Adaptive Market Hypothesis
(Study of Assumptions)

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Abstract

Adaptive Market Hypothesis (AMH) embraces Efficient Market Hypothesis (EMH) as an idealization that is economically unrealizable, but which serves as a useful benchmark for measuring relative efficiency. AMH's adaptability to changing dynamics of the market suggests that investors are potentially capable of an optimal dynamic allocation. There is nothing wrong here in the direction pointed by Andrew Lo. However the assumption that human innovation driven adaptability is the way ahead is an open-ended solution. This leaves little room for system thinking and overrules the possibility that natural systems could explain human behavior rather than vice versa. AMH just like EMH is based on a set of assumptions, which are good for illustrating market idealizations but lack in terms of addressing contradictions. This makes both AMH and EMH a system philosophy rather than a system framework. Reversion Diversion Hypothesis (RDH) (Pal, 2015) reconciles the contradictory assumptions into a statistical framework that addresses the limitations of EMH, AMH and extends the idea of a natural system functioning to markets.

AMH Assumptions

Under AMH, the traditional models of modern financial economics can coexist with behavioral models. Lo argues that much of what behaviorists cite as counterexamples to economic rationality—loss aversion, overconfidence, overreaction, and other behavioral biases—are, in fact, consistent with an evolutionary model of individuals adapting to a changing environment using simple heuristics. Market efficiency cannot be evaluated in a vacuum, but is highly context-dependent and dynamic. This is correct.

Lo considers information irrelevant but separates it from price formation. The kind of information from the how of information. AMH assumes informational inefficiency as given but does not make an effort to reconcile it with information efficiency as suggested by EMH and relies on a subjective discourse to explain the information inefficiency. It's hard to see AMH come so close in terms of illustrating the temporal limitation of the behavioral model, but still choosing to stick to understanding behavioral limitations as a lack of human innovation rather than considering behavior subsumed and driven by a statistical framework. AMH chooses the behavioral limitations to make a case for an evolutionary framework suggesting how prices, probabilities, and preferences interact and constitute market equilibrium. Assuming preference to be driving the system rather than be driven by it, Lo 's AMH has diverged away from system thinking. The connection of the taxonomy of uncertainty, limitation of quantitative models and ultimately human aspect of economic interaction as mentioned by Lo assumes that we have come to the end of the road when it comes to a more quantifiable definition of markets. This might be the reason Lo wants to stick to more philosophical approach with AMH rather than pushing further with our quantitative understanding of markets.

Barring point 5, AMH makes a thorough case. 1 To the extent that a relation between risk and reward exists, it is unlikely to be stable over time; 2 There are opportunities for arbitrage; 3 Investment strategies—including quantitatively, fundamentally and technically based methods—will perform well in certain environments and poorly in others; 4 The primary objective is survival; profit and utility maximization are secondary; 5 The key to survival is innovation: as the risk/reward relation varies, the better way of achieving a consistent level of expected returns is to adapt to changing market conditions.

Ignoring informational reconciliation, illustrating the temporal reality of risk, giving an emotional reason for such risks, labeling all of this as natural, calling it evolutionary and suggesting adaptability and innovation without defining and stating the functioning of the contextual-dependent and dynamic system is philosophy, not science.

Lo uses the present value generalization driving the market price to generate a statistical evidence (variance ratio) to challenge EMH but then chooses to stick to evolutionary subjectivity as a basis for AMH. Why does Lo ignore to extend statistical thinking to back his case for AMH? If statistics laws drive Physics, modern finance and even can not be ignored by behavioral finance then why would thinkers like Lo chose not to persist with statistical thinking?

Relying on economic history is definitely a good case for adaptive thinking, but citing Thomas Malthus for his evolutionary view and not mention his statistical contributions in ‘An Essay on the Principle of Population’ which was read by Pierre-François Verhulst to derive the logistic equation to describe the self-limiting growth of a biological population seems like an incomplete argument. Though Malthus writes that population, when unchecked, increases in a geometrical ratio as subsistence increases only in an arithmetical ratio, he also talks about the law of nature, bounds and systems and mentions that one may return again to the old mode of philosophizing and make facts bend to systems, instead of establishing systems upon facts. In a similar mention regarding Joseph Schumpeter’s business cycles, Lo ignores Schumpeter’s beliefs that innovation was not at the root of cyclical fluctuations, rather the multiplicity of cycles was a phenomenon which encompassed business cycles. Lo disregards the Schumpeterian system thinking and picks up selective ideas to back his evolutionary view.

Considering emotional response as an essential factor and “The very act of trading” as a driver for anomalies, Lo also refuses to acknowledge that behavioral anomalies are subsumed by statistical laws, which express nature as cases of reversion and diversion. Choosing to consider behavioral anomalies as driven by Darwinian natural selection rather than as a statistical expression, Lo chooses to overweight human decision driving system thinking rather than the other way around.

Temporal Nature of Anomalies

According to Lo, markets are inefficient, anomalies could come and go, new anomalies may appear, which are arbitrageable and exploitable only in the extended period of time, investment strategies undergo cycles of profitability and loss, behavioral anomalies like overreaction and underreaction can be explained statistically. Risk aversion is enough to cause the variance bound to be violated. Behavioral biases could be referred to as maladaptive and heuristics could adapt in time. Financial markets for Lo are a co-evolving ecology of trading strategies.

"Under the AMH, investment strategies undergo cycles of profitability and loss in response to changing business conditions, the number of competitors entering and exiting the industry, and the type and magnitude of profit opportunities available. ever changing the environment. By viewing economic profits as the ultimate food source on which market participants depend for their survival, the dynamics of market interactions and financial innovation can be readily derived."

"Profitable strategies accumulate capital with the passage of time, and unprofitable strategies lose money and may eventually disappear. A financial market can thus be viewed as a co-evolving ecology of trading strategies. Prices do not necessarily reflect 'true values'; if we view the market as a machine whose job is to set prices properly, the inefficiency of this machine can be substantial. Patterns in the price tend to disappear as agents evolve profitable strategies to exploit them, but this occurs only over an extended period of time, during which substantial profits may be accumulated and new patterns may appear."

"In fact, luck can play another role in the interpretation of anomalies: it can account for anomalies that are not anomalous. Regular patterns in historical data can be found even if no regularities exist, purely by chance. Although the likelihood of finding such spurious regularities is usually small (especially if the regularity is a very complex pattern), it increases dramatically with the number of 'searches' conducted on the same set of data. Such data-snooping biases are illustrated in Brown et al. (1992) and Lo and MacKinlay (1990b) – even the smallest biases can translate into substantial anomalies such as superior investment returns or the size effect."

"Overreaction and Underreaction; Moreover, Lo and MacKinlay (1990c) show that at least half of the profits reported by Lehmann (1990) are not due to overreaction but rather the result of positive cross- autocorrelations between stocks. For example, suppose the returns of two stocks A and B are both serially uncorrelated but are positively cross-autocorrelated. The lack of serial correlation implies no overreaction (which is characterized by negative serial correlation), but positive cross-autocorrelations yields positive expected returns to contrarian trading strategies. The existence of several economic rationales for positive cross-autocorrelation that are consistent with EMH suggests that the profitability of contrarian trading strategies is not sufficient evidence to conclude that investors overreact."

Mean Reversion Failure

This is not the first time academicians have talked about temporal nature of anomalies. In 'Non-Arbitrageable Anomalies' Pal (2015), the author explained the circular argument around anomalies.

Sometimes these non-arbitrageable opportunities are referred to as anomalies. The 'Size Premium', 'Value Premium', 'Equity Premium' etc. The equity premium puzzle refers to the phenomenon that observed returns on stocks over the past century are much higher than returns on government bonds. Equity Premium is a puzzle because the premium is not arbitraged away. The frequently recurring anomalies brought behavioral finance into existence. Starting Herbert Simon who suggested that the definition of the rational man needed rethinking. Anomalies violate modern financial and economic thought, which assume rationality.

The size premium is the historical tendency for the stocks of firms with smaller market capitalizations to outperform the stocks of firms with larger market capitalizations. Value

premium refers to the greater risk-adjusted return of value over growth (stocks). Size premium is also considered a non-arbitrageable opportunity. In 1964, economists Eugene Fama and Kenneth French analyzed decades of stock prices and found consistent and significant return premiums related to both small-cap and value stocks. These premiums are often present. The F&F TFM is both a historical milestone and modern mystery in the study of finance. There is still no widely accepted explanation for these premiums, but they exist. Economic theory suggests that the outperformance of these two types of stocks should either never happen, or should be arbitraged away immediately upon identification. The existence and persistence of these premiums remain a puzzle.

Anomalies come and go; John C. Bogle has argued that no value premium exists, claiming that Fama and French's research is period dependent. Bogle is the biggest proponent against the value and size premium school.

“While gross performance reverts to the mean self-evident pattern of mean reversion. Yet as we observe these extended cycles of mean reversion, it must occur to you that investors ought to be able to capitalize on them, riding one horse until it tires, then leaping to the other.”

End of behavioral Finance; The case for what causes inefficiency, what explains it has been simplified by the behavioral economists, using behavioral reasons for anomalies (cases of inefficiency). Unfortunately, this has lead to the subject becoming more of a subjective discourse rather than something objective. Ideas like anomalies are here to stay, markets can’t be predicted, but some forms of extreme anomalies can be profited from lead to the idea of behavioral funds. Adjusted for risk, behavioral funds were tantamount to value investing. Behavioral finance fund performance proved that anomalies can’t be identified and exploited on a persistent basis. The behavioral model accepts it's temporal limitations.

The five aspects Thaler points out in his paper ‘End of behavioral finance’ (a term he confidently used to suggest that behavioral finance will be the only form of finance left) are 1) The equity premium puzzle, 2) Predictability, 3) Dividends, 4) Volatility and 5) Volume myth. All of these five aspects can be explained as mean reversion failures.

First; the equity premium puzzle is that the undue premium equities get over treasuries are more than justified by the inherent risk in equities. So, the question behavioral finance is asking here is why equity premium (above the risk premium) does not revert to the mean (vanish), or why don’t equities erase the respective premium vs. treasuries over a certain period.

Second; behavioral finance suggests that predictability in markets is a factor of mispricing. When value gets mispriced versus glamor, it invariably corrects and delivers abnormal returns. Here behavioral finance suggests that because a mispriced asset reverts to mean it delivers returns. This again is a case of a mean reversion failure followed by a regular mean reversion.

Third; dividends, i.e. why do most large companies pay cash dividends? And why do stock prices rise when dividends are initiated or increased when companies can make their taxpaying shareholders better off by repurchasing shares rather than paying dividends? Here behavioral finance seems to be questioning why dividend stocks earn a premium when they shouldn’t. Or, in other words, why dividend premium should not revert to a mean value (vanish)? Fourth and fifth; volatility and volume are other cases of mean reversion failure. Both volatility and volume are unexplained, exhibit extreme behavior and don’t adhere to any standard models.

Circular Argument; Fama said that CAPM is incomplete and factors are important (A). Behavioral finance is more keen to explore behavioral flaws and psychological drivers of anomalies (B). The Bogle argument is that Beta is king and premiums come and go, value and growth move in and out of favor. Both factors are period dependent and Mean Reversion is a reality that drives markets (C). And finally, though behavioral finance accepts the reversion to mean (DeBondt and Thaler, 1985) it still sticks to behavioral explanations for ideas that are intrinsically connected to mean reversion failure. Behavioral finance also fails to develop the idea of intertemporal choices and it's importance in human decision making, which suffers from hyperbolic discounting.

Biological Paradox

Adopting a Darwinian approach in the time of complex networks may not necessarily be a step back, but focusing on human decision making as a driver for stock market anomalies, which are assumed to correct in time, is a very simplistic way to map dynamic systems. If we talk about biological and natural systems, natural selections, sociobiology, evolutionary dynamics then we should first define the working of a natural system outside the context of risk preference. Giving markets a context of risk preference is too narrow a definition of contextually-dependent dynamic systems. Before we talk about learning and adapting, we should understand the very nature of natural systems that witness reversion and diversion behavior irrespective of the fact whether it's price, height or emotion.

RDH; Information Relevance and Irrelevance

Information is an assumption for modern finance. The Efficient Market Hypothesis uses information to back its case of efficiency. The EMH case is weak. The Reversion Diversion Hypothesis challenges the information assumption in EMH based on the idea laid out first by Kenneth E. Boulding (1966), highlights the body of work discussing information relevance, information irrelevance, information content since Ball and Brown (1968) and illustrates how 'Mean Reversion Framework' (Pal, 2015) can be used to re-explain the transformation of information from relevance to irrelevance, also referred to as the 'Reversion Diversion Hypothesis' (Pal, 2015) (RDH).

The 'Reversion Diversion Hypothesis' is intrinsic to natural systems including stock market systems. The hypothesis is based on the 'Mean Reversion Framework', which explains how reversion and diversion can not be seen independently. It is the reversion and diversion process that drives assets into price momentum and into price reversion. The 'Framework' classifies price momentum into 'Value' and 'Growth' and illustrate how 'Value' and 'Growth' could be statistically driven. The Reversion Diversion Hypothesis addresses the failings of EMH in addressing discrepancies, by building a system approach to explaining how the idea of intrinsic value could be extended from the current price to something relative and dynamic. EMH accepts that the market needs a dynamic mean to oscillate to but does not develop a comprehensive framework to reconcile the arguments against market efficiency. EMH fails to address information in a comprehensive way and its insistence on market efficiency and independence of past from the future despite a large body of work on market inefficiency renders it incomplete. The 'Framework' was tested across time frames and across various groups for absolute and stationarity trends. Its transformation across states was orderly and significant. The Reversion Diversion Hypothesis proves that random and non-random systems,

inefficient and efficient market systems, dependence and independence, relevance and irrelevance of information could co-exist.

Unlike AMH, RDH explains human decision making as a part of the reversion - diversion statistical framework. The human adaptiveness or innovation as Lo suggests is not capable of altering the reversion - diversion multi durational process as first mentioned by Schumpeter in Business Cycles. Human innovation and decision-making in the context of the reversion - diversion framework can allow for better understanding of group behavior and the better understanding of uncertainty that is a part of every natural system.

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