IS RISK MANAGEMENT A SCIENCE?

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Time is a device that prevents everything from happening at once. All decisions that are made today will have their results or payoff at some time in the future. This is most obvious in investment decisions in plant and equipment where the realized rate of return will be achieved only years after the decision to invest is made. But once the decision is made, the decision maker is stuck with the investment over its useful life. In other words, investment in plant and equipment is like marriage in a Catholic world—till death due us part. Will the rate of return actually made over the life of the investment be the same as that the entrepreneur expected at the moment the investment decision was made? And how was the entrepreneur’s expected rate of return estimated?

For decisions made today for the purchase of financial assets, it is also true that the realized rate of return over the life of the financial asset will only be known at the end of that life. Again, we may ask if the return will be equal to that expected at the time the purchase decision is made. If, however, the financial asset is liquid, i.e., traded in a liquid market (characteristics to be defined below) then the moment the holder decides something is going wrong and his/her expected return is unlikely to be achieved, then the holder can make a fast exit by selling the asset and thereby limit the potential anticipated loss. Consequently the decision to buy a liquid financial asset involves estimating the rate of return from date of purchase to expected date of sale in the market. Divorce is not only possible before death, but it is very likely in the world of liquid
assets. Rarely is the expected return equal to the actual return recovered over time. If a financial asset is illiquid, then the holder is stuck with the asset until death due them part.

A sage once said about the future: “Nothing is certain except death and taxes”. To which I might add “That is why good accountants are worth their weight in gold for although they cannot tell you how to avoid the former, they can tell you how to avoid the latter”.

Unfortunately in the world of experience, little is know with certainty about future payoffs of decisions made today If the return on economic decisions made today is never known with perfect certainty, then how can managers make optimal decisions on where to put their firm’s money today?

In recent years following developments in mainstream economic and financial theory, managers were often told to base their decisions on “Risk Management” computer models that permit the decision maker to know with “actuarial certainty” the payoff on any portfolio decision made today. These risk management models were based on a scientific methodology which presumed that probabilities (calculated from past data) can be pooled, managed and tamed to reliably predict the future.

How good is this scientific methodology underlying risk management models? In an amazing “mea culpa” testimony before a Congressional committee on October 23, 2008, the Maestro of financial markets, Alan Greenspan, stated:

“This [financial] crisis ... has turned out to be much broader than anything I could have imagined....those of us who had looked to the self interest of lending institutions to protect shareholder’s equity (myself especially) are in a state of shocked disbelief.... In recent decades, a vast risk management and pricing system has evolved, combining the
best insights of mathematicians and finance experts supported by major advances in computer and communications technology. A Nobel Prize was awarded for the discovery of the pricing model that underpins much of the advance in derivatives markets. This modern risk management paradigm held sway for decades. The whole intellectual edifice, however, collapsed.” (Emphasis added)

Under questioning by members of the Congressional committee Greenspan admitted that the financial crisis forced him to reappraise his views on financial markets and the risk management model. Greenspan then stated:

“I found ...a flaw in the model ...in the [assumed] critical functioning structure that defines how the world works. ....I still do not fully understand why it [the flaw] happened, and obviously to the extent that I figure why it happened I shall change my views.”

The purpose of my presentation is to explain to Alan Greenspan and to others in this audience why “the intellectual edifice” of the risk management paradigm collapsed and what scientific theory can be used to understand movements in financial markets.

KNOWING THE CAUSE OF FUTURE OUTCOMES
We have already noted that the results of any decision today will depend on the passage of some amount of calendar time. How can we know these future outcomes?

Since biblical times humans have tried to understand what causes things to happen. The human mind believes that there must be a cause that occurs in time before any observed outcome occurs. For most of the history of mankind, it was believed that the design of God or the Gods was the cause of anything that happened in the world of experience. Beginning in the 17th century,
however, some philosophers believed that explanations of events that one observed could be
developed on the basis of reasoning of the mind rather than religious belief. This was the
beginning of the intellectual movement historians call The Enlightenment or The Age of Reason
where order and regularity was seen to come from the human analysis of observed phenomena.
The power of reason was not in the possession, but in the acquisition of truth.

Reasoning involves the human mind creating a theory to explain what we observe happening.
For example, Sir Isaac Newton saw an apple fall from the bough of a tree to the ground. Newton
explained why apples always fall by the scientific theory of gravity. Charles Darwin created the
scientific theory of evolution to explain the different species inhabiting the earth. In the 21st
century, most of society believes that understanding comes with the development of scientific
theories. Do we have a scientific theory, or is it the will of God, that explains the prices in
financial markets?

A theory attempts to explain real world observations on the basis of a model that starts with a
few axioms. An axiom is an assumption accepted as a universal truth that does not need to be
proved. From this axiomatic foundation, the theorist uses the laws of logic to reach conclusions
that explains what we observe in the world of experience. All theories are generally accepted in
some tentative fashion. Theories are never conclusively established.

Economic theorists build a theory or model based on some fundamental axioms that they accept
as a self evident truth. The tools of logical deduction are then used to reach one or more
conclusions. These conclusions are then presented to the public as the explanation of economic
events that are occurring in the world of experience. If the facts of experience conflict with the
economic theory, then one or more of the theory’s fundamental axioms are flawed and should be
discarded so a different theory can be built. [The alternative would be to change the facts to fit the unrealistic theory, as, I must admit, sometimes happens in academia and in Washington.]

So if we are to enlighten Alan Greenspan as to why the risk management intellectual theory collapsed, we most explain which of the axioms that are the foundation of that edifice are flawed. Furthermore we must recognize that the aim of science is to understand processes that are occurring in the external world around us. Prediction about future events may be a tool of certain scientific methodology but it is not the goal of science itself. Nor can all scientific theories provide the basis for making accurate predictions. At best prediction may be regarded as a useful by product if it can be attained under the theory developed.

There are two different major economic theories that attempt to explain the operation of the money using, entrepreneurial economy that we call capitalism and its financial markets. The first and most widely recognized one, and the one that I believe most members of this audience accept as correct is the classical economic theory which is sometimes referred to as the theory of efficient markets, or “mainstream economic theory”. Efficient market theorists claim that if economics is to be a science it requires rigor, consistency, and mathematics. Nobel Laureate Paul Samuelson has explicitly added one additional characteristic-- an axiom that most efficient market theorists implicitly assume-- namely, economists must accept the ergodic axiom in their models if economics is to be a rocket science on par with physics, astronomy, and chemistry. I will explain in a moment what this ergodic axiom (a term Samuelson borrowed from statistical mechanics) presumes regarding knowledge about the future. But first I raise the question that if efficient market theory possesses the characteristics attributed to it by its advocates, then how is it possible that efficient market theorists did not foresee the financial crisis that started in 2007-
8? Moreover how many risk managers in the audience who had to put their employers’ money where there computer model mouths were, saw the financial collapse of 2007-2008 coming?

The mantra of this efficient market theory is that enlightened decision makers in free financial markets will always know the future outcome for any decision made today. These decision makers, therefore, always pick those choices that provide the highest possible future returns. Consequently, free markets are efficient in the sense of allocating capital to its best (most profitable) use. Any government interference in these efficient markets will, therefore, always produce a less than optimal outcome. In other words, interventionist government economic policy is the problem, while the free market is the solution.

Whether they declare themselves Monetarists, Rational Expectation theorists, Neoclassical Synthesis [Old] Keynesians or New Keynesians, the backbone of all mainstream theories is the efficient market analysis model where it is presumed that correct information about the future exists today and this information can be obtained by decision makers. For “Old” and “New” Keynesians the only thing that prevents efficient markets operating in the short run is the presumption of some temporary fixity in money wages paid to workers e.g., union determined wages and/or government minimum wage laws and/or the fixity of output prices due to monopolies. In the long run, wages and prices will be flexible and therefore the market outcomes will be efficient as determined by the “deep” parameters (immutable fundamentals) of the system.[Thus, most mainstream economists who call themselves “Keynesians”– including Nobel Prize winners - urge government action only because they are too impatient to wait for the long run. For as Keynes said “In the long run we will all be dead”.]

HOW DO WE KNOW THE FUTURE?
Instant riches awaits anyone who knows the future of financial market prices! To know the future in financial markets, the Greenspan’s “risk management intellectual edifice” assumed one merely has to calculate probability distributions regarding future prices to develop today significant and reliable statistical inferences [information] about the future. Once self-interested decision makers have this reliable statistical information about the future, their actions on free markets optimally allocates resources into those activities that will have the highest possible future returns thereby enriching themselves and their stockholders, while assuring global prosperity.

In order to draw any statistical (probabilistic risk) inferences regarding any universe, however, one should draw and statistically analyze a sample from that universe. Drawing a sample from the future economic universe of financial markets, however, is impossible. Accordingly if one presumes, as efficient market theorists do, that the economy is always governed by an unchanging ergodic stochastic process then this ergodic axiom presumes that the economic future is already predetermined and a sample drawn from the past is equivalent to a sample drawn from the future. In other words, calculating the probability distribution from past statistical data samples is presumed to be the same as calculating the risks from a sample drawn from the future. If financial markets are governed by the ergodic axiom, then we might ask why do mutual funds that advertise their wonderful past earnings record always note in the advertisement that past performance does no guarantee future results?

[For deterministic economic models, the “ordering axiom” plays the same role as the ergodic axiom in stochastic economic models.]

This ergodic axiom is, therefore, an essential foundation for all the complex risk management
computer models developed by the “quants” on Wall Street. If, however, the economy is governed by a nonergodic stochastic process, then these computer models are potential weapons of math destruction since probability distributions generated from past market data are not reliable estimates of a probability function that would be obtained if one could draw a sample from the future.

[For a more detailed explanation of the difference between ergodic and nonergodic stochastic processes and its implications for many economic problems domestically and internationally one should read my book, THE KEYNES SOLUTION: THE PATH TO GLOBAL ECONOMIC PROSPERITY (Davidson, 2009). After reading it, perhaps you will recommend your clients and your colleagues read it as well to get the proper scientific theory for understanding the economic system and the future price movements in financial markets.]

Nobel prize winner Robert Lucas [1981, p. 287] has boasted that mainstream theory axioms such as the ergodic axiom are “artificial, abstract, patently unreal”. Like Nobel Laureate Samuelson, Lucas insists such unreal assumptions are the only scientific method of doing economics. Lucas states that “Progress in economic thinking means getting better and better abstract, analogue models, not better verbal observations about the real world” [Lucas, 1981, p. 276]. The rationale underlying this argument is that these unrealistic assumptions make the problem more tractable mathematically and, with the aid of a computer, the analyst can then statistically predict the future. Never mind that the prediction might be disastrously wrong.

To understand why the risk management theoretical edifice failed one must understand the difference (as stochastic probability mathematicians would say) between a nonergodic stochastic process and an ergodic stochastic process as the basis for obtaining reliable statistical
information today about future outcomes, i.e., about whether today we can “know” the future. [There are some processes, even in physics which are governed by nonergodic stochastic systems.]

If in the real world of experience, households, entrepreneurs, portfolio managers, etc., do not have, and can not obtain, any significant statistically reliable information about the economic future, then they cannot make decisions that will prove, from hindsight, to be efficient. The explanation of market efficiency is the result of accepting the unrealistic ergodic axiom as the foundation for mainstream economic and financial theory. It is not the fault of using the deductive method, rigor, and mathematics per se. So we should not blame the messenger for the message!

In sum, the ergodic axiom underlying the typical risk management models represents a model remote from an economic reality that is governed by nonergodic conditions. There is an alternative economic theory that is applicable to a realistic economic world of nonergodic uncertainty, and still allows one to have a scientific understanding of the functioning of financial markets in a capitalist system. This alternative theory which discards the ergodic axiom is the Keynes liquidity theory and George Soros’s concept of reflexivity. Keynes, his Post Keynesian followers, and George Soros all reject the assumption that people can know the economic future which is not predetermined. Instead they assert that people “know” they cannot know the future outcome of crucial economic decisions made today. The future is truly uncertain and not just probabilistic risky.

Keynes suggested that classical theorists invented a world remote from reality and then lived in it consistently. Keynes stated that classical economic thinkers were “like Euclidean geometers in
a non Euclidean world who discover that apparent parallel lines collide, rebuke these lines for not keeping straight. Yet, in truth there is no remedy except to throw over the axiom of parallels and to work out a non-Euclidean geometry. Something similar is required to-day in economics”. [By the way, rebuking these lines is a way of altering the facts!]

Keynes’s theory is more general than mainstream economic theory because it is based on fewer restrictive fundamental axioms. In emphasizing the uncertainty of results in making investment decisions, Keynes eliminated the ergodic axiom.

George Soros has explained why the efficient market theory is not applicable to real world financial markets with a slightly different terminology than Keynes but conceptually in the same way. Soros (2008) wrote: “we must abandon the prevailing [efficient market] theory of market behavior”. Soros states that there is a direct connection “between market prices and the underlying reality that I [Soros] call reflexivity.”

What is this reflexivity? In a letter to the Editor of The Economist magazine published in the March 14-21, 1997 issue Soros objects to Samuelson’s insistence on requiring the ergodic xiom to make economics a science. Soros argues that the ergodic axiom does not permit “the reflexive interaction between participants’ thinking and the actual state of affairs” that characterizes real world financial markets. In other words, the way people think about the market today can affect and alter the future path the market takes. The economic financial future is not predetermined by any natural law.

Soros’s concept of reflexivity, therefore, is equivalent to Keynes’s rejection of the ergodic axiom. Reflexivity means that peoples thoughts and actions create the future, while mainstream
economists presume the future has already been predetermined (like the movement of heavenly bodies in the study of astronomy).

Keynes used a beauty contest analogy for the stock market to illustrate how we try to make good portfolio investment choices—and this also illustrates Soros’s reflexivity. In picking winners in this stock market beauty contest you must anticipate the winner among the contestants in a beauty contest where the total public votes will determine the winner. In this case, you should not pick who you think is the most beautiful contestant, nor even the contestant you think most everyone else thinks is the most beautiful contestant. Instead you should devote “your intelligence to anticipating what average opinion expects the average opinion to be” as to who is the most beautiful.

The conclusions of the Keynes-Soros analysis is, as I will explain, (1) that the use of money contracts in all production and consumption decisions provides decision makers operating in an uncertain world, with some legal certainty about future cash inflow and outflow outcomes of today’s decisions and (2) liquidity, the ability to meet one’s money contractual obligations as they come due, is an essential aspect of decision making in a capitalist economy and a financial markets system.

In the introduction to his 1996 best seller book Against The Gods, a treatise that argues that the economic future “is more than the whim of the gods” [p. 1], investment advisor Peter L. Bernstein deals with the questions of relevance of risk management techniques on Wall Street. Bernstein [1996 p. 6] wrote:

“The story that I have to tell is marked all the way through by a persistent tension
between those who assert that the best decisions are based on quantification and numbers, determined by the [statistical] patterns of the past, and those who based their decisions on a more subjective degrees of belief about the uncertain future. This is a controversy that has never been resolved....to what degree should we rely on the patterns of the past to tell us what the future will be like?”

Keynes’s theory of liquidity and Soros’s reflexivity concept support Bernstein’s latter group. One would hope that the empirical evidence of the 2007-2008 financial collapse, despite Wall Street’s sophisticated risk management computer models, has at least created doubt regarding the applicability of the ergodic axiom to our economic world. Even Alan Greenspan in testimony before Congress seems to be having second thoughts although he still has not completely changed his tune.

Samuelson, Lucas and others adopted the ergodic axiom because they want economics to be in the same class as the “hard sciences” such as astronomy. The science of astronomy is based on the presumption of an ergodic stochastic process that governs the movement of all the heavenly bodies from the moment of the “Big Bang” to the day the universe ends. Accordingly statistical analysis using past measurements of the movements of heavenly bodies permit astronomers to predict future solar eclipses within a few seconds of when they actually occur. Nothing Congress, the President of the United States, the United Nations, or environmentalists can do will alter the predetermined dates and time for future solar eclipses. For example, Congress cannot pass an enforceable law outlawing solar eclipses in order to provide more sunshine and thereby enhance crop production. In an ergodic world, all future events are already predetermined and beyond change by human action today. In a nonergodic world, human actions, assuming Congress is
human, can create the future.

Following Samuelson’s lead, most economists (from on the political left Nobel Laureate Joe Stiglitz to on the political right Milton Friedman,) and most economic textbook writers either implicitly or explicitly have assumed that observable economic events are generated by an ergodic stochastic process.

What about Taleb’s black swan? Taleb’s black swan concept attempts to explain market crashes as an event lying in the far off tail of an ergodic probability distribution. Taleb’s Black Swan is an already predetermined outcome but the Black Swan event is so far out in the tail of the ergodic probability distribution that its occurrence is so rare that it is never likely to be observed—except in the long run when we will all be dead. So why was there three financial crisis (black swans) within some people’s lifetime of 100 years – 1907, 1929, 2007? Taleb’s theory is incompatible with the facts.

UNCERTAINTY, MONEY CONTRACTS AND LIQUIDITY

For decisions that involve potential large cash outflows or possible large cash inflows that span a significant length of calendar time, people “know” that they do not know what the future will bring. They do know, however, to make a mistake about the future can be very costly and therefore putting off a contractual commitment today in order to remain liquid may be the most judicious decision possible.

In their book on competitive equilibrium, Arrow and Hahn (1971, pp 256-7) wrote:

"The terms in which contracts are made matter. In particular, if money is the goods in terms of which contracts are made, then the prices of goods in terms of money are of special significance. If a serious monetary theory comes to be written the fact that contracts are made in terms of money will be of considerable importance.” [If this sounds obvious, I should point out that
economists who believe in efficient markets also assume contractual decisions are made in terms of real things—not money flows. Liquidity is irrelevant in efficient market theory.]

Keynes’s liquidity theory provides what Arrow and Hahn call “a serious monetary theory” for domestic and international transactions as a way of coping with an uncertain future.

Money is that thing that government decides will settle all legal money contractual obligations.

An individual is said to be liquid if he/she can meet all contractual obligations as they come due. For business firms and households the maintenance of one’s liquid status is of prime importance if bankruptcy is to be avoided, for bankruptcy is the economic equivalent to a walk to the gallows. Maintaining one’s liquidity permits a person or business firm to avoid the gallows of bankruptcy. [Yet as my good Monetarist friend and sometimes oped writer for the Wall Street Journal Alan Meltzer has often told me “bankruptcies are good for the health of the capitalist system.” If you believe Alan, I have a bridge nearby that I can sell you.]

Our modern capitalist society has attempted to create an arrangement that will provide people with some control over their uncertain economic destinies. In capitalist economies the use of money and legally binding money contracts to organize production, sales and purchases of goods and services permits individuals to have some control over their future cash inflows and outflows and therefore some control of their monetary economic future. Business firms that engage in forward monetary sales contracts to provide themselves with the legal promise of future cash inflows sufficient to meet the business firms’ costs of production and generate a profit.

Households and business entrepreneurs willingly enter into money contracts because each party
thinks it is in their best self interest to fulfill the terms of the contractual agreement and be able to predict and control with some legal assurance cash inflows and outflows. If, because of some unforeseen event, either party to a contract finds itself unable or unwilling to meet its contractual commitments, then the judicial branch of the government will enforce the contract and require the defaulting party to either meet its contractual obligations or pay a sum of money sufficient to reimburse the other party for damages and losses incurred. Thus, as the biographer of Keynes, Lord Robert Skidelsky has noted, for Keynes “injustice is a matter of uncertainty, justice a matter of contractual predictability”. In other words, by entering into contractual arrangements people assure themselves a measure of predictability in terms of their contractual cash inflows and outflows, even in a world of uncertainty.

Thus, liquidity is at the center of the operations of our monetary economy and therefore financial markets that are well organized and orderly permit decision makers to maintain liquidity in case some unforeseen future event should make it otherwise impossible to meet a future money contractual obligation unless they can readily sell a financial asset for money in an well organized and orderly market. The sanctity of money contracts is the essence of the capitalist system and Keynes’s liquidity analysis.

In Keynes’s theory of the operation of a monetary economy, liquidity, i.e., the ability to meet one’s contractual obligations becomes an essential foundation for understanding the operation of our economy. The primary function of well organized and orderly financial markets is to provide liquidity so that holders of financial assets traded on such markets “know” they can make a fast exit and liquify their portfolio at a price close to the previous market price at any time they fear something bad may happen in the uncertain future. With sufficient liquidity, one
can always meet one’s money contractual commitments. In our society, one can never be too beautiful, too handsome, or too liquid. The maintenance of one’s liquid position is of prime importance if default and bankruptcy is to be avoided.

Once it is recognized that in a money using economy decision makers “know” that the future is uncertain (in the nonergodic sense), then the demand for liquidity to meet unforeseen possible net cash flow problems becomes paramount in decision makers’ plans. Thus money contracts (inflows and outflows) are used by individuals to protect themselves from adverse net cash flows.

The purpose of liquid assets traded on organized and orderly financial markets is to provide a security blanket against one’s inability to meet a contractual obligation outflow. Thus when the market for mortgage backed derivatives that were advertised to be “as good as cash” and triple A rated and therefore perfectly liquid collapsed, the loss of so much liquidity caused panic (a reflexivity response) in other markets for derivative assets that had been previously thought to be very liquid. Asset holders in many markets tried to make “fast exits” and the result was a financial collapse and crisis. Since many of the holders of these assets were banks, the balance sheets of many major banks took hits that could have been fatal except for the government’s TARP effort.

An essential characteristic for a financial market to be a truly liquid market requires an institution—a market maker—whose function is to maintain orderliness. This market maker must possess sufficient resources so that if many are making a fast exit, then the market maker will step in and buy enough to maintain orderliness in their movement in the market price. Consequently markets without market makers with sufficient resources can become disorderly and result in financial crisis.

In sum, risk managers of financial assets should realize that the economic system is nonergodic, Consequently the best strategy is to maintain liquidity by dealing primarily in securities where
the market provides a market maker institution who is trustworthy and has sufficient resources (and even, in necessary, access to the Central Bank for additional funded liquidity) to maintain a orderly market. When purchasing a financial asset in a market without a market maker one must recognize the possibility of being trapped in a disorderly market till death due us part. Does any portfolio manager want to take this risk?