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PRACTITIONER'S DIGEST

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MARKET RISK, MORTALITY RISK, AND SUSTAINABLE RETIREMENT ASSET ALLOCATION: A DOWNSIDE RISK PERSPECTIVE PAGE 5

W. V. Harlow and Keith C. Brown

Few problems that investors face in their lifetimes are likely to be more significant or challenging than that of how to properly allocate the assets in their retirement portfolios. Despite its importance, however, there is no consensus on what the optimal asset allocation should be for retirement investors of varying age, gender, and risk tolerance. Indeed, solving for the proper amount of equity risk to adopt in a retirement portfolio proves to be a very complex endeavor that depends on an analysis of myriad other sources of uncertainty, such as future conditions in the capital markets as well as the health status and life expectancy of the investor.

Our goal in this study is to address the retirement allocation question by concentrating on the collective exposures created by this joint uncertainty over future investment returns and the investor's mortality risk profile. Specifically, we propose a new analytical approach that focuses on limiting the severity of retirement funding shortfalls (i.e., downside risk), rather than just the probability of ruin, which is how the problem has traditionally been addressed. An important outcome of our stochastic optimization analysis is that this emphasis on downside risk management actually increases the sustainability of the investor's portfolio during his or her retirement period.

Using our model, we also demonstrate that the range of appropriate equity allocations in the account of a recent retiree is between five and 25 percent, which implies a strikingly low level of optimal risk-taking relative to what is commonly observed in practice (e.g., existing target-date or life-cycle funds). Further, this finding proves to be robust with respect to a wide array of alternative capital market conditions and assumptions about the investor's bequest motives. Therefore, we conclude that investors who follow conventional approaches to allocating their retirement assets are likely to be adopting higher-volatility portfolios than necessary, which can adversely impact the sustainability of their savings and future incomes.

COMBINING VALUE AND MOMENTUM **PAGE 33**

Gregg Fisher, Ronnie Shah and Sheridan Titman

Within the realm of factor investing, much has been written about constructing portfolios with tilts to specific firm characteristics. We discuss the intuition for combining two such factors, value and momentum and analyze how to optimally combine these insights to improve a long-only portfolio's risk and return after accounting for trading costs. We find that a strategy that simultaneously incorporates both value and momentum improves on a strategy that combines two single factor value and momentum portfolios. There are two main benefits of the combined strategy: (i) reduction in trading costs and (ii) better utilization of unfavorable value and momentum information. Our paper has implications for how an investor should access value and momentum return premiums.

PORTFOLIO DIVERSIFICATION IN CONCENTRATED BOND AND LOAN PORTFOLIOS **PAGE 49**

Paul Kupiec

Concentration risk is an important issue in fixed income portfolios when loss exposures are dominated by relatively few obligors because of outsized loan balances or commitments, severe default loss rates, or some combination of these factors. When a portfolio has obligor concentrations, idiosyncratic risk is not well diversified and curtailing some exposures through partial sales or risk mitigation can improve the portfolio risk-return tradeoff and lower economic capital needs. Such a process, however, requires that the biggest concentrations be identified along with estimates of the benefits produced by adjusting these exposures. Existing methods for measuring concentration risk are mathematically complex or computationally cumbersome and they do not uniquely prioritize the positions most in need of adjustment.

This paper develops a new approximation for the loss rate distribution for fixed income portfolios with obligor concentrations. The approximation is intuitive, mathematically simple, and compatible with any approach for modeling default dependence. It is especially useful for economic capital allocation because of its accuracy in the upper tail of the cumulative portfolio loss distribution. Portfolio economic capital is shown to be equal to the sum of the q largest portfolio exposures, where q depends on the selected capital coverage rate (e.g. 95 or 99 percent) and selected characteristics of the portfolio. The approximation identifies the obligors most responsible for concentration risk and provides a simple way to calculate the capital benefits of loan sales, risk mitigation, or the capital needed when a marginal credit is added to a concentrated portfolio.

FACTOR MISALIGNMENT AND PORTFOLIO CONSTRUCTION **PAGE 71**

Jose Menchero

Many quantitative investors employ mean-variance optimization as a portfolio construction tool. The required inputs include: (a) a set of stock alphas, (b) an asset covariance matrix, and (c) a set of

investment constraints. The stock alphas are typically created using a proprietary alpha model, whereas the asset covariance matrix is usually obtained from a third-party risk vendor. The stock alphas in general can be decomposed into spanned alpha (explained by the risk model factors) and residual alpha (orthogonal to the risk model factors). The optimizer strongly favors the residual alpha since the risk model views it as diversifiable idiosyncratic risk. However, there is a valid concern that if the residual alpha actually contains factor risk that was omitted from the risk model, the tilt toward residual alpha may reduce the portfolio transfer coefficient, thus resulting in a lower information ratio. Our paper quantifies the magnitude of this effect.

We adopt a realistic simulation framework to study both the case in which the residual alpha contains missing factor risk, and the case in which it is truly idiosyncratic. We also consider two different risk models. The first model contains the alpha factor as an explanatory variable, whereas the second model omits it. We find that the transfer depends sensitively on the precision in which factor correlations are estimated. When the residual alpha contains true factor risk, we find that the risk model containing the alpha factor leads to a higher transfer coefficient, but only if the estimation window is sufficiently long so that correlations are reliably estimated. By contrast, we find that when the residual alpha is truly idiosyncratic, the model that omits the alpha factor leads consistently to higher transfer coefficient, regardless of the length of the estimation window.

We also empirically investigated portfolio efficiency over a 15-year sample period using a multi-factor risk model for the US market. The empirical results were in excellent agreement with the simulated results. We found, on average, an 11 percent increase in portfolio information ratio by including the alpha factor in the risk model for an unconstrained optimization. However, once the long-only constraint was applied, the increase in portfolio information ratio fell to four percent.

PRICE DYNAMICS AND LIQUIDITY OF EXCHANGE-TRADED FUNDS PAGE 86

Ananth Madhavan and Aleksander Sobczyk

Exchange traded funds (ETFs) have grown substantially in diversity, market significance and size in recent years, generating increased interest by practitioners in the pricing and trading of these investment vehicles. Why do ETFs trade at premiums or discounts, and how does this affect tracking error? Why are ETF returns sometimes much more volatile than the volatility of returns of their underlying indexes? How does ETF pricing and liquidity work in times of market stress? Do large premiums/discounts at these times reflect pricing errors? Are these persistent and if so, is this an arbitrage opportunity? How should investors incorporate deviations from net asset value into their investment decisions? Should they avoid buying funds trading at steep premiums or selling funds at a significant discount? And for policy makers, do ETFs on less liquid asset classes such as high-yield bonds pose systemic risks? Is there any evidence from the crisis on how these investment vehicles performed?

This paper develops and tests a model of ETF price dynamics to better understand these questions. We estimate the model individually for each of 947 US-domiciled equity and fixed income ETFs from 2005–2014. The observed fund premium or discounts can be decomposed into price discovery and transitory liquidity components. These components vary systematically across asset class, exposure,

and fund size. The Net Asset Value of international equity funds and bond ETFs, particularly smaller funds, can exhibit staleness, but this is largely insignificant for domestic equity funds. Staleness arises because NAV does not fully capture current valuations, and the lag in adjustment can give rise to economically significant premiums or discounts, especially in times of market stress. ETF return volatility will be greater than that of the underlying NAV returns if NAV is stale.We estimate the speed with which unobserved pricing errors in a given fund are corrected through the arbitrage mechanism. Arbitrage acts quickly to correct pricing errors for domestic equity funds, with a half-life of 0.43 days versus 6.56 days for international fixed income funds.

The cross-sectional findings provide strong evidence that observed premiums largely reflect price discovery, particularly for ETFs with constituents trading outside of US market trading hours. Apparently large discounts to Net Asset Value in periods of bond market stress such as the financial crisis reflects efficient pricing, not illiquidity. This result should mitigate concerns that ETFs are the source of additional volatility or of systemic risk.