In a previous blog I discussed the efficient market hypothesis (EMH), which can be summed up with the following statement by recent Nobel Prize winner Eugene Fama.

An efficient capital market is one in which security prices fully reflect all available information.¹

I presented the following three arguments in favor of pragmatically adopting an efficient markets view when investing.

- The logic of hyper-competition in a fair trading arena – any trading edge will quickly attract competition and be arbitraged away.
- The mathematical fact that investors as a whole cannot beat the market, and since professional investors manage the majority of assets, aggregate professional alpha must be close to zero before fees.
- While acknowledging that there can be long-term skilled winners, the empirical evidence suggests it’s very difficult to distinguish luck and skill when evaluating past performance, even when judging your own trading ability.

In this blog I’ll go one level deeper to discuss the fundamental foundations for an efficient market. Why review these? Mainly to develop a better understanding of “the enemy,” and to identify weaknesses in the EMH assumptions that may lead to trading edges. Rather than argue about whether a market is efficient, let’s search for nuanced moments in time and securities-space when the EMH assumptions may not hold – leading to an exploitable trading edge for us.

In addition, understanding the foundations should provide a common sense basis for estimating when a trading edge is likely to stop working and when evaluating investment manager claims of superior skill. Hopefully, as you read this blog, your mind will creatively wonder and perhaps spawn an idea for a new trading edge.

On a final note, I’m reviewing the EMH foundations from the point of view of an asset class trader, not a policy maker or academic. An EMH foundation must support one or more of three essential features of an efficient market:

- There are no recipes for beating risk-adjusted market returns.
- No person or entity has a sustained competitive advantage for beating the market.
- Securities prices provide an unbiased best estimate of fair value as stated above by Fama.

Without further ado, here are the foundations of the EMH.

1. Generally Accepted Asset Pricing Model

Economists develop asset pricing models in an effort to explain historical returns of financial assets like stocks and bonds. Of interest to us is the most commonly used model, which at this time is still probably the Capital Asset Pricing Model (CAPM) developed independently by Sharpe and Lintner in the 1960s.² ³
Why do we care? The asset pricing model is the scorecard used by investors to compare investment managers against each other and versus the market. Third-party performance monitors, such as Morningstar and pension consultants, use an asset pricing model to determine if a manager is adding alpha. Portfolio managers with positive alpha attract assets; those with negative alpha languish or eventually close up shop. For this reason, investment managers use the asset pricing model to evaluate their own processes and in choosing investments/trades that will improve their performance compared to the asset pricing model. Academics use the same asset pricing model to empirically test if a market is efficient.

Whatever the model used to judge and select investment managers, we can expect the market to become efficient with respect to that model over time due to the above feedback mechanisms. This mechanism is self-fulfilling.

Here is the formula for the CAPM.

\[ R_i = R_f + \delta \times \text{cov}(R_i, R_m) \]

where \( R_i \) is the return of asset i for the period (month, quarter or year), \( R_f \) is the risk free return usually equal to the U.S. T-bill rate, and \( \text{cov}(R_i, R_m) \) is covariance of asset i and the market. The second relation converts the covariance into the correlation between asset i and the market (\( \delta \)), and the standard deviation of returns for asset i and the market (\( \sigma_i, \sigma_m \)).

Typically, a monthly return series associated with a manager \((R_i - R_f)\) is linearly regressed with monthly market returns \((R_m)\) to measure the slope (which is equal to the covariance shown above) and intercept (which is equal to alpha). Morningstar uses the CAPM framework to measure historical alpha and beta (covariance) associated with equity and bond managers.

Since the introduction of the CAPM in the 1960s, academics and practitioners have noticed certain factors have stood the test of time in delivering alpha when evaluated by the CAPM. Two additional risk factors were introduced in the early 1990s – the small cap and value factors, resulting in the Fama-French Three-Factor model.

Rather than jump to the conclusion that markets are inefficient, academics improved the asset pricing model to incorporate these two effects with the very reasonable assumption that small and value stocks have additional risks that are not fully captured by volatility. Recently, Fama and French introduced a 5-factor model, adding two additional factors – profitability and investment.

Sophisticated investors now judge active stock and bond managers with these factor models. This may seem unfair to change the rules after a number of great fund managers used a value approach to beat the market over the years. But now an investor can choose among a number of inexpensive index funds and ETFs that overweight small and/or value stocks. These ETFs, or the indexes they follow, are the new benchmarks for small cap and value equity managers.

With respect to alternative strategies and hedge funds, asset allocators and investment advisors continue to use the standard CAPM parameters to judge merit. Historical performance parameters of interest are primarily:

- Annual return.
- Standard deviation of annual returns.
- Correlation with stock and bond indices.
- Sharpe ratio.

Equity-like returns with bond-like volatility and no correlation with stocks and bonds is the coveted place to be right now. Hedge funds with reduced return potential, but with high Sharpe ratios and low correlation to stock and bond indices are also attractive as such a strategy can be “ported” on top of stock and bond indexes using futures contracts to enhance returns above index returns. Again, the success of these strategies attracts capital and competition, which eventually act to force strategy returns towards zero alpha, and increase correlations to stock and bond markets.
No model is perfect, and all we really care about is the most commonly used model. When the Black-Scholes Option Pricing Model was first published in 1973, option prices immediately adjusted to fit the model. The Black-Scholes Model is mathematically founded on the elimination of riskless arbitrage opportunities, so rapid adaptation made sense. An asset pricing model for stocks and bonds is much more statistical and empirical in nature, and thus requires years of data to obtain the statistical sample required to answer questions. In the future, if and when a better asset pricing model is developed and eventually accepted, prices and returns will likely become efficient to that model. The time scale for adoption will be decades.

Are there any asset class trading edges associated with this foundation? Definitely. Investors come in various forms of sophistication. Many retail and unsophisticated investors look at past returns without any risk adjustment, sense of historical context or factor analysis. These investors chase returns and are a potential alpha source for asset class traders. Obviously a portfolio manager with a simple cap-weighted benchmark can tilt a portfolio towards riskier assets associated with a more sophisticated asset pricing model to achieve benchmark-beating returns. This has been done for decades.

At times there is a large group of investors sensitive to different risk-measures, which can create a profitable risk-transfer opportunity. One example may be insurance companies and pension funds employing liability-driven investment (LDI) approaches. The LDI methodology ignores volatility as a risk measure and prefers to invest in the longest-dated bonds to hedge far-out liabilities. Also, drawdown-sensitive investors may be advantaged by the industry-wide focus on standard deviation as the primary risk measure. Massive losses can also create an aversion to a particular asset class so that it trades at a better expected return per unit of volatility than the market for a number of years.

2. Many Arbitrageurs

Rational investors are generally forward-looking when assessing expected returns and risk. When new information is released, affected securities are immediately repriced – sometimes overshooting equilibrium value, other times undershooting. All risks are properly accounted for, including those associated with volatility, default, liquidity, politics, inflation, interest rates, competition, and more. Not everyone will agree on how to value a security, but the collective wisdom of the crowds and competition balance the overshoots and undershoots when averaged over many news events.

In Andrei Shleifer’s book Inefficient Markets, he states that the EMH relies on three theoretical arguments, progressively weaker.

- All market participants value securities rationally as described in the preceding paragraph.
- To the extent participants are irrational, their actions are random and cancel each other out.
- To the extent irrationality is not random, thus potentially pushing prices away from equilibrium value, rational arbitrageurs are there to profitably exploit the opportunity, thus quickly driving prices back to equilibrium value. With this last mechanism, fierce competition among arbitrageurs eliminates pricing inefficiencies that may be caused by systematic behavioral phenomena.

In my opinion, with the huge growth of the hedge fund industry since Shleifer’s book was published in 2000, the third argument is now the strongest.

Thousands of behavioral finance studies have shown that investors are not emotionless analytical calculators. We’ve all intuitively known this. Typical investors can panic, performance chase and trade too much, and most lack the skills needed to fundamentally value a security. In addition, behavioral tendencies among participants are often highly correlated with each other. These issues have been key arguments used by EMH antagonists and firms using behavioral finance as the justification for future expected alpha-generation.

To eliminate behavioral biases and all sorts of systematic trading edges, an efficient market must have many, many “arbitrageurs” competing with each other to deliver enhanced performance. I put “arbitrageurs” in quotes, because these folks are not limited to those putting on risk-free trades. They are traders, hedge funds, mutual
fund portfolio managers, market makers, commodity trading advisors, high frequency traders, Wall Street prop trading desks – anyone seeking to deliver enhanced risk-adjusted returns by any means and engaging in risky bets to beat the market. Competition among all professionals eventually eliminates pricing quirks in the market.

How many arbs are needed to provide price discovery? No one knows – the more the better. There are tens of thousands of mutual funds and hedge funds in the world. These funds control trillions of dollars, so it seems there are plenty of players with an enormous asset base to drive out most pricing inefficiencies.

Grossman and Stiglitz have argued that markets have to be somewhat inefficient to incentivize rational arbitrageurs to stay in business. In the market making business and firms trading house money, that’s probably true. However, the majority of arb firepower is managed by investment managers who collect fees as a percentage of assets independent of alpha generation. These fees are so lucrative, there is more than enough incentive to stay in business even if the alpha is no longer there.

Another way to get at the quantity of arbs question is to monitor the amount of assets that are indexed. Due to the historically poor performance of active managers, index investing has become very popular in recent years, especially with equities. As of 2013, 18% of U.S. equity fund assets were indexed. Bond index funds garner a much smaller percentage of the whole. At what fraction will the market become less efficient? Again, no one knows the answer, but I’d guess if over 50% of assets are indexed, it may be time to consider active managers and also worry about index reconstitution costs.

Shleifer and Vishny argued that at times, markets are inefficient due to limits in the above arbitrage activity. We agree, and finding these moments in time is an excellent place to search for trading edges. We seek to find pockets of the market where an alpha source is large and growing. There are instances in time when arb firepower can be overwhelmed, such as during bubbles, extreme volatility, market crashes and panics. Sometimes there are moments when arb firepower has been dramatically reduced, after major losses and outflows from a strategy. Instances of motivated or forced selling is another potential alpha source associated with a brief moment in time where market maker firepower is lacking.

Trading approaches to exploit these opportunities often require educated guess work, and they’ll be the subject of future blogs.

3. Information Is Disseminated Instantaneously and Fairly

In a perfectly efficient market, all relevant information is disseminated instantaneously to all market participants. This foundation became much truer during the past 25 years as the information age led to cheap and timely information flow.

A loose regulatory system that looks the other way in the face of rampant insider trading and manipulation can expect a market with mispriced securities and advantaged traders. It’s human nature to cheat, especially when the perception is everyone else is doing it. Cracking down on cheaters helps keep the markets as fair as possible and levels the playing field. In the U.S., the Securities and Exchange Commission (SEC) is primarily responsible for policing the markets; however, the SEC is not without conflicts of interest and resource constraints, nor is it immune from political influence.

Trading with non-public insider information clearly gives such a massive advantage that the SEC continues to become ever more sophisticated in cracking down on these cheaters. Yet I’m amazed at the steady stream of news stories about fund managers and traders caught every year taking advantage of insider knowledge.

The SEC is also on the lookout to eliminate any cases where preferential disclosure provides an edge to a subset of people. In the 1990s, selective disclosure of upcoming analyst upgrades/downgrades and order flow information was a large alpha source to high-commission-generating hedge funds. In 2000, the SEC introduced Regulation FD to prohibit this activity and disallow CEOs from selectively disclosing market-moving information to a subset of investors and analysts. Hedge fund use of expert networks is a relatively new approach to gain an information edge, and Michael Lewis’s latest book highlights activities of high-
frequency traders competing with each other to sense and act faster than other market participants.

The game of cat and mouse between regulators and traders is constantly evolving in this space. It’s a game I’ve never played, and it’s not that relevant to trading asset classes.

Of more relevance is the use of technical analysis. Aronson\(^7\) has a nice discussion about this foundation with respect to the use of technical analysis. Technical analysis is one of the bread-and-butter tools used by traders, including myself. Since price and volume data is so readily available and so easy to manipulate with Excel, it’s hard to believe there’s any edge associated with using technical analysis. Any predictive capabilities associated with price patterns, oscillators, etc., should already be factored into the price. Technical analysis will definitely be a topic of future blogs.

4. **Low Costs, Low Barriers to Entry and Many Trading Vehicles**

To facilitate an efficient market, there must be very low barriers to entry, small implementation costs, plenty of trading vehicles and a level playing field to encourage intense competition and eliminate preferential cost advantages for a small subset of participants.

Information technology has revolutionized and democratized trading and investing over the past 30 years. Practically any skilled practitioner can now scan the universe of stocks based on hundreds of unique data fields. Testing and automating sophisticated trading systems is well within reach of traders of very limited resources. Real-time quotes, market research, fund performance tracking and academic articles are cheap and readily accessible.

Stock trading commissions have fallen dramatically since May 1, 1975, when the SEC abolished the fixed schedule used by brokerages. A similar benefit occurred when the SEC shifted stock quotes from fractions to decimals back in 2001. As discussed in the previous section, the SEC is constant striving to level the playing field for all investors.

The final need for an efficient market is plenty of trading vehicles, including derivatives such as futures and options. With respect to making riskless and risky arbitrage easier, the more trading vehicles, the better. Schleifer\(^4\) refers to the role of substitute securities, which are needed to implement arbitrage trades. Miller\(^8\) also observed the benefit of “helper assets” in laboratory tests of market pricing. The public perception of derivatives is generally very poor, but their prescience in facilitating many forms of arbitrage and short-selling is underappreciated.

Bans or limits on short-selling and foreign investing can create a number of pricing anomalies. With few trading vehicles, or a single vehicle, we can expect a foreign ADR, closed-end fund, or an ETF to trade at a premium if it’s the only game in town to invest in an asset class. As more trading vehicles are introduced, these anomalies go away.

The dramatic increase in exchange traded funds over the past 10 to 20 years has many implications for asset class traders. Using momentum to select future outperforming asset classes is so easy to do now, it’s hard to believe it will work in the future, especially since a risk story associated with momentum is lacking. Some people naively take back-tested studies to the 1900s, such as trading the Dow Jones Industrial Index. Technical models built on this data can’t be trusted because trading and information costs were much higher back then. These are topics of future blogs.

The common sense rule is that if a trading edge is easy to implement, then it’s likely to disappoint in the future. Search for markets with few vehicles, find ways to exploit new asset classes and be wary of any strategy when new trading vehicles are introduced.

5. **Long Time Scale**

The timescale for judging whether the market is efficient is extremely long. In some ways this is a "get out of jail free" card for the efficient market proponents. All trading edges and alpha sources eventually go away.
Loopholes are eventually closed and data-mined/back-tested studies are eventually debunked.

Some anomalies are gone in a few months; others take decades. For example, when Ed Thorpe began exploiting S&P 500 futures pricing discrepancies when first introduced, the edge lasted just four months. The alpha source was gone quickly.

If a pricing anomaly doesn’t go away over time, then academics incorporate the effect into their asset pricing model. In the mid-1980s, Warren Buffet gave his famous “Graham-and-Doddsville” presentation about how value investors outperform the market. It took a decade before academics incorporated a value-effect into the asset pricing model. The scientific process takes time, especially with academic egos involved and the long timescale required to have enough data to figure out if and why an anomaly exists.

It’s interesting to read interviews of famous hedge fund managers and traders who have been around for a long time. I often see comments to the effect that it was much easier decades ago to generate exceptional returns. The EMH proponents can just play the waiting game. Eventually, they’ll be right.

How do we deal with this situation? First, don’t get into an argument about market efficiency. We are not out to prove the market is inefficient – that’s impossible. Plus, the academics will likely win (at least from a scientific point of view).

We are interested in adding alpha over a long period of time (decades). Obviously, the answer is to stay one step ahead of others in searching and exploiting anomalies. The whole point of this blog is to discuss how someone can develop skills in the trading edge search. The process requires constant innovation and creativity.

6. Investors Are Macro-Rational

The next two foundations are probably caveats of the above five foundations, but I’ve chosen to call them out separately as two additional EMH foundations.

In a truly efficient market, prices are always right in the sense that they represent an unbiased estimate of fair value given all the relevant information at the time. Yet there are moments in history when an asset class becomes so wildly popular with the masses that a price bubble occurs. By definition, a price bubble is a case where prices have been lifted well above what a rational investor would view as fair. Charles Mackay’s classic book *Extraordinary Popular Delusions and the Madness of Crowds* documents an assortment of these moments in human history up to the mid-1800s. Since then, depending on your definition, hundreds of price bubbles have occurred in a variety of markets.

When an asset class becomes extremely popular, usually after a long run of great returns, the financial firepower of the masses can overwhelm the capacity of the arbitrageurs required to force prices back to an appropriate value. When this happens, the “Many Arbitrageurs” EMH foundation breaks down, and prices can diverge from equilibrium value for a long period of time. The Internet stock bubble in the late 1990s and the Japanese stock market bubble in the late 1980s are two popular examples. The China A-shares market in 2015 also has many traits of a bubble. During these times, the arbs often rationally decide to join the masses rather than fight the tidal wave of irrationality, either as an alpha bet or to mitigate business and career risk.

A second issue with the EMH, especially as the asset pricing model becomes ever more sophisticated, is that a few paradoxes emerge with asset prices. If investors adopt the EMH conclusions en masse, they can take reasonable concepts too far, thus eating away at the efficient market mechanisms. For example, if 95% of assets were managed with passive index funds, I would guess that the lack of arb firepower could lead to larger and more frequent price discrepancies.

If all investors adopt a “stocks for the long run” attitude, such as in the late 1990s, we can imagine stocks becoming so richly priced as to deliver future returns that are less than T-bills.

From 1928 to 2014, simulated U.S. small cap value stocks have outperformed the simulated S&P 500 with a return of 13.6% per year versus 9.8% per year. That’s a large margin, so some folks have suggested that young
people put all their money in small cap value stocks. Not everyone can invest in small cap value stocks, but the efficient markets view is that these stocks should outperform over the long term because they are riskier. However, if too many investors implement this view, we can expect small cap value stocks to disappoint for an extended period of time in the future.

To some extent I could roll these issues into a breakdown of EMH foundation #2 that is ultimately rescued by EMH foundation #5 – the lack of enough arb firepower creates the issue, but eventually, after decades of poor performance, investors wake up and rebalance their portfolios such that risk premiums reemerge.

For these reasons, we need to re-adopt a rational investor foundation, although this time we’ll modify this assumption to only those behaviors that occur on a massive macro level, where the arbs have limited capacity to push prices back to fair value. Without this assumption, there will be moments in time when prices deviate far from fair value for an extended period of time.

For investors to be macro-rational they must have a sense of history and future expected returns, such that they rationally avoid chasing returns and creating bubbles. In addition, they must have the ability to assess when a good financial innovation has been taken too far.

Ultimately, this is not a good assumption, so searching for bubbles to exploit is a potential alpha source for asset class traders. Of course, bubbles do not occur very often, and exploiting them is easier said than done. John Maynard Keynes said it best many years ago: “Markets can stay irrational longer than you can stay solvent.”

7. Rule of Law, Property Rights and Effective Market Regulatory Body

In a country where property rights are shaky, or with laws that favor a small group of individuals over citizenry, we can expect the “insider class” to extract extra returns from the markets and economy. Economists call this rent-seeking. Usually in this situation, these “businessmen” downplay their political/insider competitive advantages, and unfortunately for small investors, never open a mutual fund to allow co-investment alongside them.

Expect weird and perhaps exploitable price behavior during civil wars, wartime on home soil, periods of political persecution and assassinations, periods of expropriation and excessive corruption. The threat of the gulag provides little incentive to innovate, stand out or search for trading edges. Such environments can lead to prices that are way out of whack with respect to financial fundamentals. For an example, see a recent article in Barron’s about investing in emerging Russia after the Berlin Wall fell.22

Markets can certainly price in these sorts of risks in stock and bond prices, but that doesn’t restrict the insiders from extracting enhanced profits from the markets. At this time, Russian stocks trade below book value because of these sorts of risks. While not something I’ve done, developing specialized trading techniques for these sorts of markets could be an alpha source.

Conclusions and Takeaways for Traders

Be respectful of the EMH logic. The goal of this blog is to take a more nuanced view of the efficient markets hypothesis foundations. A better understanding the foundations should help in the search for new trading edges, and when evaluating current edges well before data confirms that an alpha source is gone.

Summary of EMH Foundations

The table shows a summary of the seven EMH foundations, along with the reason(s) they are needed to facilitate an efficient market.
<table>
<thead>
<tr>
<th>Generally accepted asset-pricing model</th>
<th>No long-term formulas to beat the market</th>
<th>No preferred advantage for a subset of traders</th>
<th>Prices are right</th>
<th>Why is EMH foundation required?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many arbitrageurs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Intense competition leads to efficient pricing.</td>
</tr>
<tr>
<td>Information is disseminated instantaneously and fairly</td>
<td>X</td>
<td></td>
<td></td>
<td>Eliminate preferred market participants.</td>
</tr>
<tr>
<td>Low costs, low barriers to entry, and many trading vehicles</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Low barriers to entry and costs allow many new competitors. Lots of trading vehicles facilitates efficient pricing.</td>
</tr>
<tr>
<td>Long time scale</td>
<td>X</td>
<td></td>
<td></td>
<td>Given long enough, every market anomaly is eventually arbitraged away or incorporated into the asset pricing model.</td>
</tr>
<tr>
<td>Investors are macro-rational</td>
<td>X</td>
<td>X</td>
<td></td>
<td>No bubbles or finance paradoxes.</td>
</tr>
<tr>
<td>Rule of law, property rights, effective market regulatory body</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Eliminate preferred market participants. Perhaps no incentive to innovate and/or be an arbitrageur.</td>
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References

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The efficient market hypothesis (EMH) asserts that financial markets are efficient. On the one hand, the definitional 'fully' is an exacting requirement, suggesting that no real market could ever be efficient, implying that the EMH is almost certainly false. On the other hand, economics is a social science, and a hypothesis that is asymptotically true puts the EMH in contention for one of the strongest hypotheses in the whole of the social sciences. An efficient capital market is one in which security prices fully reflect all available information.1

I presented the following three arguments in favor of pragmatically adopting an efficient markets view when investing. The logic of hyper-competition in a fair trading arena – any trading edge will quickly attract competition and be arbitraged away. Be respectful of the EMH logic. The goal of this blog is to take a more nuanced view of the efficient markets hypothesis foundations. A better understanding the foundations should help in the search for new trading edges, and when evaluating current edges well before data confirms that an alpha source is gone. Summary of EMH Foundations.