

AN ARGUMENT AGAINST STOCK-PICKING AND MARKET-TIMING: AN EMPIRICAL APPROACH

UN ARGUMENTO EN CONTRA DE LA SELECCIÓN DE ACCIONES Y EL MARKET-TIMING: UN ENFOQUE EMPÍRICO

Enrique Rafael González Pozo

Programa Doctoral en Economía y Administración de Empresas

Universidad Privada Boliviana

egonzalez@upb.edu

(Recibido el 15 de octubre 2020, aceptado para publicación el 30 de diciembre 2020)

ABSTRACT

This paper's objective is to demystify the world of investing, first by showing and exposing the results the greatest money managers in the Wall Street have obtained over the last years compared to the performance of their benchmark indexes. Index investing represents a passive investment strategy of holding hundreds of stocks instead of the active management approach used by these experts. After exposing said results, a theoretical framework will be presented that explains why money managers have such a difficult time outperforming their benchmark indexes. Later on, a back-test experiment will be presented and thoroughly explained showing five different hypothetical investment scenarios over several 20-year periods with the attempt to quantify the potential benefit of perfectly timing the market and compare it to the cost of waiting for a better time to invest. The results find shows that the cost of waiting is much greater than the potential benefit of perfectly timing the market and the best alternative would be to invest available cash immediately regardless of market or economic outlook.

Keywords: Market -Timing, Market Efficiency Hypothesis, Portfolio Management, Investment.

RESUMEN

El objetivo de este trabajo es desmitificar el mundo de las inversiones, primero mostrando y exponiendo los resultados obtenidos por los más grandes administradores de fondos en Wall Street respecto al rendimiento de los índices con los que se los compara. La inversión en fondos que siguen a índices representa una estrategia de inversión pasiva, en comparación a una estrategia activa utilizada por los expertos. Después de exponer dichos resultados se presentará un marco teórico que explica la razón por la cual a los administradores de fondos de inversión les cuesta tanto obtener resultados superiores a los de sus índices con los cuales se los compara. Más adelante se presenta y explica un experimento realizado con varios conjuntos de periodos de 20 años e información histórica, con el cual se pretende cuantificar el beneficio potencial de invertir en el momento perfecto y el costo de esperar por un mejor momento para invertir. Los resultados obtenidos muestran que el potencial beneficio de invertir en el mejor momento es mucho más bajo que el costo de esperar por un mejor momento y que la mejor alternativa es invertir el dinero disponible lo antes posible sin tomar en cuenta el estado del mercado o la economía.

Palabras Claves: Market-Timing, Hipótesis de Eficiencia de Mercado, Administración de Portafolios, Inversiones.

1. INTRODUCTION.

Some frustrated investors say that the stock market is no better than a casino, but that might not be entirely true, or entirely false. The best investment decisions people make are based on what they know, but the outcome of that decision is heavily influenced by randomness and relevant information that is unknown to them. Thus, as Howard Marks points in one of his memos, "investing involves hidden information, luck, and skill". So, if an investor does not have much skill, the investor would be down to luck and hidden information alone. Then, investing becomes a coin toss. Most people believe that they do not have the required skill to become a superior investor, so they pay experts to do it for them. Which is a common practice people do in many other activities in life, we pay experts to do the things we cannot do.

For decades, equity managers and mutual funds have been charging between 1.5% and 3% per year to other people in order to manage their money. If, as stated above, investing involves hidden information, luck, and skill. Money managers would be charging this fee for their exceptional skill and their ability to predict what the market might do in the future.

Burton Malkiel, in his book, *A Random Walk Down Wall Street* states that "The Stock Market cannot be consistently predicted by any theory". The only predictable thing we have about the market is that it tends to increase over time. No

one can consistently predict winners over anyone else”. He even went as far as saying that “A blindfolded monkey throwing darts at a newspaper financial pages could select a portfolio that would do just as well that one carefully selected by experts” [1].

If Malkiel’s statement is correct, instead of paying high fees to experts on Wall Street to let them manage one’s wealth, all investors would be better off finding a minimum-fee fund that buys hundreds of stocks without discriminating between winners or losers and just holds them passively. In the sense that if your average return is the same for both strategies (Expert vs. Monkey) nobody would pay extra for the experts.

At the beginning of the 70s, index funds were created, which represent the minimum-fee fund that Malkiel proposed, these index funds do not presuppose skills and do not charge for it either. The most common used index benchmark is the S&P 500.

The S&P 500 is a stock market Float-Adjusted Market Capitalization Weighted Index that measures the stock performance of the 500 largest companies listed on stock exchanges in the United States. It is one of the most followed equity indices and it is considered to be a proxy of the United States equity market. [2] In Figure 1 below we can see how this index has moved over the last two decades.

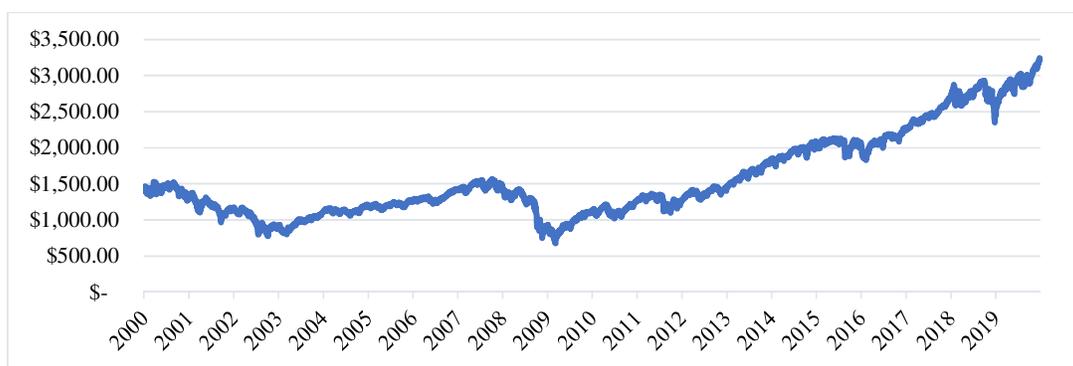


Figure 1: SP500 Index (2000-01-01 to 2019-12-31).

During 2018, S&P Dow Jones Indices LLC annual report, showed that, over 64% of large cap funds failed to outperform the S&P 500 Index, Figure 2 shows this and also shows that over 85% and 91% of large-cap fund managers failed to outperform the S&P 500 Index over the last 10 and 15 years respectively.

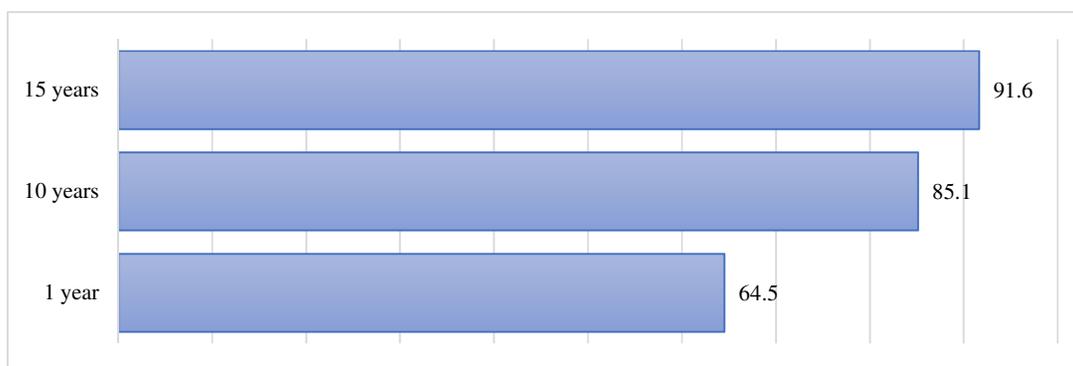


Figure 2: Percentage of Large-Cap Funds that Underperform the S&P 500.

Source: S&P Dow Jones Indices SPIVA U.S. Scorecard (2018) [3]

In Figure 3 we can observe that this phenomenon does not only occur to large-cap funds but even small-cap and middle-cap funds failed to outperform their respective benchmarks.

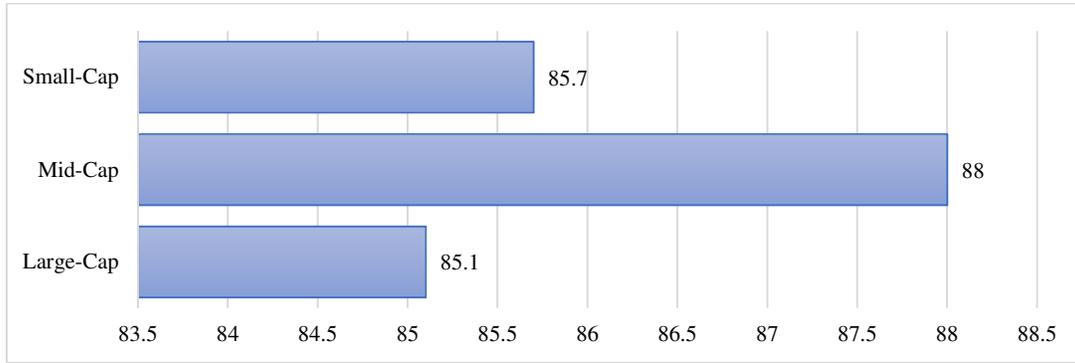


Figure 3: Percentage of Fund Managers Who Underperformed Their Benchmarks (Last 10 Years).

Source: S&P Dow Jones Indices SPIVA U.S. Scorecard (2018) [3].

The report concludes that “Over long-term horizons, 80 percent or more of active managers across all categories underperformed their respective benchmarks.” [3]

As seen in Figure 1, little over 91% of large-cap fund managers have lagged a simple S&P 500 index fund. This would mean that less than 9% of all money managers at Wall Street have outperformed the index, however, this is might not necessarily be related to the skills that Howard Marks suggested, but rather with luck. After all, given enough number of investors, it is evident that some would generate returns above the average over long periods of time. As shown in figure 4, even the funds that manage to beat the index fund 1, 2, 3, 4 and 5 years in a row have difficulty to have positive performance, and the number that continues to have a positive performance year over year is similar to the number expected by chance.

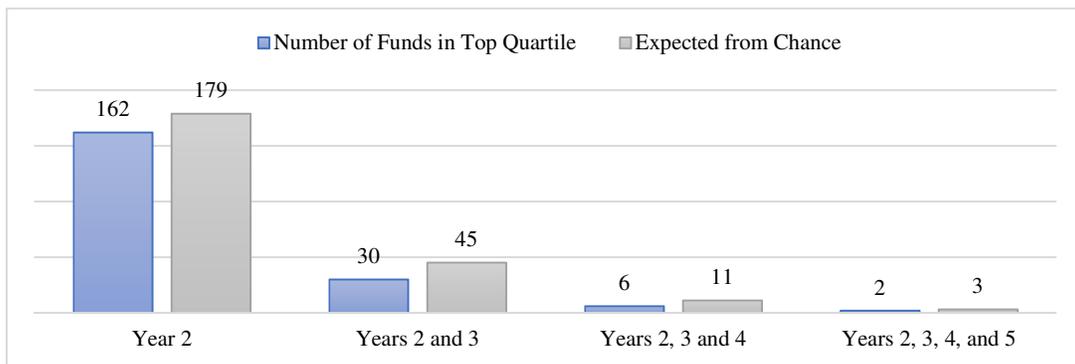


Figure 4: Number of Funds in Top Quartile vs Expected from Chance.

Source: S&P Dow Jones Indices Persistence Scorecard (2014) [4].

The reason why the future of the stock market cannot be predicted is explained by the Efficient Market Hypothesis. The Efficient Market Hypothesis is a theory developed by the Nobel Laureate in Economics, Eugene Fama, in 1970. He stated that, “In an efficient market, at any point in time, the actual price of a security will be a good estimate of its intrinsic value”, making it nearly impossible to outperform the market just by the selection of an expert.

Even disregarding the Efficient Market Hypothesis, there are so many rational agents in the system that the market cannot be predicted rationally and consistently, since every time someone gets a new method of valuing stocks, the next person will find a way to incorporate that strategy into a new strategy to beat the first strategy. In other words, each strategy must consider all other past dominant strategies in its formula to determine how the market will move, e.g.:

$$\begin{aligned}
 \text{Strategy } A_0 &= \text{Extrinsic Factors} \\
 \text{Strategy } A_1 &= f(A_0) + \text{Extrinsic Factors} \\
 \text{Strategy } A_2 &= f(A_0, A_1) + \text{Extrinsic Factors} \\
 \text{Strategy } A_3 &= f(A_0, A_1, A_2) + \text{Extrinsic Factors} \\
 &\vdots
 \end{aligned}
 \tag{1}$$

It becomes a game of constant evolution that no one will ever win for a long enough period to beat the market average. Obviously, there are arbitrage opportunities in the market, but they rarely last long and are almost always found by different people. For instance, when George Soros broke the British Pound.

Considering all we know about market efficiency, and even making the decision to only invest in an index fund or an ETF tracking the S&P 500 index consistently over long periods of time (e.g. 20 years), we might be reluctant to invest our money right away, after all, markets might have recently hit a new all-time high, or the economy might not be in the best possible shape so we might be tempted to wait for a better time, this approach of waiting based on market or economic outlook is known as market-timing. This paper pretends to answer the following research question:

When is not the right time to invest?

To answer this question some theoretical framework will be presented along with the methodology applied to get the results later shown in the paper, which will enable us to get some conclusions.

2. THEORETICAL FRAMEWORK.

Almost half a decade ago, the Efficient Market hypothesis was considered a central proposition in finance. By the mid-1970s there was such strong theoretical and empirical evidence supporting the Efficient Market Hypothesis that it seemed a proved theory. However, there has recently been an emergence of counterarguments refuting the hypothesis [5].

The Efficient Market Hypothesis is the underpinning of the theory that share prices could follow a random walk. Currently there is no real answer to whether stock prices follow a random walk, although there is research both for and against this thesis.

The paper will define what a Random Walk is and how it relates to the Efficient Market Hypothesis. Arguments and empirical evidence will be shown that both support and challenges this theory.

Today, in a world of uncertainty, the intrinsic value of securities cannot be accurately determined. Therefore, there is always room for divergence regarding the intrinsic value of a single security between the different market participants. This divergence also results in a mismatch between market prices and the intrinsic value of securities. However, in an efficient market, the behaviour of many competing participants causes that market price of a security to stray from its intrinsic value by accident. If the difference between market prices and intrinsic values is systematic rather than random, then recognizing this will enable some market operators to more accurately predict how market prices will be converted to intrinsic values [6]. Because many smart traders try to use this knowledge, they tend to offset this systematic behaviour of the price range. This implies that uncertainty in intrinsic value continues, but the market price of securities relative to intrinsic value fluctuates randomly.

Random walk theory shows that the changes in stock prices have the same distribution and are independent of each other. (“Random Walk Theory Definition and Example”) Therefore, it is assumed that stock prices, market trends, or past trends cannot be used to predict future trends. In short, the Random Walk Theory claims that the asset price moves in a random, unpredictable path, and in the long run, all methods of stock price prediction are neither reliable nor needed.

The following paragraphs are an excerpt of Samuel Dupernex’s paper “Why Might Share Prices Follow a Random Walk”:

A random walk is defined by the fact that price changes are independent of each other” [7]. For a more technical definition, Cuthbertson and Nitzsche define a random walk with drift ∂ as an individual stochastic series X_t that behaves as: [8]

$$X_t = \partial + X_{t-1} + \varepsilon_{t+1} \quad \varepsilon_{t+1} \sim \text{idd}(0, \sigma_\varepsilon^2) \quad (2)$$

The drift is a simple idea. It is merely a weighted average of the probabilities of each price the stock price could move to in the next period. However, even though it is useful, the model is quite restrictive as it assumes that there is no probabilistic independence between consecutive price increments. Due to this, a more flexible model called the Martingale Hypothesis was devised. This improved on the random walk model as it can “be generated within a reasonably broad class of optimizing models”, as mentioned by Leroy [9].

As explained by Elton, A martingale is a stochastic variable X_t which has the property that given the information set Ω_t , there is no way an investor can use Ω_t to profit beyond the level which is consistent with the risk inherent in the security.

The martingale is superior to the random walk because stock prices are known to go through periods of high and low turbulence. This behavior could be represented by a model “in which successive conditional variances of stock prices (but not their successive levels) are positively autocorrelated” [9]. This is possible to represent with a martingale, but not with a random walk. [10]

The Efficient Market Hypothesis is based on the idea of Random Path Theory, which is used to characterize price series. According to this theory, every subsequent price change is a random deviation from the previous price. The basis of the idea of walking around is that if it does not obstruct the flow of information and immediately reflect the information in the stock price, the change in tomorrow's price will only reflect the news of tomorrow, and it does not depend on the price change today [10]. This implies that price changes must be unpredictable and random. As a result, the price perfectly reflects all new information. Even unwitting investors who bought a diversified portfolio at the prices shown on the market achieved the same high-profit margins as professionals. Stock price fluctuations are independent of each other and have the same probability distribution [11]. Stock prices are generally considered to be random and unpredictable [12].

The Efficiency Market Hypothesis sustains that the prices of securities fully reflect all the information available about them. This is a very strong claim. A necessary condition for investors to have an incentive to negotiate until prices fully reflect all information relating to them is that the cost of acquiring the information and trading is zero. (“Warren Buffet”) As these costs are positive nonzero values, a more realistic assumption is that prices reflect the information up to the point where the marginal costs of obtaining the information do not exceed the marginal benefit [13].

Most of the tests of the efficient market hypothesis simply refer to the speed of incorporation of the information, but not to center the attention on whether the markets reflect prices correctly or not. In this paper, the general understanding of the hypothesis is that the prices reflect the fundamental values of assets as per the market rationality concept [14].

The Efficient Market Hypothesis has been divided into three different categories; each category manages different types of information. Fama (1970) in his work, “*Efficient Capital Markets*”, initially referred to the weak form, the semi-strong form, and the strong form of the efficiency of the markets [14]. The weak form tests refer to the fact that all the information contained in historical prices is fully reflected in current prices and past information does influence market prices. The semi-strong form tests refer to whether the publicly available information is reflected in the current prices of the securities. Finally, the strong form tests of the efficient market hypothesis consider whether all information, whether public or private, is fully reflected in the prices of the securities and whether any type of investor can obtain an additional profit in market negotiations [13].

In a more recent article, Fama expanded the definition of the first type of efficiency, considering it as a general category of performance predictability tests. Under this classification, Fama includes models of security returns, previously categorized as market anomalies that include the high returns obtained in January and on some days of the week, as well as the question of whether current returns can be predicted from past returns. The new classification becomes Predictability of Returns, the Study of Events, and the Strong Form [15].

To test any of the three forms of the Efficient Market Hypothesis, it is necessary to be precise in defining terms such as “*excess return*”. We must refer to the processes that determine prices as “*Fair Game*”. *Fair Game* is a very descriptive term, it explains that there is no way to use the information available at a time t to achieve above normal performance. To clarify this further, let us represent by a set of information σ_t , which investors can have in time t . Based on this information, an investor can estimate the scope of a security's return between t and $t + 1$. The investor can then compare the estimated return with the equilibrium return [16].

It is possible to rely on models such as CAPM, APT, or others, to estimate equilibrium performance. Deviations from the investor's estimated return on the equilibrium return should not contain any information about future returns. The fact that the investor's return estimate is above or below equilibrium should not require that the current return follows the same behavior. There is no way that the investor can use the information in the set σ_t to obtain a profit that is consistent with the risk inherent in the security. The fair game model should not be complicated if the set of information available to an investor is not incorporated in the price. For the fair game model to hold there cannot be a way that the information set σ_t can be used to obtain exceptional equilibrium returns [16].

The implication is that past information does not contain anything about the magnitude of today's performance deviation from expected performance. At this point, it is needed to introduce the Random Walk Model. As mentioned before, the random walk model assumes that successive returns are independent and that returns are identically distributed over time. As stated by Ying Huang “The random walk model is a restricted version of the fair game

model". The fair game model does not require distributions with identical performance in different periods [13]. Furthermore, the fair game model does not imply that returns are independent in time. If the Random Walk Hypothesis holds, the Efficient Market Hypothesis concerning past returns must hold. This however is not necessarily true the other way around. Thus, the evidence that supports the random walk model is evidence that supports the efficiency concerning past returns [6].

As mentioned, the Efficient Market Hypothesis is separated in three different forms of efficiency. The weak form suggests that there is no relationship between past and future prices of securities. They are supposed to be independent in time. Since the Efficient Market Hypothesis maintains that current prices reflect all available information and information moves randomly, it is assumed that there is little or nothing to gain from studying past prices of the security. The weak form of the Efficient Market Hypothesis has been tested in two different ways, by tests of independence and tests of trading rules. Independence tests have examined the degree of correlation between security prices over time and have found this correlation to be relatively small (-0.10 to 0.10) and not statistically significant. This indicates that the price changes of the financial assets tend to be independent. A further test is based on the frequency and extent of the persistence (runs) in the stock price data. Runs (persistent or not) can be expected in any data series using random factors, but a separate data series should not produce more persistence in sign than is expected in the random number generation process [17]. This also tends to indicate that the movements of the share price are independent in time, with possible exceptions in small capitalization securities [18].

While maintaining that tests of independence, correlation studies and runs are too rigid to test hypotheses of the weak form of the Efficient Market Hypothesis, explaining why academic researchers have developed additional tests. These are known as filter tests negotiation rules. These tests determine whether a given trading rule based on past price data, figures, and data volume among other things can be used to overcome a "buy and hold" approach. The general idea is to simulate the conditions under which trading rules are used, and then determine whether superior returns occurred after considering transaction costs and the risks involved [18].

For performance predictability tests, σ_t is defined as the historical prices of securities, characteristics of the company, characteristics of the market, and time of year. For semi-strong tests, it is defined as the announcement of one or a few clarifications of the information. For strong form tests, it is defined as all information that is available to some group of investors, publicly available or not. It should be noted that there is no implication that the expected return is zero. It would be expected not only to be nonzero but also positive. Besides, it is visualized that the yield will be related to risk and that the rest of the securities with risk offer higher returns. It is often argued that if the efficient market hypothesis holds, then the best estimator of tomorrow's prices is today's price or an expected return of zero. This is not a correct implication of the efficient market model [16].

The results of the independence tests and negotiation rules appear to adhere to the weak form of the Efficient Market Hypothesis. The prices of the securities seem to be independent in time, more specifically, they move under the model of a "random walk". Some criticize the study on the basis that academic research in this area does not capture the personal criteria that an experienced technician brings to the reading of charts. There is also the fact that there is an infinite number of negotiation rules, not all which can or have been tested. However, research on the weak form of the Efficient Market Hypothesis still seems to suggest that prices move independently over time, that past trends cannot be used to easily predict the future, and that technical analysis and "Chartism" may have limited value [19]. The semi-strong form maintains that all public information is already incorporated in the value of a security, therefore, fundamental analysis cannot be used to determine whether a security is under or overvalued [18].

The semi-strong form supports the reasoning that there is no delay in the distribution of public information. When a company announces something, investors across the country value the information just as quickly as it comes out. According to the semi-strong form of the EMH, investors not only assimilate information very quickly, but they can see through mere changes in accounting information and the economic consequences of public information. The implications for fundamental analysis are important, if stock values are already based on all publicly available information, it can be assumed that little will be gained from further fundamental analysis. While some suggest that fundamental analysis may not lead to superior benefits in an efficient market environment, it is fundamental analysis itself that achieves market efficiency [1].

While fundamental analysis relates to financial analysis and valuation determinants, the technical analysis relies on the study of past price and data volume as well as associated market trends to predict future movements of the market price. Technical analysis is largely based on "Chartism" and the use of key market indicators to make forecasts [19].

Although there have been many traditional arguments about whether a fundamental or technical analysis is more important, much attention has been paid to Efficient Market Hypothesis and its implications for all types of analysis. The Efficient Market Hypothesis maintains that the market adjusts very quickly to the supply of new information. Because of this, securities tend to be valued correctly at any given time. Research tends to support the weak form

efficiency, which causes many researchers to seriously question the full value of technical analysis. The semi-strong form is reasonably accepted by research and this fact tends to question the value of fundamental analysis by the individual investor, it is however, the collective wisdom of all fundamental analysis that leads the Efficient Market Hypothesis into first place. There are some contradictions for the semi-strong form and a lot of research is needed in offering supplementary data [20].

Fundamentally, little is left for unabsorbed or undigested information. Thus, an additional person doing fundamental analysis is unlikely to achieve superior introspection. Although the semi-strong form has research support, there are anomalies or deviations from the basic proportion that the market is efficient. Thus, even though it is possible that while most analysts cannot add further insights through fundamental analysis, there are exceptions to every rule. It can be assumed that some analysts have extraordinary insight and the ability to analyze publicly available information that they can perceive what others cannot. It should be noted that this is not a debate about whether the market is efficient in a semi-strong sense, but about whether researchers are properly testing efficiency [12].

The strong form of the Efficient Market Hypothesis looks beyond the semi-strong form to state that prices reflect not only all public information but all information. Thus, we start from the hypothesis that inside information is immediately embedded in the value of a security. In a sense, this goes beyond the concept of a market that is highly efficient to arrive at a perfect market. The hypothesis is that no group of market participants or investors has monopoly access to information. If this is the case, then no group of investors can be expected to show superior risk-adjusted returns in any case. Contrary to the weak-semi-strong forms of Efficient Market Hypothesis, the results of larger tests do not support the strong form of the hypothesis, suggesting the imperfection of all markets [20].

A group that seems to use non-public information to offer superior returns is corporate insiders. An insider is considered to be a corporate officer, member of a board of directors, or a substantial shareholder. The regulators require “insiders” to report their transactions to the regulatory body. A few weeks after reporting to the regulator, the information becomes public. Certain researchers can determine whether investment decisions made by investors appeared on the balance sheet. It is questioned whether strong buying by insiders preceded strong price movements and whether selling preceded downward price movements [15]. It seems that the answer is yes.

Research studies indicate that insiders consistently make higher profits than would be logical in a perfect capital market. Even though insiders cannot engage in short-term negotiations or illegal transactions that generate trading profits, they are allowed to take longer-term positions, which may prove beneficial. It has even been shown that investors, who follow the direction of insider traders after the information about their activity has been made public, can enjoy superior benefits. This is evidence contrary to the semi-strong form of Efficient Market Hypothesis [21].

Even when there is evidence about the activity of specialists and insiders that would allow rejecting the strong form efficiency, or at least not accepting it, the field of participants with access to superior information is not wide. While the strong form of efficiency suggests more opportunity for superior returns than the weak and semi-strong forms, the premium is related to monopoly access to information, rather than other factors. We note that those who act illegally can achieve superior returns, but the price of their action can be very high [9] [22].

The Efficient Market Hypothesis has contributed with its studies to improve the knowledge of the securities market, even though there seems to be a current dissatisfaction with the theory given the lack and inconsistency of the empirical studies. Some researchers have shown through theoretical studies and empirical tests that financial assets can deviate from their equilibrium values, due to psychological factors, fashions, and bargaining noise. The knowledge of the securities market must go forward through qualitative and quantitative multidisciplinary studies to converge in empirical conclusions [23]. It is necessary to achieve refinement of the knowledge of the EMH, representing the speculative and psychological aspects of the stock market through the incorporation of new paradigms [24].

To test market efficiency an answer to the following question is needed: If the capital market is relatively efficient, can random selection of an appropriately sized portfolio provide a good benchmark? Recall that the theory behind Sharpe’s CAPM shows that the most effective portfolio is the entire market portfolio, and the portfolio weight of each asset is based on relative market value [24]. Since investors can passively invest in funds with large indexes (weighted by cost) while minimizing transaction costs, such index funds will be very useful when comparing the effectiveness of two risk returns. Of course, a reasonably sized, randomly selected portfolio (possibly constructed by throwing darts) can be used to check the reliable comparison of investment performance with actively managed portfolios. Therefore, if a diversified darts portfolio is used as a proxy for measuring investment performance Index, the risk-return must match the risk-return of a typical index fund [1].

A stock index is a tool used to measure the value of a particular part of a particular stock market. Calculated at the price of selected stock, used by investors and financial managers to describe the market and compare specific investment returns [25]. There are many types of indexes. That is, it does not consider global reserves that measure the efficiency of specific country actions, such as the S&P Global 500 Index or national reserves. Another type of index includes sector

indices consisting of stocks in certain market sectors. Indexes can also be classified according to the method used to determine prices. In a price-weighted index, the price of each component of a security is the only factor that determines the value of the index [26]. In contrast, the market-cap-weighted index considers the size of the company.

First, the index provides a historical perspective on the operation of the stock market and enables investors to better understand investment decisions. Investors who are unfamiliar with the securities they invest in can use the index as a method of choosing to invest in securities. To match market performance, investors can invest in index-related funds or index-traded funds that track index-related indices. This form of the transaction provides investors with the same opportunities as the market without any significant delays. The second advantage of the stock market index is that it provides a basis for investors to compare the performance of individual stock portfolios. Individual investors with professionally managed portfolios can use the index to determine how managers manage their funds. The main conclusions of modern portfolio theory often justify the use of capitalized weighted indices. For investors, the best investment strategy is to maintain a market portfolio that is weighted by the capitalization of a portfolio of all assets [1]. However, the capitalized weighted index has been criticized, pointing out that the capitalized weighting mechanism tends to follow a strategy, resulting in a poor compromise between risk and return. The constant oscillations of the indexes in the short run and the clear upward tendency, in the long run make investors question their trading strategies and time horizons for them, introducing the concept of market timing into their strategies.

According to Metcalfe in the article “The Mathematics of Market Timing”, market timing can be defined as an investment technique based on the anticipation of price movements of financial instruments so assets with higher expected returns might be included in an investment portfolio and those with low anticipated returns can be expiated from it.

To anticipate price movements, market timing suggests that managers use economic and other data to identify possible position changes in their portfolios, this is, anticipate when to buy or sell prior to the actual movement of prices. [27]

Metcalfe shows this approach has been gaining momentum amongst fund managers, he shows how Morningstar lists hundreds of investment funds using this technique as a primary criteria for stock selection in portfolios, the author then continues showing how Market Timing is used as a defensive strategy for mainstream funds when the markets are prices are dropping. [27]

Perhaps one of the most relevant propositions of the mentioned paper is the analysis it runs on what it describes as the antithesis of Market Timing, this is the Buy-and-Hold approach. This approach suggests that fund managers allocate their portfolios based on fundamental financial features of the assets and hold their positions regardless of what is considered temporal market price gyrations. This strategy contrast and comparison later results in Metcalfe asking the following question which is a fundamental basis for this paper:

“Is market timing likely to be successful relative to investing in a static allocation to the available asset classes?” [27]

This question by no means has an easy or straight answer. The literature in this area is focused on developing sophisticated statistical tools that can detect and measure the market timing ability of professional fund managers; these methods include the analysis of Jensen’s Alpha, Treynor and Sharpe Ratios, among others showing different results some supporting market timing with empirical evidence that is statistically significant, and others showing exactly the opposite.

For instance, Dalbar measures the market timing results of the average individual investor through mutual fund sales, redemptions, and exchanges. These studies find unambiguously that market timing by the average investor is unsuccessful relative to static allocation. [27]

The ambiguous results on the efficiency of these trading strategies suggest that it might be possible to run a market timing strategy successfully; however, the operation and logistics of such strategy are hard to accomplish, while it is very easy to lose money while trying to accomplish Market Timing [27]

Another valuable contribution in terms of methodology to the present paper is the study conducted by Ravi Lokani, Theeralak Satjawathee and Kandiah Jegasothy. In their paper they test Selectivity and Market Timing Performance in the Thai Equity Fund Industry. Lokani *et al.* examine 13 years of history of equity fund managers in Thailand. The authors identify proper time frames that ensure the evaluation of the selectivity and market timing at least a full business cycle to see whether the equity fund managers are superior stock selectors or market timers. [28]

The paper represents empirical evidence that help to answer the following question for the Thai market: “Did equity fund managers behave as superior or inferior stock selectors during the period of 1992 - 2004?” Their findings are a guide to study manager abilities as well as the viability of market timing in other markets and the methodology can be extrapolated. [28]

The methodology used in the paper by Lokani *et al.* [28] include two important aspects to their study. The Estimable selectivity and market timing performance measures used in the mentioned paper are drawn from the selectivity and market timing empirical work conducted by Dellva, Demaskey and Smith [29]. The three popular selectivity and market timing models used in Dellva et.al study, which are Jensen Alpha, Treynor and Mazuy, and Henriksson and Merton are used in this investigation to obtain relevant parameters.

The second aspect related to examine market timing performance used two models. The first model is the quadratic regression equation, first developed by Treynor and Marzuy, this method includes a quadratic term to the Jensen model to measure the effects of a fund manager decisions. The idea behind this is that fund managers lower the fund beta when they anticipate a market decline and increase the beta when they expect the market to rise, and the second market timing model is dummy variable regression by Henriksson and Merton. Both models are then evaluated for statistical significance by hypothesis testing [28].

Taking into account that the objective of the paper by Lokani et all is slightly different to the present paper, since it tries to measure fund managers abilities to beat the market, while this paper contrasts different investment strategies over time to yield whether or not trying to time the market is an efficient activity, we follow and extend Lokani's methodology to check for stability of results over time. Lokani *et al.* [28] break down the time of their study into nine overlapping sub periods of time to add robustness to the study and detect possible anomalies during the subperiods in the study. The results of overlapping sub-periods are reported to determine whether any particular sub-period stands out over the entire sample period. Similar stability checking procedure also was adopted by Dellva et al. [29].

This paper will attempt to test market timing efficiency and make a comparison of different scenarios to establish and measure the relevance of timing the market and establish investment policies following the methodology used in the cited literature above.

3. METHODOLOGY

To quantify the benefit of market-timing and the cost of waiting for a better investment time, five different scenarios were defined, each with a different long-term investment strategy. In each scenario the investor receives x dollars at the beginning the year 2000 and continues to do so for every year until the start of the year 2019, resulting in a total investment of $20x$ dollars. The investments will be made in the S&P500 index as it is possible to do so through various index funds and ETFs¹ that follows the S&P 500.

Historical price of the S&P 500 index was obtained from COMPUSTAT, historical prices obtained include the Open, High, Low, Close and Adj. Close prices. To be able to run the experiment the following binary fields were created for all observations:

- a. First day of the month
- b. First day of the year
- c. Last day of the year
- d. Lowest 'Low Price' of the Year
- e. Highest 'High Price' of the Year

As additional considerations, no transaction cost was included as most brokers are continuing to drop commissions to zero, dividends were not taken into account and capital gains tax are not taken into account as the position is never closed, it also does not take into account currency exchange rates risk factors for investors in all parts of the world as it goes beyond the scope of the experiment.

Below, each of the five hypothetical scenarios will be explained:

Scenario 1 (S1): In this scenario, we assume the investor is extremely skillful or lucky and manages to invest the available x dollars in the index fund every year at its lowest price.

Scenario 2 (S2): In this scenario, the investor takes a simpler approach, x is invested in the index fund every year the first available day of the year regardless of market or economic outlook.

Scenario 3 (S3): In this scenario, the investor takes its available funds and divides them into 12 equal portions. $\frac{x}{12}$ are invested in the index fund every month the first available day of the month regardless of market or economic outlook, this method is known as Dollar Cost Averaging.

¹ Exchange Traded Funds.

Scenario 4 (S4): In this scenario, we assume the investor is the unluckiest investor of all and manages to invest x every year at the worst possible moment, at highest price of the year.

Scenario 5 (S5): In this scenario, the investor never puts the money in the S&P 500 index fund, always waiting for a better time, instead, at the beginning of every year buys and reinvest in 1-year treasury bills.

Money-Weighted Returns (MWR) were calculated over the last 20 years for every for every scenario, later the experiment was replicated to different 20-year windows starting with 1973-01-01 to 1992-12-31. Following the investigation lines and methodology taken in the papers from Lokani et all [28] and Dellva et all [29], five scenarios will be ran and analyzed for 28 sub periods of 20 years, this allows to check for stability of the results as well as robustness, this is, to detect possible differences within the studied period in comparison to the general results.

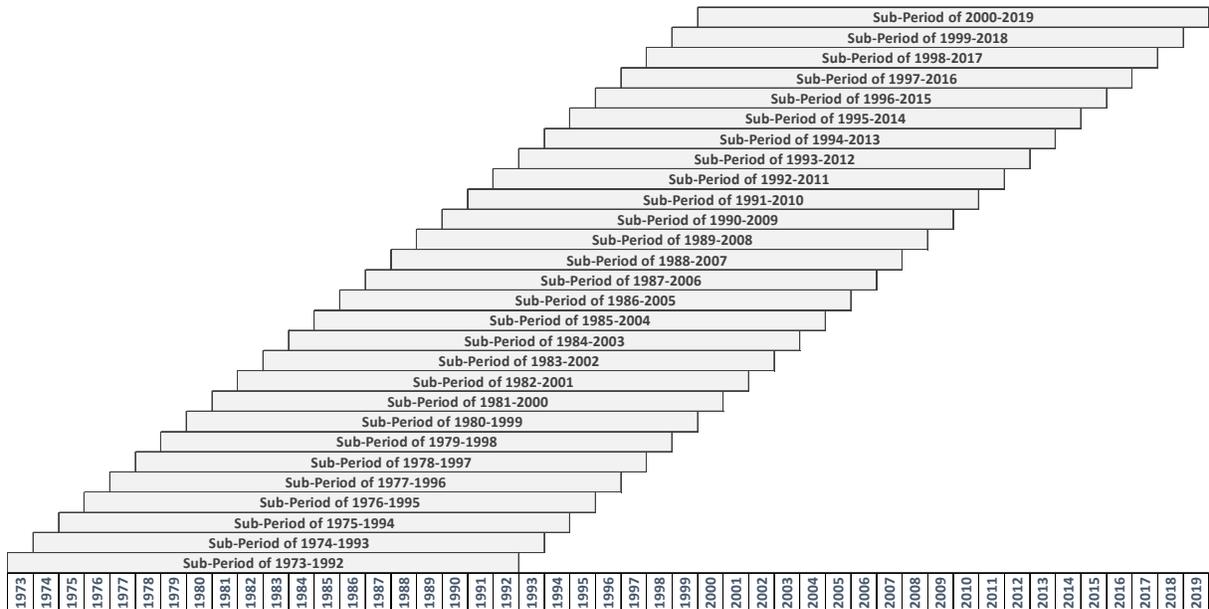


Figure 5: 20-year overlapping of 28 sup-periods.

With the information gathered all that was left was to determine the cost of waiting for a better investment and the potential benefit of market timing. The cost of waiting for a better investment time was defined as the difference in MWR between scenario 2 (investing immediately) and scenario 5 (investing in treasury bills, waiting for a better investment time) and the benefit of market-timing is defined as the difference in MWR between scenario 1 (perfect market-timing) and scenario 2 (investing immediately). Below are the results.

4. DATA AND RESULTS

In Figure 5, it is noted that the impossible first scenario yields the best results as expected, resulting in a total MWR of 174% at the end of the 20 years. The second scenario came in second place with a MWR of 132%, 42 points less than the first scenario, which is not that big of a difference considering that in scenario 2 the investor puts its money to work as soon as received. Scenario 3 results in third place with a MWR of 130%, very near to scenario 2.

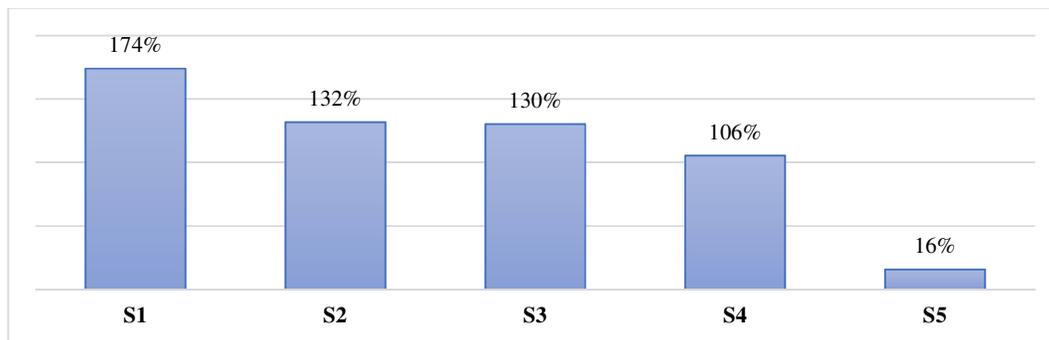


Figure 6: Portfolio Money-Weighted Return (Investment from 2000-01-01 to 2019-12-31).

Scenario 4 ends with a MWR of 106% which is 90 points higher than what is obtained in scenario 5, were the investor never puts money on the market.

In Table 1 we can observe the rank each scenario got in the 28 20-year sub periods that were back tested.

TABLE 1 - SCENARIO RANKING BY PERIODS

Start	End	S1	S2	S3	S4	S5
1973	1992	1	2	3	4	5
1974	1993	1	2	3	4	5
1975	1994	1	2	3	4	5
1976	1995	1	2	3	4	5
1977	1996	1	2	3	4	5
1978	1997	1	2	3	4	5
1979	1998	1	2	3	4	5
1980	1999	1	2	3	4	5
1981	2000	1	2	3	4	5
1982	2001	1	2	3	4	5
1983	2002	1	2	3	4	5
1984	2003	1	2	3	4	5
1985	2004	1	2	3	4	5
1986	2005	1	2	3	4	5
1987	2006	1	2	3	4	5
1988	2007	1	2	3	4	5
1989	2008	2	3	4	5	1
1990	2009	1	2	3	5	4
1991	2010	1	2	3	5	4
1992	2011	1	2	3	5	4
1993	2012	1	2	3	4	5
1994	2013	1	2	3	4	5
1995	2014	1	2	3	4	5
1996	2015	1	2	3	4	5
1997	2016	1	2	3	4	5
1998	2017	1	2	3	4	5
1999	2018	1	2	3	4	5
2000	2019	1	2	3	4	5

26 out of the 28 analyzed periods show the same results regarding Money-Weighted Returns:

$$S1 > S2 > S3 > S4 > S5$$

Even in the 4 periods that do not show the expected result, investing immediately never ends in last place, additionally it is worth mentioning that those 4 periods match with the 2008-2009 subprime crisis, and if adding one additional year to the experiment the ranks become as stated above.

Additionally, the experiment was replicated for Dow Jones Industrial Average and NASDAQ Composite Index showing similar results showing the persistence of the results obtained.

▪ Benefit of Market-Timing vs Cost of Waiting

In Figure 6, data shows that the cost of waiting heavily surpasses the potential benefit of market-timing and given that the possibility to perfectly time the market consistently is practically impossible, the best alternative would be to invest available money immediately regardless of market or economic outlook.

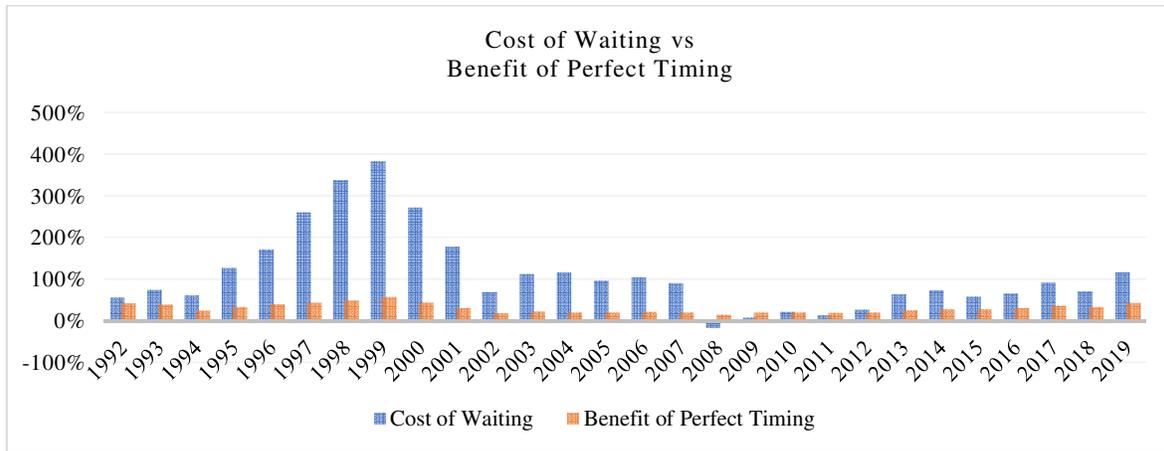


Figure 7: Cost of Waiting vs Benefit of Market-Timing.

Over the 28 periods analyzed the cost of waiting presents averages a MWR of 110% and the potential benefit for perfect market-timing averages a MWR of 30%. Table 2 shows some descriptive statistics of both series.

TABLE 2 - DESCRIPTIVE STATISTICS OF COST OF WAITING AND BENEFIT OF PERFECT TIMING

	Min	1 st Q	Median	Mean	3 rd Q	Max
Cost of Waiting	-18.28%	60.11%	81.90%	110.33%	118.50%	383.60%
Benefit of Perfect Timing	14.11%	19.96%	26.97%	29.64%	39.04%	57.48%

A one-sample Kolmogorov-Smirnov test was made for both Cost of Waiting and Benefit of Perfect Timing, resulting in P-Values of 0.09558 and 0.5842 respectively, indicating that both do not follow a normal distribution with 99% confidence.

Given that both Cost of Waiting and Benefit of Perfect Timing do not follow a normal distribution a Mann-Whitney U Test was made to compare the differences between the two samples, obtaining a P-Value of 2.282×10^{-6} indicating that both samples do not have the same distribution and that there is statistical evidence that they are different.

5. CONCLUSIONS

After reviewing the theoretical framework as well as evaluating the results obtained, this paper concurs with the Efficient Market Hypothesis. It turns out that trying to predict winners or losers is impractical over long periods of time. There is no consistently winning strategy that will work over the long haul, at the end it is much more like gambling, except that the odds are in favor of the investors. Given a big enough number of assets in a portfolio, investors are set to win some and to lose some, but there is no way of predicting which is which. Given a long enough period, chances are that the winners will be greater than the losers, the only thing one should not do is to pay someone to come up with models or strategies for something that apparently comes to chance, just go and get some dart throwing monkeys.

A beginner retail investor would be better of just investing in an index fund, but it is important to note that it is not a riskless investment as some people may think, What an index fund does is guarantee the investor performance in-line with the index, it eliminates the likelihood to fail to keep up with the index, and it also of course eliminates the possibility to outperform the index, so it trades away the two sides of the probability distribution for certainty that the investor gets index results, but it does not eliminates the risk of the investment, it only eliminates the risk of deviating from the index. What must be kept in mind is that the index fund investor loses money every time the index goes down.

Additionally, if presented with the possibility of making annual investments consistently, given that it is practically impossible to identify market tops or bottoms accurately and consistently, the best strategy would be to invest the available money as soon as possible, regardless of market or economic outlook.

Even in the scenario where investments were made at the worst possible moment each year the ending results were highly greater than the scenario where the investor is perpetually waiting for a better time. In other words, when in doubt, invest.

6. REFERENCES

- [1] B. G. Malkiel, *A Random Walk Down Wall Street*, W. W. Norton & Company, 2019.
- [2] L. Carlozo, "Why Investors Love the S&P 500," *U.S. News & World Report*, 2018.
- [3] S&P Dow Jones Indices LLC, "SPIVA U.S. Scorecard," 2018.
- [4] S&P Dow Jones Indices LLC, "Persistence Score Card," 2014.
- [5] A. Ang and W. N. Goetzmann, "The Efficient Market Theory and Evidence: Implications for Active Investment Management," *Foundations and Trends in Finance*, vol. 5, no. 3, pp. 147-242, 2010.
- [6] T. T. Chitenderu, A. Maredza and K. Sibanda, "The Random Walk Theory And Stock Prices: Evidence From Johannesburg Stock Exchange," *International Business & Economics Research Journal*, vol. 13, no. 6, pp. 1241-1249, 2014.
- [7] R. A. Brealey, F. Allen and S. Myers, *Principles of Corporate Finance*, New York: McGraw-Hill, 2016.
- [8] K. Cuthbertson and D. Nitzsche, *Financial Engineering: Derivatives and Risk Management*, Wiley, 2001.
- [9] S. F. LeRoy, "Efficient Capital Markets and Martingales," *Journal of Economic Literature*, vol. 27, no. 4, pp. 1583-1621, 1989.
- [10] S. Dupernex, "Why Might Share Prices Follow a Random Walk?," *Student Economic Review*, vol. 21, pp. 167-179, 2007.
- [11] N.-M. Jula and . N. Jula, "Random Walk Hypothesis in Financial Markets," *Challenges of the Knowledge Society*, vol. 7, p. 878 – 884, 2017.
- [12] A. Degutis and L. Novickytė, "The Efficient Market Hypothesis: A Critical Review of Literature and Methodology," *Ekonomika*, vol. 93, no. 2, pp. 7-23, 2014.
- [13] E. F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance*, vol. 25, no. 2, pp. 383-417, 2010.
- [14] E. F. Fama, L. Fisher, M. C. Jensen and R. Roll, "The Adjustment Of Stock Prices To New Information," *The International Economic Review*, vol. 10, no. 1, pp. 1-21, 1969.
- [15] E. F. Fama, "Market Efficiency, Long-Term Returns, and Behavioural Finance," *Journal of Financial Economics*, vol. 49, no. 3, pp. 283-306, 1998.
- [16] J. Martínez Barbeito, "La Hipótesis de los Mercados Eficientes, El Modelo del Juego Justo y el Recorrido Aleatorio," *Rect@*, vol. Actas 14, 2006.
- [17] M. Sewell, "The Efficient Market Hypothesis: Empirical Evidence," *International Journal of Statistics and Probability*, vol. 1, no. 2, 2012.
- [18] R. J. Sweeney, "Some New Filter Rule Tests: Methods and Results," *The Journal of Financial and Quantitative Analysis*, vol. 23, no. 3, pp. 285-300, 1988.
- [19] W. A. Brock, J. Lakonishok and B. Lebaron, "Simple Technical Trading Rules and the Stochastic Properties of Stock Returns," *Journal of Finance*, vol. 47, no. 5, pp. 1731-1764, 1992.
- [20] L. P. Rafael, J. Lakonishok, A. Shleifer and R. Vishny, "Good News for Value Stocks: Further Evidence on Market Efficiency," *The Journal of Finance*, vol. 52, no. 2, pp. 859-874, 1997.
- [21] A. G. Titan, "The Efficient Market Hypothesis: Review of Specialized Literature and Empirical Research," *Procedia Economics and Finance*, vol. 32, p. 442 – 449, 2015.
- [22] T. Delcey, "Samuelson vs Fama on the Efficient Market Hypothesis: The Point of View of Expertise," *Æconomia*, vol. 9, no. 1, pp. 37-58, 2019.
- [23] J. B. Duarte-Duarte, J. M. Mascareñas Pérez-Iñigo and K. J. Sierra-Suárez, "Testing The Efficiency Market Hypothesis for the Colombian Stock Market," *DYNA*, vol. 81, no. 185, pp. 100-106, 2014.
- [24] H. R. Oppenheimer and G. G. Schlarbaum, "Investing with Ben Graham: An Ex Ante Test of the Efficient Market Hypothesis.," *The Journal of Financial and Quantitative Analysis*, vol. 16, no. 3, pp. 341-360, 1981.
- [25] S. Agwuegbo, A. Adewole and A. Maduegbuna, "A Random Walk Model for Stock Market Prices," *Journal of Mathematics and Statistics*, vol. 6, no. 3, pp. 342-346, 2010.
- [26] L. Zatlavi and D. Y. Kenett, "The Design and Performance of The Adaptive Stock Market Index," *Algorithmic Finance*, vol. 3, p. 189–207, 2014.
- [27] G. Metcalfe, "The Mathematics of Market Timing," *PLoS One*, vol. 13, no. 7, 2018.
- [28] R. Lokani, T. Satjawathee and K. Jegasothy, "Selectivity and Market Timing Performance in a Developing Country's Fund Industry: Thai Equity Funds Case," *Journal of Applied Finance and Banking*, vol. 3, pp. 89-108, 2013.
- [29] W. L. Dellva, . A. L. DeMaskey and C. A. Smith, "Selectivity and Market Timing Performance of Fidelity Sector

- Mutual Funds," *The Financial Review*, vol. 36, no. 1, pp. 39-54, 2001.
- [30] Dalbar Inc., "Dalbar's 22nd Annual Quantitative Analysis of Investor Behavior," 2016.
- [31] W. F. Sharpe, "The Arithmetic of Active Management," *The Financial Analysts' Journal*, vol. 47, no. 1, pp. 7-9, 1991.
- [32] P. A. Samuelson, "Proof That Properly Anticipated Prices Fluctuate Randomly," *Industrial Management Review*, vol. 6, no. 2, p. 41-49, 1965.
- [33] R. D. Henriksson, "Market Timing and Mutual Fund Performance: An Empirical Investigation.," *The Journal of Business*, vol. 57, no. 1, pp. 73-96, 1984.
- [34] E. J. Elton, M. J. Gruber, S. J. Brown and W. N. Goetzmann, *Modern Portfolio Theory and Investment Analysis*, New York: Wiley, 2002.