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ARTICLES /CASES

1. 1. ADAPTIVE MARKET HYPOTHESIS*

DR. PRASANNA CHANDRA

Modern investment theory and practice is largely predicated on the Efficient Markets Hypothesis (EMH), which says that market prices reflect all available information accurately and instantaneously. The EMH assumes that market participants are rational economic beings. Driven by self – interest, they make optimal decisions by weighing statistically correct probabilities and marginal utilities. These assumptions and their implications for market efficiency have been challenged from various quarters. For example, psychologists and experimental economists have documented numerous departures from market rationality in the form of behavioral biases.

There is considerable evidence that market participants display behavioural idiosyncracies from time to time, but there seems to be no consensus on what it implies for investment management. Although several alternatives have been suggested, no single theory has succeeded in replacing the EMH in academia or industry.

While there are behavioural versions of utility theory, portfolio theory, asset pricing theory, and so on, these models do not enjoy the kind of general acceptance among behavioralists that the EMH enjoys among its votaries. There seem to be two main reasons for this.

1. Modern financial economics has had a profound impact on the theory and practice of investment management since the mid – 1950s. As Andrew Lo put it, “It is difficult to overturn an orthodoxy that has yielded such insights as portfolio optimization, the Capital Asset Pricing Model, the Arbitrage Pricing Theory, the Cox- Ingersoll – Ross theory of the term structure of interest rates, and the Black–Scholes/Merton Option Pricing Model.” And all of them, in some way or the other, are predicated on the EMH.
2. Behavioural finance is fragmentary in nature. There is a dearth of fundamental axioms from which all behavioural anomalies can be derived. For example, while the prospect theory of Kahneman and Tversky can explain loss aversion, it cannot explain biases such as overconfidence and regret at the same time. Hence behavioural finance is sometimes criticised as an intriguing collection of counterexamples without any unifying principles.

* Based on Andrew Lo, “The Adaptive Markets Hypothesis,” *The Journal of Investment Consulting*, Volume 7, Number 2, 2005.

A Neurosciences Perspective

Since the debate between the EMH and behavioral finance is primarily concerned with rationality in human behaviour, the recent findings of cognitive neurosciences can provide valuable insights. New research tools in the neurosciences such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) have revolutionised much of psychological research. These tools capture in real time the images of a subject's brain while the subject is asked to perform a given task. By comparing the amount of blood flow to different parts of the brain before, during, and after the task, these tools help in associating the performance of the task with certain regions of the brain. Thus, they provide important neurophysiological foundations for a variety of cognitive processes and behaviours.

One interesting example, especially relevant for financial decision making, is the link between rational behaviour and emotion, which till recently were considered diametrical opposites. Damasio found that patients who lost their ability to experience emotion due to surgical removal of brain tumours, suffered in their ability to make rational choices as well. This conclusion is surprising to economists who associate behavioural biases to emotions. After all, as Keynes once suggested, the “animal spirits” or fear and greed, cause prices to deviate irrationally from fundamentals.

According to modern research, emotions are central to rationality. As Andrew Lo put it, “Emotions are the basis for a reward and punishment system that facilitates the selection of advantageous behaviour, providing a kind of mental yardstick for animals to measure the costs and benefits of the various actions open to them.”

If emotions are central to rationality, what then is the source of irrationality? The neurosciences literature provides some clues.

Let us start with a basic fact about the human brain. According to the triune model, proposed by Maclean, the human brain is not a homogeneous mass of nerve cells but has three basic parts, serving different functions: brain stem, limbic system, and cerebral cortex. Located at the top of spinal cord, the *brain stem* controls basic bodily functions such as breathing and heartbeat. It is active even during deep sleep. Comprising of several regions in the middle of the brain, the *limbic system* is the seat of emotions, instincts, social behaviour, sexuality, and fight or flight responses. The *cerebral cortex* is the tangled maze of gray matter that represents the outer layer of the brain. It is the seat of complex and abstract thinking where logical reasoning, language, learning, musical abilities, and so on reside.

Maclean refers to these three areas as the *reptilian*, *mammalian*, and *hominid* brains respectively. This terminology suggests that the human brain has been shaped by an evolutionary process in which basic survival functions, emotional and social behaviour, and cognitive abilities emerged sequentially.

The triune model provides a deeper foundation for understanding some of the behavioural biases characterising financial decision making. According to neuroscientists, emotion is our “first response” to objects and events. Individuals respond emotionally first to objects and events before they can articulate what these are. Indeed, extreme emotional reactions can short-circuit rational deliberation totally. The strong stimulus to the mammalian brain tends to inhibit activity in the hominid brain. This seems to make sense from an evolutionary perspective. As Andrew Lo put it, “From an evolutionary standpoint... emotional reactions are a call – to – arms that should be heeded immediately because survival may depend on it, and higher brain functions such as language and logical reasoning are suppressed until the threat is over, that is, until the emotional reaction subsides.”

The three specialised parts of the brain may be viewed as an evolutionary adaptation meant to enhance the odds of survival in response to a particular environmental condition. As Andrew Lo put it, “As environmental conditions change, so too does the relative importance of each component. One of the unique features of *Homo Sapiens* is the ability to adapt to new situations by learning and implementing more advantageous behavior, and this is often accomplished by several components of the brain acting together.”

From this perspective, what economists call “preferences” stem from complicated interactions among the three parts of brain as well as interactions among subparts within each of the three. This means that preferences, which are likely to be shaped by several factors, internal as well as external to the individual, may vary over time. According to Andrew Lo this perspective can be operationalised within an economic context by revisiting the idea of “bounded rationality” first proposed by Herbert Simon, a Nobel laureate in economics, in 1978. Unfortunately this powerful insight was largely ignored by mainstream economics till recently because rational expectations became the de facto standard for modeling economic behaviour.

The Adaptive Markets Hypothesis

According to Andrew Lo, the neuroscientific perspective suggests an alternative to EMH which he calls the Adaptive Market Hypothesis (AMH). The essence of AMH is that the interaction between market forces and preferences results in a much more dynamic

economy, which is driven by competition, natural selection, and diverse individual and institutional behaviour.

Of course, the application of evolutionary ideas to economic behaviour is not new. Thomas Malthus invoked biological arguments to predict dire economic consequences; Joseph Schumpeter used notions of “creative destruction” and “bursts” of entrepreneurial activity which had an unmistakable evolutionary flavour to them; Elredge and Coull proposed the idea of “punctuated equilibrium,”; Wilson systematically applied the principles of competition, reproduction, and natural selection to explain certain kinds of human behavior; Niederhoffer likened financial markets to an ecosystem with speculators as carnivores, dealers as herbivores, and floor traders as distressed investors and decomposers; and Bernstein argued that evolutionary processes provide a better explanation for market dynamics.

Derived from evolutionary principles, the AMH can be viewed as a new version of the EMH. The AMH takes a biological, not physical, view of markets. According to Andrew Lo, the principal architect of the AMH, “The primary components of the AMH consist of the following ideas.

- (A1) Individuals act in their own self-interest
- (A2) Individuals make mistakes.
- (A3) Individuals learn and adapt.
- (A4) Competition drives adaptation and innovation.
- (A5) Natural selection shapes market ecology.
- (A6) Evolution determines market dynamics.”

Key Insights and Implications of the AMH

The key insights and implications of the AMH are:

1. Prices reflect as much information as dictated by the combination of environmental conditions and the ecology of the market (the number and nature of species in economy).
2. The convergence to equilibrium is neither assured nor likely to occur at any point of time – this is the key insight from evolutionary biology. As Andrew Lo put it, “The notion that evolving systems must march toward some ideal stationary state is plain wrong. In many cases, such equilibria do not exist and even when they do, convergence rules may be exceedingly slow, rendering the limiting equilibria virtually irrelevant for all practical purposes.”
3. Behavioural biases on account of heuristics are very common.

4. To the extent that a relation exists between risk and return, it is not likely to be stable over time. This means that equity risk premium is time-varying and path dependent.
5. Aggregate risk preferences are not fixed but shaped by the forces of natural selection.
6. While there are no arbitrage opportunities in the classical EMH, in the AMH arbitrage opportunities do arise from time to time. As Sandy Grossman and Joseph Stiglitz argued persuasively, without arbitrage opportunities there will be no incentive to gather information leading to a veritable collapse of price discovery in financial markets.
7. The EMH predicts an inexorable trend toward higher efficiency, but the AMH implies a far more complex market with cycles, trends, bubbles, crashes, and other phenomena. Such complex market dynamics provide motivation for active management according to Peter Bernstein.
8. Investment strategies will wax and wane, doing well in certain environments and poorly in others.
9. Under certain market conditions, for certain investors active asset allocation policies may make more sense.

The bottom line in the AMH is survival and innovation is the key to survival. As Andrew Lo put it: "The AMH has a clear implication for all financial market participants: survival is ultimately the only objective that matters. While profit maximization, utility maximization, and general equilibrium are certainly relevant aspects of market ecology, the organizing principle in determining the evolution of markets and financial technology is simply survival." The imperative for survival suggests that managers and consultants must maintain a certain degree of breadth and diversity in their skill and focus.

Rational Finance and Behavioural Finance

It appears that rational finance and behavioural finance are both correct and incorrect. Rational finance works when your mammalian brain and hominid brain are properly balanced. But during periods of extreme stress when you are overwhelmed by positive or negative emotion, your behavior is likely to be irrational.

2. SAVING ECONOMICS FROM THE ECONOMISTS*

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Ronald Coase, a Nobel laureate in economics, is very critical of economics as it is currently taught in textbooks and classrooms. As he put it, “Economics as currently practiced in textbooks and classrooms does not have much to do with business management, and still less with entrepreneurship. The degree to which economics is isolated from the ordinary business of life is extraordinary and unfortunate.”

This was not so when modern economics was founded by Adam Smith who envisioned it as a study of the “nature and causes of the wealth of nations.” The academic community at that time was small and economics addressed a broad audience. Even till the turn of the 20th century, economics had relevance to industrialists. Alfred Marshall kept economics as “Both a study of wealth and a branch of the study of man.”

As the profession of economics consolidated in the 20th century, economists enjoyed the freedom to write to each other in a very abstract manner using a hypotheco- deductive system based on unrealistic assumptions. So they did not provide any real guidance to managers and entrepreneurs in their endeavour to bring new products and services to customers in a rapidly changing environment. As a result, managers and entrepreneurs depend on their personal judgment, business acumen, and rules of thumb for decision making. As Ronald Coase lamented, “Today, production is marginalised in economics, and the paradigmatic question is rather static one of resource allocation.”

Given the institutions- intensive character of a modern market economy (an intricate web of social institutions is required for coordinating the working of markets and firms across various boundaries), reducing economics to price theory is somewhat disturbing. As Ronald Coase put it, “It is suicidal for the field to slide into a hard science of choice, ignoring the influences of society, history, culture, and politics on the working of the economy. It is time to reengage the severely impoverished field of economics with the economy.”

*Ronald Coase, “Saving Economics from the Economists,” *Harvard Business Review*, December 2012

B.SNIPPETS

1. Cash Management

In recent years the importance of cash management has increased dramatically. Cash management comprises of five basic elements.

1. *Collection* The firm must accelerate the receipts into available funds.
2. *Disbursements* The firm must control the release and timing of funds.
3. *Concentration* The firm must inexpensively mobilise funds from outlying banks to a single location for their efficient use.
4. *Investments* The firm must maximise yield within acceptable limits of risk and maturity.
5. *Information and Control* The firm must develop accurate short term cash forecasts and obtain accurate, timely data on bank balances, bank deposits, and so on.

2. Common Errors Applying Relative Valuation

The relative valuation method is a useful and popular tool for valuing unlisted companies. However, in applying this method, you should exercise care and good judgement and avoid the following errors that characterise its use in practice.

- Inadequate search for comparable companies.
- Failure to make appropriate adjustments to the financial statements of comparable companies.
- Mismatch or inconsistency between the numerator and denominator of the multiples used
- Naïve reliance on the average multiples of comparable companies.

3. Institutional Investors and Market Volatility

Ralph Wanger, a distinguished professional money manager, believes that the presence of institutional players in a stock is likely to make it *more* rather than *less* volatile.

“Herd instincts are as prevalent as ever. We’re all supposed to be more sophisticated now, but human psychology doesn’t change. In fact, in this day of high speed communications, money managers quickly react – and overreact – to recent events with frightening unanimity. Long – term thinking has practically disappeared. Institutions stampede into energy or biotechnology or emerging – market stocks and then stampede out again. Charged up by analysts’ optimistic earnings projections, they drive a stock to silly heights, only to rush for the exits when earnings come in even a penny or two below the forecast. With this kind of skittish institutional activity accounting for such a large percentage of the trading, markets have a potential for greater volatility.”

4. Reflections on IPOs

There are four characteristics of the IPO market which tilt it in favour of sellers, not buyers.

1. The sellers, being insiders, have an informational advantage over buyers.
2. The sellers decide the timing of sale. So they are likely to sell when they can get higher prices.
3. There are only a handful of sellers, but many buyers.
4. The quantity of shares offered being flexible, the merchant bankers (who are paid by the sellers) would try to optimise the price from the point of view of sellers.

IPOs thrive in bull markets and as the time goes by, the investment quality of issues deteriorates. As Ben Graham put it:

“Somewhere in the middle of a bull market the first few issues make their appearance. These are priced, not unattractively, and some large profits are made by the buyers of the early issues. As the market continues to rise, this brand of financing grows more frequent; the quality of the companies becomes steadily poorer; the prices asked verge on the exorbitant. One fairly dependable sign of the approaching end of a bull swing is the fact that new issues of small and nondescript companies are offered at prices somewhat higher than the current level for many medium-sized companies with a long market history.”

PART C: WIT AND WISDOM

1. HUMOUR

- Einstein to Chaplin: “What I most admire about your art... you don’t say a word and yet the rest of the world understands you.” Chaplin answered: “It’s true, but your glory is even greater...the whole admires you, even though they don’t understand a word of what they say..!”
- To find out how his book *Les Misérables* was selling, Victor Hugo telegraphed “?” to his publisher. The reply was “!.”

2. Wise Saws

- We are all faced with magnificent opportunities, brilliantly disguised as impossible situations
Charles R. Swindoll
- When you are getting kicked from the rear, it means you’re in front
Fulton G. Sheen