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Outperformance versus Due Diligence: Which Produces Investment Winners?

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Investment consultants are seasoned professionals who perform due diligence on portfolio strategies of allocating institutional investor funds and assign a rating. Morningstar ratings are classification schemes based on such due diligence. This face-to-face interaction with portfolio managers concludes with the assigning of one to five 'Stars' to a portfolio strategy. Ratings allocate institutional investor funds among investment managers. Consulting firms supply an avenue for plan sponsors to transfer part of a fiduciary responsibility of the retirees' welfare. Regulators are constantly concerned that consulting firms produce recommendations that serve the interests of their own, or the portfolio managers that they evaluate, in breach of fiduciary responsibility. Specifically, the Department of Labor and the Securities and Exchange Commission are concerned that the advisers encourage portfolio managers to offer monetary benefits in exchange for a favorable rating. We compare the outperformance results stemming from the following of ratings to the ones stemming from not following the recommendations implied. We derive a set of buy and sell recommendations, one based on the active performance of portfolio strategies relative to few benchmarks (outperformance), and one based on the due diligence of consultants (ratings). The algorithm J4.8 produces rules that result in recommendations for the outperformance-based and the due diligence or ratings-based decisions of the hypothetical institutional investor in each case. We expected a priori that the rules based on outperformance would bring a better result for the investor. However, our findings showed that there was a slight benefit to the investor who followed ratings, both in terms of simplicity of decision-making, and in terms of risk-adjusted returns relative to the indices or benchmarks selected.

Keywords: *investment management, information ratio, rolling coefficients, government intervention*

Introduction

This study examines investment advising manifested in the form of recommendations of portfolio strategies offered by consulting firms to their institutional clients. U.S. regulatory bodies (Securities and Exchange Commission, the Department of Labor) are keenly interested in the issue of "pay-to-play," referring to an adviser's encouraging portfolio managers to offer a monetary benefit, in exchange for the former's rating the latter's investment strategies favorably. U.S regulators investigate the payments by various methods, indirectly imposed on

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money management firms, in exchange for access to the advisor firms' clients (Office of Compliance Inspections and Examinations 2005). We explore the role of ratings assigned by a specific investment advising intermediary, Morningstar, on the behavior of institutional investors. We compare the risk-adjusted performance results to those obtained by hypothetical investors who did not follow the recommendations indicated by Morningstar ratings. We find that there may be little cause for concern: the rules of selecting strategy 'learned' by Morningstar ratings, outperform similar rules 'learned' by simple outperformance in terms of Information Ratio. The J4.8 machine learning method helped achieve this result (Quinlan 1996). The J4.8 machine learning method is an improvement over the original C4.5 method (Quinlan 1993). Both methods maximize entropy of a system by extracting all of its information in the form of a decision tree (Shannon 1948).

Investment advising firms, through ratings they assign to investment portfolio managers, tend to influence the flows of assets under management (AUM) in and out of the strategies which the investment management firms offer to institutional and retail clients. The regulators are concerned that, in place of the investor-public whose welfare they should safeguard, consulting firms may produce recommendations that serve the interests of the evaluated portfolio managers (Xanthopoulos 2019). The ratings that advising firms such as Morningstar assign to investment managers, are in essence classification schemes that are based on due-diligence, a process that involves face-to-face interaction with the portfolio managers, and a subsequent assignment of a number of 'Stars' (one through five, in the case of Morningstar). Investors may be tolerating the symbiotic relation of the investment managers with the consultants that rate the former's strategies. Consulting firms "supply" needed classification schemes to institutional investors, in their latter's effort to circumvent/ evade their own fiduciary responsibility, as is evident in literature, below. The schemes imply investment recommendations aimed at institutional clients, in allocating funds for large retiree accounts, endowments, and foundations.

Per the Investment Adviser's Act of 1940 "advisers" must evaluate portfolios in a "disinterested" manner that involves "reasonable care to avoid misleading clients" (Barbash and Massari 2008, p. 633). But rating schemes may lead to advice tainted by financial interest, because of (i) potential employment of the research advisor at a firm whose investment portfolios the research advisor evaluates and (ii) generation of excess fees by the consulting firm that owns and operates a rating platform. Since the advisor charges a fee for on-line platform access to ratings and research, an advisor is a fiduciary (Ellis 2005). Investment firms incur "Pay-to-play," as compensation outside of fees officially charged to clients. Compared to a case where institutional investors do not believe in rating schemes, their choice to rely on them instead may have resulted in underperformance. An additional concern is that, in contrast to a potentially antagonistic relationship between investment firms and the consultants, as implied by pay-to-play, investment firms seek the rating intervention supplied by a consulting platform. Literature has also documented the transfer of responsibility from institutional investors' officers, referred to as plan sponsors. Quality control on rating schemes would safeguard the retiree benefits.

The contributions of this study are that: (i) institutional investors have the choice of either examining past performance or relying on ratings provided by

Morningstar to decide where accumulated retiree funds should be invested, (ii) a plan sponsor's choice itself to either look at past strategy performance or invest based on recommendations by ratings, can be modeled by a respective decision three that 'learns' how said investor would have behaved in each choice, (iii) Morningstar ratings do marginally better than investment strategy decision rules learned from past relative performance, (iv) based on the sample and time frame of this analysis, it is not surmised here that Morningstar ratings are affected by "pay-to-play," or that the ultimate interests of retirees, whose wealth is invested either by previous-outperforming or due diligence/ratings are impacted negatively by relying on advisor ratings, and (v) Recommendations based on Quintiles of Outperformance split at the BBB rating, the middle of the credit curve, which makes more sense. The typical strategy of a portfolio manager who is 'long' the AAA and CCC credits, and 'short' long the middle of the curve. Decisions based on due diligence, on the other hand start on 'long' positions on only one end of the curve, that is, AAA.

Literature Review and Institutional Background

Fiduciary duties, fundamental to financial services, corporate governance, and legislative frameworks, have garnered increasing attention for their role in safeguarding client and stakeholder interests while addressing regulatory and ethical challenges. Corcoran (2020) explores the selective application of fiduciary duties, finding them crucial in contexts such as asset management and independent financial advising, where selfless loyalty can mitigate conflicts of interest. By contrast, bank-customer relationships rarely invoke fiduciary obligations due to their transactional nature. This nuanced application highlights the challenges in balancing loyalty with operational realities in financial services. From a corporate governance perspective, Hill (2021) examines the transnational migration of fiduciary norms, particularly through stewardship codes that integrate fiduciary principles into global governance. These codes not only promote accountability but also reflect the interconnectedness of financial markets and the growing societal expectation for corporations to align with broader environmental, social, and governance (ESG) objectives.

Bratton (2020) critiques the theory of "evolutionary erosion" in corporate fiduciary law, arguing that modern governance frameworks have adapted fiduciary principles to contemporary demands rather than weakening them. Mechanisms such as disclosure requirements and independent boards deter self-dealing and align management actions with shareholder interests. Expanding this view, Worthington (2013) addresses the inconsistent application of remedies for fiduciary breaches. She proposes a systematic framework for determining when proprietary remedies should be employed, emphasizing the importance of consistency to uphold the principles of fiduciary loyalty. Together, these works underscore the adaptability and enduring relevance of fiduciary duties within evolving governance systems. The role of fiduciary obligations extends into the financial advisory market, where their application influences both market behavior and investor outcomes. Bhattacharya et al. (2019) demonstrate that fiduciary standards improve the quality of financial advice and enhance risk-adjusted returns by aligning advisor incentives with client

interests. However, they caution that higher entry costs associated with such standards may reduce market competition, presenting a trade-off between investor protection and industry accessibility. Similarly, Egan et al. (2022) analyze the impact of fiduciary duties in the annuity market, finding that stricter standards reduce the sale of high-fee products and shift broker behavior toward prioritizing client welfare. These findings highlight the effectiveness of fiduciary regulations in mitigating conflicts of interest, though they also reveal potential tensions between regulation and market dynamics.

In the legislative context, Tsuji (2022) critiques the failure of governments to fulfill fiduciary responsibilities when formulating policies that affect Indigenous communities. Using economic recovery acts in Canada as case studies, he identifies ethical shortcomings in consultation processes, underscoring the broader implications of fiduciary principles in public policymaking. This ethical dimension enriches the understanding of fiduciary obligations, extending their relevance beyond traditional private law applications. Collectively, these studies reflect the diverse applications and implications of fiduciary duties across financial, corporate, and public domains, illustrating their critical role in fostering accountability, trust, and equity in increasingly complex and interconnected systems.

This study uses standard vocabulary of active management. For example, "[a]lpha is interpreted as a measure of skill" by the global investment community (Ang 2014, p. 307). In its most generic formulation *alpha* is the 'intercept' while *beta* is the slope of a linear regression of portfolio returns, against a portfolio benchmark. *Active return* is defined as the return of a portfolio strategy, over the benchmark, or in this case, over the eight indices that are selected to capture the credit-rating curve (as opposed to investment manager ratings), from AAA to High-Yield or CCC. *Tracking error* is defined as the standard deviation of active returns. Information ratio (*IR*) is *alpha* divided by 'tracking error.' Thus, information ratio (*IR*) measures portfolio returns beyond the returns of a benchmark, usually an index, compared to the volatility of those returns. The benchmark used is typically an index that represents the market or a particular sector or industry that pertains to a 'Universe.'

Numerous studies suggest that consultant recommendations fail to lead to the selection of investment managers that outperform. The implication is that investors who elected to rely on recommendations could have used a method that resulted in selections of equal or better relative performance. Chalmers and Reuter (2020), find that investors who go through an intermediary are younger, less educated, and less highly paid. The clients of brokers take on greater risk and pay higher fees. Investors that rely on these financial advisors would most likely select the managers near the top of a universe or peer group if not rely on advisors. In our study, the portfolios selected could have been recommended solely on estimated information ratio (*IR*). On the other hand, advice constitutes relying on schemes available through on-line platforms such as Yahoo Finance. We regress *IR* against betas to a number of indices as independent variables across all investment strategies in our sample. Institutional investors switch from estimated information ratio to following classification schemes subject a pension plan, a retirement account, endowment, or foundation, to distortions in the selection process based on these betas to indices for each investment strategy. It is these distortions that regulators are concerned about regarding the

possibility of pay-to-play. As reiterated above, we are not finding any evidence of the above in this study – quite the contrary. Machine-learning rules that were learned based on the ratings, do better than those learned out of string outperformance or *IR*, we find.

Fees generated by the platform more than a flat rate raise the incentive to the consulting firm to leave things as are. The literature finds that fee incentives skew recommendations. Chalmers and Reuter (2020), show that face-to-face interaction of financial advisors with institutional investors entail conflicts of interest. The fee-generation incentive leads to investors making riskier but underperforming choices and paying higher fees. When access to recommendations is free of charge, these conflicts of interest vanish. Peculiarly, investor-clients continue to follow ineffective recommendations. The reasoning found in literature, concerning the need or efficacy of investment consultants, extends to on-line platforms of a sizable footprint. In principle, investment firms should not need a ratings scheme. Gennaioli et al. (2015), allude to the fact that investment management firms are flexible enough to respond to the biases of institutional investors, all by themselves. Money managers pander to investors who exhibit persistent biases. This pandering affects arbitrage and poses a risk of market destabilization. To receive higher fees, portfolio managers abandon arbitrage and turn into noise traders, if investors become trusting. Contrarianism pays in the long run but becomes less attractive to profit-maximizing managers, these authors conclude. Similar results are found in Jegadeesh et al. (2004), in the context of recommending individual stocks: analysts' excessive focus on glamour stocks contributes to noise trading. In this paper, we do not conclude that rating schemes exacerbate the systemic risk of market destabilization. Noise-trading raises market volatility, as per Gennaioli et al. (2015). However, based on our results, we cannot conclude that portfolio outperformance distortion by ratings can lead to en-masse redemptions. Still, pay-to-play of any kind has been of concern to the U.S. regulatory authorities.

Weber (2015) mentions regulators' hesitation to restrict the flow of capital from banks to the stockholders before the 2008 crisis, from 2005 to 2007. In pay-to-play, it is the research advisor, who "curries" favors (Weber 2015, p. 45). By analogy, classification schemes that safeguard investor interests should act as an impediment to en-masse redemption of funds entrusted by shareholder/institutional investors. Lack of quality control in schemes contributes to the fallacy of composition, where one investor runs for the proverbial theatre exit, while every other investor does too. A cushioning effect by ratings is envisioned.

Like the original regulatory capture in Stigler (1971), who proposed a "second view" of the political process, advisory capture "defies rational explanation." Contrary to the idealistic view that a portfolio manager dreads any robust classification scheme, it is the 'Consultant Relations Team' of investment advising firms that act toward the consultant/advisor in a manner that promotes a good rating. The schemes maintained by research advisors of the consulting firms resemble "the congressman feathering his own nest" through licensing practices. In advisory capture, licensing equates to recommending a portfolio for initial or prolonged investment by a plan sponsor amid responsibility-transfer. This depiction is like Stigler's industry-demand for regulation. In issuing responsibility-shielding licenses as ratings, research advisors

evolve to 'regulators under capture' as in Levine and Forrence (1990). They develop narrow, self-interested goals of job retention, self-gratification from exercise of power, and post-advisory wealth. High tolerance for harassment develops internally, while rating schemes become valid only for small subsets of research, like Dal Bo and Di Tella (2003). Symptoms of "repeated extortion" that pertain to such capture as in Choi, 2004, lead to the perpetuation of antiquated technologies, arbitrariness, and unpredictability. Luckily, "larger plans are less likely to retain consultants to assist them in the selection process and have higher post-hiring excess returns than their smaller counterparts" (Goyal and Wahal 2008, p. 1808). Larger institutional investors are less prone to responsibility-transfer. Still, these classification schemes entail immediacy of portfolio manager contact with the research advisors who maintain them. Consultant Relations teams of portfolio management firms seek after contacts, beyond the scope required for pure strategy evaluation. Through simultaneous contact with plan sponsors, after gaining familiarity with responsibility transfer, the teams perceive the void between consultant and research advisor. In this study, we were unable to find evidence that supports the above, based on rating classification schemes, in contrast to investment manager selection based on outperformance. We conclude that rating schemes may not always result in a loss for investors. Advisors produce recommendations that are neither "fruitless," not harmful to the institutional investor[1].

The Department of Labor's Fiduciary Rule

Consulting firms serve as regulating gatekeepers for the flows of assets under management (AUM) in and out of portfolios. Recommendations are revealed through the schemes maintained by research advisory teams and made available on their on-line platforms. A concern of regulatory agencies in the U.S. is that in place of the investor-public, whose welfare they safeguard, consulting firms produce recommendations that serve interests of the evaluated portfolio managers. The undertaking by the US Department of Labor (DOL) to expand the "investment advice fiduciary" definition under the Employee Retirement Income Security Act of 1974 (ERISA), and to modify the prohibited transaction exemptions for investment activities in light of that expanded definition, had become at the time, the most controversial, politicized retirement rulemaking since the enactment of ERISA. Everything about this rulemaking has been initially unprecedented. The fiduciary rule, finalized in 2016 under the Obama administration, broadened the definition of when a person or entity was taking on fiduciary responsibilities and replaced the five-part test used to determine whether an investment professional or financial institution is a fiduciary. Before that time investment advisors fell outside of the definition of a fiduciary, and therefore, kickbacks were not only legal, but it is common practice. To curb these practices, DOL's new ERISA rules expanded the definition of a fiduciary and created a new method of exempting certain prohibited transactions. The prohibited transactions related mainly to the method that fiduciaries

[1]Jenkinson et al. (2016, p. 2333), refer to recommendations offered directly to clients. Our study refers to ones implied by ratings found on-line or housed within on-line platforms, made available for a fee.

received their compensation. For a fiduciary to receive commission-based compensation, they should comply with the requirements for a Best Interest Contract Exemption (BIC exemption) that required extensive disclosure about possible conflicts of interest. On April 8, 2016, the DOL published the final rule that modified the existing regulation of conflicts of interest in the market for retirement investment advice under ERISA.

Title I of ERISA covers and protects employee benefit plans, imposing an obligation on people who engage in activities related to the plan as fiduciaries. The fiduciary standard under this Title imposed a duty of loyalty and prudence upon the fiduciaries. Title II established rules for the tax treatment of IRA's and other plans subject to the Internal Revenue Code. Under both Titles, advisors were subject to the Prohibited Transaction rules and their exemptions. However, while still titled fiduciaries, Title II did not create a private right of action and due to its lack of state law preemption, advisors were not subject to the fiduciary duties of loyalty and prudence as Title I advisors. The fiduciary claims against advisors under this Title fell under state law. The two changes mentioned above consisted of 1) a new definition of Fiduciary under ERISA and the Code and 2) the creation of the Best Interest Contract Exemption. Registered Investment Advisors and Broker-Dealers are the two groups that provide investment advice to retirees. Outside of ERISA, these groups of professionals have different standards in regard to the duty owed to their client in the general course of business. Under the Investment Advisors Act of 1940, Investment Advisors are held to a fiduciary standard. However, this is not the same as the fiduciary responsibility under ERISA. Broker dealers are subject to the suitability standards under the Financial Industry Regulatory Authority (FINRA) guidelines. FINRA is a self-regulatory organization (SRO) that operates under the Securities and Exchange Commission (SEC), a federal government agency. While both agencies protect investors, FINRA primarily regulates broker-dealers and their agents, while the SEC has broad authority over securities markets.

To be deemed a fiduciary under the 1975 ERISA definition, one must satisfy a five-part test, the details of which are beyond the scope of this analysis. Due to the changing landscape of retirement investment products, certain one-time transactions like rolling assets into an IRA failed to satisfy the "regular basis" element of the test. The DOL was concerned of this gap because rollover investments are often "the most important financial decision that many customers make in their lifetime." Furthermore, in the fine print disclosures of the contract, advisors would commonly avoid fiduciary duties by stating: "investment advice is not intended to be the primary basis for decisions." The fiduciary rule replaced this five-part test with the goal of broadening the definition. The new rule defined a fiduciary as anyone who rendered investment advice and received compensation, directly or indirectly. Investment advice is intended to be read broadly to include any communications that are likely to be considered a suggestion to take, or refrain from taking, a particular action. For the purposes of Title II, this new rule merely expanded the range of fiduciaries subject to the prohibited transaction rules, but the rule did not necessarily burden them with the fiduciary duties set out in Title I. While this new rule did have some implications on Title I advisors, the main thrust of the rule is aimed at Title II advisors of IRAs and other non-Title I plans (Botkin 2018).

President Trump tried to have the law rescinded. The broker-dealer profession pushed back on the law, citing that "there [was] ample evidence in the record to warrant materially revising or rescinding the Fiduciary Rule, and it is entirely possible that the Fiduciary Rule Re-evaluation Study will clearly articulate the need to modify the current form of the Fiduciary Rule or eliminate it all together." At the time the Fiduciary Rule's fate was uncertain, due to fears that it invited unprecedented litigation exposure and forced financial institutions to make immediate, harmful, and sweeping changes to their businesses, operations, and compliance policies and procedures. The Department's approach to this rulemaking in this regard was critiqued to be hasty, counterintuitive and irresponsible, causing irreparable harm[2].

Ultimately, the Law was vacated, in 2018. In 2018, a three-judge panel at the 5th U.S. Circuit Court of Appeals in New Orleans vacated a Labor Department rule, commonly known as the fiduciary rule. It was done in a 2-1 decision because it said the department exceeded its legal authority. Allowing fiduciary advisors to receive compensation directly from mutual fund companies, albeit with certain restrictions, means participants don't pay out of their own pocket for advice, which might otherwise be unaffordable for them, supporters of the new guidance said. Critics contended that allowing third-party payments to advisors raised concerns about participants receiving conflicted advice that is not in their best interest. However, the Securities and Exchange Commission was still concerned with the recommendations for portfolio strategies offered by consulting firms to their institutional clients.

SEC Regulation Best Interest (Reg. BI)

On June 5, 2019, the Securities and Exchange Commission adopted a package of rulemakings and interpretations designed to enhance the quality and transparency of retail investors' relationships with investment advisers and broker-dealers, bringing the legal requirements and mandated disclosures in line with reasonable investor expectations, while preserving access (in terms of choice and cost) to a variety of investment services and products. Specifically, these actions include the new Regulation Best Interest, the new Form CRS Relationship Summary, and two separate interpretations under the Investment Advisers Act of 1940. Individually and collectively, these actions are designed to enhance and clarify the standards of conduct applicable to broker-dealers and investment advisers, help retail investors better understand and compare the services offered and make an informed choice of the relationship best suited to their needs and circumstances, and foster greater consistency in the level of protections provided by each regime, particularly at the point in time that a recommendation is made. The SEC's Best Interest Regulation (Reg. BI) under the Securities Exchange Act of 1934 establishes a "best interest" standard of conduct for broker-dealers and associated people when they make a recommendation to a retail customer of any securities transaction or investment strategy involving securities, including recommendations of types of accounts. As part of the rulemaking package, the SEC also adopted new rules and forms to require

[2]Definition of the Term "Fiduciary" and Related Prohibited Transaction Exemptions Proposed Extension of Applicability Date (RIN 1210-AB79).

broker-dealers and investment advisers to provide a brief relationship summary, Form CRS, to retail investors. In addition, the SEC published interpretations concerning investment advisers' standard of conduct under the Investment Advisers Act of 1940, and the "solely incidental" prong of the broker-dealer exclusion from the Advisers Act. Regardless of retirement plan design, the advance-funding of retirement expenses will prove difficult in the previous low-interest rate environment, which is rapidly changing to a high-interest rate environment after decades of central bank intervention (Quantitative Easing). The combination of no succinct fiduciary responsibility for financial consultants, combined with QE-induced tendency of portfolio managers to 'swing for the fences may entice the liquidation of assets backing the financial performance of U.S. retirement accounts, especially in the face of prevalence of defined benefit and defined contribution plans. Lawmakers and political leaders may exhibit the syndrome of a short memory. However, the retirees who now see market values plummet currently comprise the same cohort that watched the value of their real estate evaporate in the 2008 financial crisis. They may think, "fool me twice, shame on me," and they may exit the financial markets by prematurely liquidating their private retirement portfolios, leading to a crisis again. In the face of these fears, it is important to stress that our study did not find evidence of Morningstar's ratings contributing.

Methodology

Admissible investment strategies for most retirement plans, endowments and foundations are classified as 'long-only' meaning that short-selling is not allowed. 'Fixed income', 'equity', and 'hedge-fund' is the first level of taxonomy of investment strategies. The second level is universes of strategies, in each category above. For fixed income strategies, a general/non-inclusive list of universes is shown below:

Aggregate Bond
Aggregate Bond Intermediate
EM Bond Local Currency
Foreign Aggregate Bond
Foreign Blend
General Corporate Bond

In each universe there are investment strategies, for which data were collected on Net Asset Value (NAV) from Yahoo Finance by research assistants at Lewis University[3]. Data on NAV collected were changed to monthly percentage changes or returns. The data collection was run for investment strategies in the universes listed above. A flat file with all strategies, in all universes across, with returns per month going down the file, was put together. The top five lines had information about the name of the strategy, its universe, its overall outperformance rating by

[3]The Authors want to express their sincere thanks to Lewis Graduate Student Anudari Chuluubbaatar Graduate Research Assistant Sravya Chigurupati for their dedicated effort in pulling data for more than one thousand actual fixed income portfolios, from Yahoo Finance and other sources.

Morningstar, and its risk rating by Morningstar. The returns and the ratings were used in the analysis described below. A separate sheet of the file had index returns for the indices provided by the Federal Reserve of Saint Louis, as discussed below. Returns for strategies and indices were put together in another file, in which the following steps were programmed in VBA. This particular methodology, programmed in the VBA language, has been used in an actual industry investment consulting environment, and is thus replicated here. Given Excel's ability to record user applications through keystrokes, the point to be made here is that putting together a methodology such as this, to assess the quality and monitor the level of efficacy of ratings, should be relatively simple. The step taken in this paper, beyond that point, was that of devising a decision tree based on the J4.8 methodology, programmed in the software package Weka. But consulting and general finance companies maintain large volumes of data in Excel. We could have entered this data into R or Python and redo the analysis there. However, that additional step may have taken away a portion of the authenticity of the methodology.

Step 1: Select Strategies to be Analyzed

A lookup drop-down box in Excel lets the user select one or more of the universes listed above. The Excel file goes to the flat-file and selects the strategies that fulfill the universe criterion selected. The strategies selected from the flat file were isolated in a separate Excel sheet for data-scrubbing. For example, there may be months of missing data for some strategies. Portfolio strategies often start and terminate within a varied range of months due to their prospect of success or failure. The authors inspected the results.

Step 2: Estimate Coefficients

The VBA (Visual Basic for Applications) – programmed informs of the maximum number of months of clean data that is available across all the investment strategies selected. The estimation methodology runs on a rolling sample of successive 24 months (for this version of the paper). The 24-month sample is rolled forward one month at a time, and the estimation described below is repeated. In this version, there were 154 strategies that belonged in the first universe listed above, 'Aggregate Bond.' Estimation results as described here, were run for all these investment strategies, against eight indices selected (see below).

For each one of the 200 strategies the following processes are run: (i) Rolling Regression to Benchmarks for 24-month period that starts at a certain date, (ii) Rolling Information Ratio for a 24-month period that begins at the same date, (iii) Regression of Information Ratio against benchmark coefficients from (i). The result shows the sensitivity of the information ratio of each strategy to the 'exposure' of the strategy returns to each of the eight benchmarks selected for the analysis. The portfolio manager thus is assumed to have generated risk-adjusted return (IR) through beta-exposure of strategy returns to varying indices.

Regressing Information Ratio (IR) against beta-exposures could give new coefficients, which measure the degree to which the portfolio manager generates

performance (IR) through such exposure to each index. This work may be performed in subsequent study. In this study, we decided to translate the magnitude of the beta coefficients into categories, so that decision trees using machine-learning methodologies can be constructed. Specifically, we constructed two such decision trees that would help an institutional investor decide to invest (buy or move funds into) or divest of (sell or move funds out of) the strategies that fell within certain ranges/categories of beta coefficients.

Step 3: Produce Results

Items (i), (ii) and (iii) in Step 2 above require standard regression estimation of the monthly returns of each strategy against the benchmark of each strategy. In this study, we tried to extract as much 'alpha' out of each strategy by regressing its returns against eight selected indices or benchmarks described below.

A. Rolling Regression to Benchmark: Twenty-four monthly returns of the first of the 154 investment strategies were regressed through linear regression against eight preselected benchmarks: In this example:

- Bloomberg Global Aggregate Bond (LEGATRUU)
- ICE BofA AAA US Corporate Index Total Return Index (BAMLCC0A1AAATRIV)
- ICE BofA AA US Corporate Index Total Return Index (BAMLCC0A2AATRIV)
- ICE BofA Single-A US Corporate Index Total Return Index (BAMLCC0A3ATRIV)
- ICE BofA BBB US Corporate Index Total Return Index (BAMLCC0A4BBBTRIV)
- 10 ICE BofA BB US High Yield Index Total Return Index (BAMLHYH0A1BBTRIV)
- ICE BofA Single-B US High Yield Index Total Return Index (BAMLHYH0A2BTRIV)
- ICE BofA CCC & Lower US High Yield Index Total Return Index (BAMLHYH0A3CMTRIV)

The coefficients of regression for this rolling sample become part of the data for further analysis. This model usually has a high F-test significance, but only a few t-statistics of the coefficients are significant, pointing to possible multicollinearity. To correct this issue, we plan in future studies to arrange the returns of the eight indices (benchmarks) into linear combinations through Principal Component Analysis (PCA). We can also separate clusters of return data through k-means clustering for variable reduction. Perhaps the number and size of beta coefficients could be estimated through maximum likelihood with a penalty function, such as the Akaike Information Criterion (AIC). At any rate, this is a forecasting model for which the beta coefficients to indices indicates the sensitivity of portfolio returns to different indices that lie across the credit curve, from AAA Corporate to CCC or High Yield. Given the name of the universe, Aggregate Bond, we would have expected the top

level of separation in the decision tree to be on the most conservative index in the group, that is, Bloomberg Global Aggregate Bond (the Agg). The results below will show that this was not the case at all. In a hypothetical example, beta - coefficients of the returns of the fixed income investment strategy XYZ - Core Plus, against the eight benchmarks are produced from rolling samples of 24 months each. Fifty-nine months of data were available for all 154 strategies in the Aggregate Bond Universe. These months produced estimates for 13 months for Information Ratio, given that the rolling sample of estimation was 24 months, and that the number of monthly observations for the Information Ratio (*IR*) was also twenty-four.

B. Rolling Information Ratio: Information ratio is defined here as measuring portfolio returns beyond the returns of the combined eight-index benchmark, divided by the volatility of same difference. That volatility is called tracking error. It is the standard deviation of portfolio returns beyond the benchmark. It captures the risk-adjusted ability of a portfolio manager to generate active returns above a benchmark. The monthly portfolio returns above the benchmark, often called 'active' returns, are calculated. That is the difference between the actual monthly return of the fund known, and the return of eight benchmarks, weighted by the beta-coefficients estimated in the step above. The assumption is that if the portfolio manager held the eight indices, in proportion of the beta-coefficients, then the manager would not have to engage in active management to exceed this weighted sum of the eight benchmarks. This thread of an issue cuts into the compensation scheme of a portfolio manager, in terms of being able to justify the manager's ability to generate above-index returns.

C. Regression of Information Ratio: The information ratio, based on which probability of information ratio is estimated, is a forecast. If for the current month, the forecast is based on the regression of the 24 months of IR against the current beta coefficients. If one month forward, the forecast is based on the regression of the 24 months of IR against the lagged beta coefficients. This part of the analysis is where time-series analytics can be applied (ARMA/ARIMA, GARCH, Regime-Switches, ANN, etc.). For the version supplied here, only three 'forward-looking' items (forecasts) are provided: current month (not a forecast per se), a six-month forecast, twelve-month forecast, and a twenty-three-month forecast. In the last step of this project, Report Generation, we ran the set of *IR* and beta coefficients as of a current month (the end of our period of data which was September 2023), and divided these numbers into five quintiles, like the five star-ratings that Morningstar assigned to these strategies. Then, we devised two decision trees, (i) the first one based on *IR* the (ii) second based on Morningstar's ratings. Then, we ran the Report for *IR* and beta coefficients again but for a two-year forecast of *IR* as described herein. We applied the decision-tree rules for (i) and (ii) and looked at average *IR* for each case. Pleasantly the decision tree based on (ii) Morningstar ratings produced an average two-year-forward *IR* that was greater than that of the tree based on (i) Information Ratio.

D. Use of Machine Learning Techniques: As is the case in other applications of machine learning methodologies, it is assumed here that the beta coefficients to indices and the Information Ratio (*IR*) have a simple logical structure, which is captured by a decision tree. The idea makes sense with one 'attribute' (that is, one

beta coefficient, plus *IR*) but here, we have eight of them plus *IR*. We make rules that test a single attribute and branch accordingly. Each branch corresponds to a different value of the attribute. We first select an attribute (one beta coefficient to an index) to place at the root node and make one branch for each possible value. This splits up the example set into subsets, one for every value of the attribute. Now the process can be repeated recursively for each branch, using only those instances that reach the branch. If at any time all instances at a node have the same classification, such as Invest or Not-Invest (in the investment strategy going through the tree) we stop developing that part of the tree (Witten et al. 2016). The concept of information-measure relates to the amount of information obtained by deciding. The measure relates to the amount of information obtained by making decisions, with properties: (i) when the number of either yeses or no's is zero, the information is zero, (ii) when the number of yeses and no's is equal, the information reaches a maximum, and (iii) the information should obey a multistage property. 'Entropy' satisfies all these properties, and it is used in the methodologies programmed in the software 'Weka' that we used to derive the decision trees below[4]. The original decision tree program called C4.5 and its successor C5.0 were devised by Ross Quinlan over a 20-year period beginning in the late 1970s (Quinlan 1993). J48 is the implementation of Quinlan's C4. 5 algorithm that can generate a trimmed decision tree. Information is split into smaller subsets based on standardized data gain obtained by dividing the data by an attribute. This process ends if each subset is equivalent to a class.

E. Possible Extensions for Future Research: Other techniques could be implemented in the data, for future research. In this version of the paper, the *IR* forecast was changed to a binary response variable, in the sense that advisors recommend strategies for which *IR* exceeds a threshold (recommend = 1). We could have used logistic regression to find the beta-exposures, of strategies that are recommended versus those that are not. This method would reveal what exactly it was, which made a strategy outperform in a group of others, within a period, in a repeatable, quantitative way. In contrast, the y – variable in binary form [recommend, do not recommend] could be inferred from actual ratings assigned by vendors such as Morningstar. Logistic Regression would then be based on [recommend, do not recommend] rating decisions arrived at through some form of qualitative, subjective analysis (which Morningstar data also provides). The coefficients of that ratings-based Logistic Regression (MLE, with possibilities of use of penalty functions), would then be compared to the coefficients of Probability of Outperformance if *IR* was changed to a probability measure within the set of strategies that were examined. We could then argue as to where the qualitative analysis went wrong.

"Discriminant" analysis could also be used to produce a score, in either of the two cases or both. The researcher could then compare differences between the weights of the separating hyperplane between the two cases. Perhaps the Probability of Outperformance is associated with the coefficients of strategy returns to benchmarks, through a non-linear relationship that has as part of it, a regime-switching, hyperbolic tangent function in it. Regularly, the non-linear portion of such an equation captures 'tactical' elements of strategic investment, such as forerunning a decision on rates by the Fed. The other, the linear part of the equation

[4]https://www.cs.waikato.ac.nz/ml/weka/.

would then be the 'strategic' part of the strategy, mandated by the client or advertised as such by the investment manager firm. Is a strategy that claims to be mainly tactical good at it? What portion of the investment management do ratings assigned by professionals at Morningstar and elsewhere depict? Do funds with a higher tactical (i.e., nonlinear) element as revealed here, correspond to a higher value of the discriminant analysis on ratings assigned? Does analysis change across universes, times, or domiciles? Does the name of the analyst constitute a better forecast of outperformance (good strategies, given to seasoned raters)? These possibilities will be examined in future versions of this research effort.

Table 1. *Portion of Current Report of Information Ratio against Beta Coefficients*

Moment 1. Strategy beta Coefficient to Index, Average Over Time Measure 1. Information Ratio in Universe Forecast 0 Mo Fwd Forecast 1. Forecast of Information Ratio for Curr Mo		Global Aggregate Bond (LEGATRUU)	AAA US Corporate Index Total Return Index	AA US Corporate Index Total Return Index	BofA Single-A US Corporate Index Total	BBB US Corporate Index Total Return	BofA BB US High Yield Index Total Return	BofA Single-B US High Yield Index Total	CCC & Lower US High Yield Index Total	24 Monthly Returns From 11/30/2018 To 4/30/2023	
Portfolios that are 'Aggregate Bond'	alpha	1 Bloomberg	11 ICE BofA	15 ICE BofA	20 ICE Bo	8 ICE BofA	10 ICE Bo	12 ICE Bo	5 ICE BofA	Curr Mo	Rank
Pioneer Multi-Asset Ultrashort Income Fund - K (MAUKX	0.001	-0.045	-0.143	-0.262	0.400	0.247	-0.345	0.219	0.087	0.789	1
Pioneer Multi-Asset Ultrashort Income Fund - A (MAFRX	0.001	-0.021	-0.192	-0.257	0.496	0.208	-0.384	0.258	0.080	0.701	2
Pioneer Multi-Asset Ultrashort Income Fund - C2 (MAUC	0.000	-0.026	-0.158	-0.262	0.418	0.232	-0.355	0.224	0.088	0.609	3
BBH Limited Duration Fund - I (BBBIX)	0.001	-0.014	-0.292	0.141	0.134	0.257	-0.147	0.098	0.042	0.604	4
Pioneer Multi-Asset Ultrashort Income Fund - C (MCFRX)	0.000	-0.032	-0.211	-0.164	0.426	0.206	-0.372	0.234	0.091	0.596	5
BBH Limited Duration Fund - N (BBBMX)	0.001	-0.004	-0.263	0.190	-0.024	0.311	-0.087	0.025	0.051	0.592	6
Delaware Diversified Floating Rate Fund - Institutional (D	0.002	-0.117	-0.562	0.636	0.132	0.128	-0.408	0.550	0.150	0.542	7
Delaware Diversified Floating Rate Fund - A (DDFAX)	0.002	-0.115	-0.579	0.631	0.189	0.102	-0.410	0.548	0.152	0.523	8
Delaware Diversified Floating Rate Fund - R (DDFFX)	0.002	-0.116	-0.543	0.514	0.201	0.175	-0.408	0.535	0.153	0.456	9
Delaware Diversified Floating Rate Fund - C (DDFCX)	0.001	-0.119	-0.591	0.747	0.050	0.143	-0.411	0.543	0.150	0.437	10
Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.002	-0.311	-0.689	0.495	0.708	0.113	-0.619	0.745	0.155	0.393	11
Credit Suisse Strategic Income Fund - I (CSOIX)	0.002	-0.040	-0.298	-0.101	0.485	0.203	-0.354	0.546	0.257	0.377	12
Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.002	-0.324	-0.663	0.466	0.663	0.160	-0.614	0.738	0.149	0.377	13
Credit Suisse Strategic Income Fund - A (CSOAX)	0.002	-0.059	-0.261	-0.093	0.349	0.293	-0.333	0.513	0.257	0.353	14
CM Advisors Fixed Income Fund (CMFIX)	0.000	-0.166	-0.542	0.876	1.091	-1.171	-0.032	0.007	0.183	0.333	15
Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.002	-0.327	-0.691	0.425	0.808	0.096	-0.639	0.775	0.146	0.328	16
Lord Abbett Inflation Focused Fund - F (LIFFX)	0.003	0.435	-1.067	1.849	-1.749	0.685	0.253	0.101	0.004	0.309	17
Lord Abbett Inflation Focused Fund - R3 (LIFRX)	0.003	0.438	-1.080	1.930	-1.799	0.670	0.273	0.071	0.013	0.300	18
Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.001	-0.295	-0.641	0.402	0.680	0.169	-0.646	0.781	0.137	0.297	19
Lord Abbett Inflation Focused Fund - A (LIFAX)	0.003	0.442	-1.019	1.769	-1.779	0.730	0.255	0.095	0.003	0.296	20
Lord Abbett Inflation Focused Fund - R2 (LIFQX)	0.003	0.456	-1.063	1.830	-1.767	0.696	0.292	0.047	0.018	0.269	21
Lord Abbett Inflation Focused Fund - C (LIFCX)	0.003	0.442	-1.089	1.965	-1.875	0.715	0.237	0.108	-0.001	0.253	22
Ave Maria Bond Fund - R (AVEFX)	0.002	-0.056	-0.314	1.297	-1.277	0.312	0.618	-0.111	-0.096	0.240	23
Managers Bond Fund - Institutional (MGBIX)	0.002	0.562	-1.138	0.820	4.388	-3.088	-0.064	-0.258	0.510	0.236	24
Managers Bond Fund - Service (MGFIX)	0.002	0.565	-1.150	0.842	4.368	-3.085	-0.060	-0.266	0.512	0.225	25
Credit Suisse Strategic Income Fund - C (CSOCX)	0.001	-0.053	-0.269	-0.091	0.353	0.293	-0.328	0.505	0.262	0.194	26
AllianceBernstein Taxable Multi-Sector Income Shares (C	0.001	0.073	-0.405	0.407	0.000	0.244	-0.075	0.017	-0.026	0.059	27
Loomis Sayles Global Bond Fund - N (Trust II) (LSGNX)	0.000	0.591	-1.624	1.838	2.049	-1.611	-0.019	-0.100	0.217	-0.074	28
Loomis Sayles Global Bond Fund - Institutio (LSGBX)	0.000	0.600	-1.593	1.785	2.035	-1.591	-0.027	-0.084	0.213	-0.079	29
Loomis Sayles Fixed Income Fund - Institutio (LSFIX)	0.000	-0.684	-1.434	1.907	2.489	-1.701	0.309	-0.395	0.567	-0.103	30
DoubleLine Flexible Income Fund - I (DFLEX)	0.001	0.062	-0.546	0.382	0.330	0.378	-0.652	0.423	0.242	-0.113	31
John Hancock Income Fund - R5 (JSNVX)	0.000	0.353	0.082	-0.180	-0.092	0.216	0.276	0.092	0.000	-0.114	32
MFS Bond Fund - R5 (MFBKX)	0.000	-0.043	-0.537	0.613	1.449	-0.381	-0.037	0.061	0.063	-0.120	33
John Hancock Income Fund - R6 (JSNWX)	0.000	0.308	0.125	-0.336	0.195	0.084	0.277	0.097	0.011	-0.121	34
MFS Bond Fund - I (MBDIX)	0.000	-0.043	-0.521	0.589	1.437	-0.365	-0.035	0.053	0.064	-0.126	35
MFS Bond Fund - R4 (MFBJX)	0.000	-0.053	-0.529	0.607	1.446	-0.372	-0.037	0.058	0.064	-0.135	36
Pimco Unconstrained Tax Managed Bond Fund - A (ATM/	0.001	0.158	-0.442	0.225	0.274	0.139	-0.043	0.079	0.002	-0.137	37
Loomis Sayles Investment Grade Bond Fund - Institutio (	0.000	-0.217	-1.549	2.225	1.576	-1.327	0.280	-0.226	0.305	-0.160	38
John Hancock Income Fund - INSTITUTIO (JSTIX)	0.000	0.319	0.108	-0.269	0.059	0.149	0.295	0.073	0.009	-0.161	39
MFS Bond Fund - A (MFBFX)	0.000	-0.064	-0.570	0.659	1.483	-0.401	-0.061	0.096	0.056	-0.161	40
MFS Bond Fund - R3 (MFBHX)	0.000	-0.070	-0.563	0.640	1.499	-0.400	-0.065	0.099	0.058	-0.161	41
Madison High Quality Bond Fund - Y (MIIBX)	0.001	0.205	-0.668	1.197	0.105	-0.308	0.027	-0.017	-0.067	-0.164	42
MFS Bond Fund - R2 (MBRRX)	0.000	-0.040	-0.550	0.625	1.474	-0.400	-0.055	0.088	0.057	-0.180	43
BlackRock Strategic Income Opportunities Portfolio - Inst	0.001	-0.005	-0.431	0.198	0.818	-0.175	-0.103	0.130	0.138	-0.181	44
MFS Strategic Income Fund - I (MFIIX)	0.001	0.120	-0.197	0.256	0.886	-0.208	-0.209	0.159	0.107	-0.187	45
John Hancock Income Fund - R4 (JSNFX)	0.000	0.331	0.084	-0.346	0.144	0.176	0.219	0.164	-0.020	-0.216	46
MFS Bond Fund - B (MFBBX)	-0.001	-0.054	-0.559	0.671	1.464	-0.410	-0.062	0.080	0.067	-0.217	47
BlackRock Strategic Income Opportunities Portfolio - Inv	0.000	-0.008	-0.400	0.115	0.852	-0.151	-0.081	0.085	0.150	-0.226	48
MFS Bond Fund - R1 (MFBGX)	-0.001	-0.046	-0.531	0.601	1.465	-0.388	-0.048	0.072	0.062	-0.228	49
MFS Bond Fund - C (MFBCX)	-0.001	-0.054	-0.580	0.692	1.443	-0.394	-0.048	0.082	0.055	-0.231	50
John Hancock Income Fund - R2 (JSNSX)	0.000	0.342	0.164	-0.444	0.172	0.129	0.236	0.133	0.008	-0.232	51
BlackRock Bond Allocation Target S Shares Portfolio - S (	0.000	0.007	-0.557	0.347	0.329	0.302	-0.120	0.096	-0.024	-0.256	52
MassMutual Premier Core Bond Fund - S (MCBDX)	0.000	-0.662	-1.325	1.383	3.410	-1.825	-0.331	-0.016	0.355	-0.257	53
MFS Strategic Income Fund - A (MFIOX)	0.000	0.136	-0.200	0.259	0.876	-0.219	-0.141	0.106	0.116	-0.258	54
Pimco Unconstrained Tax Managed Bond Fund - C (ATM(	0.000	0.165	-0.436	0.252	0.246	0.122	-0.037	0.069	0.007	-0.267	55
MassMutual Premier Core Bond Fund - Y (MCBYX)	0.000	-0.650	-1.302	1.342	3.383	-1.799	-0.308	-0.025	0.355	-0.271	56
MassMutual Premier Core Bond Fund - R4 (MCZRX)	0.000	-0.606	-1.277	1.366	3.169	-1.682	-0.265	-0.069	0.345	-0.294	57
BlackRock Bond Allocation Target C Shares Portfolio - C (	0.000	-0.323	-0.563	0.697	1.751	-0.640	0.232	-0.276	0.158	-0.306	58
MassMutual Premier Core Bond Fund - A (MMCBX)	0.000	-0.603	-1.247	1.356	3.095	-1.645	-0.276	-0.040	0.336	-0.306	59
Delaware Core Plus Bond Fund - A (DEGGX)	0.001	0.155	-0.175	-0.467	0.322	0.747	-0.231	0.417	0.088	-0.335	60
BlackRock Strategic Income Opportunities Portfolio - Inv	0.000	-0.003	-0.455	0.197	0.896	-0.219	-0.096	0.123	0.141	-0.336	61

Quintiles of Outperformance versus Signs of Beta Coefficients

Under Step 3: Produce Results, above, we list items: A. Rolling Regression to Benchmark, B. Rolling Information Ratio, and C. Regression of Information Ratio. The result of these processes is Table 1.

Item D. Use of Machine Learning Techniques in our study involves connecting through a decision tree process, programmed through the J48 algorithm in Weka, the Information Ratio (*IR*) estimates in the second column from the right in Table 1, with the eight beta-coefficient columns to the right of. Thus, the first question we are answering is, where would an investment strategy fall in the ranked *IR* that is estimated contemporaneously with the estimation of beta coefficients, if the strategy had a set of beta coefficients/signs portrayed in Table 1? To make the decision tree easier to follow, we restated the *IR* numbers into quintiles by dividing the strategies ranked through *IR* into fifths. Common industry practice dictates the splitting of performance measures such as *IR* into quartiles instead of quadrants. However, a reason we selected quintiles is that Morningstar ratings are from one star to five stars, so in essence, these ratings split a universe of investment strategies into fifths (quintiles) as well. The second question we are addressing is, where would an investment strategy fall in such rating by Morningstar, based on the same beta coefficients/signs in Table 1. Thus, in this phase of the analysis, we create two decision trees, in which the attributes are the beta coefficients of investment strategies to the eight indices selected as the benchmarks, In the first tree, classification (the y-variable) entails the quintile into which a strategy would fall, given its estimated Information Ratio (*IR*) as shown in the second from the right column in Table 1. In the second tree, classification of the strategies entails the rating that analysts performing due diligence at Morningstar would undergo. A reasonable expectation may be that the levels of attributes based on which the second three splits (Figure 2), would be like the levels of attributes of the first one that is based on the relative performance of investment portfolio strategies (Figure 1). Some formal measure of the difference in the two decision trees has not been proposed, but the differences are obvious:

1. If the institutional investor did not rely on the recommendations of the consultant (Morningstar, in this case), the first characteristic of interest they would look at, would be the sign of the beta coefficient, that is the exposure of a strategy to triple-B corporate debt, which is not default-level (CCC) but is not investment grade either (AAA), as shown in the top spit of Figure 1 below. If that BBB beta exposure of a strategy is positive, then the investor not relying on ratings would jump the BB rating and look at the B rating. If that was positive, and the beta exposure to the Bloomberg Aggregate was positive, but that to A was negative, then only, the strategy would rank in the top quintile of Information Ratio (*IR*) based on outperformance.
2. Notice how much more risk is entailed in the investment recommendations implied by ratings, which may or may not result in future outperformance (we examine that aspect next). Figure 2 implies that if the institutional investor relied on recommendations by a consultant/advisor, developed

through due diligence, then the first characteristic of interest would have been the exposure of a strategy to the highest credit rating that is possible, that is AAA. Notably, if that AAA exposure was positive, that is if the strategy invested in safe, AAA-rated corporate bonds, the strategy would be recommended to fall in the fourth quintile, end of story (a similar requirement is not implied by quintile classification based on just relative performance).

Figure 1. *Classification of Strategies into Quintiles of Outperformance Based on Sign of Beta Coefficients*

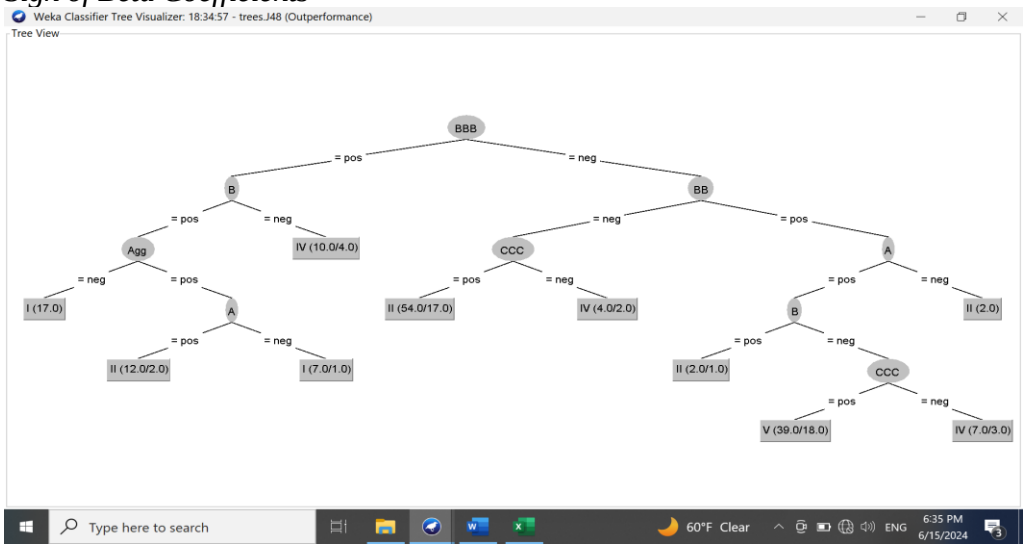
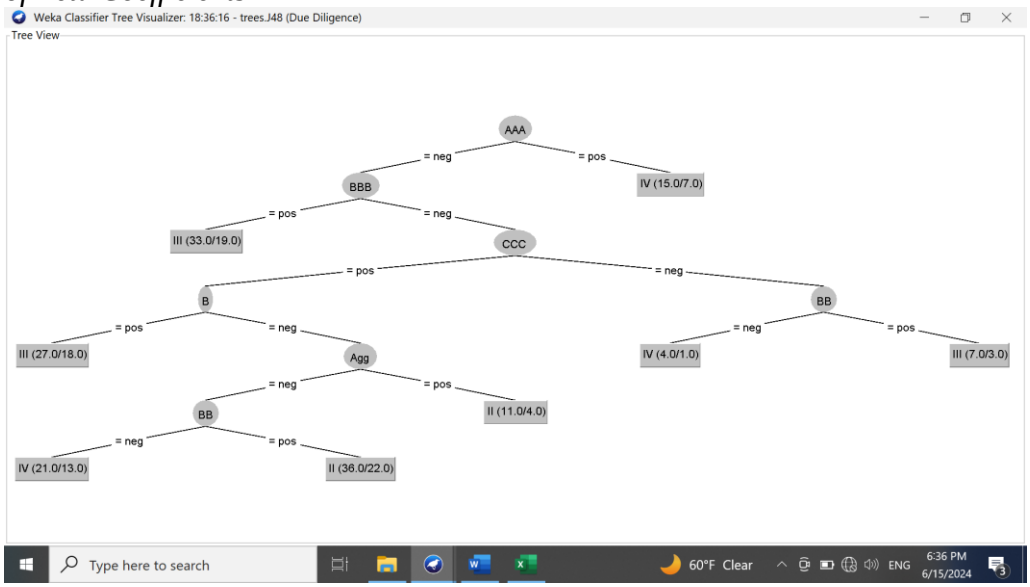


Figure 2. *Classification of Strategies into Quintiles of Due Diligence based on Sign of Beta Coefficients*



3. Based on the Morningstar ratings, as they categorize strategies according to beta coefficient attributes, a five-star strategy would never have been recommended, even though Morningstar due diligence assigns such a star rating to several rated strategies. That makes no sense. Based on the attributes, none of the strategies going down the tree would even be classified as five-star, even though some are rated as such. The highest classification, implying recommendation for investment based on star ratings, would have been the second quintile. To get there a strategy would be negative on AAA, negative on BBB in contradiction to Figure 1, positive on CCC which is risky, negative on B which is contradictive, and either positive on the Agg; or if negative on the Agg, positive on BB (contradicting the outperformance tree in Figure 1). We generally conclude that the rules of influencing institutional investors as to where to allocate retiree funds, implied by Morningstar ratings, generally contradict the rules that would have influenced investors to do the same, based purely on relative outperformance. Are the ratings 'forward-looking' relative to the past? The reader will generally notice that investment recommendations based on Quintiles of Outperformance (Figure 1), which by the way is more 'real' as it depends on actual active management, split at the BBB rating, which is the middle of the credit curve. This makes more sense. In terms of a credit barbell, the typical strategy of a portfolio manager who is 'long' the AAA and CCC credits, and 'short' long the middle of the curve. Decisions based on due diligence, on the other hand (Figure 2) solely start on 'long' positions on only one end of the curve, that is, AAA – too simplistic.

Performance of Buy-Sell Recommendations Based on Signs of Beta Coefficients

Recommendations for the allocation of retiree funds into investment strategies should differ when based on actual past outperformance, versus when based on five-star ratings assigned by due diligence analysts at Morningstar. But which ones result in the most substantial benefit to the investor/retiree, plan sponsor of a pension plan, and manager of an endowment or foundation? If either or both trees depicted in figures one or two above were forward looking, then the investment decisions undertaken today would result in a higher or lower risk-adjusted performance (Information Ratio, *IR*) in the future. We did the following:

a. Keep attribute classes as positive beta or negative beta, but change the dependent classification variable from quintiles and five-star rating categories to binary buy/sell recommendations
b. Create the report as in Table 1 again, but in the second column from the left, have forecasted information ratio 23 months (two years) into the future (see Table 2).
c. Develop a buy/sell tree of outperformance and a buy/sell tree of recommendations. Go through each tree across all 154 strategies in the sample. Take the average *IR* for buys, for each tree.

Table 2. *Portion of Forward-Looking Report of Information Ratio against Beta Coefficients*

Moment 1. Strategy beta Coefficient to Index, Average Over Time Measure 1. Information Ratio in Universe Forecast 3 Mo Fwd Forecast 4. Forecast of Information Ratio for 23 Mo(s) Fwd		Global Aggregate Bond (LEGATRUU)	AAA US Corporate Index Total Return Index	AA US Corporate Index Total Return Index	BofA Single-A US Corporate Index Total	BBB US Corporate Index Total Return	BofA BB US High Yield Index Total Return	BofA Single-B US High Yield Index Total	CCC & Lower US High Yield Index Total	24 Monthly Returns From 11/30/2018 To 4/30/2023	
Portfolios that are 'Aggregate Bond'	alpha	1 Bloomber	11 ICE BofA	15 ICE BofA	20 ICE Bo	8 ICE BofA	10 ICE Bo	12 ICE Bo	5 ICE BofA	23 Mo(s)	Rank
# BlackRock Bond Index Fund - Institutional (BMOIX)	0.000	0.136	-0.093	0.612	0.303	-0.209	0.015	-0.052	-0.019	20.242	1
# BlackRock Bond Allocation Target M Shares Portfolio - M	0.001	0.180	-0.564	0.891	0.356	-0.239	-0.010	0.075	-0.100	15.483	2
# BlackRock Bond Index Fund - Investor A (BMOAX)	0.000	0.119	-0.115	0.606	0.382	-0.242	0.022	-0.069	-0.009	7.686	3
# Delaware Diversified Floating Rate Fund - A (DDFAX)	0.002	-0.115	-0.579	0.631	0.189	0.102	-0.410	0.548	0.152	6.973	4
6 American Century Core Plus Fund - Institutional (ACCUX)	0.001	0.204	-0.351	0.861	0.233	-0.107	-0.225	0.140	0.050	6.612	5
# Principal Government and High Quality Bond Fund - A (C	0.000	0.250	-0.555	0.803	0.529	-0.388	-0.171	0.262	-0.128	5.739	6
# Delaware Diversified Floating Rate Fund - Institutional (D	0.002	-0.117	-0.562	0.636	0.132	0.128	-0.408	0.550	0.150	5.677	7
8 American Century Core Plus Fund - R (ACCPX)	0.000	0.174	-0.364	0.878	0.298	-0.146	-0.201	0.100	0.068	4.507	8
7 American Century Core Plus Fund - Investor (ACCNX)	0.001	0.175	-0.366	0.884	0.294	-0.148	-0.201	0.099	0.069	4.119	9
5 American Century Core Plus Fund - C (ACCKX)	0.000	0.173	-0.366	0.874	0.292	-0.134	-0.195	0.098	0.064	3.650	10
# Credit Suisse Strategic Income Fund - I (CSOIX)	0.002	-0.040	-0.298	-0.101	0.485	0.203	-0.354	0.546	0.257	3.460	11
# Pioneer Multi-Asset Ultrashort Income Fund - C (MCFRX)	0.000	-0.032	-0.211	-0.164	0.426	0.206	-0.372	0.234	0.091	2.708	12
# BTS Tactical Fixed Income Fund - I (BTFIX)	-0.003	0.052	-0.011	-0.272	0.821	-0.433	0.342	0.038	0.057	2.620	13
# Calvert Income Fund - I (CINCX)	0.000	-0.014	0.255	-0.540	0.446	0.607	-0.012	-0.119	0.215	2.580	14
# Credit Suisse Strategic Income Fund - A (CSOAX)	0.002	-0.059	-0.261	-0.093	0.349	0.293	-0.333	0.513	0.257	2.497	15
# Managers AMG GW&K Fixed Income Fund - Investor (MF	0.000	0.147	-0.167	0.490	0.276	-0.006	0.119	-0.022	-0.029	2.492	16
# Credit Suisse Strategic Income Fund - C (CSOCX)	0.001	-0.053	-0.269	-0.091	0.353	0.293	-0.328	0.505	0.262	2.358	17
# Calvert Income Fund - A (CFICX)	0.000	-0.019	0.247	-0.539	0.457	0.604	-0.002	-0.128	0.220	2.264	18
# Dreyfus Bond Market Index Fund - BASIC (DBIRX)	0.000	0.124	-0.207	0.718	0.530	-0.406	-0.066	-0.005	0.009	2.223	19
# BlackRock Strategic Income Opportunities Portfolio - Inst	0.001	-0.005	-0.431	0.198	0.818	-0.175	-0.103	0.130	0.138	1.952	20
# CM Advisors Fixed Income Fund (CMFIX)	0.000	-0.166	-0.542	0.876	1.091	-1.171	-0.032	0.007	0.183	1.950	21
# Pioneer Multi-Asset Ultrashort Income Fund - C2 (MAUC	0.000	-0.026	-0.158	-0.262	0.418	0.232	-0.355	0.224	0.088	1.934	22
4 American Century Core Plus Fund - A (ACCQX)	0.000	0.175	-0.343	0.784	0.369	-0.147	-0.214	0.122	0.059	1.901	23
# BlackRock Strategic Income Opportunities Portfolio - Inv	0.000	-0.008	-0.400	0.115	0.852	-0.151	-0.081	0.085	0.150	1.810	24
# Pimco Unconstrained Tax Managed Bond Fund - C (ATM	0.000	0.165	-0.436	0.252	0.246	0.122	-0.037	0.069	0.007	1.760	25
# Lord Abbett Inflation Focused Fund - R3 (LIFRX)	0.003	0.438	-1.080	1.930	-1.799	0.670	0.273	0.071	0.013	1.728	26
# Lord Abbett Inflation Focused Fund - F (LIFFX)	0.003	0.435	-1.067	1.849	-1.749	0.685	0.253	0.101	0.004	1.714	27
# Managers Bond Fund - Institutional (MGBIX)	0.002	0.562	-1.138	0.820	4.388	-3.088	-0.064	-0.258	0.510	1.703	28
# Managers Bond Fund - Service (MGFIX)	0.002	0.565	-1.150	0.842	4.368	-3.085	-0.060	-0.266	0.512	1.696	29
# Lord Abbett Inflation Focused Fund - A (LIFAX)	0.003	0.442	-1.019	1.769	-1.779	0.730	0.255	0.095	0.003	1.681	30
# Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.002	-0.311	-0.689	0.495	0.708	0.113	-0.619	0.745	0.155	1.593	31
# BBH Limited Duration Fund - N (BBBMX)	0.001	-0.004	-0.263	0.190	-0.024	0.311	-0.087	0.025	0.051	1.557	32
# Calvert Income Fund - C (CIFCX)	-0.001	-0.014	0.243	-0.504	0.412	0.620	-0.008	-0.119	0.213	1.308	33
# Pimco Unconstrained Tax Managed Bond Fund - A (ATM	0.001	0.158	-0.442	0.225	0.274	0.139	-0.043	0.079	0.002	1.245	34
# Lord Abbett Inflation Focused Fund - C (LIFCX)	0.003	0.442	-1.089	1.965	-1.875	0.715	0.237	0.108	-0.001	1.181	35
# Pioneer Multi-Asset Ultrashort Income Fund - K (MAUKX	0.001	-0.045	-0.143	-0.262	0.400	0.247	-0.345	0.219	0.087	1.179	36
# BlackRock Strategic Income Opportunities Portfolio - Inv	0.000	-0.003	-0.455	0.197	0.896	-0.219	-0.096	0.123	0.141	1.161	37
# Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.002	-0.327	-0.691	0.425	0.808	0.096	-0.639	0.775	0.146	1.084	38
# Lord Abbett Inflation Focused Fund - R2 (LIFQX)	0.003	0.456	-1.063	1.830	-1.767	0.696	0.292	0.047	0.018	1.080	39
# Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.002	-0.324	-0.663	0.466	0.663	0.160	-0.614	0.738	0.149	0.998	40
# Managers AMG GW&K Fixed Income Fund - Institutional	0.000	0.135	-0.163	0.410	0.444	-0.078	0.107	-0.011	-0.020	0.936	41
# DoubleLine Flexible Income Fund - I (DFLEX)	0.001	0.062	-0.546	0.382	0.330	0.378	-0.652	0.423	0.242	0.882	42
# Pioneer Multi-Asset Ultrashort Income Fund - A (MAFRX	0.001	-0.021	-0.192	-0.257	0.496	0.208	-0.384	0.258	0.080	0.818	43
# John Hancock Income Fund - INSTITUTIO (JSTIX)	0.000	0.319	0.108	-0.269	0.059	0.149	0.295	0.073	0.009	0.760	44
# John Hancock Income Fund - R4 (JSNFX)	0.000	0.331	0.084	-0.346	0.144	0.176	0.219	0.164	-0.020	0.758	45
# BBH Limited Duration Fund - I (BBBIX)	0.001	-0.014	-0.292	0.141	0.134	0.257	-0.147	0.098	0.042	0.691	46
# Dreyfus/Laurel Funds Inc - Dreyfus Floating Rate Income	0.001	-0.295	-0.641	0.402	0.680	0.169	-0.646	0.781	0.137	0.664	47
3 AllianceBernstein Taxable Multi-Sector Income Shares (C	0.001	0.073	-0.405	0.407	0.000	0.244	-0.075	0.017	-0.026	0.481	48
# John Hancock Income Fund - R2 (JSNSX)	0.000	0.342	0.164	-0.444	0.172	0.129	0.236	0.133	0.008	0.445	49
# Loomis Sayles Global Bond Fund - Institutio (LSGBX)	0.000	0.600	-1.593	1.785	2.035	-1.591	-0.027	-0.084	0.213	0.432	50
# Dreyfus Bond Market Index Fund - Investor (DBMIX)	0.000	0.107	-0.194	0.612	0.663	-0.427	-0.090	0.022	0.004	0.398	51
# Loomis Sayles Global Bond Fund - N (Trust II) (LSGNX)	0.000	0.591	-1.624	1.838	2.049	-1.611	-0.019	-0.100	0.217	0.372	52
# Dunham Corporate/Government Bond Fund - C (DCCGX)	0.000	0.118	-0.201	0.545	0.306	-0.040	-0.127	0.042	0.090	0.371	53
# John Hancock Income Fund - R5 (JSNVX)	0.000	0.353	0.082	-0.180	-0.092	0.216	0.276	0.092	0.000	0.334	54
# John Hancock Income Fund - C (JSTCX)	-0.001	0.344	0.068	-0.260	0.109	0.128	0.274	0.091	0.007	0.230	55
# Madison High Quality Bond Fund - Y (MIIBX)	0.001	0.205	-0.668	1.197	0.105	-0.308	0.027	-0.017	-0.067	0.129	56
# Commerce Bond Fund (CFBNX)	0.000	0.120	-0.385	0.815	0.390	-0.067	-0.176	-0.004	0.083	0.112	57
# Loomis Sayles Fixed Income Fund - Institutio (LSFIX)	0.000	-0.684	-1.434	1.907	2.489	-1.701	0.309	-0.395	0.567	0.084	58
# Thrivent Income Fund - I (LBIIX)	0.000	-0.316	-0.609	0.496	1.949	-0.601	0.144	-0.131	0.170	0.070	59
# Delaware Core Plus Bond Fund - A (DEGGX)	0.001	0.155	-0.175	-0.467	0.322	0.747	-0.231	0.417	0.088	-0.041	60
# Brandes Institutional Core Plus Fixed Income Fund - S (B	0.000	0.127	-0.090	0.658	-0.053	-0.218	0.326	-0.235	0.036	-0.070	61

Under Step 3: Produce Results, above, we list items: A. Rolling Regression to Benchmark, B. Rolling Information Ratio, and C. Regression of Information Ratio. The result is Table 1. The third question we are answering is, where would an investment strategy fall in a buy/sell recommendation (not quintile) that is estimated contemporaneously with the estimation of beta coefficients, if the strategy had a set of beta coefficients (and their signs) portrayed in Table 1, above? We restated the *IR* numbers into a buy (sell/do not buy) recommendation if the sign of *IR* in Table 1 was positive (negative). The fourth question is, where would an investment

strategy fall in such rating by Morningstar (not quintile), based on the same beta coefficients found in Table 1. Thus, we create two new decision trees, in which the attributes are the beta coefficients of investment strategies to the eight indices selected as the benchmarks. In the first tree, classification (the y-variable) entails the buy/sell recommendation into which a strategy would fall, given its estimated Information Ratio (*IR*) as shown in the second from the right column in Table 1. In the second tree, classification of the strategies entails the rating that analysts performing due diligence at Morningstar would undergo. A reasonable expectation may be that the levels of attributes based on which the second three splits (Figure 4), would be like the levels of attributes of the first one that is based on the relative performance of investment portfolio strategies (Figure 3). Some formal measure of the difference in the two decision trees has not been proposed, but the differences are shown in Table 2.

Figure 3. *Classification of Strategies into Buy/Sell Outperformance Based on the Sign of Beta Coefficients*

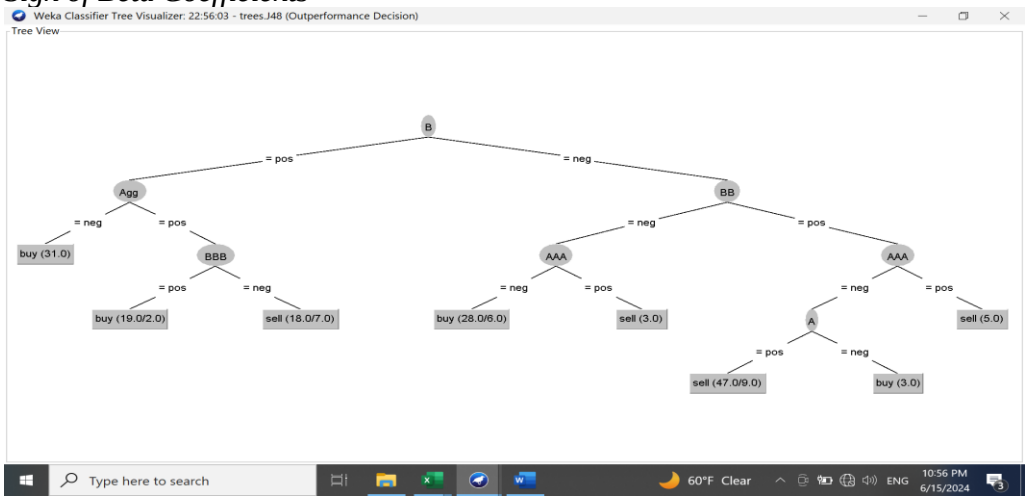
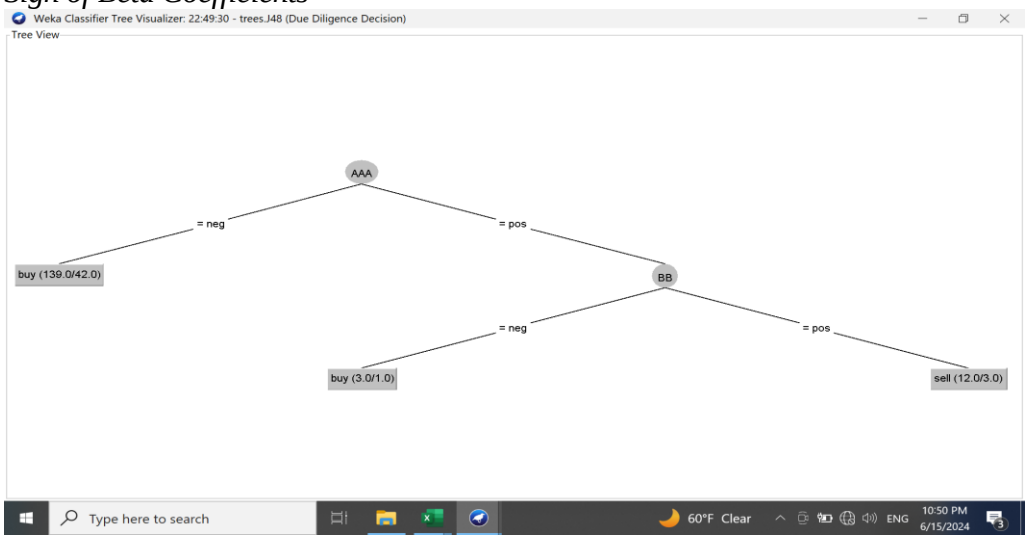


Figure 4. *Classification of Strategies into Buy/Sell Recommendation Based on the Sign of Beta Coefficients*



1. Based on simple outperformance, a buy/sell recommendation decision tree would depend on the B-rating of the investment strategy considered by an institutional investor (Figure 3). In contrast, based on Morningstar ratings, a similar recommendation and investment decision would depend on, again, whether the beta coefficient to AAA credit debt was negative. If it was, a simple rule would dictate to buy or invest in the respective strategy. Otherwise, if positive to AAA, ratings would dictate that a strategy is negative to BB (implying a credit rating barbell) to be invested in.
2. A positive BBB, a negative AAA, and a negative A would result in a 'buy' or allocate funds into, based on outperformance in Figure 3. Notice how exposure to BBB implies a credit barbell that is like Figure 4, implied by the ratings (the investor should buy a strategy that has BBB credit rating exposure, and does not have the bar-belled AAA and BB exposure). The expectation here is that BBB credit is underpriced and will appreciate, while the neighboring on each side AAA and BB credits are overpriced and will go down, causing reduced or negative returns.
3. The classification of strategies into buy and not buy/sell is captured by a much simpler decision tree on Figure 4 based on Morningstar ratings, than it is based on actual past *IR* performance on Figure 3. Average forward-looking *IR* for outperformance (ratings) was -0.57 (-0.25).

Again, we see in Figures 3 and 4 that ratings are not particularly or accurately 'forward-looking' relative to the past. In fact, they appear narrowly focusing on whether a portfolio has AAA credits and penalize recommending such portfolios if such credit sensitivity is high (Figure 4). That is not realistic, since corporate credit portfolio managers often structure credit exposure in a 'barbell' manner. Thus again, investment recommendations based on Quintiles of Outperformance (Figure 3), which are more 'real' as they depend on actual active management, split at for the first time at the single-B rating, which is the middle of the credit curve. This again makes more sense, compared to the AAA split found through due diligence. In terms of a credit barbell, the typical strategy of a portfolio manager who is 'long' the AAA and CCC credits, and 'short' long the middle of the curve. Decisions based on due diligence, on the other hand (Figure 4) solely penalize 'long' positions on one end of the curve, that is, AAA. Consultants only look to see if the portfolio holds AAA, or safe investments. If the portfolio manager has great sensitivity to best credits, the consultant merely rates the strategy lower. This is counterintuitive.

Conclusion

We examined investment advising manifested in the form of recommendations of portfolio strategies offered by consulting firms (Morningstar) to their institutional clients given that U.S. regulatory bodies are interested in the issue of "pay-to-play," referring to an adviser's encouraging portfolio managers to offer a monetary benefit, in exchange for the former's rating the latter's investment strategies favorably. We

found that there may be less cause for concern, since the buy recommendations to institutional investors based on ratings resulted in better risk-adjusted relative performance (*IR*) than the ones implied by outperformance itself. Thus, the issue of pay-to-play may not manifest through the ratings. Institutional investors who have the choice of either examining past performance or relying on ratings have fiduciary responsibility that transfers to consultant/advisors, resulting in distortions such as making decisions based on AAA ratings, as opposed to a credit barbell. There are ways to tell if consultant ratings make sense, such as a respective decision three that 'learns' how said investor would have behaved. Based on the sample and time frame of this analysis, it is not surmised that Morningstar ratings are affected by "pay-to-play," or that the ultimate interests of retirees, whose wealth is invested either by previous-outperforming or due diligence/ratings are impacted negatively by relying on advisor ratings. However, recommendations based on Quintiles of Outperformance are still more realistic than those based on due diligence and ratings.

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