Cleaning a Passive Index

How to Use Portfolio Optimization to Satisfy CSR Constraints

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Abstract

The emotionally charged debate regarding the broader role of corporations within society has landed squarely in the lap of pension fund and endowment trustees, many of whom are being pressured by their stakeholders to divest themselves of companies that lack so-called social responsibility. Some researchers claim that these companies are destined to mediocre financial performance given their irresponsible behavior and should rightfully be divested. A more traditional group argues that any attempt to second-guess an efficient financial market by constraining the investible universe is itself destined to mediocrity.

In this paper we take neither side of the debate. Rather, we illustrate how portfolio optimization can be used to locate statistical portfolio substitutes for investments and companies that fail a corporate social responsibility (CSR) screen. And, while the mathematics behind constrained portfolio optimization was developed by Markowitz more than 50 years ago, we find that the economic penalty for eliminating a small group of undesirable stocks – whether justified or not -- is economically insignificant when the remaining investments are properly realigned. We illustrate the feasibility of this procedure with a "cleansing process" for the Canadian S&P/TSX 60 index, based on an employee practice CSR screen developed by Thomson and Wheeler [2004].

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Introduction and Motivation

Most pension funds in North America own hundreds and perhaps even thousands of individual stocks of publicly traded companies, scattered around the globe, all in the name of portfolio diversification. The current investment paradigm dictates that non-systematic (i.e. diversifiable) investment risk is rarely compensated by efficient capital markets, and therefore a large proportion of pension and endowment assets end up being allocated to holding the entire market (i.e. passive investments) via index funds. Furthermore, many active fund managers are "closet indexers", at least with some proportion of their total assets under management. The overwhelming influence of this dogma routinely leads funds to token allocations without any regard for, nor any need to justify, the business or revenue model of a particular company or industry. When quizzed about having less than one hundredth of one percent of assets dispersed amongst a mishmash of companies, the standard response is a reference to the fund's policy document which mandates cold detached passivity.

Yet -- in a post Enron world -- trustees and pension fund managers are facing growing pressure to carefully monitor and perhaps even eliminate companies in their portfolios that do not maintain a minimal level of Corporate Social Responsibility (CSR). A recent article in the *Financial Times* is indicative of this trend.[i] Leading European institutional investors including Universities Superannuation Scheme (USS), PGGM, the Dutch pension fund, BNP Paribas Asset Management, RCM, part of Allianz Dresdner Asset Management, and the boutique Generation Investment Management, are reported to be challenging the investment banking and broking industries to provide research on socially responsible investment issues. These investors have told the main banks and brokers that they should allocate up to 5 per cent of their commission budget to the issue. The group feels that "non-traditional" issues of corporate performance, including corporate governance, human capital management and environmental management need to be more wholly integrated into mainstream analysis.

The increased scrutiny of investors regarding the non-financial aspects of corporate performance have placed portfolio managers in the position of having to weigh the benefits of "holding the market" against the cost of having even token positions in companies that are subsequently found to have questionable business practices. It is those costs that we examine in this paper.

Contrary to the situation faced by an individual investor, institutional portfolio managers cannot offset the costs of implementing a CSR screen by the non-pecuniary utility derived from socially responsible investing. The question faced by individual investors is whether the costs of investing in socially responsible firms are offset by the psychological benefits of those choices. In contrast, the question increasingly faced by professional fund managers is whether the reputational and economic risk of passive index replication is worth bearing for a few basis points of return. The common response from most (although not all) investment professionals facing a fiduciary duty that does not typically recognize non-financial benefits, is that (a) any constraints imposed on the investment and portfolio selection process must inevitably lead to reduced risk-adjusted performance, and (b) CSR screens –both positive and negative- are inherently subjective, intrinsically unquantifiable and subject to manipulation by politically motivated interest groups.

Recent claims by some advocates of CSR-based portfolio construction that good firms actually outperform bad firms – where both good and bad are suitably defined – have only added fuel to the debate. For example, Statman [2000] finds that the Domini Social Index[ii] outperforms the S&P 500 over the 1990- 1998 period. Examining Canadian ethical mutual funds, Asmundson and Foerster [2001] find that relative to the broader market, there is no return underperformance, and some weak evidence of lower risk for screened funds. Goldreyer and Diltz [1999], Bauer, et. al. [2002] and Guerard [1997] provide similar evidence. On the other hand, a recent paper by Geczy et. al. [2003] finds screening has the potential to impose significant penalties conditional on the prior beliefs of the investor about the ability of the fund manager to outperform the market through active management. We document some evidence of CSR screening focused on employment practices being related to stock returns in a later section of the paper. However, we remain agnostic about the subsequent performance of companies conditional on their CSR scores. Instead, we address the question from the perspective of the practitioner attempting to balance seemingly competing objectives.

The objective of this paper is to illustrate how a pension fund or endowment can maintain a statistically indistinguishable level of diversification while incorporating CSR based screens and constraints on portfolio holdings.

From a financial economic perspective, the question being investigated is whether one can *reasonably replicate* or span the stochastic distribution of a given portfolio, using a restricted universe of tradable instruments. And, while in a purely efficient market the theoretical answer is no, it is an open question whether one can get close enough so as to be properly diversified for all practical (empirical) purposes.

To illustrate how this can be achieved, we use a portfolio replicating algorithm which effectively mimics the future distribution of investment outcomes as defined by a set of scenarios (Monte Carlo, historical, etc) within a smaller constrained set of securities. Thus, the algorithm is able to locate the appropriate portfolio weights amongst a restricted group of companies, to best replicate the payoff from an unrestricted target portfolio. The algorithm is based upon minimizing the expected tracking error (two sided or one sided) between the optimal constrained portfolio and the original unconstrained portfolio, subject to the trading restrictions that define the constrained portfolio. By way of illustration we subject the 60 companies in the S&P/TSX 60 index[iii] to a CSR screen focusing on employment practices, and remove companies based on their scores. We then rebalance the remaining portfolio positions using the optimization algorithm.

We use this system to test and validate our above hypothesis. We begin by calculating the first four moments of the S&P/TSX 60 index. Using this as a baseline, we then restrict the universe of tradable equities by progressively eliminating companies from the S&P/TSX 60 using a scoring system based on metrics constructed by Thomson and Wheeler [2004], which identify those firms with the poorest employment practices. The metrics have been used to construct an index which we refer to as the York University-Corporate Social Responsibility (Employment Practices) index or YU-CSR[EP]. We subsequently overweight the remaining firms in the portfolio in an attempt to mimic the moments of the unconstrained portfolio.

Our results are encouraging. We find that removing companies with the lowest CSR scores does not *materially* impact any of the first four moments of the investment return distribution, providing the funds released by divesting from the low scoring companies are properly redistributed amongst the remaining stocks. Our findings suggest that the costs of CSR screening on passive indices may be smaller than managers might expect, and are consistent with the results in Geczy et. al. [2003] who find that for a market index investor, the cost of the CSR constraint is typically just a few basis points per month. However, in addition to re-affirming the results of Geczy et. al. [2003] we actually illustrate how to rebalance the portfolio in a optimal manner when low scoring companies are removed.

The remainder of this paper is organized as follows. Section 2 discusses the specific CSR screening criteria that were used in our analysis, and why companies might be discarded from the S&P/TSX 60 index as a result of poor scores. Section 3 examines the relationship between YU-CSR[EP] scores and investment performance. Section 4 discusses the portfolio optimization procedure employed in the analysis. Section 5 displays our main results - the unconstrained S&P/TSX 60 index and the impact that removing additional equities has on the ability of the constrained portfolio to mimic the return distribution of the original portfolio. Section 6 concludes the paper with our main insights.

How the YU-CSR[EP] scores are determined.

In a study funded by the Canadian Social Sciences and Humanities Research Council, Thomson and Wheeler hypothesize that of all potential measures of corporate social performance, those that measure labour and employment practices are likely to be especially salient to firm performance and risk minimization [Thomson & Wheeler, 2004]. This conclusion follows from an examination of a large number of sources relating firm performance and the generation of competitive advantage through the leveraging of intangible assets such as human, intellectual and social capital [Dess & Picken, 1999; Nahapiet & Ghoshal, 1998] by increasing total shareholder returns over time. Building on the resource based view of strategic management [Barney, 1991] and evidence of the growing importance of intangible assets to firm performance, the objective of this research is to establish a candidate set of investment criteria that can be applied to a basket of financial instruments to further refine an investment portfolio and thus create maximum value.

The methods for establishing candidate investment criteria are drawn from three principal sources: i) academic and practitioner/applied literatures describing prior studies of corporate social performance linked to financial performance[iv]; ii), relevant employment practice criteria currently in use by analysts[v]; and iii) direct interviews with persons in Canada and the United Kingdom knowledgeable in labour and employment practices[vi]. In order to identify criteria that might provide quantifiable evidence of good employment practices, a qualitative triangulation[vii] [Patton 2002: 247] methodology was undertaken, through which 45 candidate criteria were initially identified. This identification process consisted of interviews that followed a general interview guide [Patton, 2002], which was not provided to the interview participants in advance. In parallel, mechanisms for measuring good employment practices emerged from the literature review, and our research on criteria in use by "socially responsible investment" analysts. Using this approach, the 45 candidate indicators were identified by tabulating citations in interviews and desk research for frequency of occurrence. In order to distil the final criteria from the candidate indicators, a non-normative lens of maximum value creation as variously defined by investors and other stakeholders [Wheeler et al., 2003] was then applied to narrow the pool of candidate criteria to the fourteen criteria listed below. The conditions for inclusion in the final set are: i) objective measurability; ii) comparability; iii) accessibility; iv) materiality; v) significance; and vi) likely 'win-win' impact on value creation for investors and other stakeholders (e.g. employees)[viii].

These indicators collectively form what we now call the York University Corporate Social Responsibility [Employment Practice] Index (YU-CSR[EP]). Each of these primary indicators is given a score measured according to sub-criteria available from public sources (web sites, reports and accounts etc). The allocation of scores (to a total of 100) is denoted below together with the number of sub-criteria measured.

1. Board Composition, Skills and Diversity [9 points allocated between 4 sub-criteria]

2. Health and Safety Record [4 points allocated between 2 sub-criteria]

3. Health and Safety Culture [10 points allocated between 5 sub-criteria]

4. Public Reputation as Good Employer [9 points allocated between 9 sub-criteria]

5. Community Investment [6 points allocated between 2 sub-criteria]

6. Employee Attitude Survey [6 points allocated between 3 sub-criteria]

7. Employee Retention [3 points allocated for one criterion]

8. Work/ Life Balance [5 points allocated between 5 sub-criteria]

9. Performance Based Compensation [10 points allocated to one criterion]

10. Pension Plan [6 points allocated to one criterion]

11. Training [6 points allocated to one criterion]

12. Employment Practice and Other Policies [12 points allocated between 6 sub-criteria]

13. Convictions and Fines [8 points allocated between 4 sub-criteria]

14. Freedom of Association (i.e. Unionization) [6 points allocated to one criterion]

Scores for the constituents of the S&P/TSX 60 index are shown in Table 1. Scores range from a low of 9 to a high of 82, with the median score being 60.5. There is no evidence of sectoral bias, with high and low scoring companies being evenly dispersed among the 10 sectors of the S&P/TSX.

(insert table 1 about here)

Relationship between CSR scores and performance.

The optimization methodology outlined in Section 4 of this paper is independent of the screening algorithm chosen by the fund trustee. While our optimization result does not depend on the use of the YU-CSR[EP], we present some evidence on the relationship between YU-CSR[EP] scores and investment performance here. If the market is rewarding (punishing) firms with good (poor) employment practices (as measured by the YU-CSR[EP]), regression analysis should uncover any potential relationship between scores and returns. Results of univariate regression analysis are presented in column (1) of Table 2[ix]. Using 1-year returns as the dependent variable, the YU-CSR[EP] coefficient has the expected sign and is significant at the 5% level. *In other words, firms with better employment practices have better stock performance.* On the other hand, the regression has only marginal explanatory power (R^2= 6.7%). In unreported tests, the analysis was done using the residuals from the market model as the dependent variable. No statistically significant relationship was present, suggesting that the YU-CSR[EP] is neither a source of "alpha", in the Sharpe-Lintner CAPM framework, nor an additional factor in a Fama-French [1993] or Carhart [1997] setting. Similar tests using two, three, and five-year returns yield no significant relationships. Therefore the balance of the analysis focuses on one-year returns[x].

(insert table 2 about here)

Noting the noisiness inherent in the measurement of several of the 14 criteria, the regression equation was re-estimated with each of the 14 primary sub-criteria as independent variables. Results are reported in column (2). This approach allows us to view the relative power of each criterion, independent of the masking effects of aggregation. Most of the coefficients have the expected signs, but the results of (2) need to be interpreted with caution given the insignificance of some of the coefficients and the presence of multicollinearity among some of the variables[xi].

The result in (2) gives rise to question of whether some of the variables should be included at all. The refinement of the YU-CSR[EP] is an ongoing process, and reported results are clearly conditional on the period examined. While the ultimate explanatory power of any given predictor remains unclear, it is instructive to determine which predictors best explain the returns in the period examined. In order to distil the best possible YU-CSR[EP] from the available data, best subsets regressions are performed. Column (3) of Table 2 shows the results of the best regression given the available criteria. Using criteria 4, 5, 6 and 8 yields a model with an adjusted R^2 of 25%, a clear improvement over either of the other models presented. Correlation between predictors is gone, with no VIF greater than 2.1 in the final specification[xii].

The optimization algorithm.

The optimization process begins with the assumption that the portfolio manager wishes to use the screen to identify and remove firms with low YU-CSR[EP] scores because those firms may not be maximizing the value of their intangible assets (human, intellectual and social capital), and they may instead be potential attractors of real or perceived risk. The actual optimization algorithm is constructed by first defining tracking error, y_s, as the difference between the value of a portfolio and that of the target index under a given historical scenario s ($s = 1,\ldots S$), for a given time horizon, or:

$$y_s = \sum_J x_j Q_{js} - I_s \qquad \text{(eq.1)}$$

where I_s, is the value of the target index under scenario s, Q_{js} is the value of security j under scenario s and x_j is the holdings of security j ($j = 1,\ldots J$) in the portfolio. I_0 and Q_{j0} denote the current values of the target index and each security respectively. The target index contains the 60 constituent firms in the S&P/TSX 60. The relative weights of each position match the weights of the S&P/TSX 60 on July 5, 2004, as reported by TSX Datalinx. We then rank the constituents of the S&P/TSX 60 by YU-CSR[EP], and create new portfolios by successively removing the two stocks with the lowest CSR score. The first "cleaned" portfolio will therefore have 58 stocks, the next 56. We continue the process recursively until we create ten portfolios, each one containing two fewer stocks than its predecessor.[xiii] The sequential removal of stocks generates portfolios ranging from 40 to 58 stocks, which we label in Table 3 as TSX40 to TSX58 for convenience. In creating this range of portfolios, our purpose is twofold. First, we want to test the ability of the algorithm to create portfolios that mimic the return distribution of the target index, and we want to examine the tradeoffs between the use of screens and return distributions. The second reason is simply that we do not wish to make normative judgments about how extensive screening should be. Whether removing two stocks from the index or removing twelve stocks is either sufficient or necessary, this is a judgment that will need to be made by the stakeholders of the fund. Our aim is simply to illustrate how the process can be undertaken.

In order to perform the optimization, we next need to define the regret function *R*, as the expectation of the absolute value of tracking error across all scenarios, or:

$$R = \sum_S p_s \mid y_s \mid \qquad \text{(eq.2)}$$

where p_s is the probability of occurrence of scenario *s*. The scenarios used in the algorithm are the historical two-week returns for the S&P/TSX 60 calculated over the three years preceding the optimization date. These form the universe of possible returns for the new portfolios. Implicit in this framework is the assumption that the returns during the three-year horizon are representative of returns in the period being optimized. We emphasize again that our model and analysis is predicated on the assumption that future returns obey the same statistical generating process as historical returns.

It is worth noting that the historical returns are not used simply to generate portfolio variance covariance matrices. Our approach is not constrained by the assumption of joint normality of the variance covariance matrix, and while our portfolios do not contain derivative instruments, the approach can also handle the non-linearities of the more general case if the underlying index were to contain derivative instruments.[xiv]

The optimization problem is cast as a linear program whereby the primary decision variables are the holdings, x_j in each security and where the objective function is a minimization of regret function subject to a number of constraints including:

- Maximum portfolio investment
- Individual and group trading limits
- Tracking error bounds

In the context of the CSR screening problem described in this paper, we define the target index to be the original *unscreened* index whereby X_j is the original holdings of security j and, thus the current value of target index can be expressed as:

$$I_0 = \sum_J X_j Q_{j0} \qquad \text{(eq.3)}$$

and the values of the target index under all scenarios $s = 1,\ldots S$ can be expressed as;

$$I_s = \sum_J X_j Q_{js} \qquad \text{(eq.4)}$$

As each new portfolio is formed, the algorithm forces the weight of the two discarded stocks to zero and redistributes that mass among the remaining stocks in the index. The investment weights chosen by the algorithm represent those asset allocations that produce the least tracking error between the portfolio and the S&P/TSX 60 target index. We rank the securities $j = 1,\ldots J$ on the basis of increasing CSR score and, for each formulation, determine the number of offending securities J^* (starting with $J^* = 2$ and increasing in increments of 2 until $J^* = 20$).

The linear program can therefore be expressed as follows:

Minimize: $\mathrm{R} = \sum^S p_s \cdot |y_s|$ (eq.5)

Subject to: $\sum^J x_j \cdot Q_{j0} \leq \sum^J X_j \cdot Q_{j0}$

$$y_s = \sum_J x_j Q_{js} - I_s$$

$x_j = 0$ for $j = 1,\ldots J^*$

$x_j \geq X_j$ for $j = J^*+1,\ldots J$

where p_s is equal across all scenarios. The first constraint limits portfolio investment in any of the constrained alternatives to be no larger than the amount invested in the original index. The second constraint forces the weighting for any stock removed from the index to be equal to zero. The rebalancing process is further constrained by not allowing short selling or the selling of any position, except those that are identified as poor performers by the YU-CSR[EP]. The third constraint forces weightings for any stock remaining in the new portfolio to be at least as large as in the original portfolio. The net effect is to replicate a situation where a portfolio manager initiates the use of a CSR screen on a passive index portfolio. The stocks failing the screen are sold and the funds are reallocated to the remaining constituents in the portfolio. In other words, the portfolio manager implementing this algorithm need not move in and out of multiple positions. The only positions sold at any time are those stocks that are being completely eliminated. No constraints on tracking error bounds have been set. Finally, we assume no transaction costs in the reported results. Running the algorithm yields portfolio weights for the S&P/TSX 60 and ten constrained portfolios as shown in Table 3.

(insert Table 3 around here)

Results and Analysis.

In order to understand the tradeoffs inherent in implementing our CSR screens, a tracking error measure is computed as the mean squared error (two-sided) between the expected return distribution of the S&P/TSX 60 and that of the constrained portfolio. Because the tracking error is relatively small, it is reported as deviations from the true index value of 469.28 on July 5th 2004, the optimization date. Hence, the expected tracking error of the TSX 60 is 0, while the "TSX 58" has an average squared error of less than 0.08 points. As expected, the tracking error increases as stocks are removed, but errors remain exceedingly small with mean absolute deviation never exceeding 0.87 points, with the maximum absolute deviation being 6.79 points when 16 stocks are removed from the index. Results are given in Table 4.

(insert Table 4 about here)

To be able to track the index (on average) to within a single point of its true value of 469.28 is a remarkable result. Perhaps of equal importance, however, is an analysis of how the reported tracking errors impact the return distributions of the constrained portfolios. Obviously, the index tracking error is only relevant to the extent that it changes the risk/ return distribution of the constrained portfolios. We begin by calculating the two-week returns (r_s) across all scenarios for the target as well as each of the constrained portfolios. We evaluate the change in the risk/return distribution by measuring the first four moments of the target and each of the constrained portfolios. The first moment, the sample mean, is defined:

$$\frac{1}{S}\sum r_s \qquad \text{(eq.6)}$$

The second moment is the sample standard deviation and is defined as

$$\sqrt{\frac{S\sum r_s^2 - \left(\sum r_s\right)^2}{S(S-1)}} \qquad \text{(eq.7)}$$

The third moment of the distribution is computed as

$$\frac{S}{(S-1)(S-2)}\sum\left(\frac{r_s - \bar{r}}{d}\right)^3 \qquad \text{(eq.8)}$$

where d is the sample standard deviation computed in (2) and the fourth moment is defined as

$$\left\{\frac{S(S+1)}{(S-1)(S-2)(S-3)}\sum\left(\frac{r_s-\bar{r}}{d}\right)^4\right\}-\frac{3(S-1)^2}{(S-2)(S-3)} \qquad \text{(eq.9)}$$

where d is similarly defined. The resulting statistics characterize the return distribution for the unconstrained portfolio and each of the “cleaned” portfolios. Along with the tracking error, the moments of the return distribution form the basis for evaluating the tradeoffs inherent in incorporating the YU-CSR[EP] screen.

The results imply that the cost incurred in “cleaning” a passive index is negligible. We argue that the tracking error is financially irrelevant. Perhaps more importantly, Figure 1 reveals several of the restricted portfolios would have *higher* expected returns than the fully indexed portfolio. This result is somewhat counterintuitive. One expects that restricting the universe of tradable instruments must strictly lower the risk adjusted return, but that is only true if the target portfolio lies on the efficient frontier. There is no reason to expect an arbitrarily constructed index portfolio to lie on the frontier, and as a result, more efficient portfolio choices are possible. The optimization routine has found just such a portfolio in these cases.

(insert Figure 1 about here)

Examining each of the moments of the return distribution yields a similar story. The restricted portfolio has the same shape as the unconstrained index. There is no appreciable change in skewness or kurtosis. The maximum loss of return (49 bps) comes when 12 stocks are removed.

Examining the weighting of the stocks in the "cleaned" indices, it is apparent that the algorithm is searching for the stocks most closely correlated to the ones being removed, and loading on those stocks. The mass is not spread evenly among the remaining stocks. This is an appealing result since it suggests that the costs of implementation need not be onerous. Looking at the 58 stock portfolio, the value of the two deleted stocks is not redistributed among the 58 remaining stocks, but on only 15 of the remaining 58 stocks. The highest number of rebalancing transactions occurs in the 44 stock portfolio, where the rebalancing requires additions to 26 positions. Obviously, the total number of rebalancing transactions is an increasing function of the number of stocks removed. However, there does seem to be a sizeable increase in the dispersion of the additional mass as the number of index deletions increases, suggesting that transaction costs (both implicit and explicit) may become increasingly important as screening becomes more aggressive.

Conclusion

This paper illustrates how a pension fund or endowment trustee -- while remaining agnostic about the investment performance of companies with low CSR scores -- can maintain a statistically indistinguishable level of diversification while incorporating CSR based constraints on portfolio holdings. Our results are broadly consistent with previous research that finds CSR screening does not impact portfolio returns. However, instead of viewing the problem through the prism of active portfolio management, we cast the problem in a passive indexing context. Instead of testing screened portfolios for evidence of abnormal return performance, we ask whether pension fund managers can simultaneously meet stakeholder demands for socially responsible investment while remaining indexed. Our results demonstrate that fiduciaries and trustees should be able to comfortably eliminate undesirable companies, and perhaps even entire industries from their investment portfolios – using a replication algorithm to find statistical substitutes – and not risk violating their legal fiduciary responsibilities. The trustees and managers can be viewed as taking a pro-active role in value maximization and risk reduction without sacrificing risk-adjusted performance.

Indeed, perhaps a fund should only be allowed to divest itself of a given security once it has passed the above-mentioned statistical substitute test. This would add a level of quantification to the screening process as well. And, even if the fund decides not to divest itself of a particular holding, it can use this strategy as a credible threat to affect change.

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Table 1

YU-CSR[EP] Scores

YU-CSR[EP] scores reported by sector, as defined by the Toronto Stock Exchange. Tickers are likewise defined. The constituent firms are the members of the S&P S&P/TSX 60 index as of July 5, 2004. The YU-CSR[EP] is calculated as described in Section 2. Ranking is for the period ending Q2, 2004.

Sector	Ticker	Name	CSR Score
Consumer Discretionary	CTR.A	Canadian Tire	73
	FHR	Fairmont Hotels	50
	MG.A	Magna International	71
	RCI.B	Rogers Communications	48
	SJR.B	Shaw Communications	70
	TOC	Thompson Corp.	46
Consumer Staples	BCB	Cott	70
	WN	George Weston Ltd.	49
	L	Loblaw Companies Ltd.	62
	MOL.A	Molson Inc	69
Energy	CNQ	Canadian Natural Resources	69
	ECA	EnCana Corp	49
	HSE	Husky Energy	73
	IMO	Imperial Oil	48
	NXY	Nexen	69
	PCA	Petro-Canada	50
	PD	Precision Drilling Corp	69
	SU	Suncor Energy	51
	TLM	Talisman Energy	72
Financials	BMO	Bank of Montreal	57
	BNS	Bank of Nova Scotia	60
	BNN.A	Brascan	70
	CM	CIBC	62
	MFC	Manulife Financial	49
	NA	National Bank of Canada	71
	RY	Royal Bank of Canada	46
	SLF	Sun Life Financial	71
	TD	Toronto Dominion Bank	50
Health Care	BVF	Biovail	9
	MDS	MDS	55
Industrials	BBD.B	Bombardier	71
	CAE	CAE	46
	CP	Canadian Pacific Rail	71
	CNR	CNR	71
	TEU	CP Ships	47
	IQW	Quebecor World	73
	RYG	Royal Group Technologies	45
Information Tech	ATY	ATI Technologies	67
	CLS	Celestica	46
	CSN	Cognos	66
	NT	Nortel Networks	52

Sector	Ticker	Name	CSR Score
Materials	A	Abitibi Consolidated	61
	AGU	Agrium	61
	AL	Alcan	59
	ABX	Barrick Gold	55
	CCO	Cameco	61
	DFS	Dofasco	72
	DTC	Domtar	48
	N	Inco Limited	70
	K	Kinross Gold	62
	NRD	Noranda	82
	NCX	Nova Chemicals Corp.	50
	PDG	Placer Dome	59
	POT	Potash Corp	51
	TEK.B	Teck Corporation	42
Telecom	BCE	BCE	72
	T	TELUS Corp.	45
Utilities	ENB	Enbridge	57
	TRP	Trans Canada Corp	48
	TA	Trans-Alta Corp	69

Table 2

Regression of 1-year Returns on YU-CSR[EP] Scores

The dependent variable is the 1-year return for the period ending July 5, 2004. Regression 1 contains only YU-CSR[EP], the score for each firm as reported in Table 1 for the period ending Q2, 2004, with high (low) scores indicating more (less) socially responsible business practices. Regression 2 includes the fourteen sub-criteria that constitute the YU-CSR[EP] composite score. Each of the variables is defined in Section 2. Regression 3 reports the results of the best-subsets regression. It contains only those variables that maximize the coefficient of determination for this data set. For each variable the first row reports the OLS coefficient and the second row reports the t-statistic of the coefficient. Sample includes S&P/TSX 60 constituent stocks as of July 5, 2004 with the exception of a single YU-CSR[EP] outlier.

Variable	**(1)**	**(2)**	**(3)**
Constant	-0.1204	-0.4361	-0.2476**
	(-0.80)	(-1.49)	(-2.28)
YU-CSR[EP] Score	0.005622**		
	(2.27)		
Board Composition		0.00313	
		(0.18)	
Health and Safety Record		-0.01325	
		(-0.37)	
Health and Safety Culture		0.01552	
		(0.64)	
Reputation		0.01952	0.03386***
		(0.79)	(2.68)
Community Investment		-0.07782*	-0.03351
		(-1.77)	(-1.33)
Employee attitude Survey		0.05804*	0.02548
		(1.76)	(1.28)
Employee Retention		-0.03724	
		(-0.63)	
Work/ Life Balance		0.13055***	0.11561***
		(3.68)	(4.07)
Performance based Compensation		0.03300	
		(1.13)	
Pension Plan		-0.01675	
		(-0.52)	
Training		-0.00928	
		(-0.26)	
Policies		0.02934	
		(1.38)	
Convictions		0.01303	
		(0.27)	
Freedom of Association (i.e. Unionization)		-0.02638	
		(-0.96)	
R^2	6.7%	14.8%	25.0%
N	59	59	59

Table 3
Relative Weights for Constrained Portfolios

YU-CSR[EP] scores are for the period ending Q2, 2004. The constituent firms are the members of the S&P S&P/TSX 60 index as of July 5, 2004. The relative weights for the S&P/TSX 60 are as reported by TSX Market Datalinx on July 5, 2004. The relative weights of the constrained portfolios are generated by optimization in Riskwatch©. Columns do not sum to 100% due to rounding.

Name	TSX 60	TSX 58	TSX 56	TSX 54	TSX 52	TSX 50	TSX 48	TSX 46	TSX 44	TSX 42	TSX 40
Biovail	0.64%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Teck Cominco	0.72%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Royal Group Tech.	0.15%	0.15%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Telus	1.10%	1.13%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CAE	0.24%	0.24%	0.24%	0%	0%	0%	0%	0%	0%	0%	0%
Celestica	0.74%	0.74%	0.79%	0%	0%	0%	0%	0%	0%	0%	0%
Royal Bank	6.28%	6.28%	6.28%	6.28%	0%	0%	0%	0%	0%	0%	0%
Thomson Corp	1.49%	1.49%	1.59%	1.49%	0%	0%	0%	0%	0%	0%	0%
CP Ships	0.34%	0.34%	0.51%	0.87%	1.24%	0%	0%	0%	0%	0%	0%
Domtar	0.65%	0.65%	0.65%	0.87%	0.65%	0%	0%	0%	0%	0%	0%
Imperial Oil	1.11%	1.11%	1.11%	1.11%	1.11%	1.11%	0%	0%	0%	0%	0%
Rogers Comm.	0.72%	0.76%	1.09%	1.20%	1.27%	0.72%	0%	0%	0%	0%	0%
TransCanada Corp	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	0%	0%	0%	0%
EnCana	4.27%	4.27%	4.27%	4.27%	4.27%	4.27%	4.27%	0%	0%	0%	0%
George Weston	0.73%	0.76%	0.73%	0.73%	0.95%	0.73%	0.73%	0.73%	0%	0%	0%
Manulife Fin'l	7.10%	7.19%	7.10%	7.10%	7.12%	7.10%	7.57%	7.10%	0%	0%	0%
Fairmont Hotels	0.47%	0.47%	0.47%	0.47%	0.47%	0.47%	0.54%	1.06%	0.62%	0%	0%
NOVA Chemicals	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0%	0%
Petro-Canada	2.48%	2.57%	2.48%	2.48%	2.48%	2.84%	3.08%	3.55%	4.73%	4.56%	0%
T-D Bank	4.64%	4.64%	4.64%	4.64%	4.97%	5.94%	6.06%	6.85%	5.53%	5.34%	0%
Potash Corp	1.13%	1.13%	1.13%	1.13%	1.13%	1.13%	1.13%	1.13%	2.28%	2.53%	1.13%
Suncor	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%	2.49%
Nortel Networks	4.06%	4.07%	4.06%	4.16%	4.10%	4.06%	4.06%	4.17%	4.06%	4.06%	4.23%
Barrick Gold	2.28%	2.28%	2.28%	2.28%	2.28%	2.28%	2.28%	2.28%	2.28%	2.28%	2.30%
MDS	0.47%	0.47%	0.47%	0.47%	1.15%	0.67%	0.47%	0.87%	1.54%	1.16%	1.73%
Bank of Montreal	4.33%	4.33%	4.33%	4.33%	5.34%	4.33%	4.33%	4.33%	4.33%	4.81%	5.94%
Enbridge	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	2.86%	2.04%	2.28%	1.39%
Alcan	3.27%	3.48%	3.41%	3.27%	3.30%	3.70%	3.56%	3.89%	3.66%	4.11%	4.41%
Placer Dome	1.51%	1.51%	1.51%	1.51%	1.94%	1.54%	1.63%	1.51%	1.51%	1.51%	1.51%
Bank of Nova Scotia	5.84%	5.84%	5.84%	5.84%	5.84%	5.84%	5.84%	5.84%	7.10%	7.54%	10.06%
Abitibi	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%
Agrium	0.41%	0.41%	0.41%	0.41%	0.41%	0.51%	0.84%	0.41%	0.41%	0.41%	0.41%
Cameco	0.71%	0.98%	0.71%	0.71%	0.71%	0.71%	0.71%	0.71%	0.71%	0.71%	0.71%
CIBC	3.77%	3.77%	3.77%	3.77%	3.77%	3.77%	3.77%	3.77%	3.77%	3.77%	5.53%
Kinross Gold	0.42%	0.42%	0.42%	0.42%	0.42%	0.49%	0.42%	0.74%	1.03%	1.04%	0.87%
Loblaw Co.	1.00%	1.00%	1.00%	1.00%	1.00%	1.04%	1.00%	1.00%	1.32%	1.00%	1.10%
Cognos	0.69%	0.91%	0.69%	0.74%	1.13%	1.29%	1.32%	0.94%	1.30%	1.52%	1.94%
ATI Technologies	0.97%	1.00%	1.13%	1.44%	1.33%	1.74%	1.69%	1.34%	1.18%	1.24%	1.55%
TransAlta	0.52%	0.52%	0.57%	0.53%	1.05%	1.82%	2.27%	1.72%	0.52%	0.98%	1.48%

Name	TSX 60	TSX 58	TSX 56	TSX 54	TSX 52	TSX 50	TSX 48	TSX 46	TSX 44	TSX 42	TSX 40
Canadian Natural Resources	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	1.75%	3.43%	1.75%	1.75%	1.75%
Molson	0.62%	0.62%	0.62%	0.62%	0.62%	0.66%	0.62%	0.62%	1.38%	1.14%	1.43%
Nexen	1.09%	1.09%	1.09%	1.09%	1.09%	1.09%	1.09%	1.09%	1.09%	1.09%	1.09%
Precision Drilling	0.58%	0.62%	0.65%	0.58%	1.33%	1.74%	1.88%	2.86%	1.65%	1.82%	2.51%
Brascan	1.32%	1.32%	1.32%	1.32%	1.32%	1.32%	1.32%	1.32%	1.32%	1.32%	1.32%
Cott	0.50%	0.51%	0.56%	0.50%	0.81%	0.50%	0.55%	0.87%	1.15%	1.22%	1.97%
Inco	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%	1.39%
Shaw Comm.	0.81%	0.81%	0.81%	0.81%	1.27%	0.81%	1.52%	0.81%	0.81%	0.81%	0.81%
Bombardier	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	0.93%	1.15%	1.17%	1.29%
CNR	2.68%	2.68%	2.68%	2.68%	2.68%	2.85%	2.68%	2.73%	3.34%	3.29%	3.18%
CPR	0.84%	0.84%	0.84%	0.84%	0.84%	0.84%	0.84%	0.84%	0.84%	0.84%	0.84%
Magna	1.74%	1.74%	1.74%	1.74%	1.74%	1.74%	1.74%	1.74%	3.51%	3.61%	1.74%
National Bank	1.18%	1.18%	1.18%	1.18%	2.27%	2.65%	2.23%	2.69%	3.68%	3.39%	2.56%
Sun Life Fin'l	3.78%	3.78%	3.78%	3.98%	4.77%	4.66%	4.85%	5.30%	10.65%	9.94%	9.13%
BCE	4.00%	4.00%	4.56%	4.24%	4.69%	4.85%	4.40%	6.73%	5.65%	5.87%	7.96%
Dofasco	0.48%	0.65%	0.95%	0.87%	0.72%	1.21%	1.25%	1.53%	0.71%	0.80%	2.44%
Talisman	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	2.80%	3.11%	3.96%
Canadian Tire	0.61%	0.61%	0.67%	0.87%	1.30%	1.94%	1.94%	0.97%	1.50%	1.67%	2.67%
Husky Energy	0.52%	0.55%	0.52%	0.52%	0.60%	0.74%	1.31%	0.82%	0.82%	0.52%	0.52%
Quebecor World	0.40%	0.49%	0.75%	1.01%	0.88%	0.68%	0.60%	0.40%	0.54%	0.62%	0.83%
Noranda	0.64%	0.64%	0.64%	0.64%	0.64%	0.64%	0.64%	0.64%	0.64%	0.64%	1.13%

Figure 1
Expected Return and Standard Deviation

Expected return is the annualized mean of the return distribution over 76 historical 2-week returns for the S&P/TSX 60 index ending July 5, 2004. Standard deviation is the annualized sample standard deviation of expected returns.

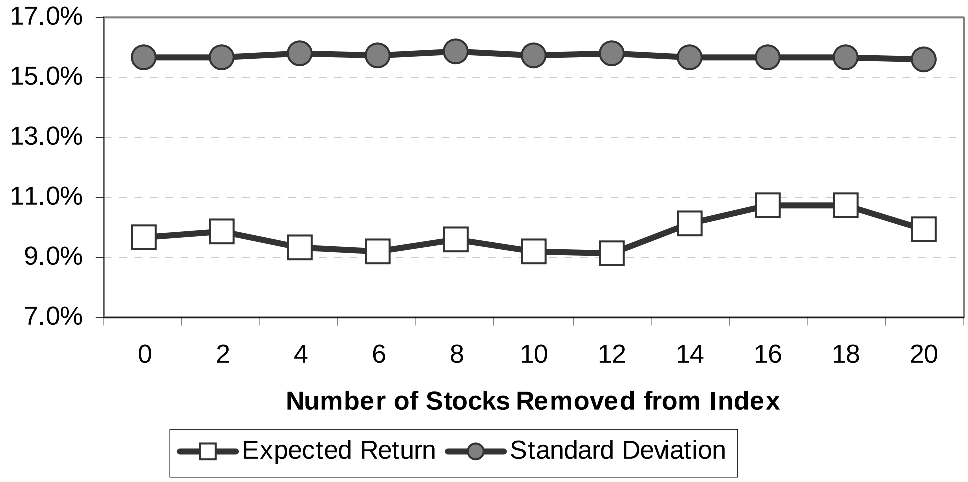

Table 4

Portfolio Moments and Tracking Error

Return is the annualized mean of the return distribution, given 76 historical realizations for the S&P/TSX 60 ended July 5, 2004. Standard deviation is the annualized sample standard deviation of expected returns. Skewness and kurtosis are similarly defined. Mean squared error is the average squared deviation of the constrained portfolio from the expected value of the S&P/TSX 60. Mean absolute deviation is the absolute value of the average deviation of the constrained portfolio from the expected value of the S&P/TSX 60 Index. Maximum deviation is the largest deviation from the expected value over any of the 76 realizations of returns. For both mean absolute deviation and maximum deviation, the units are index points. Rebalancing transactions is the total number of transactions (buying and selling) required to implement the YU-CSR[EP] screen.

Stocks Removed	**0**	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**
Return (%)	9.65	9.85	9.36	9.23	9.66	9.22	9.16	10.13	10.70	10.70	9.92
Standard Deviation (%)	15.69	15.68	15.77	15.74	15.83	15.76	15.79	15.66	15.70	15.70	15.63
Skewness	-0.936	-0.933	-0.918	-0.956	-0.945	-0.960	-0.943	-0.954	-0.946	-0.918	-0.922
Kurtosis	2.522	2.534	2.457	2.635	2.549	2.499	2.448	2.543	2.634	2.544	2.643
Mean Squared Error	0	0.078	0.233	0.355	0.584	0.677	0.706	0.881	1.686	1.565	2.392
Mean Absolute Deviation	0	0.19	0.31	0.42	0.50	0.54	0.53	0.61	0.71	0.69	0.88
Maximum Deviation	0	0.93	1.74	1.80	2.50	2.35	2.56	3.43	6.79	6.75	5.77
Rebalancing Transactions	0	17	17	18	31	32	32	35	42	43	45

[i] "Big investors want SRI research: European institutions to allocate part of brokers' fees to 'non-traditional' information." Financial Times, 18 October 2004

[ii] Created by the social research firm of KLD Research & Analytics, the Domini 400 Social Index is a market capitalization-weighted common stock index. It monitors the performance of 400 U.S. corporations that pass multiple, broad-based social screens. The Index consists of approximately 250 companies included in the Standard & Poor's 500 Index, approximately 100 additional large companies not included in the S&P 500 but providing industry representation, and approximately 50 additional companies with particularly strong social characteristics.

[iii] The S&P/TSX 60 index is the large-capitalization component of a series of S&P Canadian indices, including the S&P/TSX Composite, the leading benchmark for Canada. It is market cap weighted, with weights adjusted for available share float, and is balanced across 10 economic sectors. Offering exposure to 60 large, liquid Canadian companies, the S&P/TSX 60 is the Canadian component of the S&P Global 1200 index. The choice of the S&P/TSX index is purely one of convenience, given that all of the authors are domiciled in Canada.

iv Margolis and Walsh (2001) have reviewed more than 80 such studies. Watson Wyatt (2002) is just one example of a practitioner organization that has also undertaken empirical research explicitly linking human resource management practices and firm performance.

[v] Sources included: Michael Jantzi Research Associates (MJRA), KLD Research & Analytics, Innovest IVA, FTSE4Good, Real Assets, Global Reporting Initiative (GRI 2002), Sustainable Asset Management (SAM), Dow Jones Group Sustainability Indices (DJSI), Ethibel, GrowthWorks Working Opportunities Fund, and AMP Henderson.

[vi] A total of 37 interviews were conducted with experts in labour and employment practices; the group comprised labour representatives (23), SRI specialists (3), investment managers (3), pension fund administrators (2), consultants (3) and non-governmental organizations (3).

[vii] Patton asserts that triangulation strengthens a study by combining methods. This research incorporates both data triangulation (the use of a variety of data sources; in this case books, newspaper articles, academic papers, consultant reports, websites, newsletters, etc.) and methodological triangulation (the use of multiple methods to study a single problem or program) in this case, both data analysis and interviewing was used to determine a set of criteria to measure a firms' capacity to develop and foster human capital.

[viii]Indicators were discarded if they were determined to be too normatively skewed to any one stakeholder's perspective, i.e. they risked reducing opportunities for 'win-win' value outcomes between the firm and its various stakeholders.

[ix]It needs to be noted that the Biovail YU-CSR[EP] score is a significant outlier. Given that this firm also had very low returns, a single data point was significantly influencing the regression results. For this reason, it was removed from the analysis. In the complete sample, Biovail drives the regression result, with R^2 rising to 24.6%.

[x] The impact of industry effects was also tested using industry indicator variables. Results are qualitatively unchanged.

[xi] Variance inflation factors (not reported) are greater than 5 for five of the variables in the full specification, indicating the coefficients are poorly specified. Those variables are, Health and Safety culture, Reputation, Community Investment, Performance –based Compensation and Convictions.

[xii] Research is currently being undertaken to explore the power of these criteria to explain firm performance in other settings, and to design proxies for the other theoretical predictors of performance that are better able to capture the desired effects.

[xiii] In order to discriminate between firms having the same CSR score, the following tie breaking system is used. When two firms have the same score, the YU-CSR[EP] score is calculated using specification (3) from Table 2. The rationale for this decision rule is that the variables in specification (3) are the best predictors of firm performance among the sub-criteria in the YU-CSR[EP]. The lower of the two firms as measured by this score is the next one chosen for removal. If, after recalculating the YU-CSR[EP], there is still a tie, firms are removed in alphabetical order.
[xiv] For more technical discussion see Dembo (1991) and Dembo and Rosen (1999).