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Index Fund Investment Model: A System Dynamics Approach

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Abstract

Index Funds and Exchange Traded Funds (ETFs) have experienced tremendous growth in the US and Indonesia in the past decades. While index funds have grown in popularity, they do not all operate equally, nor do they perfectly mimic the market index. Various factors affect the performance and survival of these funds, but they are often overlooked or studied separately. This study fulfilled the gap by modeling the structure that drives fund performance and flow behavior. The proposed model incorporated several feedback mechanisms and considered variables that have previously been studied in isolation to better understand how an index fund operates. It was found that fund management and investor decision-making processes are endogenous parts of a system that influences fund performance and flows. The proposed model offered a more holistic view of index fund structure which could help fund managers identify leverage points to improve fund performance.

Keywords: *Complex Structure, Fund Performance, Fund Flow, Index Fund, Leverage Points.*

Introduction

Index fund is a means of investment designed to track market index performance. This means that the fund manager purchases all the securities in the underlying index, with the expectation that the fund performance will mimic the value of the underlying index. The idea behind index fund is that it provides investors with a low-cost, diversified investment option that can give returns similar to the overall market. Index mutual funds were first offered in the US in the 1970s, followed by ETFs in the 1990s. In Indonesia, the first index fund and ETFs were offered in the late 2000s.

In the US, the popularity of index funds has grown rapidly, with total net assets in index mutual funds and ETFs reaching $10.9 trillion by the end of 2022. This represented a significant increase from the 19% of assets held in these funds at the year-end of 2010 (Investment Company Institute, 2023). Surprisingly, the outflow of the actively managed funds from 2006 to 2018 had shrunk almost by the same inflows to the passively managed funds (Fichtner & Heemskerk, 2020). This trend had also been observed in Indonesia, where the cumulative assets held by index funds and ETFs increased by 569% between 2015 and 2022, reaching IDR 26,8 trillion at the end of the period. However, despite this growth, index funds and ETFs represented only 4.26% of the total Mutual Funds assets in Indonesia (Financial Service Authority (OJK), 2022).

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One concerning trend in Indonesia is the fact that over the last nine years, nearly one-third of index funds have become unavailable for investment (see Figure 1). This means that investors who might have been interested in these funds were unable to invest their saving. While some funds have been active for over a decade, the majority have only been around for four years or less. This raises questions about the survivability of index funds in Indonesia. While there is extensive literature on the survivability issues of actively managed funds, there is a lack of research on index funds. Furthermore, further investigation is needed to understand why so many index funds are becoming unavailable for investment and what can be done to address this issue.

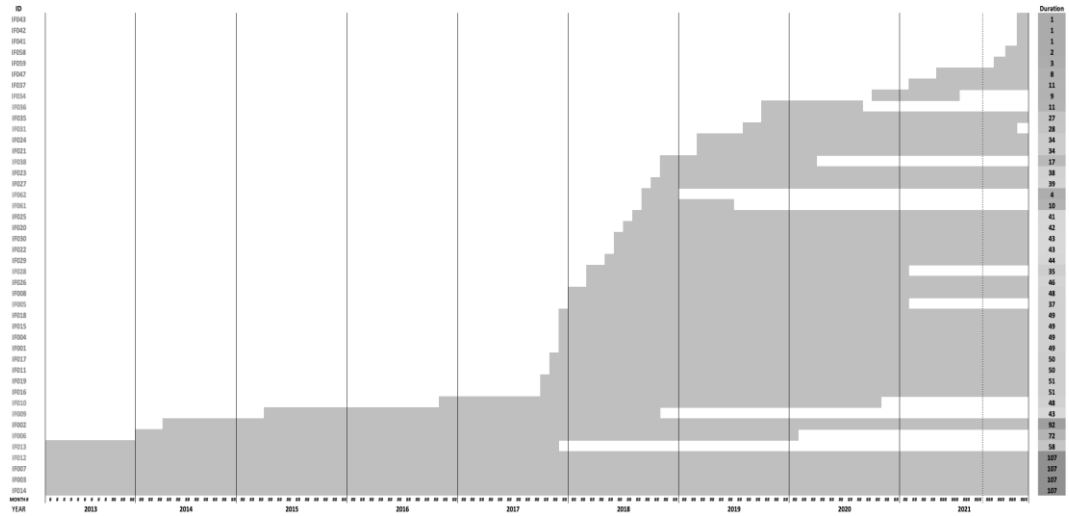

Figure 1: Index Funds for the Period Jan 2013 – Dec 2021.

The success and survivability of index funds are influenced by various factors. While existing literature offers various explanations on factors driving the fund performance and flows, the literature often views them in isolation. Based on a system perspective, differences between behavior in index fund performance and survivability are related to various variables and interdependent relationship between them which form a complex structure. Furthermore, index mutual fund has a dynamic structure since performance, fund flows, and decisions of fund manager and investor are dynamic (change over time). Hence, it is essential to understand why some index funds attract more investment and grow their assets over time for stakeholders who want to make decision-making on their investments.

The performance of index funds varies even if they follow the same underlying index. Figure 2 indicates a sample of two index funds mimicking the LQ45 index as one of major indexes in Indonesia stock exchange consisting of 45 stocks which accounted for 60% market cap of Indonesia stock exchange. Kresna index 45 shows a performance above LQ45 index, while Batavia LQ45 Plus offers a performance below LQ45 index. The performance graph is system behavior over time (BOT). As the structure of a system is responsible for producing the behavior, Kresna Index 45 and Batavia LQ45 Plus must have different structures even though they follow the same Index. Each fund is expected to have a unique structure. The structural differences could be variables, causal relationships between variables, parameters, or all of these factors.

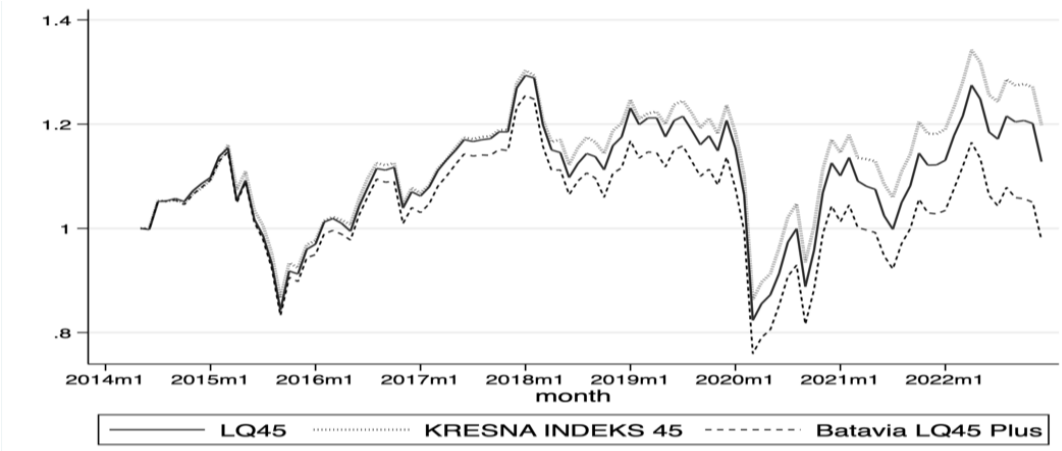

Figure 2: Sample of Index Fund Performance against the Underlying Index.

Based on the results of reading, there is a lack of research on developing models for mutual funds from a system perspective, particularly for index funds. Furthermore, the application of such models must be reexamined in the context of dynamic market conditions. Therefore, this study addressed this gap by modeling the structure that drives fund performance by incorporating variables that have previously been studied in isolation. By doing so, this study aimed to provide a better understanding of how mutual funds operate and identify leverage points for improving their performance. Additionally, its was incorporated fund flows as an inherent feedback mechanism to account for investor decisions related to fund performance. This approach allowed us to capture the complex interplay more accurately between various factors that influence fund performance and flow.

The structure of this paper will begin with a thorough literature review of the development and current research on index funds. Following the literature review, the methodology that uses system thinking and system dynamics to analyze the complex and interrelated variables that influence index fund performance and flow will be presented. Then, it is followed by visual representations, explanations, and discussions for the proposed models, including the index fund investment and flow models. Finally, it will be concluded with the findings and practical applications of the models, highlighting the potential benefits of a more holistic, systems-based approach to index fund analysis. Additionally, it offers recommendations for further research to enhance the model.

Literature Review

Diversification is a widely used strategy in modern portfolio management to eliminate company-specific risks in equities while maintaining expected returns by dealing only with systematic risks (Booth, 2022). Based on Modern Portfolio Theory (MPT), Markowitz identified that investors could achieve optimal results by choosing an asset mix that matches their risk tolerance (Markowitz, 1952).

Despite differing opinions on market efficiency, the Efficient Market Hypothesis (EMH) is widely accepted, wherein stock prices incorporate all available market information. Fama's empirical data supported Samuelson's mathematical proof that future market equity prices fluctuate randomly because of investor competition (Samuelson, 1965 , Fama, 1965). Individual investors form expectations rationally; markets aggregate information efficiently; and equilibrium prices fully incorporate all the available information.

The EMH considers the collective wisdom of all the investors constantly analyzing the market and reflecting their best assessments of how well stocks will do at the price they are willing to buy and sell. It is generally agreed that individual investors cannot outperform the market's collective wisdom, making it a loser's game to beat the market (Ellis, 2014), which would involve spotting something that everyone else has missed. In his famous "Arithmetic of active management" article, Sharpe proclaimed that return of an actively managed dollar, which tries to beat the market, will be less than a passively managed dollar after the cost (Sharpe, 1991). Moreover, since consistently beating the market is unlikely, the standard advice is to "join the market" by investing in the long-term, low-risk index funds, which comprise a collection of market stocks. By sticking with index funds for a long period, a patient investor can expect to take advantage of the stock market's gradual increase in value over time.

Index fund conclusion is certainly not without a challenge. Many people disagree and reason that active investment can be worth positive fees in aggregate. Both active and passive investment have important economic roles (Pedersen, 2018), and the choice ultimately depends on an investor's goals and risk tolerance. Active value funds better hedge downside risk, while active growth funds better capture upside potential (Polkovnichenko et al., 2019). Although investors might be able to find fund managers who can beat the appropriate benchmark by an amount higher than the offset of the added costs, the reality is that active management is very high compared with the readily available passive alternative. It is a challenging task to identify them in advance (Ellis, 2012).

However, although the business model of passive funds is not yet well understood (Fisch et al., 2020), the growth of index funds indicates that they have become a popular and practical investment option for investors seeking low-cost, diversified, and return as the market. While there may be challenges and disagreements, they remain a viable option for those seeking to join the market and benefit from the stock market's gradual increase in value over time. In advancing our knowledge of index funds, it is essential to formalize the index fund model. By subjecting the index fund model to rigorous testing against evidence, it can be better understand how it works and how it can be improved. It can help people move from a reactive response to the phenomena into a more prescriptive approach at the structural level.

While there have been numerous studies on index funds, there is still more to uncover. One area of research is the development of risk-adjusted return models suitable for evaluating index fund performance. There are existing models like Jensen's Alpha, Sharpe Ratio, and Treynor Ratio, but these are more suited to actively managed funds than index funds. Lintner (1965), Mossin (1969), and Sharpe (1964) independently proposed the Capital Asset Pricing Model (CAPM), a single-factor model that considered only a market premium factor to explain the possible asset prices. Following these studies, Fama et al. (1992) formulated a CAPM-based three-factor model by including size and value premium as pricing factors. Carhart (1997) introduced a four-factor model, which added a momentum factor to the three-factor model. In 2015, Fama & French (2015) proposed a five-factor model by adding profitability and investment premium factors to the three-factor model. Later in 2018, they incorporated the momentum factor into their five-factor model, known as the CAPM six-factor model (Fama & French, 2018). In the following year, Sha & Gao (2019) systematically compared various capital asset pricing models to measure the performance of the Chinese mutual fund industry. They concluded that each performance evaluation model has different results in identifying the risk-adjusted return.

There are abundant studies of the empirical test utilizing the current risk-adjusted return model for different markets, products, and investment periods. To mention a few, Elton & Gruber (2020) presented passive mutual fund performance and comparison among index funds and

ETFs in the US market. Zawadzki (2020) provided a performance comparison of ETFs in developed and emerging markets for 18 iShares ETFs from 2013 to 2019. Additionally, other studies evaluated what is attributed to the return. For instance, Crane & Crotty (2018) conducted a stochastic dominant test to assess fund managers' skills by comparing passive and active mutual funds. However, the differences in the index fund performance are related to factors derived from endogenous factors and other exogenous issues which intertwined as a complex system. As Lo (2019) claimed that individual heuristics are subject to an adaptation based on the received feedback (negative or positive), it is worth to explore the investor decision from the feedback standpoint. Meadows reasoned that a decision affecting inflows to or outflows from any state of the system (in this case, index fund) is continuously influenced by a feedback loop of the system itself through perceived information discrepancy of the expected goal(s) (Meadows, 1997). Adopting the same approach as that of Meadows, this framework will explore a feedback structure that affects fund performance and flow behind the growth and survival of index funds using system thinking and system dynamics methodology.

Methodology

A system is a set of things interconnected in such a way that they produce their own pattern of behavior over time (Meadows, 2009). System thinking (ST) is a methodological approach involves moving from observing events or data, to identify patterns of behavior overtime, to surface the underlying structures that drive those events and patterns in an attempt to create a more satisfying solution to the problem(Goodman, 2022). System dynamics (SD), on the other hand, is an analytical approach that complements system thinking by using simulation modeling based on feedback system theory. The methodology has its roots in organizational and management cybernetics, which is a part of complexity science. System dynamics distinguishes itself by focusing on nonlinear and endogenous behavior by utilizing nonlinear endogenous feedback (Sterman, 2000). The combination of ST and SD offers a comprehensive perspective on complex systems and enables a better understanding of the behavior of complex systems over time.

The methodology of ST and SD has been used in studies within the fields of business and economics since Forrester's publication of "Industrial Dynamics" in 1958. However, no single study had applied ST approach to mutual funds or index funds. The most relevant theory to this study was the Adaptive Market Hypothesis (Lo, 2019), which acknowledges feedback in investor decision-making. Previous studies that might be useful in the modelling of the growth and survivability of index funds were the model of liquidity risk management in the banking system (Asadollahi et al., 2021) and the model of Fortis Bank (Pruyt, 2009), when Pruyt studied the potential dynamics of bank crises and tested policies for keeping banks from collapsing. Another study that was close in spirit to this study analysis was the one related to the firm value analyzing the interrelation of exogenous and endogenous factors affecting the company values (Azeem Qureshi, 2007; Khan et al., 2021; Khan & Qureshi, 2022).

The use of ST and SD in this study contributed to the literature on index fund investment by filling several gaps. *First*, a theoretical gap in the literature on index fund investment was addressed by presenting system theory-based different perspectives. This approach accounted for the dynamic nature of fund flows and investor decision-making by incorporating interdependent causal relationships between variables within the fund management process (including fee setting, marketing expenses, cash liquidity, and index tracking strategies) and variables related to the investor decision-making process. This can help resolve contradictory conclusions and debates over which factors are the true drivers of fund flows.

Second, a methodology gap was addressed by utilizing ST and SD-based simulation approach. Traditional statistical analysis using linear regression has been the predominant method used in the studies on index funds. However, this approach has limitations in capturing the complex and dynamic nature of fund flows and investor decision-making. Simulation is a powerful tool for exploring complex systems. By creating a computer model of the index fund system, the study can be conducted with different scenarios and observe how the system responds. This can provide valuable insights into how different factors affect index fund performance and flow.

Sampling and Data Collection

This study aimed to address the significant population gap and lack of empirical evidence from emerging markets in the study of Index Funds, such as those in Indonesia. The scarcity of literature on Indonesia's passive investment industry highlighted the need for further research in this area to gain a better understanding of the index fund investment model. Monthly data for all index funds were collected from the Financial Services Authority (OJK/Otoritas Jasa Keuangan) website for a ten-year period from January 2013 to December 2022. The long-term investment perspective was used to select monthly data, considering the minimum settlement period of one working week for buying or selling mutual funds. Along with the index fund data, market data and benchmark index were collected from the Indonesia Stock Exchange (IDX, 2022) website. Three index funds, namely BRI Index Syariah, UOBAM Index Bisnis-27, and Kresna Index 45 with their associated benchmark indexes (Jakarta Islamic Index, LQ45 and Bisnis-27), were selected for use in the model, as they were available within the observed ten-year period.

Result and Discussion

Index Fund Performance Model

The growth and decline of index fund assets were directly influenced by the inflow and outflow of the fund. When there was a net inflow, the asset grew, but it declined when there was a net outflow. As indicated in Figure 3, both endogenous and exogenous factors affect the inflow and outflow of the fund. Endogenous factors include cost policy, trading frequency, cash holding policy, technology adoption, marketing, and portfolio weighting, while exogenous factors include market conditions, comparative performance to other asset classes, equity indexing, and investor behaviors.

Figure 3: Index Fund Asset Inflow and Outflow.

In the investment model, as illustrated in Figure 4, the asset is the center of attention. A causal loop links the asset and acquisition, with the asset increasing with acquisition and decreasing with redemption. Since there can be no redemption without available assets, there is a feedback loop between the asset and redemption, creating a balancing loop (noted as B). If redemption continues, the asset will eventually lead to zero. It is the case where investors choose to liquidate all their investments.

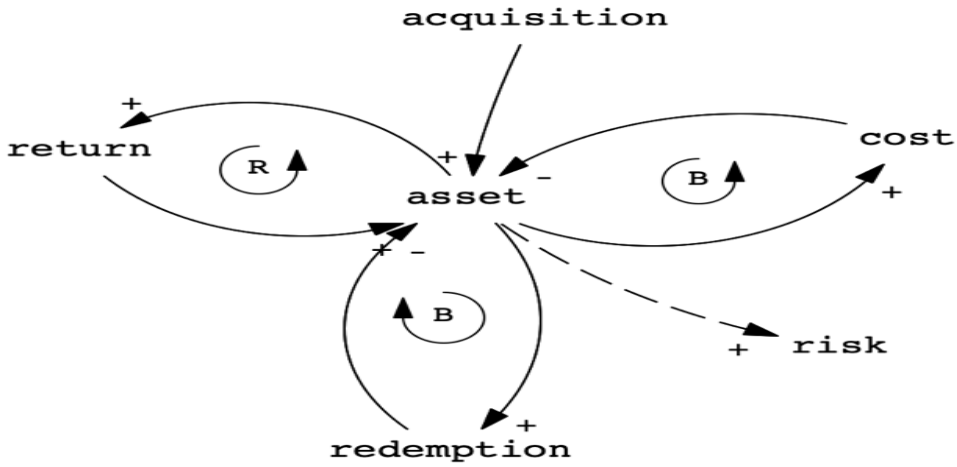

Figure 4: Basic Investment Model with Asset in the Canter.

Investment is all about generating returns from assets. The higher the asset is, the more returns it can generate, leading to a reinforcing loop (noted as R) over time. The relationship between return and asset is not a linear causal loop, but rather an integral function of the return that acts as a rate to the level of the asset. The magnitude of asset increases will be determined by the rate of return (ROR). The higher the ROR is, the faster and higher the magnitude of asset increase will be. Understanding these causal loops and feedback mechanisms is critical in developing effective investment strategies and managing index fund assets.

The standard approach for calculating asset returns is to use CAPM, which was introduced by Sharpe (1966). In its simplest form, CAPM formulates an asset's expected return as a function of risk, using the following equation:

$$E(Ri) = Rf + ßi(E(Rm) - Rf) \quad (1)$$

where E(R_i) is the expected return, ß$_i$ is the volatility of an asset to market (idiosyncratic risk), E (R_m) is the expected return of the market, and R_f is the risk-free rate. In the case of a fully diversified index fund, the ßi close to 1, and the return will be affected only by the market (systematic risk). Figure 5 illustrates the relationship between the risk and return of the asset. The feedback creates a reinforcing loop that drives the growth of the asset. In line with this, the higher risk (ßi) results in the higher the expected return. This initial relationship in the model is indicated as dashed lines. Since the model is dynamics, the risk might be represented as negative return, which could be represented as one single variable that can move on both directions (positive and negative directions). Further evaluation of this relationship is necessary.

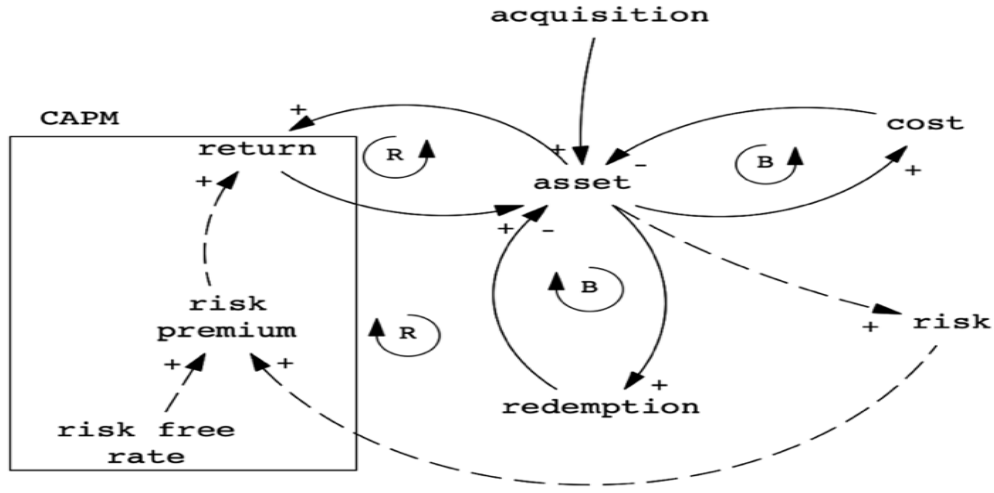

Figure 5: Asset Return as a Function of Risk.

The index fund asset consists of two main components: cash and portfolio securities (see Figure 6) which have a different causal feedback loop. Cash or its equivalent further will be referred to as cash. Cost is taken from cash, while portfolio gain/loss affects the value of portfolio securities. Dividends affect cash, not the portfolio. The same effect on cash happens if the fund manager decides to rebalance the portfolio by selling or buying securities. Acquisition and redemption by investors will affect the cash position.

Return of an index fund, as described by Bodie et al., (2022), comprises of income and capital gain. Income is either a dividend, capital gain distribution, or both. Capital gain (or loss) indicates the valuation of assets at the current market price compared to either the positive or negative acquisition value. Portfolio securities increase. The same applies for a positive return. Meanwhile, asset value decreases with a negative return.

Asset value also decreases with cost (see Figure 6). The higher the cost for managing the asset is, the lesser the asset value will be. The metric commonly used to represent the cost of an index fund is the expense ratio, which includes operating expenses and fund manager fee. When introducing the Terminal Wealth Ratio (TWR) to compare the investment return to investor, Sharpe (2013) pointed out the significant of cost to return, and then proved mathematically that the terminal wealth is solely based on the retention amount (1 – expense ratio) power the period of the investment. Considering the fund expense ratio itself, investors saving for retirement who choose low-cost funds could have a living standard throughout retirement more than 20% higher than a comparable investor in high-cost investments (Sharpe, 2013).

Transaction cost in the index fund is expected to be minimal as there will be no active buying and selling securities except for the portfolio rebalancing following the changes in the underlying index. However, Adams et al. (2022) claimed that transaction costs are significant yet unobserved, dragging the mutual fund performance. Using portfolio holdings and transaction data, Edelen et al., (2013) found the same conclusion that funds' annual trading costs are higher than their expense ratio. Consequently, it poses negative effect on the fund performance.

Although the expense ratio is commonly used to indicate index fund cost, it does not represent the total cost to the investor. Bogle (2014) advocated the use of all-in cost, which accounts for additional investor cost, in measuring the fund performance. As seen in **Error! Reference source not found.**, an investor must pay an additional cost (front-end loads, back-end/sales loads, and taxes). The investor's return on investment (net return) will be less than the fund rate of return reported by the funds. Considering all-in investment expenses compared with costly active managed funds, over time, low-cost index funds create an extra wealth of 65% for retirement plan investors (Bogle, 2014). The asset return reported in the index fund ROR does not represent the net return of the investment. Counting the front-end load on every acquisition, back-end load, and taxes on every redemption, the investor's net return on investment (ROI) is even lower than the reported fund ROR.

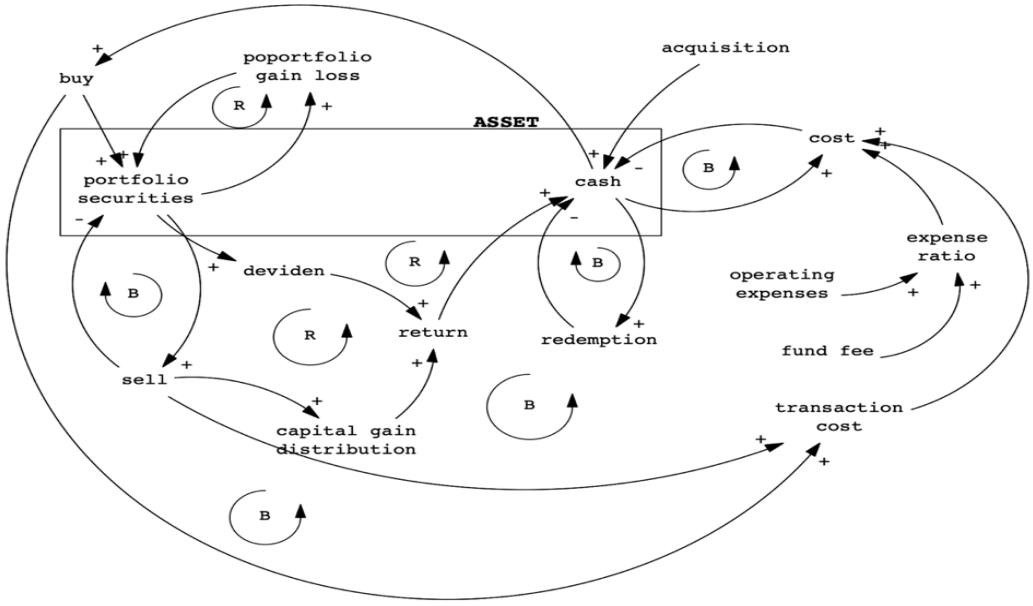

Figure 6: Index Fund Asset Consisting of Cash and Portfolio Securities.

This study also contributed to the literature on fund liquidity management. A model of liquidity management on index funds was offered by clearly devising causal variables between cash and portfolio securities (see Figure 7**Error! Reference source not found.**). The model can simulate various liquidity conditions of fund manager cash policy and show its behavior on various equity market conditions. The simulation might help explain the fund manager skill in maximizing investment opportunities while fulfilling their obligation on a cash basis. Referring to Wermers (2000), holding cash is costly because funds must give up investment opportunities, but cash can help them withstand redemption shocks.

Among other studies, Chernenko & Sunderam (2016) studied the effect of cash holding. They investigated the liquidity management of different portfolio securities, both bond and equity funds, showing that even careful liquidity management cannot fully alleviate price impact externalities created by the liquidity transformation. The most relevant study on the effect of cash holdings on index fund performance was conducted by de Mingo-López et al., (2020). They reported that higher levels of cash holdings imply a drag on the index fund performance, providing investors with lower returns. Liquidity management is important as volatility shocks severely impact open-end mutual funds with underlying illiquid assets. A study using a dynamic

model by Zeng (2017) proved that liquidity management is a challenge for fund managers to avoid equity selling involuntarily in a risky market situation. If a fund allocates 5% of assets as cash and an annual equity premium for stocks is 6%, there would be an additional of 30 bp drag on fund returns (Bogle, 2014).

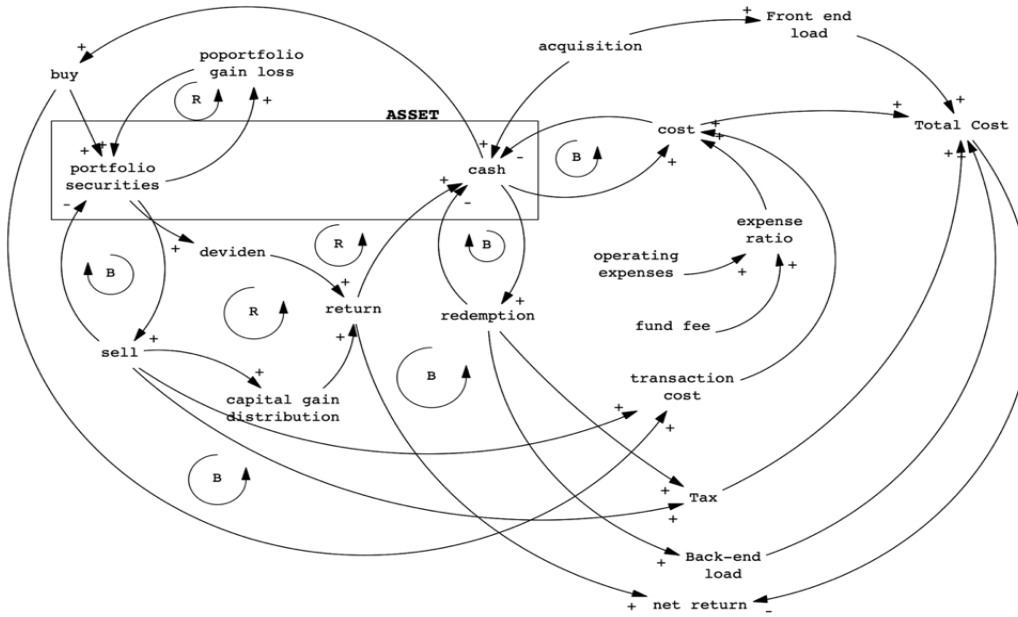

Figure 7: Index Fund Cost Structure.

Figure 8 displays the stock and flow diagram of the index fund performance model that represents the dynamic relationships between the fund assets, cash, portfolio securities, cost, acquisition and redemption, and the benchmark index. The monthly data of one particular index fund including fund assets under management and unit were obtained from the Financial Services Authority (OJK). The changes in the fund unit were used to develop the acquisition and redemption pattern. Positive changes were considered as net acquisition and negative changes are registered as net redemption. The data from the Indonesia Stock Exchange for index returns were used to represent the benchmark index.

The cash management strategy was simple where portfolio securities would be bought or sold depending on the excess return. Since this study used monthly data, manager decision delay which would take days is not presented here. The relation between excess cash and sell or buy activities is instantaneous. Usually, an index fund is a long-term investment where positive excess cash is expected and will be allocated to portfolio securities immediately through buying action. However, as the fund is an open fund type where the investor can cash out their investment at any time and fulfill any cash-basis obligation, the excess cash may turn negative, and then it negative excess cash will pressure the manager to liquidate the asset. To avoid forced sales, the manager usually averages the total cash-out flow and sets the desired cash coverage based on their previous cash demand. The manager needs to balance between keeping the cash low enough but sufficient to cover the need and maximizing return by converting cash into portfolio securities.

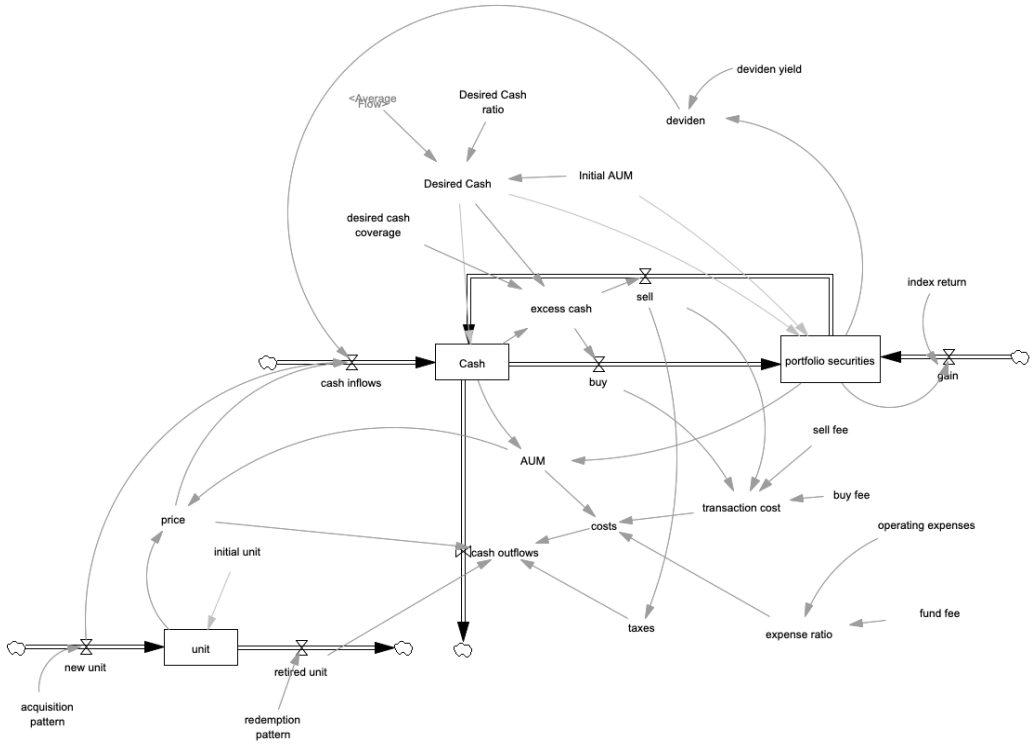

Figure 8: Stock and Flow Diagram of Index Fund Performance Model.

The total assets under management (AUM) reflect the sum of cash and portfolio securities, which will vary over time. Costs include total fund expenditures resulting from transaction costs and expenses set by the manager expense ratio. Cash outflows consist of costs, redemption value (retired unit*price), and taxes. In this fund performance model, the acquisition value (new unit*price) that increases the cash inflows and redemption value that increases the cash outflows will use the price at the time of the transaction defined as AUM per unit. When an investor purchases a unit investment in an index fund, they will pay the price at the time of the transaction. The same applies when they sell their unit of investment. To build confidence in this model, Figure 9 shows how the price behavior generated by our model compares to historical price. The modeled price fluctuates very closely to the historical price. A benchmark price is also added using the fund's underlying index return to show that the return of index fund is below the return of the underlying index (both modeled and historical price are below the benchmark price).

Figure 10 illustrates the tracking error of the price generated from the model and the historical data compared to the benchmark price. Tracking errors can be used to evaluate its performance. By comparing the price behavior generated by the model to historical data and a benchmark price based on the fund's underlying index return, it can be assessed how closely the model tracks actual price changes. In this case, the model's tracking appears close to historical data and fluctuates near the benchmark but exhibits a downtrend in the long run. This result is consistent with the general theory that index funds are expected to have returns below their underlying index.

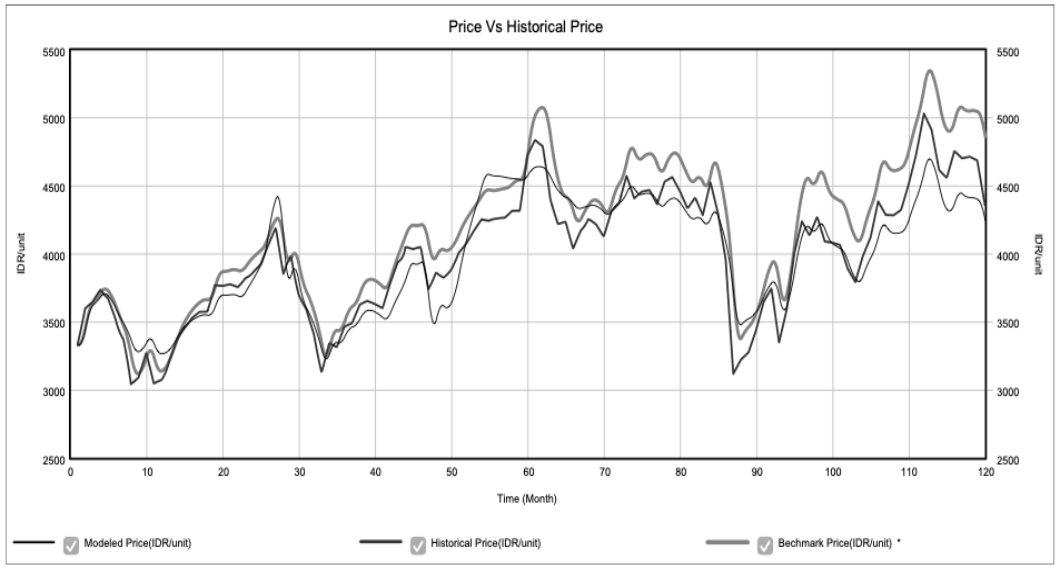

Figure 9: Price Model Behavior Vs Historical Data.

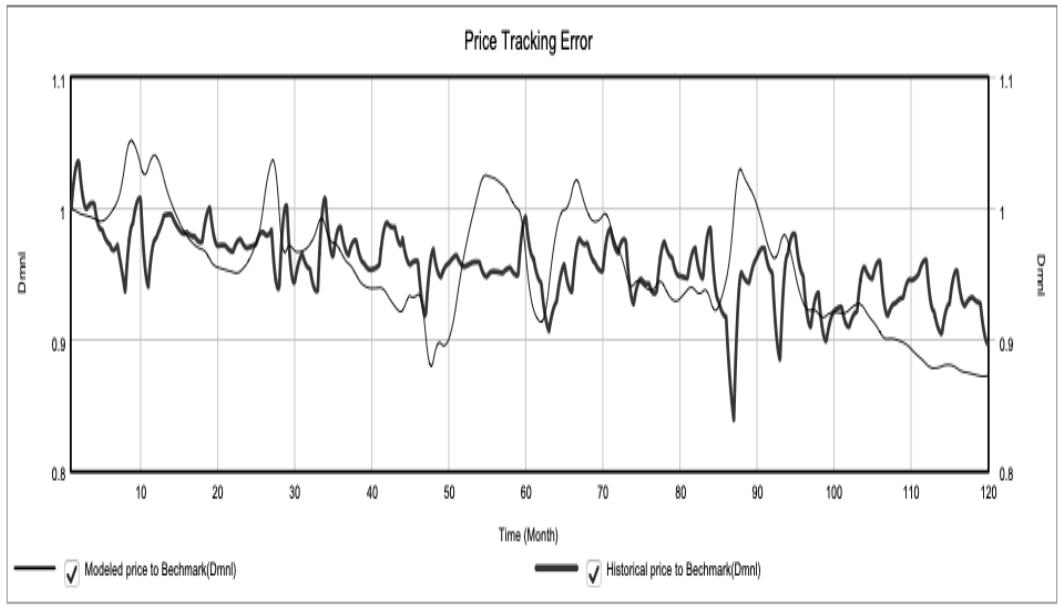

Figure 10: Comparison between Modeled Price and Historical Price to Price Benchmark.

The literature presents a long-standing academic debate on whether fund performance can be attributed to management skills or luck. While some researchers argue that fund manager skill exists, others attribute it to luck (Berk et al., 2020; Berk & van Binsbergen, 2015; Fama & French, 2010; Song, 2020). Crane & Crotty (2018) applied statistical methods to measure mutual fund skill across a cross-section of funds and found that index fund skill exists and is persistent in proportions similar to active funds.

The stock and flow diagram represent the index fund performance model. It demonstrates the dynamic relationships between the fund assets, cash, portfolio securities, costs, acquisitions and

redemptions, and the benchmark index. The model indicates that the fund manager needs skill to modify any variable that impacts the fund performance behavior. The manager might not solve problem, but in Ackoff's words, the manager's job is to cope with messes – as problems are dynamic situations involving complex systems (Ackoff, 1979).

Index Fund Flow Model

Since performance is widely believed to be the driver of the flow, understanding the causal structure that drives the fund inflows to or outflows from index fund assets is necessary for analyzing fund growth and survivability. Feedback loops play a crucial role in understanding the dynamics of these factors and their impact on index fund performance. Scholars agree that fund flows are strongly correlated with past performance. However, there is little agreement on interpreting this phenomenon. Some studies document that investors are *homo economicus*. They invest in mutual funds following utility maximization theory which implies that individuals are rational and consistently seek to maximize their well-being by increasing their wealth. Investors are Bayesian agents and continually assess fund manager skills and re-allocating money accordingly (Berk & Green, 2004; Berk & van Binsbergen, 2015). Further studies examined fund flows in a revealed preferences framework to deduce what asset pricing factors (CAPM) investors take into account in their investment decision (Barber et al., 2016; Berk & van Binsbergen, 2016).

In contrast, other studies suggested that retail investors show behavioral bias and pursue simple signals when investing their savings. It became obvious that, when people were faced with economic choices with uncertain outcomes, they had many behavioral biases (Kahneman & Tversky, 1984). Investors have a naïve understanding of diversification (Mauck & Salzsieder, 2017). They likely do not engage in sophisticated learning about managers' alpha, as widely believed (Ben-David et al., 2022). Retail investors form expectations about future asset performance by extrapolating past performance (Choi & Robertson, 2020; Greenwood & Shleifer, 2014). Overconfidence is potential reason retail investors engage in intensive trading despite earning poor returns (Barber & Odean, 2000). Retail traders also tend to trade attention-grabbing and high-sentiment securities (Barber & Odean, 2008, 2013).

Figure 11 indicates feedback loop between the asset return and the investor decision-making process. An investor decision to acquire or redeem an asset is affected by the feedback on the portfolio performance. It is in line with utility maximization theory when investors seek the highest satisfaction from their economic decisions on a positive return. A rational investor is expected to keep the asset and acquire more assets when the asset return is relatively higher than expected. On the other hand, when the return is relatively below the investor's expectation, the investor will refrain from acquiring a new asset or even redeeming the asset to be reallocated to other assets with a more attractive return.

The feedback on the past return effect also aligns with the bubble argument by Shiller (2015). He argued that there is a striking correlation between prices and opinions about the best investment. Adopted from his property prices argument, generally, when index fund prices are rising, the percentage of investors who think index fund is the best investment also increases. When index fund prices sink, the portion who thinks index fund is the best investment decreases. It is an amplification mechanism that works through a feedback loop. Our model clearly shows the reinforcing loop. Investor's confidence and expectations affected by past price increases drive up speculative prices further and invite more investors to buy the asset, resulting in an amplified response.

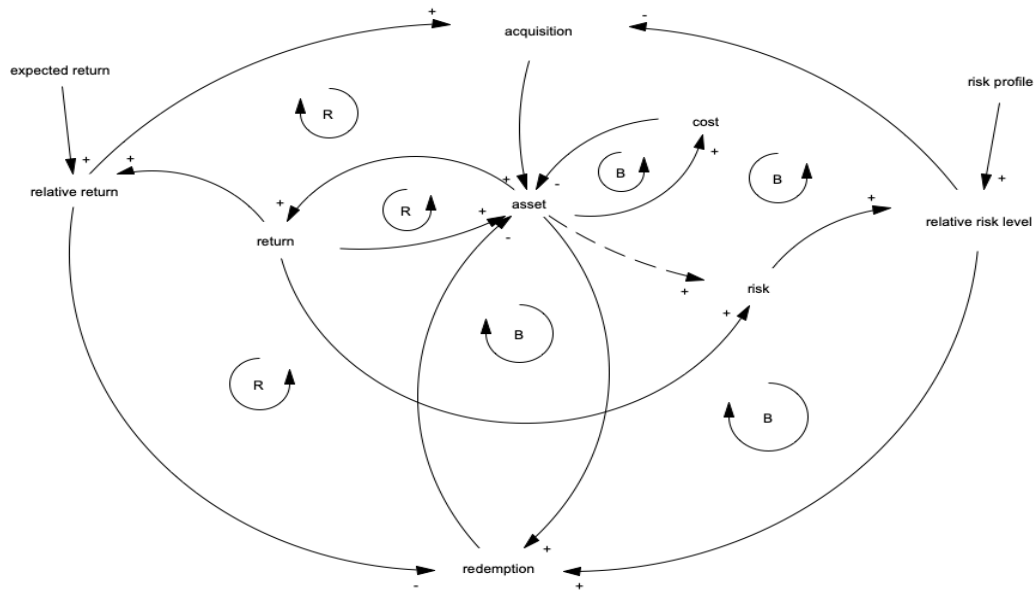

Figure 11: Feedback Loop in the Investor's Decision-Making Process to Redeem or Acquire Assets.

Another feedback to the investor decision making (see Figure 11) is the asset risks. Their willingness to accept a particular risk depends on their risk profile. Index fund risk level changes over time following the performance of the underlying index. At any given time, when the asset risk is relatively higher than the inventor's risk tolerance, a rational investor is expected to refrain from acquiring more assets or cash out their investment to minimize their risk. Nevertheless, investor might display loss aversion according to prospect theory.

Prospect theory suggests that an investor's willingness to buy or sell the asset depends on the reference point, whether or not they own the asset now. They will consider the pain of giving up the loss if they own it. They consider the pleasure of portfolio gain if they do not own it. Unfortunately, the values are unequal because of loss aversion; giving up the loss is more painful than the pleasure of having the gain. Kahneman (2011) explained this psychological value of gain and loss through an S-shaped graph. The function's slope is steeper in the negative domain; the response to a loss is stronger than the response to a corresponding gain. In this model, the concept using a dynamic reference point is improved by providing a feedback loop between return to the expected return and risk to the risk tolerance.

Conclusion and Recommendation

To conclude, this study developed the index fund literature in several ways. An index fund structural model was proposed to explain how various variables interact dynamically influencing fund performance and flows. This study also provided a 'house" for prior studies within the index fund investment model. It is suggested that fund management endogenous processes and investor decision-making processes are parts of a system that influence fund performance and flow. Its frameworks offer a holistic approach to understanding the index fund investment model, which can help fund managers identifies leverage points to improve fund performance and help inform the investors to achieve their investment goals.

Further study could be to enhance the model considering all other factors affecting the fund flows. The model of the fund flows could include several groups of investors with different investment goals and risk tolerance, as each group will behave differently depending on their relative return and relative risk level. The model could also account for fund flow as the effect of the following factors. *Firstly*, the impact of fund rating, like the one issued by Morning Star, resulted from fund performance behavior (return, persistence, tracking error, etc.), which is an inherent part of the model. *Secondly*, the marketing efforts especially the targeted one was conducted through a financial adviser and social media influencer is a viable marketing option even though index fund managers are expected to minimize operating costs, targeted marketing. *Thirdly*, fund family strategy shading an index fund manager might leverage the fund flow to an index fund in offering diversification to the investor. Fund managers usually manage an entire family of funds, including a mixture of passive and actively managed funds. The sponsor's business model involves maximizing the revenue from the whole family (Fisch et al., 2020), which in some cases, compresses the index fund cost to nearly zero.

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