Valuation-Indifferent Weighting for Bonds[1]

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ABSTRACT

In historical testing, valuation-indifferent weighting as applied to U.S. and global equities has produced statistically significant and economically large outperformance when compared with traditional capitalization-weighted benchmarks. In this paper, we apply the method to U.S. investment-grade corporate bonds, U.S. high-yield bonds, and hard-currency emerging market bonds. We find that fixed-income portfolios constructed using valuation-indifferent weighting outperform the corresponding cap-weighted benchmarks.

We also find that the outperformance is higher for markets in which we might typically expect more inefficiencies and greater volatilities. Both findings are consistent with the empirical evidence found in the equity applications of valuation-indifferent weighting, as well as the proposed noise-in-price theoretical rationale for these results.

Valuation-indifferent weighting has gained significant interest as a strategy for creating alternative indexes or quasi-indexes. The weighting scheme has empirical support from Arnott, Hsu, and Moore [2005] and many subsequent papers extending their approach. It also has theoretical support from models based on the classic noise-in-price framework. In this paper, we extend this body of research by applying the valuation-indifferent weighting approach to a new asset class.

Noise-in-Price Framework

The noise-in-price framework has been used to examine a variety of equity market anomalies[2]. Blume and Stambaugh [1983] and Roll [1983] use bid–ask bounce to motivate a rational noise-in-price model for high frequency stock price dynamics. They conclude that the microstructure effect could explain about 50 percent of the documented size premium. The pricing noise, or the bid–ask bounce, through the Jensen effect results in a higher compounded return than warranted by the stock's true risk exposure. Smaller stocks, which are more likely to face larger bid–ask spreads (and, therefore, contain greater price noise), earn higher risk-adjusted returns. The excess return is eroded, however, when one factors in the implied transaction cost associated with the bid–ask spread.

Summers [1986] and Poterba and Summers [1986, 1988] extend the noise-in-price framework to look at non-rational pricing dynamics, where prices can significantly deviate from fundamental values over long periods. They conclude that standard econometrics could not reject the efficient market hypothesis when the true asset pricing process contains economically significant mean-reverting noise. It is precisely this econometric identification problem that does not allow inefficiencies to be fully exploited. Building on Summer's [1986] conjecture on persistent price inefficiency, Arnott and Hsu [2008] and Arnott, Hsu, Liu, and Markowitz [2010] use the noise-in-price framework to explain the size and value effect. They conclude that size and value premiums are not risk-based but are, in fact, free lunches.

Arnott, Hsu, and Moore's [2005] fundamental indexation outperformance can be interpreted as an empirical validation for the noise-in-price model. They argue that when prices are inefficient, cap-weighted portfolios overallocate to overvalued stocks and underallocate to undervalued stocks. They propose and show that, on average, an accounting-based (valuation-

[2] Noise-in-price models set market price equal to fair value plus a transient pricing noise ($P = V + \varepsilon$).

indifferent) weighting scheme would deliver better performance than traditional cap-weighting. Hsu [2006] uses a noise-in-price model to compute the advantage of a valuation-indifferent weighting strategy and estimates the advantage to be approximately two times the noise variance. Empirical works by Tamura and Shimizu [2005], Chen, Chen, and Bassett [2007], Hsu and Campollo [2006], Estrada [2008], Hemminki and Puttonen [2008], Houwer and Plantinga [2008], and Neukirch [2008] have found outperformance of valuation-indifferent weighting strategies in a variety of equity market applications.

While empirical evidence supporting the merit of valuation-indifferent weighting appears to be robust, the source of outperformance remains controversial. The efficient market hypothesis cannot be rejected in favor of the noise-in-price framework. A significant portion of the valuation-indifferent weighting outperformance is explained by the value and size factors. The inference on this result depends on one's interpretation of the size and value premiums. Arnott [2005b], Arnott and Hsu [2008], and Arnott, Hsu, Liu, and Markowitz [2010] argue that size and value premiums are artifacts of noise in prices. They show that value and size premiums and valuation-indifferent weighting outperformance are free lunches driven by the same inefficiency. Critics reject the noise-in-price premise and argue that the size and value are well known proxies for hidden risks that we do not fully understand. Under this interpretation, valuation-indifferent weighting strategies are simply strategies that load up on more risk, thus offering no useful advantage for investors.

Valuation-Indifferent Weighting

Valuation-indifferent weighting strategies refer to the class of mechanical portfolio weighting schemes based on non-price weighting metrics. Equal weighting is perhaps the oldest and most well known valuation-indifferent weighting approach. Recent empirical evidence has rigorously demonstrated the performance advantage of valuation-indifferent weighting strategies against cap-weighting. The excess returns appear robust across markets and applications and are economically and statistically large.

A popular variant is proposed in Arnott, Hsu, and Moore [2005] which uses non-price-based accounting variables to create portfolio weights. Using the traditional noise-in-price framework, the authors argue that if a stock is overvalued, its price will contain a positive pricing error[3]. When portfolio weights are formed based on prices or market capitalizations, portfolio weights become positively correlated with pricing errors. In comparison, valuation-indifferent weighting does not exhibit this positive correlation between portfolio weights and pricing errors. As a result, a price-weighted portfolio would have greater portfolio weights committed to overvalued stocks versus a non-price-weighted portfolio, which results in sub-optimal performance.

Others argue that the valuation-indifferent weighting strategy works because it indirectly exploits the small-cap and value premiums in equity markets[4]. Although critics do not uniformly regard size and value exposure as risk exposures, they agree that valuation-indifferent weighting is best interpreted as a simple way of incorporating size and value premiums into a portfolio instead of a strategy that exploits new market anomalies. This is corroborated by Arnott and Hsu [2008] and by Arnott, Hsu, Liu and Markowitz [2010], where size and value premiums and the valuation-indifferent weighting strategy outperformance are shown to be two sides of the same mispricing coin.

The real debate, then, is whether one subscribes to the efficient market hypothesis or the noise-in-price hypothesis. The former suggests that valuation-indifferent weighting is mean–variance superior to cap-weighting because it takes on non-Gaussian hidden risks that are correlated with small-cap and value exposure. The latter remains controversial because it suggests a financial market free lunch.

Perold [2007] questions the noise-in-price model proposed in Hsu [2006] and Arnott and Hsu [2008], where valuation-indifferent weighting outperformance is shown as a financial market free lunch. Perold argues that the noise model must also generate negative autocorrelation in stock returns and would predict the existence of strategies that would identify stock valuation errors. This flies in the face of the extensive empirical literature supporting market efficiency. Perold's concerns are, in fact, general to the entire class of noise-in-price models. Summers [1986], Poterba and Summers [1988], Rosenberg, Reid, and Lanstein [1985], Black [1986], DeBondt and Thaler [1985, 1987], and others address the possibility of persistent mispricing opportunities.

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[3] See Arnott (2005b), Hsu (2006), Arnott and Hsu (2008).

[4] See, Asness (2006), Schoenfeld and Ginis (2006), Jun and Malkiel (2008), and Blitz and Swinkels (2008).

This Paper's Contribution to the Literature

There remain strong disagreement and diverse interpretations regarding the benefits and efficacy of valuation-indifferent weighting schemes and the reasonableness of the noise-in-price modeling framework. In this paper we contribute to this debate by applying the valuation-indifferent weighting technique to bonds.

We believe the results of this study add to the growing body of literature in at least two important ways. First, the fixed-income application provides a reliable out-of-sample test for the efficacy of valuation-indifferent weighting. Second, in applying the methodology to bond markets, we examine the strategy in markets where equity size and value factors do not play a role as return/risk drivers, and where the known risks are different in nature than those present in the equity market. If valuation-indifferent weighted bond portfolios do not add value, then the noise-in-price model loses some credibility. On the other hand, if we observe outperformance in valuation-indifferent weighted bond portfolios, then noise-in-price gains credibility and we have a few more "hidden risks" to explain.

In a similar spirit, the valuation-indifferent concept has been extended to listed real estate investing by Hsu, Li and Kalesnik [2010]. However, due to the high correlation between investable real estate markets and equity markets, the evidence found there alone is insufficient to address the criticism that the approach outperforms simply though size and value tilts.

We apply the valuation-indifferent weighting scheme to investment-grade corporate bonds, high-yield corporate bonds, and emerging market bonds. The common risk factors for pricing corporate and emerging sovereign bonds are sensitivities to changes in the interest rate term structure, default probability, collateral quality, and maturity. These factors differ from those governing equity dynamics. Examining the valuation-indifferent weighting performance in the context of these bond risk factors can bring new insights, particularly if we observe outperformance adjusted for standard bond risk factors and other hidden risk factors proxied by equity value and size factors.

CONSTRUCTION OF FIXED-INCOME VALUATION-INDIFFERENT PORTFOLIOS

The construction of a valuation-indifferent portfolio in the fixed-income area essentially uses the same methodology as that applied to equity portfolio construction, modified for several challenges unique to fixed-income. For example, most companies have only one issuance of common stock, but many companies issue multiple bond offerings. The emerging debt markets offer a plethora of country data, but the measures of company size used for corporate issuers (e.g., sales, profits, book values, dividends) have no meaning in defining the size of an emerging market economy.

We first describe the construction of the U.S. corporate investment-grade and high-yield portfolios. Because the only difference between the underlying constituents in these portfolios is the credit quality, we use the same factors and methodology to construct both portfolios. These factors and methodology are broadly similar to the factors and methodology applied in Arnott, Hsu, and Moore [2005]. Then, we turn our attention to the different factors needed for construction of the valuation-indifferent portfolio of emerging market bonds.

U.S. Corporate Investment-Grade and High-Yield Bonds

As with the application of the valuation-indifferent weighting scheme in equity markets, in the fixed-income space, it is also important to define weighting metrics that produce a representative portfolio of the scale of the underlying debt issuers and, therefore, deliver a broad representation of the particular asset class. We have good reason to assume that the same metrics that measure representativeness in the equity markets should also be useful in the corporate bond markets. Both debt and equity offerings are, at the most basic level, vehicles for financing a corporate enterprise, and both are simple claims on the future cash flows from these projects. The metrics that determine the strength of these cash flows and the economic viability of their underlying projects are the basis for the cash distributions and, therefore, valuations of both corporate equity and debt.

Because the bond investor's perspective of a company's economic scale differs somewhat from the equity investor's perspective, we deviate slightly from the primary metrics used in the equity portfolio to construct the corporate debt benchmarks. We examine five factors: total cash flow, total dividends, book value of assets, sales, and face value of the debt issue. We compute lagged five-year average numbers for all factors except book value of assets, for which we use the most recently reported number. The total dividends figure includes the aggregate dividends paid, both common and preferred. The equity index uses shareholders' book equity, but for fixed-income we use the book value of *assets,* recognizing the claims that bondholders have on the asset side of the corporate balance sheet. We use the debt offering size, measured by the face value of debt, rather than company size. We do not include face value in our composite measure because of the link with default probability. [5] Data on these corporate financials are from the Worldscope database.

Before applying a fundamental weight to the individual bond offerings, we first use the four company-specific factors to construct fundamental weights for each corporation. Each company is ranked on each of the four metrics and given a relative weight on that metric. We compute a *composite* measure by equally weighting four of these measures: assets, dividends, cash flow, and sales. If a company does not pay a dividend, we equally weight the remaining three metrics, as we did in the equity markets (Arnott, et al. [2005]).

We then turn our attention to the individual bonds. The corporate bond constituent data is for January 1997 through December 2009 from the Merrill Lynch US Corporate Master Index (for investment-grade bonds) and the Merrill Lynch US High Yield Master II Index (for the high-yield universe). The Merrill Lynch US Corporate Master Index includes all corporate investment-grade bonds (bonds rated AAA to BBB–), and the Merrill Lynch US Master II Index includes all corporate bonds rated BB+ and below. We exclude C and D rated bonds and compare our results to the subset of the Merrill Lynch US High Yield Master II Index that includes bonds rated BB+ to B–.

Our next step is to merge the data for individual bonds with the corporate fundamental data. Here we encounter a matching problem: Many of the bonds in the Merrill Lynch (ML) indexes are issued by unlisted corporations for which we lack public access to accounting data. We encounter difficulty trying to match privately owned or employee-owned companies and companies that are based in foreign countries or traded on the OTC markets. For example, GMAC is a large issuer of high-yield debt, but the automobile financing company is 49 percent owned by General Motors and 51 percent owned by private equity. We lack direct corporate financials for measuring this debt. Another example is Freescale Semiconductor, a company that was taken private in 2006 but whose debt still trades on the public markets and is included in the ML index. December 2009 includes 1,408 bonds in the high-yield index. Of those, 1,177 are

[5] Since amount of debt outstanding is correlated with default probability, including this measure leads to added risk in a fixed-income index. It also allows us to provide some insight into the "bums" problem – that is, the biggest debtors are given the biggest weight in a fixed income index.

domiciled in the United States. We can match 993 of those issues to corporate accounting data by using either a ticker symbol or CUSIP number, but this 84 percent match rate removes a sizable portion of the published index from our analysis.

To minimize the impact of sample bias, and to reduce the risk that our results spring from fundamental selection and weighting, we compare our valuation-indifferent portfolios with both the published benchmark *and* a cap-weighted index that we construct from the more limited universe of successfully matched bond issues. While this does not eliminate the possibility of selection bias, we can get a crude indication of the magnitude of the potential problem by observing the difference between the published benchmark and our cap-weighted measure of the bonds that are in the valuation-indifferent indexes.

Another complication is that many corporations have multiple bond issues. To avoid overweighting a single company in the index simply because it parcels its debt among a variety of instruments, we do not directly apply the fundamental weight from the corporation to each of its bonds. Instead, when a company issues multiple bonds, we divide the fundamental score among the bonds according to the ratio of each bond's *face value* to the sum of the *face value* of the overall debt issued by that corporation.[6] We then rescale the weights to correct the fact that not all corporations with a fundamental score have debt issues on their books.

The resulting list of debt issues and weights constitutes our portfolio. With this construction, we are reasonably assured a valuation-indifferent index that is *liquid, tradeable, and scalable*, in marked contrast with other valuation indifferent methodologies such as equal weighting.

Emerging Market Bonds

We use a similar procedure with different factors to construct the valuation-indifferent portfolio of emerging market bonds. Searching for factors to base a fundamental emerging market index provides many choices. To state the obvious, emerging market bonds do not have metrics such as sales, profits, book value, or dividends on which to gauge the size of the bond issuer! Still, there are analogues in country size. We focus on four factors that signify the current and potential importance of a country in the world economy: total population, square root of land area (as a

[6] We also examined a specification of assigning $1/N$ of the weight to each bond issue; the results are similar to those we report.

crude proxy for resources)[7], total gross domestic product (GDP), and energy consumption. The information on the country factors, except energy consumption, is from the *CIA World Factbook* from 1993 through 2009. The information on energy consumption comes from the 2009 *British Petroleum Statistical Review of World Energy* and includes aggregate consumer and industrial consumption of oil, natural gas, coal, nuclear energy, and hydroelectric power. All factors are computed as smoothed five-year averages.

These factors are much less volatile than the ones used for corporate U.S. bonds (in particular, land area does not, of course, change much from year to year!). Therefore, the target weights move only gradually. We then proceed by giving each country a weight on five-year averages of each factor, proportional to its representation. A country's aggregate weight is the equally weighted average of its score on the four individual factors.

We then gather the constituent issues in the Merrill Lynch USD Emerging Market Sovereign Plus Index, U.S. dollar-denominated foreign sovereign debt rated BBB+ and lower. As of 2009, this group includes 198 separate issues from 36 countries. To avoid the overrepresentation problem created by one country with multiple debt issues, we split the country weight among each of its issues according to the face value of the debt in a manner analogous to the procedure used with corporate bonds. In merging the data for individual bonds with the emerging market fundamental data, we successfully match nearly 100 percent of the emerging market bonds.

PORTFOLIO PERFORMANCE AND ATTRIBUTION

In the exhibits that follow, we present results for all three valuation-indifferent portfolios and their respective market-value weighted benchmark. For each, we also examine two portfolios. One is based on the top 500 names for corporate and high-yield debt and top 50 for the emerging markets debt, selected and weighted by composite fundamental value. A second includes all bonds in the database (as of 2009 there were 993 qualifying issues for the high-yield index and 2,833 issues for the corporate bond index).

Returns to the three valuation-indifferent portfolios and their benchmark indexes for the constrained (500-name indexes) sample are presented in **Exhibit 1**. Panel A indicates that the

[7] We use a square root function on land area, to avoid a "Russia problem." The results are very similar if we do not use the square root, but this expedient affords us a bit broader diversification.

valuation-indifferent composite portfolio outperforms the index in the U.S. high-yield corporate bond space by 260 bps per year; Panel B shows the composite valuation-indifferent investment-grade portfolio outperforms the relevant ML index by 42 bps per year; and Panel C shows outperformance by the valuation-indifferent debt portfolio in emerging markets by 143 bps per year, with *much* lower risk. In addition to these positive results for the composite indexes, *all* of the individual metrics outperform their respective benchmarks as well.

This strong result provides evidence that valuation-indifferent indexing works in fixed-income markets: By severing the link between price and portfolio weight, the approach also separates the weight in the portfolio from any error in the price. So, the approach does not inherently overweight the overvalued and underweight the undervalued relative to their unknowable *ex post* realized fair value weights. Furthermore, these tests in the bond market serve as out-of-sample tests confirming results we have found in the equity markets – regardless of the metric used to create the weights, a valuation-indifferent weighting outperforms the cap-weighted benchmark in every specification.

In **Exhibit 2**, we present results for the entire available universe of bonds for which the valuation-indifferent metrics of size are available—that is, excluding the selection component. The outperformance of the valuation-indifferent indexes is very similar to the outperformance of the more restricted indexes. This suggests that a real-world portfolio created from the subset of the largest weights will not cause any significant biases when compared to the entire universe of debt offerings. Panel A also shows that the matched custom benchmark in the high-yield space, created to match the valuation-indifferent index sub-sample, outperformed the listed ML index by 81 bps. Apparently, there is great value in *excluding* foreign-based corporations and those not listed on the major domestic stock exchanges.[8] We believe this is a fruitful path for future study. Still, the strategy based on valuation-indifferent indexing shows sizable risk-adjusted outperformance over both the ML index and the substitute cap-weighted benchmark.

As the reader will see later, in general the valuation-indifferent fixed-income portfolios are less volatile and less risky than the ML indexes. Furthermore, the incremental return does not generally come from credit quality or duration risk, which might be viewed as the bond

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[8] Our high-yield published benchmark, the BB+ to B– rated subset of the Merrill Lynch US High Yield Master II Index, underperforms the broad ML index by 18 bps per year over our sample period. Our self-constructed benchmark also ignores constituents moving in and out of the index intra-month, but it is unlikely that this effect could account for such a large discrepancy.

analogues of value and beta. Almost all boast a superior average credit rating; and duration tends to be similar to, or shorter than, the benchmark, especially for emerging markets bonds. So—with higher returns and lower volatility—they generally have much higher Sharpe ratios than the ML benchmarks.

IS THIS ALPHA DRIVEN BY KNOWN RISK SOURCES?

The investment-grade and high-yield space provide an excellent opportunity to test the proposition that the efficacy of a valuation-indifferent portfolio is correlated with the level of noise in a marketplace. The direct comparison between the investment-grade valuation-indifferent portfolio and the high-yield valuation-indifferent portfolio shows that much greater outperformance is realized in the noisier high-yield space than in the presumably more efficient investment-grade space.

A common criticism of valuation-indifferent indexing in the equity market is that the strategy is merely a value play in disguise. Because the value and size factors are of primary importance in the equity markets, we cannot expect them to adequately explain the returns on a fixed-income portfolio. Instead, to fully examine the risk loadings on our valuation-indifferent returns for fixed-income securities we follow the footsteps of Fama and French [1993, 1996] and use the classic equity three-factor model, augmented by the two most relevant factors in the fixed-income markets: duration and credit risk.

CAPM and Fama–French Analysis

We present a formal analysis of the valuation-indifferent portfolios in relation to the risk factors in **Exhibit 3.** Panel A shows the results of the basic regression of the three valuation-indifferent portfolio returns and the benchmark returns using the Capital Asset Pricing Model (CAPM). Of course, we do not expect the CAPM to fully capture the risk present in these portfolios, but it serves as a starting point and interesting comparison between the valuation-indifferent portfolios and their benchmarks. The benchmark alphas are smaller and less significant across the board, whereas all of the valuation-indifferent portfolios show significantly positive risk-adjusted alphas.

Panel B shows that the three-factor model of Fama–French [1992] has some explanatory power for the fixed-income valuation-indifferent portfolios. Although the alphas are positive, adding in these additional sources of risk weakens the *t*-statistics. Note that the three-factor model does a reasonable job of explaining the returns in the benchmarks. Most notably, the valuation-indifferent indexes have a small and value tilt, not significantly different from that of the benchmarks and far milder than the tilts observed in valuation-indifferent equity market indexes. This outcome is not entirely surprising because Fama and French [1993] suggested the size and value factors proxy for unknown risk sources that are common to stocks and bonds, even though these risk factors may be difficult to measure in the fixed-income area. However, most of alpha is not explained by the Fama–French factors in Exhibit 3.

Panel C of Exhibit 3 details the results for the regression of the Fama–French three factors augmented by a duration risk factor and a default risk factor. The term spread is the difference in returns between a portfolio of 10-year to 15-year U.S. Treasury notes and the three-month T-bill. The default risk factor is the difference between the returns given by a portfolio of investment-grade corporate debt and the 10-year T-bond. It's no surprise that these factors explain much of the alpha in the benchmark, but it is very interesting to see how little of the *incremental* alpha of the valuation-indifferent indexes is explained by these bond factors.

Our results are robust to these risk adjustments. In Panel C of Exhibit 3, we see that the valuation-indifferent portfolios have, in general, higher sensitivities to the term spread and default risk factors. Despite adjusting for these loadings, the alphas still far exceed those of the benchmarks. And while the five-factor model does a reasonable job of explaining the returns to the benchmark portfolios, the t-stats on the alphas for two of the valuation-indifferent portfolios are highly significant. These results make it clear that the outperformance of the valuation-indifferent strategy in fixed-income markets is not—or at least historically has not been—a result of excess exposure to the well-known stock or bond market risk factors.

Attribution Analysis

Of course, all these models attempt to explain the returns of a portfolio above the risk-free rate. Because the valuation-indifferent portfolio is so closely related to its cap-weighted counterpart, a comparison of the attribution details of these two indexes is of great interest. Accordingly, we carry out a Brinson-type attribution analysis (see Brinson and Fachler, [1985]) of the variation in excess returns of the valuation-indifferent portfolios against the cap-weighted benchmarks. The results are presented in **Exhibit 4**. We include the results of a dynamic version of this analysis (see Hsu, Kalesnik, and Myers, [2010]) in which the portfolio holdings are examined on a security-by-security basis. This approach determines how much of the outperformance of valuation-indifferent indexing is a result of stock selection and how much is a result of a static or dynamic allocation to risk factors.

We examine duration risk and credit risk in this attribution analysis. The matched group of cap-weighted portfolios serve as benchmarks rather than the published indexes. Because of the difference in the selection universe, these benchmarks give a better appraisal of the risk assumed by the valuation-indifferent portfolios. Our constructed cap-weighted benchmarks outperform the published benchmarks and are, therefore, a higher hurdle for the valuation-indifferent portfolios.

Because the valuation-indifferent portfolios provide superior performance even after controlling for the risk exposures, the results in Exhibit 4 are quite illuminating. For the investment grade and emerging markets valuation-indifferent fixed-income portfolios, most of the outperformance comes from "security selection." Because a valuation-indifferent portfolio does not engage in security selection in any conventional sense of the word—bonds are selected and weighted based on the size of the issuer—this is a very interesting outcome. We found similar results for valuation-indifferent equity portfolios,[9] so the results for fixed-income are an independent ratification of the equity evidence.

A possible – and controversial – explanation can be that the valuation-indifferent portfolios "select" comparative overweights in names with negative pricing errors, and underweights in those with positive pricing errors. According to the model set forth in Arnott, Hsu, Liu, and Markowitz [2010] this result would come about naturally for a valuation-indifferent portfolio and these differences would not be captured by the standard bond risk factors. Hence, attribution models would categorize this as "security selection".

In short, the outperformance of the valuation-indifferent portfolios in the fixed-income markets cannot be explained away by exposure to either the Fama–French equity market risk factors or the main conventional risk factors in the bond market—duration and credit risk. Rather, the gains come from superior security selection in a process that does no "security selection," *per se*. To the extent that risk factors play a role, they do so dynamically through shifts in the risk factor "bets" rather than from persistent factor loadings. Because these risk factor bets are merely

[9] Hsu, Kalesnik, and Myers (2010).

a mirror image of the risk factor bets that the cap-weighted bond markets are making, relative to the economic scale of companies or countries, the following gains attributable to dynamic shifts in these factors are interesting:

- The high-yield index benefits from exposure to the risk factors. Panel B shows that the net duration impact helps performance by 43 bps, with two-thirds of that coming via dynamic allocation to duration risk. Panel C shows that the credit exposure helps significantly (62 bps) with the majority of that coming through a dynamic allocation.

- For the investment-grade corporate bonds, both duration and credit risk are negligibly different from the benchmark. However, a closer look shows that the static average allocation had a negative effect on the portfolios, but that was more than offset by a positive dynamic component to the credit and duration risk. Superior security selection delivers 44 bps of outperformance.

- For emerging markets, the portfolio shows a significant allocation to duration risk (accounting for 56 bps) but a negative impact from credit risk of -45 bps. Both of these were primarily due to a static exposure. These results still leave 117 bps of outperformance to security selection.

SENSITIVITY TO MARKET AND ECONOMIC CONDITIONS

An important element of examining the performance of a valuation-indifferent approach is to dissect the performance in various macroeconomic conditions. **Exhibit 5** shows the performance in bull and bear markets and in regimes of a rising versus falling federal funds rate.[10] Previous research has shown a pattern in the equity markets where the valuation-indifferent portfolio generally matches the cap-weighted benchmark performance in good markets but outperforms significantly in most flat or down markets , especially when such weak markets span multiple years[11].

Exhibit 5 shows that to a large extent this pattern is repeated in the fixed-income space. High-yield bonds (Panel A) is the exception, where the valuation-indifferent portfolio strongly outperforms the cap-weighted benchmark in bull markets (3.4%) and outperforms in bear

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[11] See Arnott, Hsu, and Moore, 2005.

markets by a comparatively small amount (0.6%). We also see that it outperforms in periods of a falling federal funds rate (2.7%) more strongly than in periods of rising rates (1.9%).[12] For corporate investment-grade debt, we show underperformance in bull markets (-0.5%) but strong outperformance in bear markets (2.5%); and outperformance in falling short-rate regimes (1.8%) compared to underperformance in rising rate environments (-1.0%).

Finally, the emerging market valuation-indifferent portfolio shows a wonderful result: strong outperformance across all macroeconomic environments. The outperformance is significantly stronger, however, in bear markets and falling fed fund rates periods. These results show that for both corporate bonds and emerging market debt, applying valuation-indifferent indexing results in a portfolio that is less vulnerable to macroeconomic events than using the cap-weighted benchmarks. Such a countercyclical trend indicates that hidden macroeconomic risk factors are not likely to be behind the returns.

CONCLUSION AND FUTURE RESEARCH

Valuation-indifferent weighting has been shown to outperform cap weighting in the mean–variance space for equity portfolios. In this paper, we extend the method described in Arnott, Hsu, and Moore [2005] to show outperformance of valuation-indifferent weighing in investment-grade, high-yield, and emerging market bonds. More interestingly, we show that very little of the outperformance in the bond markets can be attributed to hidden risks proxied by the small-cap and value equity factors or by traditional fixed-income risk factors. This suggests that we have identified a new anomaly in fixed-income pricing and that the proposed valuation-indifferent weighted bond strategies can provide new opportunities to bond investors.

The results reported in this study are entirely consistent with the noise-in-price model predictions of Hsu [2006] and Arnott and Hsu [2008]. Not only do we observe outperformance in the valuation-indifferent weighting approach, we also observe greater value-added for the more noisy bond markets like high-yield and emerging markets. A further testable implication of the noise-in-price model would be to detect the existence of size and value equivalent factors in bonds and measure their factor premiums. Arnott and Hsu [2008] and Arnott, Hsu, Liu, and

[12] For most categories of investors, this pattern of returns is very auspicious. If our assets are falling in value—a bear market—adding value is more important than when our assets are rising in general (a bull market). If interest rates are falling—so our liabilities or the net present value of future obligations are rising—adding value is especially important.

Markowitz [2010] predict the existence of these two non-risk-based factor premiums for all asset classes when premium is measured against a cap-weighted market beta.

Finally, there is no theoretical reason that valuation-indifferent weighting should only be valid in the equity and fixed-income areas. Extending this study to other asset classes could further contribute to the current debate and improve our understanding on valuation-indifferent weighting strategies.

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Exhibit 1: Performance of Valuation-Indifferent Bond Portfolios vs. Cap-Weighted Benchmarks, (500-Name Portfolios), 1997– Dec 2009

	Return	Standard Deviation	Sharpe Ratio	Average Credit Rating	Duration	Excess Return	Alpha vs. Pub. Index	*t*-Statistic of Alpha	Tracking Error	Information Ratio
A: High Yield Corporate Bonds										
Assets	9.61	17.74	0.36	BB3	4.92	3.36	2.14	0.63	12.75	0.26
Dividends	8.62	12.94	0.42	BB2/BB3	5.21	2.38	2.21	0.92	8.64	0.28
Cash Flow	8.73	11.44	0.48	BB3	4.77	2.48	2.21	1.42	5.66	0.44
Sales	8.61	10.38	0.52	BB3	4.65	2.36	2.32	1.81	4.62	0.51
Face Value	7.68	10.35	0.43	BB3/B1	4.68	1.43	1.10	2.20	2.08	0.69
Composite	**8.85**	**12.65**	**0.45**	**BB3**	**4.92**	**2.60**	**2.19**	**1.09**	**7.29**	**0.36**
500-Bond Benchmark	*6.69*	*9.13*	*0.38*	*BB3/B1*	*4.58*	*0.45*	*0.51*	*1.26*	*1.46*	*0.31*
Published Index	*6.25*	*9.19*	*0.33*							
B: Investment Grade Corporate Bonds										
Assets	6.35	6.13	0.51	A1/A2	5.37	0.01	0.16	0.22	2.63	0.01
Dividends	6.88	5.40	0.68	A1	6.03	0.54	0.87	2.15	1.56	0.35
Cash Flow	6.78	5.39	0.66	A1/A2	6.07	0.44	0.74	2.17	1.33	0.33
Sales	6.86	5.31	0.69	A2	6.04	0.52	0.89	2.23	1.58	0.33
Face Value	6.49	6.12	0.54	A2	5.90	0.16	0.18	0.31	2.00	0.08
Composite	**6.75**	**5.43**	**0.65**	**A1**	**5.88**	**0.42**	**0.71**	**1.90**	**1.43**	**0.29**
500-Bond Benchmark	*6.30*	*6.02*	*0.51*	*A2*	*5.93*	*-0.03*	*0.03*	*0.06*	*1.94*	*-0.02*
Published Index	*6.33*	*5.81*	*0.54*							
C: Emerging Market Bonds										
Population	11.24	10.18	0.79	BB1	5.11	0.43	3.44	2.09	8.00	0.05
Area	13.10	13.38	0.74	BB1/BB2	5.10	2.30	3.18	2.10	5.63	0.41
GDP	11.47	10.53	0.79	BB1	5.35	0.67	3.07	2.36	6.36	0.10
Energy Consump.	13.31	13.28	0.76	BB1	5.20	2.50	4.04	1.95	7.87	0.32
Face Value	14.82	16.94	0.69	BB2/BB3	6.21	4.02	2.73	2.01	5.47	0.73
Composite	**12.23**	**11.72**	**0.77**	**BB1**	**5.13**	**1.43**	**3.38**	**2.14**	**6.64**	**0.22**
50-Bond Benchmark	*10.95*	*14.97*	*0.52*	*BB2*	*6.33*	*0.15*	*-0.39*	*-0.76*	*2.07*	*0.07*
Published Index	*10.80*	*13.87*	*0.55*							

Notes: For the valuation-indifferent portfolios, the top 500 names are selected by fundamental weight for the high-yield and investment-grade indexes. For the corporate and high yield portfolios, the "Composite" includes assets, dividends, cash flow, and sales. For the valuation-indifferent emerging market portfolios, the top 50 names are selected by fundamental weight. For the emerging markets, "Composite" includes population, area, GDP, and energy consumption. "Benchmark" is the cap-weighted benchmark constructed from our particular matched subsample. "Published Index" is the index return for the relevant ML benchmark return provided by Bloomberg. Excess returns and tracking errors are computed against the published index. The *t*-statistics are for the null hypothesis that the estimated alphas are not different from zero.

Exhibit 2: Performance of Valuation-Indifferent Fixed-Income Portfolios vs. Benchmarks: Entire Index, 1997–Dec 2009

	Return	Standard Deviation	Sharpe Ratio	Average Credit Rating	Duration	Excess Return	Alpha vs. Pub. Index	*t*-Statistic of Alpha	Tracking Error	Information Ratio
A: High Yield Corporate Bonds										
Assets	9.69	17.48	0.37	BB3	4.89	3.45	2.29	0.68	12.53	0.28
Dividends	8.60	12.91	0.42	BB2/BB3	5.20	2.36	2.19	0.91	8.61	0.27
Cash Flow	8.69	11.06	0.50	BB3	4.74	2.44	2.24	1.55	5.24	0.47
Sales	8.56	10.17	0.53	BB3	4.62	2.32	2.31	1.91	4.37	0.53
Face Value	7.72	9.75	0.46	BB3/B1	4.65	1.47	1.32	3.45	1.50	0.98
Composite	**8.79**	**12.24**	**0.46**	**BB3**	**4.87**	**2.54**	**2.19**	**1.17**	**6.83**	**0.37**
Benchmark	*7.06*	*8.88*	*0.43*	*BB3/B1*	*4.58*	*0.81*	*0.94*	*3.14*	*1.15*	*0.70*
Published Index	*6.25*	*9.19*	*0.33*							
B: Investment Grade Corporate Bonds										
Assets	6.41	5.94	0.54	A1/A2	5.52	0.07	0.18	0.33	1.97	0.04
Dividends	6.89	5.47	0.67	A1/A2	6.04	0.56	0.80	2.68	1.15	0.48
Cash Flow	6.82	5.51	0.66	A2	6.10	0.49	0.68	2.68	0.98	0.50
Sales	6.83	5.46	0.66	A2	6.08	0.50	0.74	2.38	1.20	0.41
Face Value	6.68	5.74	0.61	A2/A3	5.95	0.34	0.40	2.06	0.71	0.48
Composite	**6.76**	**5.49**	**0.65**	**A2**	**5.94**	**0.43**	**0.63**	**2.65**	**0.93**	**0.46**
Benchmark	*6.52*	*5.66*	*0.59*	*A2/A3*	*5.95*	*0.18*	*0.28*	*1.49*	*0.70*	*0.26*
Published Index	*6.33*	*5.81*	*0.54*							
C: Emerging Market Bonds										
Population	11.17	9.94	0.80	BB1	5.11	0.37	3.23	2.31	7.19	0.05
Area	12.63	13.07	0.72	BB1/BB2	5.13	1.83	2.64	2.23	4.47	0.41
GDP	11.45	10.53	0.78	BB1	5.31	0.64	2.86	2.65	5.57	0.12
Energy Use	13.01	13.01	0.75	BB1	5.16	2.21	3.66	1.98	7.08	0.31
Face Value	13.74	15.39	0.68	BB2/BB3	5.69	2.94	2.35	2.28	3.91	0.75
Composite	**12.07**	**11.45**	**0.77**	**BB1**	**5.17**	**1.27**	**3.09**	**2.43**	**5.60**	**0.23**
Benchmark	*11.06*	*13.98*	*0.56*	*BB2/BB3*	*5.79*	*0.26*	*0.22*	*0.78*	*1.00*	*0.26*
Published Index	*10.80*	*13.87*	*0.55*							

Notes: For the corporate indexes, “Composite” includes assets, dividends, cash flow, and sales. For the emerging markets, Composite includes population, area, GDP, and energy consumption. "Benchmark" is the cap-weighted benchmark constructed from our particular matched subsample. "Published Index" is the index return for the relevant ML benchmark return provided by Bloomberg. Excess returns and tracking errors are computed against the published index

Exhibit 3: CAPM, Three-Factor, and Five-Factor Regressions for Cap-Weighted Benchmark and Valuation-Indifferent Portfolios, 1997-Dec 2009

A. CAPM Model

	Benchmark			Valuation-Indifferent Index		
	Alpha	Beta	Alpha *t*-Stat.	Alpha	Beta	Alpha *t*-Stat.
High Yield	1.76	0.34	0.87	4.26	0.36	1.38
Investment-Grade	2.77	0.09	1.77	3.31	0.06	2.21
Emerging Markets	5.68	0.50	1.87	7.44	0.42	2.87

B. Three-Factor Model

	Benchmark					Valuation-Indifferent Index				
	Alpha	Beta	SMB	HML	Alpha *t*-Stat.	Alpha	Beta	SMB	HML	Alpha *t*-Stat.
High Yield	1.15	0.34	0.13	0.11	0.57	2.78	0.38	0.16	0.23	0.91
Investment-Grade	2.30	0.10	–0.01	0.05	1.44	2.87	0.07	–0.01	0.05	1.88
Emerging Markets	5.35	0.51	0.00	0.04	1.72	6.69	0.43	0.04	0.10	2.54

C. Five-Factor Model

	Benchmark							Valuation-Indifferent Index						
	Alpha	Beta	SMB	HML	TERM	DEF	Alpha *t*-Stat.	Alpha	Beta	SMB	HML	TERM	DEF	Alpha *t*-Stat.
High Yield	0.48	0.17	0.10	0.06	0.66	1.34	0.35	1.79	0.09	0.10	0.14	1.08	2.28	1.01
Investment Grade[a]	N/A							0.58	-0.01	0.00	0.00	0.93	0.82	1.81
Emerging Markets	3.41	0.45	0.02	0.00	0.77	0.62	1.18	4.66	0.33	0.05	0.05	0.90	0.92	2.07

[a] No regression results are given for this row because the investment-grade benchmark is perfectly correlated with the DEF factor, making results not meaningful.

Notes: Monthly regressions of portfolio and benchmark returns on risk factors. Results for alphas are presented as annualized return percentage. The beta, SMB (small minus big), and HML (high minus low) regressors are the three Fama–French factors and taken from Kenneth French's website, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. The TERM regressor is the return on a portfolio of 10-year to 15-year T-bills minus the risk-free rate. The DEF (default) regressor is the return on the ML Corporate Master (Investment Grade) Index minus the risk-free rate.

Exhibit 4: Dynamic Brinson Performance Attribution, January 1997-December 2009

Panel A: Total Returns	Valuation-Indifferent	Benchmark	Difference
High Yield	8.85%	6.69%	2.16%
Investment Grade	6.75%	6.30%	0.45%
Emerging Markets	12.23%	10.95%	1.28%

Panel B: Duration Impact on Returns	Total	Static	Dynamic
High Yield	0.43%	0.14%	0.29%
Investment Grade	0.08%	–0.05%	0.13%
Emerging Markets	0.56%	0.48%	0.08%

Panel C: Credit Impact on Returns	Total	Static	Dynamic
High Yield	0.62%	0.16%	0.46%
Investment Grade	–0.07%	–0.14%	0.07%
Emerging Markets	–0.45%	–0.41%	–0.04%

Panel D: Security Selection	Valuation-Indifferent
High Yield	1.11%
Investment Grade	0.44%
Emerging Markets	1.17%

Notes: This exhibit displays a holdings-based attribution of the performance of the valuation-indifferent indexes versus the internally constructed cap-weighted benchmarks. The risk sources are broken down into static and dynamic components as demonstrated in Hsu, Kalesnik, and Myers (2010).

Exhibit 5: Performance of the Valuation-Indifferent Indexing Strategy in Macroeconomic Cycles, 1997–Dec 2009

	Bull Market	Bear Market	Rising Federal Fund Rate	Falling Federal Fund Rate
A. High-Yield Bonds				
Valuation-Indifferent High-Yield Bond Index Return	16.0%	-5.8%	11.9%	5.5%
Merrill Lynch US High-Yield Master II Index Return	12.5%	-6.4%	10.0%	2.8%
U.S. 3-Month T-bill Return	3.5%	3.6%	3.4%	3.6%
Valuation-Indifferent High-Yield Bond Volatility	11.0%	14.8%	10.7%	14.1%
Merrill Lynch US High-Yield Master II Volatility	6.0%	13.0%	5.5%	11.4%
Valuation-Indifferent High-Yield Bond Sharpe Ratio	1.13	-0.63	0.79	0.13
Merrill Lynch US High-Yield Master II Sharpe Ratio	1.51	-0.76	1.19	-0.07
Valuation-Indifferent High-Yield Bond Excess Return over Merrill Lynch US High-Yield Master II	3.4%	0.6%	1.9%	2.7%
Valuation-Indifferent High-Yield Bond Tracking Error with respect to Merrill Lynch US High-Yield Master II	7.6%	6.7%	7.6%	7.0%
Valuation-Indifferent High-Yield Bond Information Ratio	0.45	0.08	0.26	0.38
B. Investment-Grade Bonds				
Valuation-Indifferent Corporate Bond Index Return	6.7%	7.0%	3.6%	9.6%
Merrill Lynch US Corporate Master Index Return	7.2%	4.5%	4.6%	7.8%
U.S. 3-Month T-bill	3.5%	3.6%	3.4%	3.6%
Valuation-Indifferent Corporate Bond Volatility	4.9%	6.5%	4.9%	5.8%
Merrill Lynch US Corporate Master Volatility	5.0%	7.3%	4.9%	6.5%
Valuation-Indifferent Corporate Bond Sharpe Ratio	0.66	0.54	0.04	1.04
Merrill Lynch US Corporate Master Sharpe Ratio	0.75	0.14	0.25	0.65
Valuation-Indifferent Corporate Bond Excess Return over Merrill Lynch US Corporate Master	-0.5%	2.5%	-1.0%	1.8%
Valuation-Indifferent Corporate Bond Tracking Error with respect to Merrill Lynch US Corporate Master	0.6%	2.3%	0.9%	1.7%
Valuation-Indifferent Corporate Bond Information Ratio	-0.91	1.10	-1.19	1.02
C. Emerging Market Debt (EMD)				
Valuation-Indifferent EMD Index Return	15.6%	5.4%	17.9%	7.6%
Merrill Lynch IGOV Index Return	15.2%	0.9%	16.5%	5.4%
U.S. 3-Month T-bill	3.5%	3.6%	3.4%	3.6%
Valuation-Indifferent EMD Volatility	11.1%	12.8%	8.9%	13.6%
Merrill Lynch IGOV Volatility	14.2%	13.0%	8.3%	17.2%
Valuation-Indifferent EMD Sharpe Ratio	1.09	0.14	1.63	0.30
Merrill Lynch IGOV Sharpe Ratio	0.82	-0.20	1.57	0.10
Valuation-Indifferent EMD Excess Return over Merrill Lynch IGOV	0.5%	4.4%	1.4%	2.3%
E Valuation-Indifferent MD Tracking Error with respect to Merrill Lynch IGOV	6.8%	6.3%	5.6%	7.5%
Valuation-Indifferent EMD Information Ratio	0.07	0.71	0.25	0.30

Note: We define the bull/bear cycle in a forward-looking way: if next month is a bull market, but we just hit a new low this month, then this month is a bear market, otherwise we are in a bull market. If next month is a bear market, but this month we hit a new high, then we are in a bull market, otherwise we are in a bear market. The S&P 500 returns are used to measure the new highs and lows. Similarly, the rising and falling rate cycles are defined using 1-month T-bill rates.