Investing in Socially Responsible Mutual Funds

by*

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Abstract

We construct optimal portfolios of mutual funds whose objectives include socially responsible investment (SRI). Comparing portfolios of these funds to those constructed from the broader fund universe reveals the cost of imposing the SRI constraint on investors seeking the highest Sharpe ratio. This SRI cost depends crucially on the investor's views about asset pricing models and stock-picking skill by fund managers. To an investor who believes strongly in the CAPM and rules out managerial skill, i.e. a market-index investor, the cost of the SRI constraint is typically just a few basis points per month, measured in certainly-equivalent loss. To an investor who still disallows skill but instead believes to some degree in pricing models that associate higher returns with exposures to size, value, and momentum factors, the SRI constraint is much costlier, typically by at least 30 basis points per month. The SRI constraint imposes large costs on investors whose beliefs allow a substantial amount of fund-manager skill, i.e., investors who rely heavily on individual funds' track records to predict future performance.

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Abstract

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1. Introduction

Socially responsible investment (SRI) has experienced strong worldwide growth in recent years, both in relative and absolute terms. The Social Investment Forum (SIF) defines SRI as "an investment process that considers the social and environmental consequences of investments, both positive and negative, within the context of rigorous financial analysis." The SIF reports that professionally managed SRI assets totaled a substantial $2.14 trillion in 2003, or roughly 11% of total assets under management in the U.S. according to the 2003 Nelson's Directory of Investment Managers. From 2001 to 2003, the most recent period of comparison available from the SIF, those SRI assets grew by 7%, as compared to a 4% drop in all professionally managed assets (SIF, 2003). During this three-year period, the assets managed in screened private portfolios for individuals and institutions jumped 7% to $1.9 trillion. In addition, while the amount of new assets flowing to all mutual funds saw a $10.5 billion drop during that time, there was a $1.5 gain for SRI funds (SIF, 2003). Moreover, in a 2001 poll by the Opinion Research Corporation (sponsored by MMA-Praxis), about 50% of U.S. investors reported that they consider social criteria when making investment decisions. In response to this demand, some of the largest pension funds in the United States have pursued SRI initiatives. The California Public Employees' Retirement System (CALPERS) actively engages companies to promote socially responsible behavior and was one of the leaders of the tobacco divestment of the late 1990's. (Of the numerous SRI screens applied, the most popular is to exclude tobacco stocks.) TIAA-CREF, the largest private pension fund in the world, has offered a Social Choice Account fund since 1990 (Yach, Brinchmann, and Bellet, 2001)[1]. In addition, public corporations have also responded. For instance, nearly 10% of all S&P100 companies produce annual corporate social responsibility reports (Social Investment Research Analyst Network, 2005). Our study focuses on socially responsible mutual funds, which by themselves constitute a $151 billion market but also

[1]The SIF data show that the vast majority of SRI assets and growth relate to the strong involvement of institutions such as religious organizations, municipal and state governments, unions, federations, corporations, universities and colleges, and insurance companies. Organizations like the Council on Institutional Investors (CII) and the Association of British Insurers (ABI), which control approximately $1.5 trillion and $1 trillion, respectively, have each issued statements that corporate social responsibility is a key factor of long-term financial success (SIF, 2001). The ABI warns: "It is increasingly accepted that failure to take [social and environmental] risks into account can lead to a long-term loss not just in [a company's] reputation but also in [its] value" (Targett, 2001a). To a certain extent, British institutional investors have been forced to recognize this notion by laws requiring pension funds to disclose the extent to which they apply social and environmental criteria to their investment strategies (Neale, 2001).

serve as a proxy for the larger institutional market for which data are less available.

We examine SRI from the perspective of an investor who seeks to create a portfolio of U.S. domestic equity mutual funds with the highest return-risk tradeoff (Sharpe ratio). The investor restricts the funds considered to be those that include non-financial "social" objectives in their investment policies. We assume that investors make their portfolio selections by combining the information in the historical returns data with their prior judgments about the usefulness of various asset-pricing models and about the potential stock-picking skill possessed by fund managers. In this respect our methodology follows that of Pástor and Stambaugh (2002a,b). We then compare the optimal portfolio of funds selected under the SRI-only constraint to the optimal portfolio chosen from the larger fund universe. The difference between the certainty-equivalent returns on these portfolios reveals the cost of imposing the SRI constraint. This risk-return cost must, presumably, be offset by the utilty a socially responsible investor derives from knowing that the funds he has selected engage in SRI.

The cost of imposing the SRI constraint depends critically on a mutual-fund investor's prior beliefs about pricing models and fund-manager skill. Of course, to an investor who rules out the possibility of fund-manager skill, the SRI constraint cannot be costly due to its depriving the investor of skilled managers. In such cases, the SRI constraint can still impose diversification costs, in the sense that the constrained investors are less able to balance optimally their portfolios' exposures to factor-related risks and to eliminate risks that, on average, investors are not compensated to bear. This diversification cost is only a few basis points per month for an investor who precludes skill and believes strongly in the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965). Such an investor can combine SRI funds to create a portfolio whose returns closely track those of a market index fund, the optimal portfolio for such an investor. In contrast, an investor who rules out skill but believes in the usefulness of the three-factor model of Fama and French (1993), instead of the CAPM, finds that the SRI constraint imposes substantially higher diversification costs—at least 30 basis points per month. In essence, when compared to the broader fund universe, the SRI universe does not offer funds that come as close to offering the exposures to the size and value factors possessed by portfolios identified as optimal under the Fama-French model. A similar result occurs if the investor instead believes in the four-factor model of

Carhart (1997), where the SRI cost is then even slightly higher. The most dramatic SRI costs are those not confined to diversification. In our setup, investors who believe that fund managers might possess substantial stock-picking ability rely heavily on funds' individual return histories to identify such skill and predict future performance. The funds from the broader fund universe that happen to have the most spectacular track records are not present in the smaller universe of SRI funds. Not surprisingly, to an investor who believes such track records convey information about skill, being deprived of those historical high-flyers imposes a high perceived cost—rising to more than 1000 basis points per month for the extreme limiting case in which the investor relies completely on a fund's track record to forecast the magnitude of its future performance.

We also consider a number of additional issues related to investment in SRI funds. Since many investors who consider SRI to be important do not confine their entire portfolios to SRI funds, we also consider SRI costs from the perspective of investors who dedicate only a portion of their total portfolios to SRI funds. We find that the costs can still be substantial. For example, in the case of the investor who rules out skill but believes in the Fama-French model, a minimum allocation of only one-third of the overall portfolio to SRI funds still imposes a cost of 16 basis points per month. Expanding both the SRI and non-SRI universes to include funds that charge load fees often changes the identities of funds in the optimal portfolios but typically produces only small changes in the certainty-equivalent cost of the SRI constraint. On the other hand, further restricting the SRI universe to include only the funds that screen out "sin" stocks associated with alcohol, tobacco, or gambling increases monthly diversification costs by 10 basis points or more for investors who believe in the Fama-French or four-factor models. Finally, we consider a two-asset investment problem in which the investor must allocate between two equally weighted composites, one containing only the SRI funds and the other containing the non-SRI funds. When skill is ruled out completely, the investor prefers the SRI composite, essentially due to the fact that, on average, those funds have substantially lower turnover than the average non-SRI fund. When the possibility of fund-manager skill is admitted, however, the non-SRI composite becomes more attractive.

The remainder of the paper is organized as follows. Section 2 presents the investment framework used to compute optimal portfolios and the costs of the SRI constraint. Section 3 describes features of the mutual fund data and the methods used to identify funds that

engage in socially responsible investing. Section 4 then presents the investment results, and section 5 reviews the study's conclusions.

2. The Investment Framework

Our methodology closely mirrors that of Pástor and Stambaugh (2002a,b), hereafter PS. Broadly speaking, we select and combine domestic equity mutual funds to form portfolios having maximal ex ante Sharpe ratios, as perceived by different investors who use the available returns data to update their prior beliefs about the accuracy of various asset-pricing models as well as the potential for fund-manager skill. The key distinction in our setting is that each investor constrains his universe of available funds to those whose investment policies are identified as socially responsible. The cost of this constraint is then evaluated by comparing an investor's optimal portfolio under the SRI constraint to the unconstrained optimal portfolio of funds chosen from the broader universe. Our universe of available funds is determined by imposing minimum requirements for availability of historical data, and short sales of funds are prohibited throughout.

2.1. Models for Returns

An investor's beliefs about the accuracy of pricing models can be distinguished from his beliefs about potential fund-manager skill by avoiding the usual model for a mutual fund's returns,

$$r_{A,t} = \alpha_A + \beta_A r_{B,t} + \epsilon_{A,t}, \tag{1}$$

in which $r_{A,t}$ is the excess return on fund A in month t, $r_{B,t}$ contains returns on k benchmark portfolios (excess returns or zero-cost spreads), whose identities are typically motivated by a pricing model, and the residuals, $\epsilon_{A,t}$ are assumed to be independent and identically distributed. In that traditional setup, a positive α_A is interpreted as fund-manager skill. If the pricing model is deficient, however, in that there exist mechanical "passive" investment strategies whose returns produce positive values of "skill" (α_A) when measured in the same fashion, then α_A need not represent skill on the part of the fund manager (who can then invest in those passive assets and thereby produce a positive α_A).

The PS framework used here entertains the possibility that there exist non-benchmark passive assets not priced by the k benchmark portfolios. That is, in the regression

$$r_{N,t} = \alpha_N + B_N r_{B,t} + \epsilon_{N,t}, \tag{2}$$

where $r_{N,t}$ is an $m \times 1$ vector of returns on non-benchmark passive assets in month t, the elements of α_N can be nonzero. The disturbance vector $\epsilon_{N,t}$ is assumed to be distributed identically and independently over t and have covariance matrix Σ. Moreover, the same non-benchmark passive assets are assumed to be useful in explaining additional variation in the mutual fund's return, beyond that captured by the k benchmark returns, so that in the regression,

$$r_{A,t} = \delta_A + c'_{AN} r_{N,t} + c'_{AB} r_{B,t} + u_{A,t}, \tag{3}$$

some elements of c_{AN} are non-zero, and thus the intercept δ_A is a better measure of managerial skill. That is, it is harder for the fund manager to produce a positive δ_A than a positive α_A.[2] The specifications of the benchmark and non-benchmark passive assets under various pricing models are explained later. The disturbance $u_{A,t}$ is assumed to be normally distributed with mean zero and variance σ_u^2.

2.2. Priors on Model Mispricing and Manager Skill

The investor's beliefs about potential model mispricing are represented by the prior for α_N. Conditional on Σ, that prior is given by

$$\alpha_N | \Sigma \sim N(0, \sigma^2_{\alpha_N}(\frac{1}{s^2}\Sigma)). \tag{4}$$

The marginal prior density of Σ specified as inverted Wishart,

$$\Sigma^{-1} \sim W(H^{-1}, \nu), \tag{5}$$

with $\nu = m + 3$, so that the prior is not informative about the residual covariance matrix in (2). The parameter matrix H is specified as $H = s^2(\nu - m - 1)I_m$, so that $E(\Sigma) = s^2 I_m$, and s^2 is set to the average diagonal element of Σ when estimated using OLS residuals.

[2]Recall from standard results that a positive α_A indicates that some positive investment in the fund is useful in obtaining a higher (squared) Sharpe ratio than can be obtained by combining just the k benchmark portfolios, while a positive δ_A yields the same statement with the latter combination including the m non-benchmark passive assets as well.

It is easily verified that $\sigma^2_{\alpha_N}$ is the unconditional prior variance of each element of α_N. Setting $\sigma_{\alpha N} = 0$, which is equivalent to setting $\alpha_N = 0$, places perfect confidence in the model; setting $\sigma_{\alpha N} = \infty$ disregards the pricing model completely. In general, $\sigma_{\alpha N}$ represents "mispricing uncertainty," which is the prior standard deviation of the amount by a non-benchmark passive asset's expected return can deviate from the exact implication of the pricing model. The prior on B_N is diffuse.

Prior beliefs about managerial skill are specified as follows. Conditional on σ^2_u, the prior for δ_A is given by,

$$\delta_A|\sigma^2_u \sim N(\delta_0,\ \left(\frac{\sigma^2_u}{\mathrm{E}(\sigma^2_u)}\right)\sigma^2_\delta), \tag{6}$$

The prior for σ^2_u, the variance of $u_{A,t}$, is specified as inverted gamma, or

$$\sigma^2_u \sim \frac{\nu_0 s^2_0}{\chi^2_{\nu_0}}. \tag{7}$$

To represent a prior belief that precludes stock-picking skill by fund managers, we set $\sigma_\delta = 0$ and

$$\delta_0 = -\frac{1}{12}(\textit{expense}\ +\ 0.01 \times \textit{turnover}), \tag{8}$$

where *expense* is the fund's average annual expense ratio and *turnover* is the fund's average annual reported turnover. Nonzero values of σ_δ represent prior beliefs that admit some possibility of skill. In those cases we specify

$$\delta_0 = -\frac{1}{12}\textit{expense} \tag{9}$$

as the prior mean of δ_A when $\sigma_\delta > 0$. The latter specification corresponds to a prior belief, as in PS, that turnover has an indeterminate effect on performance when the prior allows for the presence of skill.

The prior for c_A, conditional on σ^2_u, is assumed to be independent of the prior for δ_A and is given by

$$c_A|\sigma^2_u \sim N(c_0,\ \left(\frac{\sigma^2_u}{\mathrm{E}(\sigma^2_u)}\right)\Phi_c). \tag{10}$$

Values for s_0, ν_0, c_0, and Φ_c in (7) through (10) are specified for each fund using the same empirical-Bayes procedure in PS. Their approach uses cross-sectional sample moments of these parameters estimated in OLS regressions, where the cross-section contains funds with the same investment objective.

The priors for δ_A and c_A are also assumed to be independent across funds. Recently, Jones and Shanken (2005) and Stambaugh (2002) have modeled prior beliefs incorporating dependence across funds. In the Jones-Shanken setup, an investor's belief about the potential for a given manager to possess skill depends on the inferred distribution of skill across all other managers. That is, inferences about individual fund managers' skills are shrunk toward the cross-sectional mean, and that effect becomes stronger as the number of funds increases. In the framework used here, the investor has stronger beliefs that examining a larger fund universe is more likely to reveal managers with a given high level of skill, and the inferred skill levels of the high-flying funds found in such a universe are not shrunk toward the overall average. Of course, the value of the perceived utility loss arising from being deprived of the high-flying funds is greater for such an investor than for one who shrinks toward the overall mean. Whether or not shrinkage is applied, however, it seems clear that the investors who place the greatest reliance on funds' track records (instead of pricing models) when inferring expected fund returns will be those who will perceive the greatest utiity losses from being deprived of the funds with the most stellar track records, which are more likely to be present in the larger unconstrained fund universe.

2.3. Benchmarks

Our set of eight benchmark and non-benchmark assets are similar to those in PS. Monthly returns on these passive assets are constructed for the $38\frac{1}{2}$-year period from July 1963 through December 2001. As in PS, the sample period for any given fund is typically a much shorter subset of that overall period. There are up to four benchmark series, consisting of the Fama-French (1993) factors (MKT, SMB, and HML) and a momentum factor (MOM), constructed as in Carhart (1997).[3] When pricing-model beliefs are centered on the CAPM, then the Fama-French factors become three of the non-benchmark series; when beliefs are centered on the Fama-French model, MOM is then one of the non-benchmark series. Four additional non-benchmark passive assets are used with beliefs centered on any of the three pricing models. These additional assets are constructed from a set of 20 value-weighted industry portfolios created using the classifications in Moskowitz and Grinblatt (1999). The four assets are portfolios mimicking the first four principal components of the disturbances in

[3]We are grateful to Ken French for supplying the updated Fama-French factors.

multiple regressions of the 20 industry returns on the other passive returns (MKT, SMB, HML, and MOM). The vector of weights in each portfolio is proportional to the eigenvector corresponding to one of the four largest eigenvalues of the sample covariance matrix of the residuals in those regressions.[4]

2.4. Assessing the SRI constraint

We construct the optimal portfolios of mutual funds for mean-variance investors having a range of prior beliefs about model mispricing and manager skill. Each optimization uses the predictive distribution of fund returns,

$$p(r_{Funds,T+1}|R) = \int_{\theta} p(r_{Funds,T+1}|R,\theta)p(\theta|R)d\theta \tag{11}$$

where θ is the parameter vector, $r_{Funds,T+1}$ contains the returns in month $T+1$ on all eligible funds, and R represents the data observed through month T. This distribution's first two moments, relevant to our mean-variance investor , are derived in Pástor and Stambaugh (2002b).

We measure the cost of the SRI restrictions in terms of certainty-equivalent loss. Specifically, the investor is assumed to select an optimal portfolio (with no short selling of funds) by maximizing the mean-variance objective[5].

$$C_p = E_p - \frac{1}{2}A\sigma_p^2, \tag{12}$$

where E_p and σ_p are the predictive mean and standard deviation of the portfolio's excess return, and $A = 2.75$, which is the approximate value that would result in the investor allocating all of his wealth to the stock-market index portfolio when it is the only available risky asset. The investor's overall portfolio can include an unrestricted long or short position in the riskless asset, so maximizing (12) is equivalent to maximizing the Sharpe ratio. We then calculate

$$\Delta C_p = C_{p,All\ Funds} - C_{p,SRI}, \tag{13}$$

[4]PS use three industry-based principal components plus returns on a characteristic-matched spread between portfolios with high and low HML betas, as compared to our use of four industry-based components.

[5]Grossman and Sharpe (1986) discuss a related approach in the context of evaluating the investor's cost of being prohibited to invest in firms with presences in South Africa.

where $C_{p,All\ Funds}$ is the maximized value of (12) when funds can be selected from the broad universe, and $C_{p,SRI}$ is the maximized value of (12) when only SRI funds can be selected. In other words, ΔC_p is the certainty-equivalent loss associated with the SRI constraint. We also compute the correlation, based on the predictive distribution, between returns on the unrestricted optimal portfolio and the returns on the SRI-restricted portfolio. These calculations are repeated under various beliefs about model mispricing and manager skill, as represented by σ_{α_N} and σ_δ, respectively. Table A.5 details the implications for δ and α_N of different prior values of σ_δ and σ_{α_N}, respectively.

3. Mutual Fund Data and Characteristics

3.1. The Mutual Fund Universe

The mutual fund data employed in the paper are from the Survivorship Bias Free Mutual Fund Database from the Center for Research in Security Prices at the University of Chicago. The time span of the data covers July 1963 through December 2001. To employ the empirical Bayes procedure for specifying some of the priors, as mentioned earlier, we first exclude multiple share classes for a given fund and funds that have twelve or fewer months of return data. We do not include fixed income (bond) funds, international equity funds, or balanced funds that invest not only in equities but in bonds or other fixed income instruments. The resulting sample used in the empirical Bayes procedure contains 3,545 domestic equity mutual funds. Our subsequent attention is restricted to the subset of the 3545 funds with at least three years of history under the current manager as well as data in the last month of the sample. In addition, since it is not clear in a single-period setting how to treat the load fees of funds that charge them, we, like Pástor and Stambaugh (2002a,b), focus most of our attention on no-load funds, bringing the size of our final sample of no-load domestic equity mutual funds to 894.[6] At the same time, since some authors (e.g., Brill, Brill, and Feigenbaum, 2000) suggest that socially responsible funds might charge higher fees to support their social screening and related activities, we also report some results, as a robustness check, obtained by adding back the load funds to the sample.

[6]For a fund to be included in the final no-load sample, it must have data on expenses and loads. Thus, for example, if a fund has missing data on its load, we treat it as if it has a load and exclude it from the no-load sample.

3.2. Socially Responsible Mutual Funds

Having defined our broader universe of domestic equity mutual funds, we turn to determining which of those nearly 900 funds have non-financial, "social" investment goals. We first construct a list of screening criteria used by managers in pursuing the social aspect of their strategies. Fund managers employ various kinds of techniques when investing with respect to social goals. While there seems not to exist firm widespread agreement on precisely what defines "socially responsible investing," we build a set of elements that generally capture most of the methodologies we have found to be used in practice.

3.2.1. Developing Social Screen Classifications

We develop our list of SRI screen criteria used by mutual funds by combining information from a number of sources. Using these sources, we identify twenty classification categories representing in some sense the "best practice" screening standards in the available literature and the asset management industry. These are the screens appearing in Table 1. Our sources include The Social Investment Forum (2001), Morningstar (www.morningstar.com), Brill, Brill, and Feigenbaum (2000), SRI World (www.socialfunds.com), Lexis/Nexis key word searches of national and regional newspapers, magazines and journals, fund prospectuses and websites, and especially direct contact with managers via telephone, email and written communication.

We limit the categories to twenty by aggregating what appear elsewhere in the literature and practice as distinct criteria. For instance, the "Labor Relations" and "Workplace Conditions" categories are combined into a single category, just as we merge "Oppressive Regimes" and "Mistreatment of Indigenous Peoples" into a single screen for "Irresponsible Foreign Operations[7]. We also form one classification from the six screens, listed in Panel B of Table 1, in which stocks can either be excluded due to negative characteristics or included due to positive ones.

[7]Nonetheless, we classify separately "Diversity" and "Labor Relations" and distinguish between "Firearms" and "Military Weapons Production."

3.2.2. Identifying SRI Equity Mutual Funds

The Social Investment Forum (2001) reports that, in 2001, social screens were imposed by 219 mutual funds, not all of which are equity mutual funds. Our initial sample includes the equity funds from that list as well as a number of funds we identify via the other sources listed above.[8,9] After assembling those identities, we then contacted the manager or representatives of each fund, verifying their social investment policies and clarifying the nature of any changes in them over time.[10] We identify the mutual funds in our sample that enforce one or more social screens in their investment criteria as being "socially responsible" for this study, and thus our SRI sample contains several mutual funds that employ only a few screens, such as the tobacco-screening funds of AARP and Bridgeway, the DEM Equity Fund, which screens for diversity, and the American Mutual Fund, which excludes solely alcohol and tobacco companies. Furthermore, in selecting the funds for the study, we do not distinguish between moral and social responsibility. Although some religious funds prefer to label themselves as "morally responsible" rather than "socially responsible," they typically employ traditional screens such as alcohol and tobacco as well as screens more often associated with religious interests, such as abortion and birth control.

One difficult aspect of compiling our sample of SRI funds involves deciding which borderline funds—those that utilize social criteria in a loose and transitory fashion—should qualify. To make such a decision in an objective manner, one could distinguish between funds that define their screens in their prospectuses, and thus can only change them with a vote of the shareholders, and funds that screen by policy, which can be altered without consulting the shareholders (Brill, Brill, and Feigenbaum, 2000). For the current study, we do not limit our analysis to funds whose screens formally appear in their prospectuses and instead allow for funds to screen as part of their functional investment policies. This is also the method of the Social Investment Forum (Social Investment Forum, 2001, 2003). For instance some of the

[8]We thank the Social Investment Forum for generously sharing their list of socially responsible funds with us.

[9]Previous versions of this paper identified the California Investment S&P Mid-Cap Index as an SRI fund following the Social Investment Forum, and it routinely played important roles in optimal SRI portfolio. However, the Social Investment Forum subsequently retracted its classification of that fund as being an SRI fund. We contacted the managers of the fund and verified that while there were *de facto* exclusions of certain stocks typically identified as not socially responsible (e.g., tobacco stocks), screening was and is not an active policy. We thus exclude it from the SRI subset in our sample.

[10]Only Ariel, Calvert, Devcap, Evergreen, and Meyers Pride Value funds have added or altered a screen since inception, and Rightime Social Awareness stops screening entirely in February 1999.

mutual funds in the Pioneer family screen alcohol, tobacco, and gambling companies, but there is no policy or written mandate to employ these criteria, simply a tradition of doing so. We include Pioneer in our initial sample, although it does not pass subsequent filters for inclusion in the final sample.

Our final list of no-load SRI equity mutual funds with at least three years of return history through December 2001 are listed in Table A.1 in Appendix A. This final sample is comprised of 106 single share class SRI funds with one year of data, 49 of which survive the requirement of having 36 months of return history, expense data and turnover data. Of those 49 funds, 34 charge no load fee.

3.2.3. Characteristics of Socially Responsible Mutual Funds

Investors in mutual funds in general, and especially those considering "following their hearts and not their wallets," might naturally form opinions about fund manager ability by considering fund characteristics. In fact, as discussed above, in the framework used here the investor specifically forms his prior mean for a fund's δ_A as a function of that fund's expenses. Moreover, investors who rule out skill completelyalso considers the fund's turnover, which further reduces their ex ante views of the fund's expected return.

The first panel of Table 2 reports turnover and total net assets for the average non-socially responsible fund and the average socially responsible mutual fund. The averages are computed over time and across funds. Since the management of socially responsible funds ostensibly requires at least some form of active analysis of firm social performance, one might presume that expenses might be higher for the average socially responsible fund than for the average non-socially responsible fund. This turns out to be true, although not dramatically so: the average non-socially responsible fund in our sample has an expense ratio of 1.10% per year, whereas investors in the average SRI fund pay 1.36% per year for management and operating expenses. Interestingly, non-SRI funds turn over their investments twice as frequently as their SRI counterparts on average: 175.2% per year vs. 83.3% per year. This substantial turnover difference will have implications for our analysis of the performance of fund composites in Section 4.3. Finally, the average SRI fund has about $153 million in net assets, while the average non-SRI fund has nearly $260 million in net assets, a size difference

noted before in the literature (e.g., Statman, 2000).

4. Investment Results

4.1. Optimal Portfolios

Tables 3, 4 and 5 present the SRI funds in portfolios with the highest Sharpe ratio under various degrees of prior uncertainty about model mispricing (σ_{α_N}) and prior uncertainty about manager skill (σ_δ)[11] Recall that the Sharpe ratio is based on the investor's predictive distribution, which is obtained by updating the investor's prior beliefs with the information in the data. Table 3 reports results when the investor's prior beliefs about a pricing model are centered around the CAPM, while tables 4 and 5 present results for the the Fama-French (1993) three-factor model and the Carhart (1997) four-factor model, respectively. Short sales of funds are prohibited. Panel A in each table gives the weights of each mutual fund in the portfolio optimal for that combination of mispricing and skill uncertainty. For instance, the first column in Panel A of Table 3 indicates positive weights on five funds, the AHA Investment Funds Diversified Equity Portfolio (44%), Domini Social Equity Fund (31%), the Citizen's Funds Core Growth Fund (19%), the Liberty Young Investor Fund (3%) and the Lutheran Brotherhood Fund (3%). Those weights produce the highest Sharpe ratio among all 34 funds available to our socially responsible investor. That column sets $\sigma_{\alpha_N} = \sigma_\delta = 0$ and represents the case in which the investor dogmatically believes in the CAPM and does not allow for skill on the part of the manager. In other words, the first column represents the case of a market indexer, and the funds chosen are those which in combination best track the market index. Short-sale constraints have the effect not only of disallowing negative positions but also of zeroing-out weights on many funds that would have nonzero weights in an unconstrained portfolio; funds not appearing in the table have zero weights for all priors considered in the table.

The costs of being constrained to invest only in SRI funds are reported in Panel B of each table. The certainty equivalent difference is the value of ΔC_p, defined earlier in (13), and it compares the optimal portfolio selected from all 894 mutual funds in the overall no-load

[11]Table A.5 reports the implications for δ and α_N of different prior values of σ_δ and σ_{α_N}, respectively.

sample to the optimal portfolio formed from the subset of 34 SRI funds. In the first column of Table 3, representing complete belief in the CAPM and utter disbelief in the possibility of manager skill, the certainty equivalent difference between the two optimal portfolios is a relatively small amount, only seven basis points per month. Also reported is the correlation of the returns between the two portfolios. For that same case, the SRI-constrained portfolio, formed using the three funds mentioned above, has a correlation of 98% with the optimal broad-universe portfolio.

Market indexers in the standard CAPM/no-skill setting evidently bear little cost by restricting their equity mutual fund investments to socially responsible funds. Put another way, the socially responsible market indexer chooses index funds whose returns closely mimic those of the index funds otherwise chosen without reference to social investment goals. Table A.2 in Appendix B presents optimal portfolios constructed in the same way as in Table 3 but from the entire universe of 894 funds. For the dogamtic CAPM/no-skill indexer choosing from the entire no-load universe, the Vanguard Total Stock Market Index represents 100% of the equity portion of the optimal portfolio. Using five SRI funds, the market indexer can reasonably mimic that Vanguard fund.

Now suppose the dogmatic believer in the CAPM's ability to price passive investments nevertheless admits the possibility that mutual fund managers might have skill in implementing their active strategies. Specifically, suppose an investor assigns a value of 1% to σ_δ, which, given our assumptions about the prior distribution of δ_A for a given fund, means that he assigns a 2.5% probability to the possibility that the manager will generate a positive skill measure gross of expenses of at least 2% per year (1% mispricing times approximately 2 standard deviations).[12] Equivalently, the investor assigns about a 15% prior probability to the manager's generating 1% or more in excess performance (Table A.5 tabulates additional values). Such a case appears in the second column of Table 3. The funds appearing in the optimal portfolio differ somewhat from the case of a market indexer, with the only funds in common being the Domini Social Equity Fund, whose weight drops from 31% to 3% and the AHA Investment Funds Diversified Equity Portfolio whos weight increases from 44% to

[12]As do Pástor and Stambaugh (2002b), we note that unlike Baks et al (2001), our investor assigns an equivalent prior probability to the prospect of a negative measure of skill. This is important from an interpretive view of the prior on skill. However, we also rule out the possibility of short sales and so this negative performance possibility is unlikely to be important computationally.

77%. Nonetheless, the certainty equivalent loss, ΔC_p is only 7 basis points per month, the same as for the previous case. The correlation between the optimal portfolios barely drops, from 98% to 94%.

Raising skill uncertainty to 3% (so that there is about a 10% prior probability that a manager can add at least about 3.5% performance per year) results in a shift from diversified, index-style portfolios to growth and micro-cap funds, with the Baron Growth Fund receiving a 75% allocation and the Bridgeway Micro-Cap Limited Portfolio fund getting 17% of the investor's fund portfolio. In other words, allowing for the possibility that managers add a large amount of value moves the investor into actively managed funds that have done well in the recent past. The certainty equivalent difference between optimal portfolios grows to 99 basis points per month, representing a significant change from case of the market indexer.

Allowing for mispricing uncertainty under the CAPM in Table 3 again tends to move the indexer away from broad market index funds like the Domini Social Equity Fund and toward actively managed funds and those with exposure to non-benchmark factors. For instance, when manager skill is ruled out, allowing for CAPM mispricing of 1% per year causes the investor to place 60% of his mutual fund portfolio in the AHA Investment Funds Diversified Equity Portfolio, and increase of 33% in the CAPM case, 12% in the Liberty Young Investor Fund and 27% in the Domini Social Equity Fund. At the same time, however, the certainty equivalent loss remains small at only 7 basis points per month. In fact, admitting the possibility of either 1% or 2% mispricing uncertainty results in nearly the same certainty equivalent loss (7 b.p.) as in the pure-indexer case. It thus appears that priors on the prospect of manager skill are of first-order importance, while mispricing uncertainty, at least for the CAPM, is relatively less important.

For the case of completely diffuse beliefs about skill, the Bridgeway Micro-Cap Limited fund gets nearly all of the investor's mutual-fund allocation. This fund has produced high returns in our sample period, with an OLS $\hat{\delta}_A$ of 187 basis points per month. The investor with diffuse beliefs, or *infinite* skill uncertainty, essentially views ex post track records as being equivalent to ex ante skill. Since the Bridgeway fund and the other ex post highest fliers do not happen to be in the SRI subset of funds, the SRI-constrained investor with infinite skill uncertainty is deprived of funds that he infers to have very high ex ante expected returns. In this extreme case, certainty equivalent losses associated with the SRI-constraint

are 1,431% per month and the correlation between optimal portfolios is only 58%. Again, whether CAPM mispricing is admitted is of second order importance relative to prior beliefs about manager skill. With $\sigma_\delta = \infty$, certainty equivalent losses in Table 3 range from 1,432% for no model mispricing to 1,493% for 2% mispricing uncertainty per year.

For investors skeptical about the presence of managerial skill, portfolios formed under prior beliefs centered on the Fama-French (1993) three-factor model are considerably different from those under CAPM beliefs. Recall that the Fama-French model includes the spread between value and growth stocks (HML) and small-cap and large-cap stocks (SMB) along with the excess market return. With dogmatic beliefs in the three-factor model and no allowance for skill ($\sigma_{\alpha_N} = \sigma_\delta = 0$), the investor allocates heavily to funds that invest in small value stocks. As shown in the first column of Table 4, the investor then puts 69% of his mutual fund portfolio into the Stratton Small Cap Value Fund and 21% of his portfolio in the Third Avenue Small-Cap Value Fund. In this case, the certainty equivalent cost of the SRI constraint is relatively large, at 31 basis points per month. As noted earlier, the costs of the SRI constraint when skill is precluded can be viewed as arising solely from the inability to diversify, in that the investor is less able to construct a portfolio whose return mimics the optimal combination of factor exposures. The correlation between the optimal portfolio from the broader no-load universe and the SRI alternative this investor is forced to hold in this case is only 84%, as compared to 98% for the CAPM-oriented index investor.

The investor who admits skill uncertainty (and no mispricing uncertainty) of 1% per year retains most of his investments in the Stratton and Third Avenue funds but also allocates 8% to the Baron Growth Fund and 9% to the Bridgeway Micro-Cap Limited Portfolio Fund. When the investor's prior beliefs admit 3% mispricing uncertainty, that allocation rises to 58% and 42%, respectively, and the previous allocation to small value stock funds goes to zero. In addition, as occurs in the previously discussed case with CAPM-oriented priors, the Bridgeway Micro-Cap Limited fund occupies all (or nearly all) of the mutual fund portfolio of an investor with diffuse prior beliefs about manager skill. Finally, as under the CAPM, the properties of the optimal portfolios are affected less by mispricing uncertainty than by uncertainty about manager skill. Portfolio compositions, certainty equivalent losses, and optimal portfolios' correlations are fairly similar across the different values of σ_{α_N}, although raising σ_{α_N} from 0 to 2% does increase the weight on the Stratton Small Cap Value Fund

from 69% to 76% for an investor who precludes skill ($\sigma_\delta = 0$).

When the investor has dogmatic priors in favor of the Carhart (1997) four-factor model (Table 5) and disallows skill, he allocates the bulk of his investment (91%) to the Stratton Small Cap Value Fund. He favors the later fund over substantial investment in the 3rd Avenue Small-Cap Value Fund, chosen under analagous priors centered on the Fama-French model (Table 4). The certainty equivalent cost of the SRI constraint in this case is substantial, at 37 basis points per month, and the correlation between the returns on the constrained and unconstrained optimal portfolios is only 79%.

Allowing modest skill uncertainty of 1% per year results in tilting away from small-cap value and toward small-cap growth, via the Baron Growth Fund (22%) and a decrease in allocation to the Stratton Small Cap Value Fund to 62% from 91%. In addition, the Third Avenue Small-Cap Value Fund allocation goes to zero and the Bridgeway Micro-Cap Limited Portfolio gets an additional 9% allocation. With 3% skill uncertainty, the investor no longer invests in funds that have value exposures. Instead, he shifts his wealth into small cap growth funds, namely the Baron Growth Fund and the Bridgeway Micro-Cap Limited Portfolio fund, both of which play similar roles in the previous tables with different benchmark models but under similar prior mispricing uncertainty. The Bridgeway fund again gets 100% of the investor's fund portfolio when he is diffuse in his beliefs about skill, and the SRI certainty equivalent cost in that case is again large.

The results in Table 3, 4 and 5 suggest that, in general, certainty equivalent losses of investors in socially responsible mutual funds are larger when pricing beliefs are centered on either of the multifactor models or when investors' priors admit the possibility of manager skill. While market indexers appear not to suffer economically significant costs from restricting their investments to socially responsible funds, that constraint can be quite costly to investors with different prior beliefs.

4.2. Partial Allocations to SRI

4.2.1. The Typical Socially Responsible Investor

The previous analysis makes the simplifying assumption that the investor in socially responsible mutual funds allocates 100% of his equity-fund portfolio to those funds. However, Silby (2002) estimates that the typical investor in SRI mutual funds allocates between 25% and 33% of his wealth to such funds. Tables 6, 7 and 8 repeat the analysis of the last section but with the restriction that the investor allocates a minimum of 33% of his wealth to SRI funds and the remaining amount (67% at most) to other funds. We impose no upper bound (less than 100%) on the fraction invested in SRI funds, although the investor never chooses to exceed the minimum for the cases we consider.

Of course, the certainty equivalent losses and the corresponding correlations reported in Panel B of Tables 6, 7 and 8 are smaller than those in Table 3, 4 and 5. With only a 33% allocation to SRI funds, market indexers bear only a 2 basis point per month cost and are able to create portfolios that have a 100% correlation with the unconstrained optimal portfolios for that prior specification (Table 6, first column). Recall that the Vanguard Total Stock Market Index constitutes 100% of the investor's portfolio in the unconstrained case. In the 33% allocation case, the same Vanguard market index fund gets 73% of the investor's portfolio, while the remaining allocations are spread across the Vanguard Extended Market Index (with 9%), the AHA Investment Funds Diversified Equity Portfolio (with 11%) and the Citizens Funds Core Growth and Domini Social Equity Fund (with 3% and 4%, respectively).

This low-cost result continues for $\sigma_\delta = 1\%$, where losses range only from 2 basis points per month to 4 basis points per month under increasing priors on mispricing uncertainty. However, when 3% skill uncertainty is allowed, the losses range from 46 basis points per month to 54 basis points per month. As before, the extreme case of completely diffuse skill uncertainty priors still exhibits very large losses.

With dogmatic priors in favor of either the Fama-French three-factor model or the Carhart four-factor model, certainty equivalent losses are 16 and 19 basis points per month, respectively, which are significantly higher than for the CAPM case. These losses, as well as those corresponding to the other priors we consider, are about half what they are under the con-

straint of a 100% allocation to SRI funds. For instance, with 1% skill uncertainty and 1% model mispricing uncertainty, the 33% allocation loss is 20 basis points per month for the the three-factor model and 22 basis points per month under the four-factor specification. Correlations are consistently above 90% except when $\sigma_\delta = \infty$, in which case they drop to 70% in each case.

Thus, under the less restrictive SRI constraint based on the allocation estimates of Silby (2002), the average socially responsible investor does not necessarily suffer losses of quite the magnitudes in Tables 3 through 5, but he nevertheless incurs economically significant losses unless he is a dogmatic CAPM believer who admits little or no possibility of manager skill, i.e., unless he is essentially an index investor. The minimum loss when he centers beliefs around either multifactor model is 16 basis points per month. With less than dogmatic priors about the absence of skill, those costs exceed 20 basis points per month on average.

4.2.2. Alternative Allocations to SRI Funds

Figure 1 presents certainty equivalent differences (ΔC_P, left-hand plots) and correlations (right-hand plots), corresponding to those in Panel B of Tables 3 through 8, but for a range of minimum allocations to SRI mutual funds. The minimum SRI allocations appearing along the horizontal axis range from 10% through 90%. (Recall that the 100% cases appear in Tables 3 through 5 and that the 0% case appears in Appendix B.) The representative cases for which the figure is constructed have no model mispricing ($\sigma_\alpha = 0$) and three different levels of skill uncertainty (σ_δ): 0% (figs. 1a and 1b), 1% (figs. 1c and 1d), and 2% (figs. 1e and 1f). Results are shown for all three pricing models (CAPM, three-factor, and four-factor).

In all figures, the results under priors for the two multifactor models are quite similar. As before, larger differences arise between either of those models and the CAPM. For instance the low cost of SRI investing to dogmatic market indexers in Table 3 is made even smaller for the lower allocations appearing in Figure 1a, where they range from about 1 basis point per month to only 4 basis points per month for a 90% allocation. With priors for mispricing centered around the three- and four-factor models, however, investors lose from just over 15 basis points per month for a 10% allocation to as much as 25 basis points for a 90%

allocation. Of course, as investors admit the possibility of greater manager skill, the losses increase. For instance, with skill uncertainty of 2%, even a dogmatic believer in the CAPM (our prototypical market indexer) loses just under 40 basis points per month with as little as a 10% SRI allocation and about 80 basis points per month with a 90% SRI investment. For a dogmatic believer in either of the multifactor models, those numbers rise to roughly 60 and 140 basis points.

4.3. Allocations Across Composites: SRI versus Non-SRI

This study treats SRI as an investment constraint and explores its cost in a mean-variance setting. To an SRI-sensitive investor whose preferences are otherwise in accord with the mean-variance paradigm, the cost of this investment constraint must be offset by the non-pecuniary utility derived from knowing the constraint is being imposed. As observed above, that cost threshold can be high, depending on the investor's views about pricing models and fund-mananger skill. This costly view of SRI might seem a bit puzzling to those acquainted with previous studies reporting that SRI's historical performance actually compares favorably to that of a broader universe. For example, Statman (2000) reports that, over the 1990–98 period, the Domini Social Index outperforms the S&P 500, and the average performance of SRI mutual funds slightly exceeds that of a sample of matched conventional funds. Similar conclusions in related contexts have been noted by Statman, et al. (1993), Kurtz and diBartolomeo (1996), Guerard (1997), Goldreyer and Diltz (1999), Bauer, et al (2002), and Plantinga and Scholtens (2001).

Comparing the average performance of SRI funds to that of non-SRI funds need not provide useful information to an investor who can selectively invest in funds. To a mean-variance investor who can select any combination of funds, restricting the investment universe to a subset of funds cannot, by definition, provide a benefit. If for some reason the investor is limited to investing in broad composite portfolios of funds, akin to equally weighted funds of funds, then there can be scenarios in which even a mean-variance investor who places no value on SRI might prefer to invest substantially in such a composite of SRI funds as compared to a non-SRI alternative. In the latter investment setting, comparing average performances across SRI and non-SRI funds might be meaningful.

Restricting investment to composite portfolios of mutual funds is probably less realistic for most investors, whether or not they are SRI-sensitive. Nevertheless, in order to give the reader a broader perspective on SRI and provide some additional insight regarding the relevance of previous evidence on composite averages, we provide here an analysis of an allocation problem with two risky assets. The first asset is the equally weighted portfolio of the 34 SRI mutual funds analyzed earlier, and the second is the equally weighted portfolio of the remaining 860 funds in our no-load universe. The second panel of Table 2 reports, for both assets, the posterior means and associated "t-statistics" of the regression coefficients in (3). Note that the posterior mean of the skill measure δ for the SRI portfolio is actually slightly higher than that of the non-SRI portfolio, by about 13 basis points per month. It is, however, critical to interpret the meaning of δ carefully for portfolios of SRI funds since an SRI investor would not be able to hold the factors in the 4-factor model generally. One could find that δ's of SRI funds are positive, yet δ's really say nothing about the desirability or cost of SRI investing. Positive δ's would simply say that, for an unconstrained investor who currently holds the right hand side factors, moving some amount of money into SRI funds would improve the overall Sharpe ratio. The Sharpe ratio for an SRI-only investment could still be low. Thus, basing a decision to invest in SRI funds purely on their δ's or other measures of skill (like traditional α's), would be a mistake.

Table 9 reports the relative allocations to the SRI and non-SRI equally weighted composites under the same range of prior beliefs specified earlier. In this two-asset problem, allocations are affected primarily by views about potential fund-manager skill. When no possibility of skill is admitted, i.e. when $\sigma_\delta = 0$, then the investor allocates 100 percent of his investment in these two assets to the SRI composite, for any of the alternative beliefs about pricing models. On the other hand, when the possibility of skill is admitted, i.e. when $\sigma_\delta > 0$, then the investor places a substantial fraction in the non-SRI composite. The explanation for the switch to the non-SRI composite, once the possibility of skill is admitted, rests largely on the treatment of turnover in forming the prior mean of δ_a in (8) and (9). As noted earlier, we follow Pástor and Stambaugh (2002b) in having turnover play a neutral role in the prior mean of δ_A when skill is admitted.[13] The key to the current result is that the average

[13]As Pástor and Stambaugh (2002b) observe, once one admits the possibility of skill, then the investor might well associate higher turnover with higher skill, since a skilled manager acting on his stock picks would produce turnover. At the same time, turnover is costly, especially if it is not associated with skillful picks. Thus, it becomes unclear whether turnover provides useful prior information about skill when one admits the

turnover of funds in the SRI composite is less than half that of the non-SRI funds: 83% versus 175%. When skill is precluded ($\sigma_\delta = 0$), turnover unambiguously depresses returns, so the prior mean is as given in (8). In that case, the lower turnover of the SRI funds puts the SRI composite at an advantage. When skill is admitted ($\sigma_\delta > 0$), the prior mean for δ_A is given instead by (9), and the higher turnover of the non-SRI composite no longer imposes a penalty. In those cases, the non-SRI composite becomes more attractive, especially for the smaller values of σ_δ. Observe that, when $\sigma_\delta > 0$, the allocation to the SRI composite is increasing in σ_δ, due to the higher posterior mean of δ_A for the SRI composite under diffuse priors (Table 9).

4.4. Loaded Funds

Our results to this point exclude funds with load fees because it is not clear how to account for these fees appropriately. Some loads are charged to investors upon initial investment in a fund, some are charged upon withdrawal of assets from a fund, and some decrease with the time assets remains invested in a fund. Accounting for these expenses correctly would depend on a number of assumptions and probably involve dynamic optimizations not part of the current single-period framework. Nonetheless, it might interest some readers to learn whether including funds with loads impacts our results. Tables 10, 11, and 12 repeat the analysis of the previous sections with load funds included. We do not account for the load fees in any way and simply ignore them. Thus, in some sense the results likely underestimate the effective expenses faced by investors when allocating to loaded funds.

The additional loaded funds expand both the overall universe of funds and the SRI subset, with the former increasing from 860 to 1,443 and the latter increasing from 34 to 49. The average load fees of funds that charge them appear in the final column of Table 2. Non-SRI funds with loads have maximum load fees of 3.63%, as compared to 4.26% for SRI funds. We note that SRI funds that charge loads charge 1.3% in annual expenses, the amount charged by no-load SRI funds, while non-SRI funds with loads charge higher non-load expenses, approximately 1.4% compared to 1.1% for those without loads. Those higher annual expenses are implicit in the results of Tables 10, 11, and 12.

possibility that skill might exist. Pástor and Stambaugh (2002a) also report empirical evidence supporting their specification.

Expanding both the SRI and non-SRI samples produces only small net changes in certainty equivalent differences and correlations between optimal portfolios. Of course, in many cases, the funds chosen by the investor differ from the no-load-only case, even though the costs of the SRI constraint do not change significantly. The dogmatic indexer whose SRI portfolio appears in the first column of Table 3 does not significantly alter his portfolio when presented with the opportunity to invest in loaded funds, even when the load does not enter into returns. Obviously this investor's certainty equivalent loss remains the same as in the no-load case, at only 7 basis points per month. An SRI investor who admits skill uncertainty of 1% but maintains complete confidence in the CAPM still incurs a certainty equivalent loss of only 7 basis points as well, although a new fund, Washington Mutual Investors Fund, receives an 8% allocation. Likewise, when significant amounts of manager skill are entertained, such as $\sigma_\delta = 3\%$ and $\sigma_\delta = \infty$, the Calvert Social Investment Equity Fund (a load fund) receives large allocations of 69% and 61%, and the certainty equivalent loss is 92 b.p. and 1,385 b.p. per month, respectively. The latter values are only marginally less than in the no-load case (99 b.p. and 1,431 b.p.). A similar pattern occurs with the other portfolios in Table 10.

For both the Fama-French three-factor model and the four-factor model (Table 11 and 12), the values of ΔC_p have approximately the same magnitudes for the sample including loaded funds as the sample without these additional funds with similar patterns across priors. The portfolios again differ in composition, largely in favor of the Calvert Social Investment Equity Fund (especially when larger amounts of skill are entertained), the Washington Mutual Investor's Fund (especially when manager skill is ruled out or when only a modicum of skill is entertained), the Ariel Fund (especially for the four-factor model), and the Calvert New Vision Small Cap Fund. In about one-half of the combinations of skill uncertainty and model mispricing in both Tables 4 and 5, ΔC_p is marginally higher for the no-load only sample. The difference in ΔC_p values is never more than about 13% and averages less than 1%.

4.5. Funds Commonly Accessible

Our initial data filters do not discriminate as to whether a given fund is specifically open to allocations from all investors in either the overall universe of funds or among SRI funds.

For instance, some funds chosen in the optimal unconstrained portfolio are institutional share class funds like the Vanguard Total Stock Market Index Institutional fund which are often available at lower cost yet higher minimum investments than funds available to non-institutional investors with lower minimums. This rule does not necessarily impart a bias since SRI funds are a subset of the overall sample, and both SRI and traditional funds may indeed be institutional funds and may have relatively high required minimum investments. For example, the optimal SRI portfolio under priors for the CAPM in Table 3 for a market indexer (attaching zero mispricing and skill uncertainty to investor priors) contains at least two institutional funds out of the five that appear: the Citizens Funds Core Growth Fund and The Lutheran Brotherhood Fund.

Table 13, 14, and 15 contain results for priors on fund manager skill and CAPM, 3-factor and 4-factor model mispricing, respectively, based on a set of non-institutional funds with minimum requied investments of at most \$2,500[14]. Only 23 of the 34 or two-thirds of SRI funds are available to investor under this restriction, and 569 of the 894 funds in the broader universe, slightly less than two-thirds. The additional constraints of course imply a lower Sharpe ratio than would be attainable by considering funds that have higher minimums and often lower fees in the larger, unconstrained set. However, of more interest to us is the relative certainty equivalent loss associated with the additional SRI contraint.

Table 13 shows that the certainty equivalent difference between the constrained and unconstrained non-institutional funds with low minimums for the market indexer is 5 basis points and involves a full investment in the Domini Socialy Equity Fund, in line with the results for the larger set of funds in Table 3 where the difference for the same priors is 7 basis points per month and a 31% allocation to the Domini Fund. In fact, for all priors in Table 13, the certainty equivalent differences reflect the same pattern as in Table 3 with the largest differences associating with skill uncertainty, although for larger prior skill uncerteinty, the losses are generally lower than in Table 3 (e.g., 55 basis points per month instead of 99 basis points per month for no prior model uncertainty and $\sigma_\delta = 3\%$). Similarly, in Tables 14 and 15 certaintly equivalent losses are lower when only non-institutional fund with low minimums are considered, although they are still economically quite significant. For instance, for the case of dogmatic belief in the Fama-French 3-factor model and increasing beliefs in skill

[14]We determined minimum investment amounts during our sample period by using the Morningstar database, doing internet searches and by calling fund companies and administrators directly.

uncertainty from zero to ∞, the differences are 17, 26, 68 and 298 basis points per month whereas in Table 4 allowing larger minimums and institutional funds the losses are 31, 38, 150 and 1,542 basis points per month. The same pattern persists in Table 15 for the 4-factor model where certainty equivalent differences are 25, 34, 70 and 354 basis points per month for dogmatic belief in the 4-factor model and varying beliefs in skill uncertainty, which compare for similar priors in Table 5 to 37, 46, 149 and 1,580 basis points per month.

Thus, the quadtratic investor who cannot allocate to institutional funds or those with minimums greater than \$2,500, the SRI constraint implies substantial certainty equivalent loss. However, the relative loss is generally less than if funds with higher minimums were also feasible. The source of the added advantage likely derives from the exclusion of funds with lower fees and those that have value, growth and momentum exposures.

4.6. The Sin Screens

One traditional set of social screens eliminates so-called "sin stocks" of companies typically associated with the production of alcohol, tobacco or gambling.[15] Investing in mutual funds eschewing such stocks further tightens the SRI constraint. Tables 13, 14 and 15 solve the investment problem after narrowing the original field of 34 SRI funds to the subset of 18 funds that screen out sin stocks (and perhaps engage in other socially responsible activities). As before, these three tables alternately assume that the investor centers prior beliefs about pricing around the CAPM, the Fama-French three-factor model, and the Carhart four-factor mispricing, respectively.

As one might expect, placing the additional sin constraint on the investor's allocation reduces the Sharpe ratio of the optimal portfolio and increases the certainty equivalent loss (ΔC_p) relative to the unconstrained portfolio, although, especially for the market-indexer, the change is small. In that case, the certainty equivalent loss is only 7 basis points, the same as in the overall 34-fund SRI universe, which contains funds that do not engage in sin stock screening. In fact, when admitting the possibility of managerial skill for all levels of CAPM mispricing, the cost of the SRI constraint changes little, at least in terms of the investor's certainty equivalent loss. When $\sigma_\delta = 1\%$, that loss is 10 basis points per month,

[15]We note that the Vice Fund (www.vicefund.com) defines sin stocks as those above as well as those related to aerospace and defense.

compared to 7 basis points for the 34 fund universe. When $\sigma_\delta = 3\%$ the loss is 113 (vs. 99) basis points per month, and when $\sigma_\delta = \infty\%$ the loss is 1,586 (vs. 1,431) basis points per month. This pattern remains largely the same when CAPM mispricing is entertained.

When priors center around the three- or four-factor models, the SRI costs rise significantly more under the sin screen. For investors who believe completely in the Fama-French model and rule out skill, losses are 41 (vs. 31) b.p. per month. As skill uncertainty is introduced, the certainty equivalant losses increase to 49 b.p. per month for $\sigma_\delta = 1\%$, 186 b.p. per month for $\sigma_\delta = 3\%$, and 1,770 b.p. per month for $\sigma_\delta = \infty\%$. (The corresponding values when all 34 SRI funds can be selected are 38, 150, and 1,542.) Yet again, model mispricing uncertainty is not tremendously important, although it generally results in small increases in SRI costs. Finally, for priors centered on the four-factor model, losses are larger, but only by about 10% on average compared to the three-factor model case. Thus, investors restricting their investments to mutual funds that eschew "sin stocks" pay an additional cost when admitting skill or when they center their priors on the multiple factor models we consider. However, as above, the investor in SRI funds who believes strongly in market indexing sacrifices relatively little.

5. Conclusion

Do investors who allocate their wealth to socially responsible equity mutual funds pay a price for their willingness to "do good deeds" via their investments? The answer clearly depends on what fraction of their portfolios they resrict to SRI funds as well as their prior beliefs about pricing models and manager skill. We find that the costs of the SRI constraint can be as little as 1 or 2 basis points per month in certainty equivalent terms, but only when investors adhere rather strongly to a belief in the CAPM and maintain complete disbelief in manager skill, or when their minimum allocation to SRI funds is small. When the investor's beliefs shift toward multifactor models like the Fama-French (1993) three-factor model or the Carhart (1997) four-factor extension, or when the investor admits the possibility that fund managers have skill, then the costs associated with socially responsible investing can be economically significant. The cost of the SRI constraint is especially high for investors who insist upon allocating their entire mutual fund investments to socially responsible funds,

but it is also quite substantial for the average SRI investor who (according to Silby, 2002) allocates only a third to that subset of funds.

Given its focus on mutual funds, this paper formally considers less than the entire universe of socially responsible managed funds. The intent is that the setting and general characteristics of the mutual funds studied are representative of the SRI industry at large, including institutional investments. If this assumption is reasonable—and we believe it to be—then those who access investments via institutional distributors of SRI funds, which have witnessed a large amount of growth in recent years, should be able to calculate the risk-return costs of their participating in socially responsible investment plans from our results.

A proponent of SRI might argue that a mean-variance setting leaves out the non-financial utility derived from "doing good," and thus our estimates of certainty equivalent costs of imposing the SRI constraint overstate the net total cost to a socially responsible investor. This is of course correct, but as long as the elements of the mean-variance objective are in harmony with the financial risk-return goals of the socially conscious investor, our results put a lower bound on the value of the non-financial utility that one should derive from socially responsible investing. We find that this bound can range widely, depending on the investor's views about pricing models and the skill of fund managers.

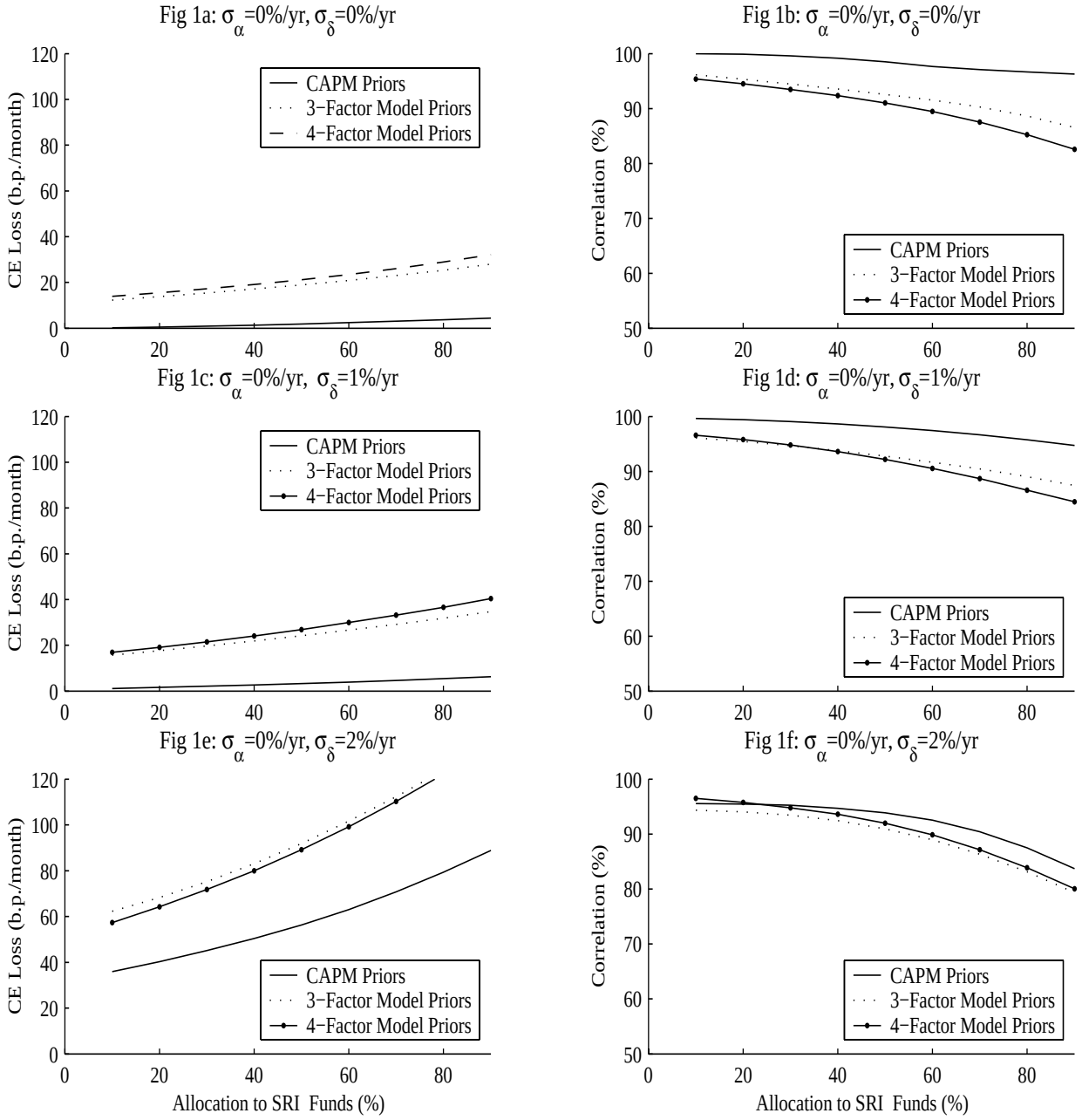

Figure 1. Differences between Optimal Mutual Fund Portfolios with and without SRI Allocation Restrictions: Certainty Equivalent Loss and Correlations

Table 1: Screens Employed by Socially Responsible Mutual Funds

We categorize the screens typically employed by SRI funds using 20 classifications. Some funds employ only one of these positive or negative screens, but most employ one or more. Negative screens represent the types of firms that managers of socially responsible mutual funds may eschew. Positive screens characterize firms that socially responsible funds may hold as investments.

A. Negative Sceens

Screens	Definitions
Alcohol	Firms that produce, market, or otherwise promote the consumption of alcoholic beverages
Tobacco	Manufacturers of tobacco products
Gambling	Casinos and suppliers of gambling equipment
Nuclear Power	Manufacturers of nuclear reactors and related equipment and companies that operate nuclear power plants
Firearms	Companies producing firearms for personal use
Defense Contracting (Military) Weapons	Production of weapons for domestic or foreign militaries
Irresponsible Foreign Operations	Investment in oppressive regimes such as Burma or China and mistreatment of indigenous peoples
Abortion/Birth Control	Abortion providers; drug manufacturers that manufacture and distribute abortifacients; insurance companies that pay for elective abortions (where not mandated by law); or companies that provide financial support to Planned Parenthood; Manufacturers of birth control products
Usury	Predatory lending, bonds, fixed income securities
Pornography	Pornographic magazines; production studios that produce offensive video and audio tapes; companies that are major sponsors of graphic sex and violence on television

B. Positive or Negative Sceens

Screens	Definitions
Products/Services	Strong investment in R&D, quality assurance, product safety; avoidance of antitrust violations, consumer fraud, and marketing scandals.
Animal Rights	Seeks promotion of humane treatment of animals; avoids animal testing, hunting/trapping equipment, and the use of animals in end products.
Labor Relations and Workplace Conditions	Avoids worker exploitation and sweatshops; seeks strong union relationships, employee empowerment, and/or profit sharing.
Diversity	Minorities, women, gays/lesbians, and/or disabled persons recruited and represented among senior management and the board of directors
Environment	Avoids companies that pollute, produce toxic products, and contribute to global warming; seeks proactive involvement in recycling, waste reduction, and environmental cleanup
Human Rights	Avoids companies directly or indirectly complicit in human rights violations; seeks companies promoting human rights standards

Table 1, Cont'd.

Screens Employed by Socially Responsible Mutual Funds

C. Positive Sceens

Screens	**Definitions**
Renewable Energy	Power derived from sources such as hydroelectric damns, fuel cells geothermal energy, solar energy, and/or wind energy.
Community Involvement/Investment	Proactive investment in surrounding communities by sponsoring charitable donations, employee volunteerism, and/or housing and education programs
*Fund Participation in Community Investment	The mutual fund itself invests in community development financial institutions (CDFIs)
*Shareholder Activism	The mutual fund attempts to influence company policies and actions through direct engagement with management and/or sponsoring shareholder resolutions

*These categories apply to the investment and management policies of the socially responsible mutual fund itself, rather than to those of the companies in which in which it invests.

Table 2
Mutual Fund Characteristics

Panel A reports arithmetic average expense ratios, turnover, and total net assets (TNA) for the typical no-load equity mutual fund having at least three years of return history through December 2001. The averages are calculated across time and across funds and are split into two categories: non-socially responsible funds (860) and socially responsible funds (34). The expense ratio as reported by CRSP is the percentage of total investment that fund shareolders pay for the fund's management and administrative (operating) expenses. Turnover is the turnover ratio of the fund, and TNA is the market value of all securities owned plus assets minus liabilities. Load is the arithmetic average of maximum fund loads for funds that pass all data requirements except the no-load filter and that report having loads, and it is reported separately for non-socially responsible funds (1,443) and socially responsible funds (49). Panel B presents the posterior means and "t-statistics" of the intercepts (δ's) and loadings from a regression of composite funds' returns on the returns of eight passive assets. The passive assets are MOM, the difference between returns on stocks with high and low returns over the previous twelve months (excluding the most recent "resting period" month), SMB, the difference between the returns on a portfolio of small stocks and a portfolio of large stocks, HML, the difference between returns on high and low book-to-market stocks, MKT, the excess return on the value-weighted CRSP NYSE/AMEX/NASDAQ stock market, and IP1 though IP4, four portfolios formed by applying principal component analysis to the disturbances in regressions of the returns on a set of 20 industry portfolios on the other passive returns. We compute "t-statistics" by dividing a given coefficient's posterior mean by its posterior standard deviation.

A. Average Fund Characteristics

Aggregate Mutual Fund Portfolios	Expense Ratio (%/yr)	Turnover (%/yr)	TNA ($MM)	Load (%)
Average (EW) Non-Socially Responsible Mutual Fund	1.10	175.2	257.24	3.63
Average (EW) Socially Responsible Mutual Fund	1.36	83.3	153.09	4.26

B. Posterior Means and "t-statistics" of Four-Factor Model δ's and Factor Loadings

Aggregate Mutual Fund Portfolios	δ	MOM	SMB	HML	MKT
Average (EW) Non-Socially Responsible Mutual Fund	0.0008	0.0278	0.1638	-0.0359	0.8330
	(0.17)	(2.06)	(9.66)	(-1.23)	(22.41)
Average (EW) Socially Responsible Mutual Fund	0.0021	0.0504	0.2047	-0.0299	0.8935
	(0.23)	(3.72)	(12.07)	(-1.02)	(24.04)

Table 3

Socially Responsible Portfolios with the Highest Sharpe Ratio Under Priors for CAPM Mispricing and Skill of Fund Managers

The investment universe from which the portfolios in Panel A are constructed consists of 34 no-load equity mutual funds that screen for socially responsible investments and have at least three years of return history through December 2001. The benchmark index return MKT is the excess return on the value-weighted stock market. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 no-load funds, including the former 34 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
AHA Inv Funds:Diversified Equity Portfolio	44	77	1	0	60	72	0	0	48	54	0	0
ARK Funds:Small Cap Equity Fund/Instl	0	0	7	0	0	0	6	0	0	1	5	0
Baron Growth Fund	0	20	75	0	0	28	72	0	0	39	64	0
Bridgeway Fund:Aggressive Investors/1	0	0	0	4	0	0	0	3	0	0	0	1
Bridgeway Fund:Micro-Cap Limited Port	0	0	17	96	0	0	22	97	0	6	30	99
Citizens Funds:Core Growth Fund/Instl	19	0	0	0	0	0	0	0	0	0	0	0
Domini Social Equity Fund	31	3	0	0	27	0	0	0	0	0	0	0
Liberty Young Investor Fund/K	3	0	0	0	12	0	0	0	10	0	0	0
Lutheran Brotherhood Fund/Inst	3	0	0	0	0	0	0	0	0	0	0	0
Stratton Small Cap Value Fund	0	0	0	0	0	0	0	0	33	0	0	0
Third Avenue Small-Cap Value Fund	0	0	0	0	0	0	0	0	9	0	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times$100)	98	94	79	58	97	94	78	57	92	90	76	56
Certainty-equivalent difference (basis pts./mo.)	7	7	99	1431	7	8	105	1452	11	12	117	1493

Table 4

Socially Responsible Portfolios with the Highest Sharpe Ratio Under Priors for Fama-French-Model Mispricing and Skill of Fund Managers

The investment universe from which the portfolios in Panel A are constructed consists of 34 no-load equity mutual funds that screen for socially responsible investments and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 no-load funds, including the former 34 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
Baron Growth Fund	0	8	58	0	0	8	57	0	0	9	55	0
Bridgeway Fund:Micro-Cap Limited Port	0	9	42	100	0	11	43	100	0	14	45	100
Scudder Small Company Stock Fund/AARP	10	0	0	0	9	0	0	0	7	0	0	0
Stratton Small Cap Value Fund	69	70	0	0	72	70	0	0	76	72	0	0
Third Avenue Small-Cap Value Fund	21	13	0	0	19	11	0	0	17	5	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times 100$)	84	85	75	54	82	84	75	54	80	82	74	54
Certainty-equivalent difference (basis pts./mo.)	31	38	150	1542	32	39	150	1549	34	40	150	1561

Table 5

Socially Responsible Portfolios with the Highest Sharpe Ratio Under Priors for Four-Factor-Model Mispricing and Skill of Fund Managers

The investment universe from which the portfolios in Panel A are constructed consists of 34 no-load equity mutual funds that screen for socially responsible investments and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, HML, the difference between returns on high and low book-to-market stocks, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month). Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 no-load funds, including the former 34 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
ARK Funds:Small Cap Equity Fund/Instl	0	0	1	0	0	0	1	0	0	0	2	0
Baron Growth Fund	0	22	60	0	0	20	58	0	0	16	56	0
Bridgeway Fund:Micro-Cap Limited Port	2	11	39	100	2	12	41	100	3	14	43	100
Flex-fund:Total Return Utilities Fund	4	5	0	0	5	6	0	0	7	8	0	0
Stratton Small Cap Value Fund	91	62	0	0	90	62	0	0	87	62	0	0
Third Avenue Small-Cap Value Fund	3	0	0	0	3	0	0	0	3	0	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times 100$)	79	81	76	55	79	81	75	55	79	81	75	54
Certainty-equivalent difference (basis pts./mo.)	37	46	149	1580	38	46	150	1582	39	47	152	1586

Table 6

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio and a Minimum 33% Wealth Allocation to SRI Funds Under Priors for CAPM Mispricing and Skill of Fund Managers

The investment universe from which the portfolios in Panel A are constructed consists of 894 no-load equity mutual funds that have at least three years of return history through December 2001. The portfolios are constructed under the constraint that socially responsible funds have weights summing to 33% of the mean-variance investor's portfolio. The benchmark index return, MKT, is the excess return on the value-weighted stock market. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 no-load funds, including the former 34 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
AHA Inv Funds:Diversified Equity Portfolio	11	28	0	0	15	24	0	0	18	22	0	0
ARK Funds:Small Cap Equity Fund/Instl	0	0	0	0	0	0	1	0	0	0	0	0
Ameristock Mutual Fund	0	10	0	0	0	17	0	0	0	13	0	0
Baron Growth Fund	0	9	45	0	0	13	42	0	0	17	36	0
Bridgeway Fund:Micro-Cap Limited Port	0	0	3	72	0	0	7	73	0	0	15	73
CGM Focus Fund	0	0	0	0	0	0	0	0	0	5	0	0
Century Shares Trust	0	0	0	0	0	0	0	0	11	0	0	0
Citizens Funds:Core Growth Fund/Instl	3	0	0	0	0	0	0	0	0	0	0	0
Domini Social Equity Fund	4	0	0	0	0	0	0	0	0	0	0	0
Elfun Trusts	0	51	0	0	0	36	0	0	0	0	0	0
Franklin Custodian Fds:Utilities Series/Adv	0	0	0	0	0	0	0	0	13	7	0	0
Galaxy Funds II:Small Company Index	0	0	0	0	0	0	0	0	2	0	0	0
Galaxy Funds II:Utility Index	0	0	0	0	0	0	0	0	8	6	0	0
Morgan Stanley Instl:Small Cap Growth/Inst	0	1	4	0	0	0	1	0	0	0	0	0
PIMCO Funds:Value Fund/Admin	0	0	0	0	0	0	0	0	0	6	0	0
Prudential Utility Fund/Z	0	0	0	0	0	0	0	0	3	0	0	0
Schroder Capital:Ultra Fund/Inv	0	0	47	28	0	5	49	27	0	12	48	27
Stratton Small Cap Value Fund	0	0	0	0	0	0	0	0	8	0	0	0
Turner Funds:Micro Cap Growth	0	0	0	0	0	5	0	0	0	11	0	0
Vanguard Extended Market Index/Instl	9	0	0	0	18	0	0	0	13	0	0	0
Vanguard Extended Market Index/Inv	0	0	0	0	4	0	0	0	0	0	0	0
Vanguard Small Cap Index/Instl	0	0	0	0	1	0	0	0	23	0	0	0
Vanguard Total Stock Market Index/Instl	73	0	0	0	62	0	0	0	0	0	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times$100)	100	99	95	74	99	99	95	74	99	98	96	73
Certainty-equivalent difference (basis pts./mo.)	2	2	46	1165	1	2	49	1184	3	4	54	1220

Table 7

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio and a Minimum 33% Wealth Allocation to SRI Funds Under Priors for Fama-French-Model Mispricing and Skill of Fund Managers

The investment universe from which the portfolios in Panel A are constructed consists of 894 no-load equity mutual funds that have at least three years of return history through December 2001. The portfolios are constructed under the constraint that socially responsible funds have weights summing to 33% of the mean-variance investor's portfolio. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 no-load funds, including the former 34 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
Baron Growth Fund	0	2	30	0	0	3	29	0	0	6	28	0
Bridgeway Fund:Micro-Cap Limited Port	0	5	26	75	0	7	27	75	0	9	28	75
CGM Focus Fund	0	5	0	0	0	6	0	0	0	7	0	0
DFA Invest Grp:Real Estate Securities Port	3	0	0	0	3	0	0	0	4	0	0	0
Franklin Custodian Fds:Utilities Series/Adv	14	5	0	0	17	9	0	0	22	15	0	0
Franklin Real Estate Securities Fund//Adv	4	0	0	0	3	0	0	0	2	0	0	0
Galaxy Funds II:Utility Index	13	11	0	0	13	12	0	0	14	13	0	0
Goldman Sachs Small Cap Value/Inst	12	6	0	0	8	2	0	0	2	0	0	0
PIMCO Funds:Value Fund/Admin	0	14	0	0	0	10	0	0	0	0	0	0
Schroder Capital:Ultra Fund/Inv	0	5	44	25	0	7	44	25	0	9	44	25
Stratton Small Cap Value Fund	40	40	0	0	41	40	0	0	43	39	0	0
Third Avenue Small-Cap Value Fund	15	5	0	0	15	3	0	0	14	0	0	0
Turner Funds:Future Financial Services	0	3	0	0	0	2	0	0	0	2	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times 100$)	94	94	93	70	94	94	93	70	93	94	94	70
Certainty-equivalent difference (basis pts./mo.)	16	20	77	1265	16	21	76	1271	17	21	75	1283

Table 8

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio and a Minimum 33% Wealth Allocation to SRI Funds Under Priors for Four-Factor-Model Mispricing and Skill of Fund Managers

The investment universe from which the portfolios in Panel A are constructed consists of 894 no-load equity mutual funds that have at least three years of return history through December 2001. The portfolios are constructed under the constraint that socially responsible funds have weights summing to 33% of the mean-variance investor's portfolio. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, HML, the difference between returns on high and low book-to-market stocks, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month). Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructedb from the larger universe of 894 no-load funds, including the former 34 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
American Gas Index Fund	3	0	0	0	2	0	0	0	0	0	0	0
Baron Growth Fund	0	15	33	0	0	14	32	0	0	11	30	0
Bridgeway Fund:Micro-Cap Limited Port	1	6	24	75	1	7	25	75	2	9	27	75
CGM Focus Fund	2	15	0	0	1	14	0	0	0	13	0	0
DFA Invest Grp:Real Estate Securities Port	4	0	0	0	4	0	0	0	3	0	0	0
Franklin Custodian Fds:Utilities Series/Adv	23	15	0	0	25	16	0	0	27	17	0	0
Galaxy Funds II:Utility Index	12	11	0	0	12	11	0	0	13	10	0	0
Schroder Capital:Ultra Fund/Inv	0	6	43	25	0	6	43	25	0	8	43	25
Stratton Small Cap Value Fund	53	32	0	0	52	32	0	0	51	33	0	0
Third Avenue Small-Cap Value Fund	2	0	0	0	2	0	0	0	3	0	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times 100$)	93	94	94	70	93	94	94	70	93	94	94	70
Certainty-equivalent difference (basis pts./mo.)	19	22	74	1299	19	23	74	1301	19	24	75	1305

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Table 9

The Investment Problem with Mutual Fund Composites

The investment universe from which the portfolios in the table are constructed consists of no-load equity mutual funds that have at least three years of return history through December 2001. In Panel A, the benchmark index return MKT is the excess return on the value-weighted stock market. In Panel B, the benchmark factors are MKT, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks. In Panel C, the benchmark factors are MKT, SMB, HML, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month). In all panels, there are 860 non-socially responsible fund from the overall universe of 894, and the socially responsible funds are 34 funds that apply non-financial, social-responsibility screens as part of their investment strategies.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Priors for the CAPM – Portfolio weights ($\times$100)												
Average (EW) Non-Socially Responsible Mutual Fund	0	95	76	65	0	94	75	64	0	91	72	62
Average (EW) Socially Responsible Mutual Fund	100	5	24	35	100	6	25	36	100	9	28	38
B. Priors for the Fama-French Three-Factor Model – Portfolio weights ($\times$100)												
Average (EW) Non-Socially Responsible Mutual Fund	0	99	81	71	0	98	80	70	0	96	78	67
Average (EW) Socially Responsible Mutual Fund	100	1	19	29	100	2	20	30	100	4	22	33
C. Priors for the Carhart Four-Factor Model – Portfolio weights ($\times$100)												
Average (EW) Non-Socially Responsible Mutual Fund	0	72	57	49	0	72	57	49	0	72	57	49
Average (EW) Socially Responsible Mutual Fund	100	28	43	51	100	28	43	51	100	28	43	51

Table 10

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for CAPM Mispricing and Skill of Fund Managers and Including Funds with Loads

The investment universe from which the portfolios in Panel A are constructed consists of 49 possibly loaded equity mutual funds that screen for socially responsible investments and have at least three years of return history through December 2001. The benchmark index return MKT is the excess return on the value-weighted stock market. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 1,443 possibly loaded funds, including the former 49 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
AHA Inv Funds:Diversified Equity Portfolio	39	56	0	0	40	34	0	0	0	0	0	0
ARK Funds:Small Cap Equity Fund/Instl	0	0	1	0	0	2	1	0	0	5	1	0
ARK Funds:Small Cap Equity Fund/Retail A	0	0	0	0	0	0	0	0	0	1	0	0
Ariel Fund	0	0	0	0	0	0	0	0	2	0	0	0
Baron Growth Fund	0	15	24	0	0	17	24	0	0	18	24	0
Bridgeway Fund:Micro-Cap Limited Port	0	0	6	39	0	0	10	41	0	2	19	46
Calvert Social Invstmnt Fd:Equity/A	0	0	69	61	0	0	64	59	0	0	55	54
Citizens Funds:Core Growth Fund/Instl	19	0	0	0	0	0	0	0	0	0	0	0
Domini Social Equity Fund	28	0	0	0	2	0	0	0	0	0	0	0
Liberty Young Investor Fund/K	4	0	0	0	13	0	0	0	0	0	0	0
Lutheran Brotherhood Fund/Inst	2	0	0	0	0	0	0	0	0	0	0	0
Pioneer Value Fund/A	0	0	0	0	0	0	0	0	7	0	0	0
Stratton Small Cap Value Fund	0	0	0	0	0	0	0	0	14	0	0	0
Third Avenue Small-Cap Value Fund	0	0	0	0	0	0	0	0	9	0	0	0
Washington Mutual Investors Fund/A	8	29	0	0	45	46	0	0	69	73	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 1,443 possibly loaded funds.												
Correlation ($\times 100$)	98	96	80	61	97	97	79	61	91	92	78	60
Certainty-equivalent difference (basis pts./mo.)	7	7	92	1383	7	7	100	1408	9	10	115	1456

Table 11

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Fama-French-Model Mispricing and Skill of Fund Managers and Including Funds with Loads

The investment universe from which the portfolios in Panel A are constructed consists of 49 possibly loaded equity mutual funds that screen for socially responsible investments and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 1,443 possibly funds, including the former 49 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights (×100)												
Ariel Fund	1	3	7	0	1	3	7	0	3	4	5	0
Baron Growth Fund	0	0	25	0	0	0	25	0	0	0	25	0
Bridgeway Fund:Micro-Cap Limited Port	0	2	31	53	0	3	32	54	0	5	34	55
Calvert Social Invstmnt Fd:Equity/A	0	0	37	47	0	0	36	46	0	0	35	45
Stratton Small Cap Value Fund	48	31	0	0	50	32	0	0	53	33	0	0
Third Avenue Small-Cap Value Fund	15	4	0	0	14	2	0	0	10	0	0	0
Washington Mutual Investors Fund/A	36	61	0	0	35	60	0	0	33	58	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 1,443 possibly loaded funds.												
Correlation (×100)	84	87	77	57	83	85	77	57	81	83	76	57
Certainty-equivalent difference (basis pts./mo.)	32	33	158	1513	32	34	158	1520	35	36	157	1535

Table 12

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Four-Factor-Model Mispricing and Skill of Fund Managers and Including Funds with Loads

The investment universe from which the portfolios in Panel A are constructed consists of 49 possibly loaded equity mutual funds that screen for socially responsible investments and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, HML, the difference between returns on high and low book-to-market stocks, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month). Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 1,443 possibly loaded funds, including the former 49 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
Ariel Fund	24	19	17	0	23	18	15	0	19	14	12	0
Baron Growth Fund	0	0	36	0	0	0	35	0	0	0	33	0
Bridgeway Fund:Micro-Cap Limited Port	0	4	31	57	0	4	32	57	0	6	34	58
Calvert New Vision Small Cap Fund/A	0	3	0	0	0	3	0	0	2	4	0	0
Calvert Social Invstmnt Fd:Equity/A	0	0	16	43	0	0	17	43	0	0	21	42
Stratton Small Cap Value Fund	52	27	0	0	53	27	0	0	55	28	0	0
Washington Mutual Investors Fund/A	23	47	0	0	24	47	0	0	24	48	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times 100$)	79	82	78	58	79	81	77	58	78	81	77	58
Certainty-equivalent difference (basis pts./mo.)	38	42	154	1556	39	43	155	1558	40	45	157	1563

Table 13

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for CAPM Mispricing and Skill of Fund Managers – Non-Institutional Funds with a Maximum Minimum Investment of $2,500

The investment universe from which the portfolios in Panel A are constructed consists of 23 equity mutual funds that screen for socially responsible investments, have at least three years of return history through December 2001 and have minimum investments of at most $2,500. The benchmark index return MKT is the excess return on the value-weighted stock market. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 funds including the former 23 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
Baron Asset Fund	0	0	0	0	3	0	0	0	0	0	0	0
Baron Growth Fund	0	43	82	0	6	57	77	0	3	76	69	0
Bridgeway Fund:Micro-Cap Limited Port	0	0	18	100	0	0	23	100	1	14	31	100
Domini Social Equity Fund	100	57	0	0	81	43	0	0	38	10	0	0
Scudder Small Company Stock Fund/AARP	0	0	0	0	0	0	0	0	4	0	0	0
Stratton Small Cap Value Fund	0	0	0	0	0	0	0	0	40	0	0	0
Third Avenue Small-Cap Value Fund	0	0	0	0	10	0	0	0	14	0	0	0
B. Comparison to the portfolio that is optimal for the overall universe funds.												
Correlation ($\times$100)	96	94	85	70	97	93	85	70	93	90	86	70
Certainty-equivalent difference (basis pts./mo.)	5	9	55	360	6	9	56	358	8	10	59	356

Table 14

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Fama-French-Model Mispricing and Skill of Fund Managers – Non-Institutional Funds with a Maximum Minimum Investment of $2,500

The investment universe from which the portfolios in Panel A are constructed consists of 18 equity mutual funds that screen their investments for assocation with the production of alcohol, tobacco and gambling as well as other socially responsible criteria and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 funds, including the former 23 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
Baron Growth Fund	0	8	58	0	0	8	57	0	0	9	55	0
Bridgeway Fund:Micro-Cap Limited Port	0	9	42	100	0	11	43	100	0	14	45	100
Scudder Small Company Stock Fund/AARP	10	0	0	0	9	0	0	0	7	0	0	0
Stratton Small Cap Value Fund	69	70	0	0	72	70	0	0	76	72	0	0
Third Avenue Small-Cap Value Fund	21	13	0	0	20	11	0	0	17	5	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 1,442 possibly loaded funds.												
Correlation ($\times$100)	89	89	85	71	88	89	85	71	86	87	85	71
Certainty-equivalent difference (basis pts./mo.)	17	26	68	298	18	26	67	303	19	26	66	316

Table 15

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Four-Factor-Model Mispricing and Skill of Fund Managers – Non-Institutional Funds with a Maximum Minimum Investment of $2,500

The investment universe from which the portfolios in Panel A are constructed consists of 18 equity mutual funds that screen their investments for assocation with the production of alcohol, tobacco and gambling as well as other equity mutual funds that screen for socially responsible criteria and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, HML, the difference between returns on high and low book-to-market stocks, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month). Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 funds, including the former 23 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
Baron Growth Fund	0	22	60	0	0	20	59	0	0	16	57	0
Bridgeway Fund:Micro-Cap Limited Port	2	11	40	100	2	12	41	100	3	14	43	100
Flex-fund:Total Return Utilities Fund	4	4	0	0	5	6	0	0	7	9	0	0
Stratton Small Cap Value Fund	91	62	0	0	90	62	0	0	87	62	0	0
Third Avenue Small-Cap Value Fund	3	0	0	0	3	0	0	0	3	0	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times$100)	82	84	86	70	82	85	85	70	83	86	85	70
Certainty-equivalent difference (basis pts./mo.)	25	34	70	354	25	34	70	354	25	33	70	355

Table 13

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for CAPM Mispricing and Skill of Fund Managers – The Sin Screens

The investment universe from which the portfolios in Panel A are constructed consists of 18 equity mutual funds that screen their investments for assocation with the production of alcohol, tobacco and gambling as well as other socially responsible criteria and have at least three years of return history through December 2001. The benchmark index return MKT is the excess return on the value-weighted stock market. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 funds including the former 18 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times 100$)												
ARK Funds:Small Cap Equity Fund/Instl	0	10	28	63	0	14	31	66	0	16	37	65
Calvert Large Cap Growth Fund/I	0	0	22	0	0	0	20	0	0	0	12	0
Citizens Funds:Core Growth Fund/Instl	25	0	18	17	0	0	0	4	0	0	0	0
Domini Social Equity Fund	49	90	32	0	57	85	42	0	46	58	28	0
Flex-fund:Total Return Utilities Fund	0	0	0	0	0	0	0	0	0	1	0	0
Lutheran Brotherhood Fund/Inst	26	0	0	0	31	0	0	0	16	0	0	0
Lutheran Brotherhood Mid Cap Growth Fund/Inst	0	0	0	21	0	2	7	30	0	15	23	35
Third Avenue Small-Cap Value Fund	0	0	0	0	11	0	0	0	38	10	0	0
B. Comparison to the portfolio that is optimal for the overall universe of 1,443 possibly loaded funds.												
Correlation ($\times 100$)	97	94	76	60	97	93	75	60	89	87	72	59
Certainty-equivalent difference (basis pts./mo.)	7	10	113	1586	8	12	121	1614	12	18	137	1667

Table 14

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Fama-French-Model Mispricing and Skill of Fund Managers – The Sin Screens

The investment universe from which the portfolios in Panel A are constructed consists of 18 equity mutual funds that screen their investments for assocation with the production of alcohol, tobacco and gambling as well as other socially responsible criteria and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks. Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 funds, including the former 18 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
ARK Funds:Blue Chip Equity Port/Instl	0	0	19	0	0	0	11	0	0	0	0	0
ARK Funds:Small Cap Equity Fund/Instl	0	0	5	44	0	0	8	45	0	0	15	47
Flex-fund:Total Return Utilities Fund	13	16	20	18	19	21	24	18	27	32	30	18
Lutheran Brotherhood Mid Cap Growth Fund/Inst	0	0	8	38	0	0	12	37	0	0	18	35
Neuberger Berman Socially Responsive/Investor	0	5	0	0	0	3	0	0	0	0	0	0
Neuberger Berman Socially Responsive/Trust	7	17	0	0	2	14	0	0	0	9	0	0
Third Avenue Small-Cap Value Fund	80	62	48	0	79	61	45	0	73	59	36	0
B. Comparison to the portfolio that is optimal for the overall universe of 1,443 possibly loaded funds.												
Correlation ($\times$100)	76	81	78	59	75	80	77	59	74	79	76	59
Certainty-equivalent difference (basis pts./mo.)	41	49	186	1770	42	50	186	1774	44	52	185	1782

Table 15

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Four-Factor-Model Mispricing and Skill of Fund Managers – The Sin Screens

The investment universe from which the portfolios in Panel A are constructed consists of 18 equity mutual funds that screen their investments for association with the production of alcohol, tobacco and gambling as well as other equity mutual funds that screen for socially responsible criteria and have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, HML, the difference between returns on high and low book-to-market stocks, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month). Panel B reports comparisons of the portfolios in Panel A with the portfolio having the highest Sharpe ratio constructed from the larger universe of 894 funds, including the former 18 funds plus funds not identified as applying social-responsibility screens. The correlations and certainty-equivalent differences in Panel B are computed with respect to the same predictive distribution used to obtain the optimal fund portfolio in the same column. The certainty-equivalent differences are computed with relative risk aversion equal to 2.75.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
A. Portfolio weights ($\times$100)												
ARK Funds:Small Cap Equity Fund/Instl	0	15	37	59	0	14	36	58	0	13	35	57
Flex-fund:Total Return Utilities Fund	43	46	37	17	43	46	37	17	44	46	38	17
Lutheran Brotherhood Mid Cap Growth Fund/Inst	0	1	18	24	0	2	19	25	0	4	21	26
Third Avenue Small-Cap Value Fund	57	38	8	0	57	38	7	0	56	37	6	0
B. Comparison to the portfolio that is optimal for the overall universe of 894 no-load funds.												
Correlation ($\times$100)	76	77	72	58	76	77	72	58	76	77	72	58
Certainty-equivalent difference (basis pts./mo.)	49	58	180	1784	49	58	181	1786	49	59	182	1791

Appendix A: Identities of SRI Equity Mutual Funds

Table A.1

No-Load Socially Responsible Mutual Funds in the Final Sample

These 34 socially responsible mutual funds are from the overall sample of 894 no-load equity mutual funds that have at least three years of return history through December 2001 as well as data on expenses and turnover. The screens characterizing the social objectives of these funds appear in Table 1.

SRI Funds	
AHA Inv Funds:Diversified Equity Portfolio	Flex-fund:Total Return Utilities Fund
American Trust Allegiance Fund	Green Century Equity Fund
Aquinas Growth Fund	IPS Millennium Fund
Aquinas Value Fund	IPS New Frontier Fund
ARK Funds:Blue Chip Equity Port/Instl	Liberty Young Investor Fund/K
ARK Funds:Small Cap Equity Fund/Instl	Lutheran Brotherhood Fund/Inst
Baron Asset Fund	Lutheran Brotherhood Mid Cap Growth Fund/Inst
Baron Growth Fund	Neuberger Berman Socially Responsive/Investor
Baron Small Cap Fund	Neuberger Berman Socially Responsive/Trust
Bridgeway Fund:Aggressive Investors/1	Scudder Capital Growth Fund/AARP
Bridgeway Fund:Micro-Cap Limited Port	Scudder Small Company Stock Fund/AARP
Bridgeway Fund:Ultra Sm Company Port	SteinRoe Investment Trust:Young Investor Fund
Calvert Large Cap Growth Fund/I	Stratton Growth Fund
Citizens Funds:Core Growth Fund/Retail	Stratton Small Cap Value Fund
Citizens Funds:Core Growth Fund/Instl	Third Avenue Small-Cap Value Fund
Citizens Funds:Emerging Growth Fund/Retail	USAA First Start Growth Fund
Domini Social Equity Fund	Womens Equity Mutual Fund

Appendix B: Optimal Equity Mutual Fund Portfolios

We construct optimal equity mutual fund portfolios from the perspective of a mean-variance investor from the universe of no-load funds with at least three years of return history used in the paper and against which we judge certiainty equivalent returns. Here we report the identities of those funds

Table A.2

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for CAPM Mispricing and Skill of Fund Managers

The investment universe from which the portfolios are constructed consists of 894 no-load equity mutual funds that have at least three years of return history through December 2001. The benchmark index return MKT is the excess return on the value-weighted stock market.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
Portfolio weights ($\times 100$)												
Advisors Inner Circle:FMC Select	0	0	0	0	0	0	0	0	0	1	0	0
Ameristock Mutual Fund	0	16	50	0	0	22	48	0	0	19	44	0
CGM Focus Fund	0	0	0	0	0	0	0	0	0	5	0	0
Century Shares Trust	0	0	0	0	0	0	0	0	6	0	0	0
DFA Invest Grp:Real Estate Securities Port	0	0	0	0	0	0	0	0	9	0	0	0
Elfun Trusts	0	65	0	0	0	52	0	0	0	20	0	0
First Funds:Growth and Income Portfolio/I	0	12	0	0	0	13	0	0	0	7	0	0
Franklin Custodian Fds:Utilities Series/Adv	0	0	0	0	2	0	0	0	20	12	0	0
Franklin Real Estate Securities Fund/Adv	0	0	0	0	0	0	0	0	1	0	0	0
Galaxy Funds II:Small Company Index	0	0	0	0	0	0	0	0	1	0	0	0
Galaxy Funds II:Utility Index	0	0	0	0	3	0	0	0	9	7	0	0
Morgan Stanley Instl:Small Cap Growth/Inst	0	1	6	7	0	0	5	6	0	0	1	5
PIMCO Funds:Value Fund/Admin	0	0	0	0	0	0	0	0	0	6	0	0
Prudential Utility Fund/Z	0	0	0	0	0	0	0	0	6	0	0	0
Schroder Capital:Ultra Fund/Inv	0	3	38	93	0	7	40	94	0	11	44	95
Turner Funds:Micro Cap Growth	0	2	6	0	0	6	8	0	0	11	11	0
Vanguard Extended Market Index/Instl	0	0	0	0	3	0	0	0	7	0	0	0
Vanguard Extended Market Index/Inv	0	0	0	0	0	0	0	0	3	0	0	0
Vanguard Small Cap Index/Instl	0	0	0	0	3	0	0	0	17	0	0	0
Vanguard Total Stock Market Index/Instl	100	0	0	0	89	0	0	0	22	0	0	0

Table A.3

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Fama-French-Model Mispricing and Skill of Fund Managers

The investment universe from which the portfolios are constructed consists of 894 no-load equity mutual funds that have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, and HML, the difference between returns on high and low book-to-market stocks.

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
Portfolio weights ($\times$100)												
AllianceBernstein Real Estate Investment/Adv	2	0	0	0	2	0	0	0	2	0	0	0
Ameristock Mutual Fund	0	2	33	0	0	1	32	0	0	0	29	0
Babson Enterprise Fund	0	0	0	0	0	0	0	0	1	0	0	0
CGM Focus Fund	0	4	2	0	0	4	3	0	0	6	3	0
CGM Realty Fund	0	0	0	0	0	0	0	0	0	1	0	0
COHEN & STEERS REALTY SHARES	2	0	0	0	3	0	0	0	4	1	0	0
Columbia Real Estate Equity Fund	2	0	0	0	3	1	0	0	4	1	0	0
DFA Invest Grp:Real Estate Securities Port	14	6	0	0	14	6	0	0	15	6	0	0
DFA Invest Grp:US Large Cap Value Port	4	0	0	0	0	0	0	0	0	0	0	0
DFA Invest Grp:US Small Cap Val Portfolio	7	0	0	0	8	0	0	0	5	0	0	0
Delaware Pooled Tr:Real Estate Invest Tr/II	3	4	0	0	3	4	0	0	3	4	0	0
Delaware Pooled Tr:Real Estate Invest Tr/Inst	1	2	0	0	1	2	0	0	1	2	0	0
Deutsche Real Estate Securities/Inst	5	0	0	0	5	0	0	0	5	0	0	0
First American Real Estate Securities/Y	9	8	0	0	10	8	0	0	10	8	0	0
Franklin Custodian Fds:Utilities Series/Adv	15	12	0	0	17	14	0	0	19	18	0	0
Franklin Real Estate Securities Fund/Adv	11	7	0	0	10	6	0	0	9	5	0	0
Galaxy Funds II:Utility Index	9	9	0	0	9	9	0	0	9	10	0	0
Goldman Sachs Real Estate Securities/Inst	7	7	0	0	7	7	0	0	7	6	0	0
Goldman Sachs Small Cap Value/Inst	5	3	0	0	4	1	0	0	0	0	0	0
LaSalle Partners US Real Estate Fund/Instl	3	0	0	0	4	1	0	0	4	1	0	0
Morgan Stanley Instl:Small Cap Growth/Inst	0	0	0	1	0	0	0	1	0	0	0	1
Morgan Stanley Instl:US Real Estate/A	0	2	0	0	0	2	0	0	0	2	0	0
Munder Funds:Real Estate Equity Invmnt/Y	1	0	0	0	1	0	0	0	1	0	0	0
Mutual Shares Fund/Z	0	2	0	0	0	0	0	0	0	0	0	0
PBHG REIT Fund/PBHG	0	0	0	0	0	0	0	0	0	1	0	0
PIMCO Funds:Value Fund/Admin	0	20	24	0	0	18	24	0	0	14	22	0
SSgA:Tuckerman Active REIT Fund	0	4	0	0	0	4	0	0	0	4	0	0
Schroder Capital:Ultra Fund/Inv	0	6	41	99	0	7	42	99	0	8	44	99
Turner Funds:Future Financial Services	0	1	0	0	0	1	0	0	0	1	0	0
Turner Funds:Micro Cap Growth	0	0	0	0	0	0	0	0	0	0	2	0

Table A.4

Equity Mutual Fund Portfolios with the Highest Sharpe Ratio Under Priors for Four-Factor-Model Mispricing and Skill of Fund Managers

The investment universe from which the portfolios are constructed consists of 894 no-load equity mutual funds that have at least three years of return history through December 2001. The benchmark factors are MKT, the excess return on the value-weighted stock market, SMB, the difference between returns on small and large stocks, HML, the difference between returns on high and low book-to-market stocks, and MOM, the difference between returns on stocks with high and low returns over the previous year (excluding the most recent month).

Mispricing uncertainty (σ_{α_N}) in percent per year:	0	0	0	0	1	1	1	1	2	2	2	2
Skill uncertainty (σ_δ) in percent per year:	0	1	3	∞	0	1	3	∞	0	1	3	∞
Portfolio weights ($\times$100)												
AllianceBernstein Real Estate Investment/Adv	2	0	0	0	2	0	0	0	1	0	0	0
American Century Vista/Instl	0	3	0	0	0	3	0	0	0	3	0	0
American Gas Index Fund	11	5	0	0	11	4	0	0	9	3	0	0
Ameristock Mutual Fund	0	0	16	0	0	0	16	0	0	0	16	0
CGM Focus Fund	2	12	9	0	2	11	8	0	1	10	7	0
CGM Realty Fund	0	3	0	0	0	3	0	0	0	2	0	0
COHEN & STEERS REALTY SHARES	5	2	0	0	5	2	0	0	5	2	0	0
Columbia Real Estate Equity Fund	4	2	0	0	4	2	0	0	4	1	0	0
DFA Invest Grp:Real Estate Securities Port	16	7	0	0	16	7	0	0	16	7	0	0
Delaware Pooled Tr:Real Estate Invest Tr/II	2	3	0	0	2	3	0	0	2	3	0	0
Delaware Pooled Tr:Real Estate Invest Tr/Inst	0	1	0	0	0	1	0	0	0	1	0	0
Deutsche Real Estate Securities/Inst	3	0	0	0	3	0	0	0	3	0	0	0
First American Real Estate Securities/Y	9	7	0	0	9	7	0	0	9	7	0	0
First American Small Cap Value/Y	2	0	0	0	2	0	0	0	1	0	0	0
Franklin Custodian Fds:Utilities Series/Adv	20	23	5	0	21	24	6	0	23	26	7	0
Franklin Real Estate Securities Fund/Adv	5	1	0	0	5	1	0	0	5	1	0	0
Galaxy Funds II:Utility Index	8	10	0	0	8	10	0	0	8	11	0	0
Goldman Sachs Real Estate Securities/Inst	2	1	0	0	3	2	0	0	3	2	0	0
ICON Healthcare Fund	0	1	0	0	0	1	0	0	0	2	0	0
LaSalle Partners US Real Estate Fund/Instl	2	0	0	0	2	0	0	0	2	0	0	0
Morgan Stanley Instl:Small Cap Growth/Inst	0	0	0	2	0	0	0	2	0	0	0	2
Munder Funds:Real Estate Equity Invmnt/Y	1	0	0	0	1	0	0	0	0	0	0	0
PBHG REIT Fund/PBHG	1	2	0	0	1	2	0	0	1	2	0	0
PIMCO Funds:Mid Cap/Instl	4	0	0	0	4	0	0	0	5	0	0	0
PIMCO Funds:Value Fund/Admin	0	6	20	0	0	5	19	0	0	2	17	0
SSgA:Tuckerman Active REIT Fund	0	3	0	0	0	3	0	0	0	3	0	0
Schroder Capital:Ultra Fund/Inv	0	7	43	98	0	8	43	98	0	8	44	98
Turner Funds:Micro Cap Growth	0	1	7	0	0	1	7	0	0	2	9	0

Table A.5

Prior Skill and Mispricing Uncertainty Parameters

The table reports the implications for δ and α_N of different prior values of σ_δ and σ_{α_N}, respectively.

Skill Uncertainty (σ_δ): 1%
2.5% prob. that $\delta > 2.0\%$
15.0% prob. that $\delta > 1.0\%$
30.0% prob. that $\delta > 0.5\%$

Skill Uncertainty (σ_δ): 3%
2.5% prob. that $\delta > 6.0\%$
15.0% prob. that $\delta > 3.0\%$
30.0% prob. that $\delta > 1.5\%$

Misprcng. Uncty. (σ_{α_N}): 1%
5.0% prob. that $\alpha_N > 2.0\%$
30.0% prob. that $\alpha_N > 1.0\%$
60.0% prob. that $\alpha_N > 0.5\%$

Misprcng. Uncty. (σ_{α_N}): 3%
5.0% prob. that $\alpha_N > 4.0\%$
30.0% prob. that $\alpha_N > 2.0\%$
60.0% prob. that $\alpha_N > 1.0\%$

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