reducing ambiguity in theories so that they may be refuted, but in the absence of refutation they may be the best quality of knowledge available for forecasting outcomes.

Popper also notes that science is advanced by having propositions that are informative as well as falsifiable. The thrust is the development of knowledge as close to the truth as is feasible with propositions that may be tested and potentially found false.[vii]

This discussion asserts that there may be a trade-off in attempting to get highly informative content at the expense of a lesser quality of the knowledge thus derived. Furthermore, in trying to understand a system both exploration and exploitation are involved, and scientists may choose a balance depending on the complexity of the situation. These are considerations in the discussion that follows.

Enhancing the Traditional View of Science

The traditional view of science may be enhanced by blending disciplines for an interdisciplinary approach to interdisciplinary problems and especially integrating the newer disciplines, even when the methodology diverges from the standard methodology. Such a process contributes to gaining insights which is an extension of the view that "Kant left us with three as against two components of possible knowledge about this world: empirical observation, logical derivation, and the forms in which all these are mediated by our mental and sensory apparatus."

These forms in science are heavily mathematical set in the less rigorous language such as is here being used to communicate. These forms are called discursive by Langer.[viii] They use symbols and words in sequences where sequence is critical to meaning. While this discursive form may be used to communicate some very complicated ideas, some things are so complex that an auditory or visual media is more suitable. A symphony may be reduced to a musical score, but reading it is not the same as hearing it. Recognizing a face, as with hearing music, is the result of use of the presentational form. A road map is in a presentational form, and while directions may be given in a discursive form the whole set of relationships among the streets is too complicated for a discursive presentation. To quote from Langer, "They do not present their constituents successively, but simultaneously, so that relations determining a visual structure are grasped in one act of vision." [page 93.]

Perception is critical for communication of information. Information and energy are basic constituents of organic systems, an important consideration when one considers the transitions in science of perspectives of the relationships between physics and biology. Returning to a discussion of the work of Francis Bacon, here is a quotation: "It is certain that all bodies whatsoever, though they have no sense, yet they have perception; for when one body is applied to another, there is a kind of election to embrace that which is agreeable, and to exclude or expel that which is ingrate; and whether the body be alterant or altered, evermore a perception precedeth operation; for all bodies would be like one another. And sometimes this perception, in some kinds of bodies, is far more subtile than sense; so that sense is but a dull thing in comparison to it; we see a weatherglass will find the least difference of the weather in heat or cold, when we find it not…"[ix]

That quotation, taken from Bacon's *Natural History*, was probably written between 1620 and 1626. That preceded Bernard Mandeville's 1705 poem "The Grumbling Hive: or, Knaves turn'd Honest," by the better part of a century, and Adam Smith's *The Theory of Moral Sentiments*, written in 1759 by more than a century. The significance is in the metaphor, the invisible hand, used by Adam Smith in his first book, *The Theory of Moral Sentiments,* although it became well known through his second book, *The Wealth of Nations*. Contemporary science calls the phenomenon *emergence*.

The poem, by Mandeville, a physician with literary talent, may have been written as a political satire making the point in which he "…describes a thriving bee community until many of the bees decide to seek honesty and virtue. Without their desire for personal gain the colony loses the hive, thus concluding that without private vices there exists no public benefit." [Wikipedia.] The poem did not reflect an understanding of the biological basis of the behavior of bees. Biologically, bees have a genetic diversity in which "…[the] individual bee's [body] temperature for huddling and fanning are tied to a genetically linked trait." There is a genetic diversity so that while the hive needs to maintain a temperature in a fairly narrow range, the bees by seeking their own comfort fan their wings and cluster responding to their different comfort zones.[x]

The bees have a self-organizing system described as driven by genetics. In the case of ants, there is also a self-organizing system for the colony, But while the genetics are critical in that they direct the ants, so is the communication system. The ants communicate by leaving trails and emitting odors.

The use of the metaphor by Smith in *The Theory of Moral Sentiments* appears as follows: "They are led by an invisible hand to make nearly the same distribution of the necessaries of life which would have been made had the earth been divided into equal portions among all its inhabitants; and thus, without intending it, without knowing it, advance the interest of society, and afford means to the multiplication of the species." [page 182.] The behavior of the bees is an *emergent phenomenon*. It occurs in complex systems in which the agents (bees) in the system adapt.

Understanding the metaphor in terms of contemporary science would enhance the traditional view of science. Potentially it could produce a paradigm shift. Some impediments to that progress are discussed in the previously cited essay, the "Roots of Modern Disciplines."[xi] Some contributions within the last century, and especially the most recent decades, are noted in the discussion that follows.

Some Contributions from Recent Science

The stage is set by Alfred North Whitehead in his *Science and the Modern World*, published in 1925. He wrote "Science is taking on a new aspect which is neither purely physical, nor purely biological. It is becoming the study of organisms. Biology is the study of the larger organisms; whereas physics is the study of smaller organisms. There is another difference between the two divisions of science. The organisms of biology include as ingredients the smaller organisms of physics; but there is at present no evidence that the smaller of the physical organisms can be organized into component organisms." [page 103.] Whitehead continues the discussion leading to an interaction of organisms and seems to be at the brink of discussing emergence.

Fast forwarding to an article in the *Financial Times* of November 26, 2009, titled "Organic Mechanics" here are some excerpts: "At least since the 18th century, economists have been borrowing from physics, redeploying everything from thermodynamics and the 'conservation of energy' principle to the understanding of macroeconomics and the generation of fancy derivatives. The global financial crisis has, however, seen financiers cast their scientific net further as they try to understand what went wrong and how to make the banking system more stable in future. As a result, they are developing 'biology envy'… the regulatory structure for banking may be shaped by studies now in progress that treat global finance as a 'complex adaptive system' like a living ecosystem… Hence the move to look at branches of science beyond physics - and at biology in particular. Professor Andrew Lo of MIT has developed the adaptive market hypothesis, attempting to introduce the principles of evolution - competition, adaptation and natural selection - to his financial models."

Complexity economics, a new discipline, draws from other recently created disciplines. It is an application of complexity theory to economics. What may emerge in economic thought is a substantial development of *complexity economics* which integrates complexity theory and views the economy as a *complex adaptive system*. *Emergence* is at the heart of a complex adaptive system and *reflexivity* is the lung in the system. It breathes life into the system by actions in the market, but it also changes the market by those actions - it is reflexive. It operates on the basis of information and energy just as the human body does.

Complexity economics applied to real estate economics starts at the local level where space markets are financed through capital markets. The space markets have price behavior generally viewed in traditional terms of supply and demand as a locus of points; for supply it is the locus of points at which different quantities would be supplied at different prices, and for demand it is the locus of points at which different quantities would be taken at different prices. The two curves, in standard economics are viewed as independent. In complexity economics there is a reflexivity and an adaptation to changed market environment. As a result, rather than a reversion toward a balance in the system with a movement toward an equilibrium necessarily being the result of a free market, there may be a discontinuity as occurred with the capital market freeze that triggered the *Great Recession*.

Complexity economics is built upon an understanding of the science of networks which deals with group behavior. Consider the following quote from Duncan J. Watts, in his book, *Six Degrees: The Science of a Connected Age:* "While knowing the rules that govern the behavior of individuals does not necessarily help us to predict the behavior of the mob, we *may* be able to predict the very same mob behavior without knowing very much at all about the unique personalities and characteristics of the individuals that make it up." [page 26.]

Watts points out that different disciplines may need to be brought to bear in order to better understand the science of networks. He writes, "Physicists and mathematicians have at their disposal mind-blowing analytical and computational skills, but typically they don't spend a whole lot of time thinking about individual behavior, institutional incentives, or cultural norms. Sociologists, psychologists, and anthropologists, on the other hand do. And in the past half century or so they have thought more deeply and carefully about the relationship between networks and society than anyone else - thinking that is now turning out to be relevant to a surprising range of problems from biology to engineering. But, lacking the glittering tools of their cousins in the mathematical sciences, the social scientists have been more or less stalled on their grand project for decades." [page 29.]

Part of the difficulty in the blending of disciplines is that the physicists that have a good deal to bring to the table are not accustomed to thinking about the social science problems and the social scientists haven't developed the skills the physicists have far enough to be able to make the transfer of the principles and the tools. Some progress has been made, as Watts notes with reference to the work of Herbert Simons of a half century ago in developing the concept of "bounded rationality." Watts notes the difficulty in drawing the lines once one goes beyond the bounds of rationality. [page 66.]

Networks are composed of nodes that are connected. Up until forty years ago mathematicians assumed that the distribution of the frequency of connections between nodes in a system was random "…with nodes distributed like a normal curve, dominated by averages." That is from Joe Podolsky's review of the book authored by Albert-László Barabási, *Linked: The New Science of Networks*, appearing in *The IT Journal*, Third Quarter, 2002. Here is more from the same the review, "This theory [referring to the one now obsolete] predicts that most people have roughly the same number of acquaintances; most neurons connect roughly to the same number of other neurons; …most Web sites are visited by roughly the same number of visitors. As nature blindly throws the links around, in the long run, no node is favored or singled out.

"We now know that this is definitely not so. First came research in 1967 on 'degrees of separation' by experimental psychologist Stanley Milgram, who showed that the median number of links between any two people in the United States is only 5.5. More recently, experiments done by Barabási and some of his graduate students showed that the 800 million nodes on the Worldwide Web are, on average, only 19 clicks away from each other. The reason, first noted in a 1973 paper by Mark Granovetter, is that networks have both strong and weak ties. The strong ties form clusters, families, work colleagues, church members, while the weak ties are the people who link the clusters together, who are members of several clusters and who, therefore, pass information around. Range is created through the weak ties. 'Weak ties play an important role in any number of social activities, from spreading rumors to getting a job.… To get new information, we have to activate our weak ties.' The strong ties merely reinforce what we already know."

The significance of this is in the predictability of the behavior of the system. This predictability is attributable to some underlying principles in the order of the system. Furthermore, one's ability to predict outcomes is in some measure dependent on going outside the circle of one's close ties; could that mean beyond one's own discipline?

Emergence is an important concept related to forecasting behavior and outcomes from the interaction among nodes (sometimes called agents) in a network. In order to better understand emergence it is useful to refer to John Khosh's essay posted on Strategy Matters (**http://www.hoyt.org/decision_making.phtml**), particularly the statement "… [this] essay explores the role of information and energy in the operation of the biosystem and the interaction with other systems. Information and energy are the lowest common denominators. They are basic for all relationships involving communications and interactions in nature, animate and inanimate. Simply put, if there is no exchange of information and energy between systems, there will be no change, no dynamism, no life, and everything in the universe will be at standstill."

Steven Johnson in his book *Emergence: The Connected Lives of Ants, Brains, Cities, and Software* explains emergence in a variety of societal systems. In the case of ant colonies his explanation develops the following ideas. The ant queen is not the head of a hierarchical structure, but is simply the protected ant because she lays the eggs for the ant colony. When danger strikes, she is sequestered deep in the ground. The ants are directed by genetics, not instructions. The ants communicate by leaving trails and emitting odors. This organization of the society, the colony, is self-organized in that it an emergent phenomenon.

Emergence, as a phenomenon, links two different levels of activity; for example, the individual decisions of the agents (nodes in a system) and the resulting spatial patterns. In the case of the ant colony consider the following: Ants, shortly after dying emit an odor. That odor is a signal to the live ants to carry the dead ant to a location in the colony as far from the cluster of ant activity as possible. The signal is read biologically communicating the instruction to bring the dead ant to the location of the cemetery. The ants also have a dump for discarded remnants of food. It is at another distant area. This spatial pattern emerges from the bottom-up; it is not directed by a central planning authority.

In research experiments after the Johnson book, the response of ants to fake ant odors sending the message that an ant has died, live ants were carried to the cemetery. The importance of decision rules by the ants as agents in a complex system will be discussed later.

Another book, *Harnessing Complexity: Organizational Implications of a Scientific Frontier*, discussing emergence is by Robert Axelrod and Michael D. Cohen. It takes the science of networks to complexity theory. It makes the point that the human brain is an incredibly complex organ of the human body. As such it is useful to consider the idea of harnessing complexity in order to understand the operation of the organ. Consider the following quote: "Complexity often results in features, called **emergent** properties, which are properties of the system that the separate parts do not have. For example, no single neuron has consciousness, but the human brain does have consciousness as an emergent property." [see page 15.]

The concept of emergence came into play in Stephen Jay Gould's *The Hedgehog, the Fox, and the Magister's Pox* in which he makes a case for "…rejecting Wilson's solution." [page 201.] The "Wilson solution" is the development of consilience, the concept expounded on in his book *Consilience: The Unity of Knowledge*. The idea is that, "everything in our world is organized in terms of a small number of fundamental natural laws that comprise the principles underlying every branch of learning."

That call for rejection is in the chapter in which Gould is discussing reductionism and the original meaning and intent of consilience. The topic is the relationship between the sciences and humanities. He argues that one of the two different reasons why reductionism fails in the Wilson argument is that he "does not believe that reductionism can come even close to full success as a style of explanation for levels of complexity (including several aspects of evolutionary biology, and then proceeding 'upward' in intricacy toward cognitive and social systems of even greater integration sand interaction) for two basic reasons that allow these subjects to remain fully within the domain of factual and knowable science, but that require additional styles of explanation for their resolution." The two basic reasons are "First, emergence, or the entry of novel explanatory rules in complex systems, laws arising from 'nonlinear' or 'nonadditive' interactions among constituent parts that therefore, in principle, cannot be discovered from the properties of the parts considered separately…Second, *contingency*, or the growing importance of unique historical 'accidents' that cannot, in principle, be predicted, but that remain fully accessible to factual explanation after their occurrence."

Gould has a point, but just as Einstein expanded on Newton by enlarging the parameters of the paradigm, so has Gould enlarged the parameters of Wilson's concept of consilience. The principles referred to in consilience still apply, but reductionism is not a viable way to explain emergence. Consilience still applies because by understanding the self-organization of ants in developing the spatial relationships in the colony we can get better insight into the spatial relationships that emerge in the city.

Supporting this point is the following statement by John H. Miller and Scott E. Page in their recent (2007) book, *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*. The quote is as follows: "When a scientist faces a complicated world, traditional tools that rely on reducing the system to its atomic elements allow us to gain insights. Unfortunately, using these same tools to understand complex worlds fails, because it becomes impossible to reduce the system without killing it…'The innate features of many social systems tend to produce complexity. Social agents, whether they are bees or people or robots, find themselves enmeshed in a web of connections with one another and through a variety of adaptive processes, they must successfully navigate through the world." [page 10.]

The book, *Complex Adaptive Systems*, is moving toward a science of complexity by exploring complexity theory through agent-based modeling. It is designed to gain better insights of a system's operation, hopefully with a better forecast of outcomes. The prime difficulty in the forecasts of such outcomes is that the system is non-linear. There are outliers that can result from small changes of agents' behavior within the network.

Research by use of agent-based modeling broadens the concept of scientific research. "Using traditional tools, social scientists have often been constrained to model systems in odd ways. Thus, existing models focus on fairly static, homogeneous situations composed of either very few or infinitely many agents (each of whom is either extremely inept or remarkably prescient) that must confront a world in which time and space matter little." [page 5.] But time and space may matter a lot and the activity may be at the in-between. Modeling the in-between where not all agents are extremely inept or remarkably prescient is facilitated by computational techniques. The powerful tools allow a wider range of models to be explored, going beyond the simplified assumptions in standard economic models such as the independence of supply and demand.

Such models may aid in the development of insights that are closer to reality than represented by standard methodology. But, standard methodology is inductive, as is agent-based modeling. Thus, in either case, there is no certainty!

Dealing with the Uncertainty

The *Theory of Games and Economic Behavior* by John von Neumann and Oskar Morgenstern provides an excellent foundation for approaching the uncertainty of situations at the extremes such as very few or very many agents. The "interesting in-between" is more complex because of the diversity. It therefore can result in greater instability of the system.

The invisible hand is a case of the interesting in-between. The emergence arises from the adaptive character of the agents and not all agents adapt the same in complex adaptive situations; and that is different from complex systems that are not adaptive. In a free society, the individuals (the agents) have choices and while there are some decision rule constraints, the authority arises from the individuals rather than the church or the state.

The role of the state may be seen differently according to diverse values, but within the constitutional and legislative constraints the governmental administration is charged with liberty and justice for all. That may call for intervention of various sorts; and the issue at hand is intervention to avoid the instability arising from excessive volatility.

Intervention may be predicated on applying principles from human biology to complexity economics. As a start, consider that in the case of the housing market, individual decisions are made by buyers and sellers and result in transactions and prices. In standard economics the paradigm is of a system in which the supply and demand curves are independent of each other. The curves represent a locus of points at which quantities would be supplied at various prices and quantities would be demanded at various prices. The intersection is at the equilibrium price. However, neither the latest transactions nor the next set of transactions are necessarily at the equilibrium price, or close thereto.

If the market is viewed as a biological system, the supply and demand curves are not independent of each other and the most probable prices may not be at equilibrium levels or even at the level indicated by the latest transactions . In essence, the system may be out of balance even though the system has self correcting forces, and the momentum that has taken the system out of balance may continue to move price levels away from an equilibrium point.

The adjustment process is the issue. One scenario is that the volatility of cycles is normal and the self correcting system will set in motion corrective measures as part of a continuum. Another scenario is that the momentum of a cycle assisted by exogenous forces may on the upswing reach an abrupt end with a discontinuity. The medical analogy is that a cancer has occurred, the cells are running amuck, and the body cannot self correct to return to a healthy state.

In the case of housing the recent housing bubble produced a drop in price level that destroyed so much wealth in the form of presumed house values, that investors in derivatives based on that wealth suffered such great capital losses on those derivatives that it led to a freeze in the capital markets, the discontinuity that triggered the current Great Recession.

Consider the housing market as one organ in the biological system of the urban economy. The participants in the housing market (buyers and sellers) are receiving information and energy from other organs in the urban economy, including lenders and employers among others. As a result of that and information on other transactions and offering, as well as their own bounded reason thinking, operate with position adjustments.

Those position adjustments set in motion a reflexive action: an alteration of market conditions. The new market conditions may then again alter positions of buyers and sellers. The new individual decisions, in the aggregate, send information to the housing market and generate the energy to cause the market to adjust. The question is how to forecast outcomes as to market prices, both long term and short term.

Standard economics methodology is relatively simple as to forecasting price direction if the assumption is a movement toward equilibrium over time. It is built on fundamental relationships of household formation and net in-migration for demand, which may be segmented by price, locality, and product. The supply side of the equation is relatively fixed in the short run by the standing stock and the pipeline. But, if the movement is not toward equilibrium, the complexity is horrendous.

That horrendous complexity may be viewed by modeling bounded rationality. Bounded rationality may be forecastable when there is sufficient historical information to infer a consistency. The great difficulty arises on two counts. First, the historical information may be insufficient for extrapolation. And second, the extrapolation is based on assumptions of continuum. And this is assuming an analysis of group behavior rather than aggregating individual behavior (which isn't the answer anyway). This analysis of group behavior is a subject of network science and the first step in application of the theory of emergence.

The advancements in complexity economics may come up with an ability to mathematically handle the emergence so as to quantify the resulting market changes. In the meantime, from a policy perspective, the question is what to monitor in order to have the clue for intervention.

Monitoring the flow of funds is a start. By using agent based-models as surrogates for *mirror world*[xii] generated data insights may be gained as to when volatility reaches a range that would call for influencing the flow of funds through changes in leverage requirements and other conditions influencing agent-based decisions for both borrowers and lenders, especially investors in derivatives.

Summarizing Some Points and Concluding Comments

The application of the principles of human biology to economics may be the latest trend in application of principles from other disciplines, dominated in the late twentieth century by applications of principles from physics. This concept of a commonality of principles is sometimes confused with the commonality of methodology.

The laboratory experimental methodology available in the physical sciences has severe limitations in the social sciences. In both cases the best that the methodology can do is strengthen belief in the validity of the conclusions reached by inductive reasoning. The *Black Swans*[xiii] do arrive, however, as outliers in long tail distributions beyond the ken of neoclassical economics.

The issue is the strength of validity of the forecasted outcomes resulting from the methodology. Much of the methodology of *normal science*[xiv] as applied in economics assumes the tendency an equilibrium situation will emerge and understanding the system is built upon a theory of *reductionism.*[xv] While standard economic methodology will work for many issues, markets are an emergent phenomenon and have the possibility of bubbles as in housing markets and freeze-ups as in the capital market.

Traditional science models relying on laboratory experiment methodology are not feasible under many social science circumstances, especially research on markets as holistic systems. The closest methodology currently available is *agent-based modeling*[xvi] in which emergence is simulated. That simulation uses behavior rules for agents and may use various criteria for intervention by public policy in an experimental fashion. Although some components of the lower level system are amenable to standard economic research methodology, understanding the system as a whole can be enhanced by use of agent-based models that provide insights not revealed by traditional methodology.

While the quality of knowledge may be less with the newer methodology that it would be if the standard science methodology were applied, it is not feasible to apply the standard methodology. Furthermore, societal progress of the last few centuries, the period during which contemporary science flourished, was based on innovation not confined to linear based reasoning.[xvii] The advancement of social sciences while mimicking physics loosened methodology as with applications by Freud.[xviii]

Additionally, science is expected to produce knowledge that may be utilized and there are some practical limitations to quality.[xix] And, since quality will always be limited, although better quality is preferred, decisions may be made on a strategic basis that recognizes the uncertainty and may consider multiple scenarios rather than the single one that seems to be the most likely. If science is viewed in this context, research may well be focused on that which is reasoned to be most relevant, with speculative research as part of the picture, and with the best methodology available for the issues at hand. A better vision of the invisible hand will provide a better basis for guiding it.[xx]

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[i] The Homer Hoyt Institute (HHI) has supported substantial research on the flow of funds. The opening paragraph of the research program supported early in the previous decade as follows: "The purpose of the Homer Hoyt Institute's Capital Flows Research program is to identify and quantify the sources and costs of funds available for real estate investment during various phases of the economic cycle. This research program is part of HHI's continuing effort to gain a better understanding of the system and in order to help improve the quality of decisions. The program addresses the long-term problem that the real estate industry experiences with over and under supplies of capital as the economic environment changes." The web link is **http://www.hoyt.org/capital_flows/index.html**. The current program is an extension of HHI's Subprime Crisis Research Program, also described on the Hoyt Group website, **http://www.hoyt.org/subprime/index.html**.

[ii] See the second of the series of newsletter inserts dealing with the subprime crisis for a discussion of three levels of meeting problems and a minimax strategy, "Spring 2008: Panic Doesn't Help - Strategy Does: A Personal Perspective.". The link is **http://www.hoyt.org/asi/spring2008.pdf**.

[iii] Much of this discussion is tied to the Chapter 2, "Traditional View and Popper's View," of Bryan Magee's *Philosophy and the Real World: An Introduction to Karl Popper*.

[iv] The cryptic summaries are heavily drawn from *A World of Ideas: A Dictionary of Important Theories, Concepts, Beliefs, and Thinkers* by Chris Rohmann. It is supplemented by a *Dictionary of Philosophy* by Antony Flew.

[v] The others are aesthetics, ethics, logic, and metaphysics. See Rohmann, op. cit.

[vi] This quotation is in the Spring 2003 insert to the *M_SASI - HF LLC Newsletter*, The Roots of Modern Disciplines. The link is **http://www.hoyt.org/asi/spring03.pdf**. Some excerpts are as follows: "The combination of the opening sentences of the first two paragraphs of Kant's, *Critique of Pure Reason* is a pivotal point in the development of contemporary disciplines. It is retrospective in indicating the emergence the modern approach to research in that our Western heritage of philosophical roots is built upon the *a priori* reasoning of the ancient Greek philosophers, especially Plato and Aristotle.

"The part that did not arise from experience was, in the words of Steven Jay Kline [*Conceptual Foundations for Multidisciplinary Thinking*, p.195] summarized as follows: 'These Greek ideas exalted rational thought, logic, and the life of the mind. For the most part, however, the ancient Greek thinkers did not use empirical evidence; they relied on thought and discussion, not only as the sources for knowledge, but also as the means of verification."

"In the beginning of the Enlightenment era there was a unity of all knowledge outside the theological knowledge that provided the 'sacred canopy' [see Peter Berger's 1969 book referred to on page 194]. Kline identifies this unity of knowledge as a single body in the ensuing paragraph. 'Ancient Greek thought about the physical world had been summarized by Aristotle, and his writing was taken as an authoritative source regarding natural phenomena by many European scholars in the period during and following the Renaissance. The use of Aristotle as a source of 'the truth' about the physical world was similar to the away the Scriptures had served during the Middle Ages. This view led to what was called 'natural philosophy,' which was taken to include all the scholarly knowledge that lay outside the theological knowledge. For several centuries, natural philosophy was seen as largely a single body of knowledge. Kant blended the *a priori* with the empirical that turned out to be the foundation for the highest quality of knowledge, empirically verifiable results. The methodology, which is of great rigor, turns out to be the altar at which modern day academics worship."

'An additional excerpt under the subheading of Enhancing the System is as follows: 'The key is in the selection of problems to be defined. Momentum is a great force in research, as in other areas. The tendency is to define problems in the context of existing research, solvable with existing methodology. New disciplines may emerge when there is, in the words of Kline, relevant to identifying the first step in the development of a discipline, a 'Selection of a class of systems with an associated set of problems.' It is the selection of problems that needs the attention in order to improve predictive ability relevant to improving quality of life.'

'The alternative view that the goal of social science should be increasing intelligibility rather than predictive ability is an epistemological issue addressed by Alexander Rosenberg in his Philosophy of Social Science. He writes, 'If increasing the understanding of human actions improves our predictive powers, then of course there is no conflict.' [p.213.] The philosophy of social science underlying this essay is that what we know and how we know it is important for the purposes of improving the quality of life. The basic research is to develop knowledge where the applicability is not yet evident, but where there is faith that in time it will make a difference'

'Making a difference is what it is all about. And the birth of a new discipline is a way to sharpen the focus in studying a set of problems in order to get a better understanding of relationships useful in predicting outcomes. Auguste Comte, a philosopher in the Age of Enlightenment, was a pioneer in launching new disciplines in the social sciences. He believed that '…the future of humanity lay in science and that scientific methods could equally be applied to social studies." [A World of Ideas, by Chris Rohmann, p.72.] Comte wrote about sociology, referring to it in the sense of a broad range of human sciences, as a discipline that should 'descend from the other disciplines in a series of hierarchical steps…' [Kline page 208.] In Kline's words, 'The hierarchy that Comte suggested went in descending order: math, astronomy, physics chemistry, biology (including physiology), sociology.' The sociology was conceived as a 'master discipline.' It included anthropology and psychology as well as sociology, all of which were borne in the late nineteenth century.' *(Cont.)*

'Edward O. Wilson's hierarchy goes from physics, chemistry, and biology to sociobiology which is the link to the social sciences that he develops in his concept of consilience. Within the social sciences, political sciences goes back to ancient times, but is combined with economics in the discipline of political-economy. Economics develops on its own starting in the eighteenth century."

[vii] See Bryan Magee's *Philosophy and the Real World*, pages 34-37.

[viii] See *Philosophy in a New Key: A Study in the Symbolism of Reason, Rite, and Art*, by Susanne K. Langer. The focus here is on her chapter titled "Discursive and Presentational Forms." In that chapter she sheds a good deal of light on the "mediation by our mental and sensory apparatus." At the beginning of the chapter she discusses how one might believe that Greenland is larger than Australia when looking at a Mercator projection because by appearance one finds it larger. However, if one understands the nature of the Mercator projection one could by blending the observation and logic get a closer approximation to reality. The relevance of this will come to bear when the discussion gets to modeling complex adaptive systems.

[ix] As quoted by Alfred North Whitehead in *Science and the Modern World*, pages 41-2. The quote is from Bacon's *Natural History* probably written sometime between 1620 and 1626.

[x] See page 15 of *Complex Adaptive System*s by John H. Miller and Scott E. Page.

[xi] Some excerpts are as follows: "Academia has been enthralled with the rigor. Thus, much of science, including social science, has focused on rigorously 'mopping up' details of the discipline. Thomas S. Kuhn, in his seminal work, *Structure of Scientific Revolutions*, writes, 'Normal research which is cumulative owes its success to the ability of scientists regularly to select problems that can be solved with conceptual and instrumental techniques close to those already in existence. (That is why an excessive concern with problems, regardless of their relation to existing knowledge and technique, can so easily inhibit scientific development.)" [p.96, Second Edition] The parentheses are his, and the key word is 'excessive…'

"No part of the aim of normal science is to call forth new sorts of phenomena; **indeed those that will not fit the box are often not seen at all** [emphasis added]. Nor do scientists normally aim to invent new theories, and **they are often intolerant of those invented by others** [emphasis added]. Instead, normal-scientific research is directed to the articulation of those phenomena and theories that the paradigm already supplies." [Kuhn, Thomas S. The Structure of Scientific Revolutions, 2nd edition, Chicago, The University of Chicago Press, 1970, p. 24.]

"The thrust of modern research being in the box, and the difficulty of going beyond the established paradigm, is indicated in the following quote, again from Kuhn. [p.76] 'Philosophers of science have repeatedly demonstrated that more than one theoretical construction can always be placed upon a given collection of data. History of science indicates that, particularly in the early development stages of a new paradigm, it is not even very difficult to invent such alternates. But that invention of alternates is just what scientists seldom undertake except in the pre-paradigm stage of their sciences development and at very special occasions during its subsequent evolution. So long as the tools of a paradigm supplies continues to prove capable of **solving the problems it defines** [emphasis added], science moves fastest and penetrates most deeply through confident employment of these tools. The reason is clear. As in manufacture so in science - retooling is an extravagance to be reserved for the occasion that demands it. The significance of crises is the indication they provide that an occasion for retooling has arrived."

[xii] As in the David Gelernter book *Mirror Worlds*.

[xiii] As in Nassim Nicholas Taleb's book *The Black Swan*.

[xiv] This term is used as used by Kuhn. See endnote xi.

[xv] Reductionism holds that properties at one level can be explained by properties at lesser levels. This is in conflict with *emergence* which holds that properties at a higher level system may differ from properties of the lower level, the bees and ants are the examples used to illustrate this invisible hand concept that also applied to real estate and capital markets.

[xvi] Agent-based models in the context of economics, according to Wikipedia, is briefly identified by the following quotation,"**Agent-based Computational Economics (ACE)** is the computational study of economies modeled as evolving systems of autonomous interacting agents. Starting from initial conditions, specified by the modeler, the computational economy evolves over time as its constituent agents repeatedly interact with each other and learn from these interactions. ACE is therefore a bottom-up culture-dish approach to the study of economic systems."

[xvii] See Stephen Jay Kline, Conceptual Foundations for Multidisciplinary Thinking, page 210.

[xviii] See Kline, op.cit., page 209.

[xix] See *The Spirit of American Philosophy* by John E. Smith, page 176, for a discussion of Whitehead's points.