Les Cahiers du GERAD ISSN: 0711–2440

Canadian Investors and the Discount on Closed-End Funds

M.A. Ayadi, H. Ben-Ameur
S. Lazrak, Y. Wang

G–2011–06

February 2011

Canadian Investors and the Discount on Closed-End Funds

Mohamed A. Ayadi

Department of Finance, Operations, and Information Systems
Faculty of Business, Brock University
St. Catharines (Ontario) Canada, L2S 3A1
mayadi@broku.ca

Hatem Ben-Ameur

GERAD & HEC Montréal
Montréal (Québec) Canada
hatem.ben-ameur@hec.ca

Skander Lazrak

Brock University
St. Catharines (Ontario) Canada
slazrak@brocku.ca

Yue Wang

State University of New York
Buffalo (New York) USA

February 2011

Les Cahiers du GERAD
G–2011–06

Abstract

We explore the role of the discount on closed-end funds (CEFD) in asset pricing and weakly tests its validity as a proxy for sentiment in the Canadian stock market. Results show that CEFD is not a priced factor. Both cross-sectional and time-series tests confirm that stocks with different exposures to CEFD do not have significantly different average returns. CEFD does not even provide incremental explanatory power after controlling for firm characteristics and risk factors. This evidence, together with the findings from our weak test of CEFD as a sentiment index, suggests that CEFD is unlikely to be driven by sentiment in Canada.

Key Words: Closed-end funds; sentiment; cross-sectional regressions.

Résumé

Ce papier explore le rôle de la décote sur les fonds d'investissement à capital fermé (CEFD) dans l'évaluation des actifs financiers. On offre un test faible de la validité de cette mesure comme indicateur de sentiment sur le marché des actions Canadiennes. Les résultats montrent que le CEFD n'est pas un facteur qui explique la formation des prix. Les tests économétriques confirment que les titres avec des expositions différentes au CEFD ne produisent pas des rendements significativement différents. Par ailleurs, le CEFD n'a aucun pouvoir explicatif supplémentaire après contrôle des caractéristiques des titres et des facteurs de risque. Cette preuve, ainsi que les résultats de notre test de la faiblesse de CEFD comme un indice de sentiment, suggèrent que le CEFD est peu probable pour être engendré par le sentiment au Canada.

Mots clés : Fonds d'investissement à capital fermé; sentiment; régressions en coupe transversale.

Acknowledgments: Financial support from the Faculty of Business at Brock University, NSERC, and IFM2, is gratefully acknowledged. We would like to thank Zismos Koustas for many helpful comments. The usual disclaimer applies. Please do not quote without the authors' permission.

1 Introduction

The behavior and even the existence of discounts on closed-end funds present an enduring puzzle in the financial economics literature. Once incepted, a typical closed-end fund is, on average, traded at a discount from the value of the underlying assets it holds, but the discount has wide cross-sectional and time-series variations. This empirical evidence seems to violate the efficient market hypothesis as one can arbitrage between the fund and its underlying components. However, various theories including the limited rationality or behavioral finance provide potential explanations.

DeLong et al. (1990) are among the first to propose that the discount on closed-end funds (CEFD) as a measure for sentiment is an empirical implication of their general noise trader theory on U.S. closed-end funds. Put briefly, closed-end funds are mainly held by individual investors who are likely to trade on noise or sentiment (Black, 1986). These investors' systematic sentiment-induced trading drives the prices of closed-end funds away from their fundamental values based on the limits of arbitrage (Shleifer and Vishny 1997). Since the underlying assets of closed-end funds are normally held by institutional investors who are less likely to trade on the same sentiment as small investors, these sentiment-induced mispricings are finally reflected in the form of an observable discount (pessimistic sentiment) or premium (optimistic sentiment) from fund net asset values (NAVs). In addition, since the risk from sentiment represents a new source of systematic risk, closed-end funds are usually traded at discount.

Following the seminal paper of Delong et al. (1990), numerous empirical studies have been conducted in the U.S. to validate the CEFD as a sentiment index. They examined the relationship between this proxy for sentiment and stock returns. However, the empirical tests in the U.S. have thus far shown mixed results. Evidence for investor sentiment has documented that the change in discount is correlated to other proxies of sentiment. Moreover, the magnitude of the discounts is related to the difficulty of arbitrage and ultimately, the change in discount is a priced factor in the stock market (e.g., Lee et al., 1991; Bodurtha et al., 1993; Pontiff, 1996, 1997; Swaminathan, 1996; Neal and Wheatley, 1998). However, the evidence against investor sentiment finds that the change in discount is not priced in both closed-end funds and common stocks in the U.S. Moreover, it also shows that the discount or the change in discount can be explained by rational factors such as management fees and unrealized capital gains (e.g., Malkiel, 1977; Chen et al., 1993; Elton et al., 1998; Ross, 2005).

More recently, an increasing volume of research using data outside the U.S. has contributed to this debate. To date, data from both developed markets (such as the U.K.) and emerging markets (such as China and Greece) have been used. However, these out-of-sample tests have still provided ambiguous results (e.g., Gemmill and Thomas, 2002; Doukas and Milonas, 2004; Chen et al., 2004; Zhang et al., 2004).

The objective of this paper is to contribute to this longstanding debate by empirically exploring the relevant issues for discounts on Canadian closed-end funds. Our study examines the role of CEFD in asset pricing in cross-sectional and time-series frameworks and attempts to validate the CEFD as a sentiment index in the Canadian market. The main contributions of this study are twofold: 1) to the best of our knowledge, there has been no test on Canadian closed-end funds. Without testing the robustness of the findings outside the environment where they were initially established, it remains unclear whether the empirical results in the U.S. apply to financial markets outside the U.S. 2) most of the tests outside the U.S. have failed to provide a formal cross-sectional test of the relation between CEFD and stock returns. To address this issue, we conduct a formal Fama-MacBeth cross-sectional tests where firm characteristics and various risk factors are adequately accounted for. To that end, we construct size, book-to-market, and momentum factors for the Canadian stock market following the Fama and French (1993, hereafter FF) and Carhart (1997).

The empirical results of our study suggest that CEFD is not a priced factor. Specifically, stocks with different exposures to CEFD do not earn significantly different average returns, nor does CEFD provide significant incremental explanatory power for cross-sectional or time-series variations of stock returns. This evidence, together with the findings from our direct test of CEFD as a sentiment index, suggests that CEFD is unlikely to be driven by sentiment in Canada given the theoretical argument by Delong et al. (1990). We believe that our result makes contribution to research in business overall. For instance, event studies that

aim to identify the impact of a particular corporate incident on the value of the firm need not use CEFD to explain the normal return.

The remainder of this paper is organized as follows. In the next section, we provide a brief literature review. Section 3 presents the data sources, the sample, and preliminary statistical tests. Section 4 describes the empirical methodologies and results. Section 5 concludes the paper.

2 Literature review

A rich body of literature has been devoted to explaining the existence and behavior of CEFD. Rational factors have been proposed to support the efficient markets arguments. Alternatively, behavioral based models advocate sentiment as explanatory for the existence of the discount. Since the main purpose of the study is to test for the latter explanation, the following brief literature review focuses on the direct empirical evidence for and against the sentiment explanation.

2.1 Rational factors for discounts

The literature has focused on three types of rational factors to explain funds' discounts, although these factors fail to fully account for the empirical behavior of CEFD. The first factor is related to agency costs: One of the most convincing rational explanations may be management fees and other expenses. Ross (2005) showed that if δ is a percentage of NAV paid out as management fees (or as other expenses) and ξ is a percentage of NAV paid out as dividend to investors, the fee-based discount is $\delta/(\xi+\delta)$ of NAV.[1] However, this argument does not account for the temporal variations of discounts since both management fees and distribution policy are very stable over time,[2] nor can it explain why funds can be traded at a premium. Another rational factor related to agency costs is fund performance: According to rational expectations, the discount or premium reflects investors' expectations for funds' future NAV performance; however, there is little empirical support for this argument, and most prior studies, using various techniques to measure NAV performance, have failed to find a correlation between fund NAV performance and fund discount (Malkiel, 1995; Lee et al., 1991; Dimson and Minio-Kozerski, 1999).

The second set of rational factors to explain the discounts is related to biases in the NAV. In effect, some researchers have attributed discounts to biases in calculating NAV derived from tax liabilities from unrealized capital gains and illiquid underlying assets (Malkiel, 1995). However, neither of unrealized capital gains nor illiquid underlying assets can explain why prices rise to NAV when funds are liquidated. Consider that, in terms of unrealized capital gains, UK funds behave remarkably like U.S. funds, even though the British funds are not allowed to distribute any capital gains and, in terms of illiquid assets, many funds sell at discounts even though they hold very few illiquid assets (Lee et al., 1991).

The third factor was proposed by Brickley et al. (1991) and Kim (1994), who argued that closed-end funds should be traded at discounts because the managed funds deny taxable investors the tax-timing option that is available from holding the underlying individual securities. However, this proposition cannot account for funds' selling at premiums. In addition, Seyhun and Skinner (1994) showed that only a very small fraction of investors (5% to 7%) trade continually to minimize the present value of their net tax payments, so the potential importance of tax-timing is negligible.

2.2 Empirical tests of sentiment explanations

The sentiment explanation for CEFD rests on the noise trader theory. As a result, most of the empirical analysis has focused on testing the implications of its two basic assumptions: systematic sentiment and limits to arbitrage. Systematic sentiment implies that the time-series variation of CEFD should be highly correlated to the trading and the returns of securities, which are also "habitats" for retail investors and so are affected

[1] Gemmill and Thomas (2002) derived a similar formula.
[2] The management fees and distribution policy cannot be changed without approval by the shareholders or unitholders.

by the same sentiment. Stocks of small-size firms are widely used in this type of test, given the evidence that small-size firms are mainly held by individual investors.

Lee et al. (1991) first examined this implication by regressing returns of size-decile portfolios on market returns and the discount on closed-end funds. They identified a significant incremental explanatory power of the discount on the returns of size-decile portfolios. However, Chen et al. (1993) refuted the Lee et al.'s finding by pointing out that, regressing the fund return on the returns of NAV and the returns of size-decile portfolios results in the marginal contribution of the returns of size-decile portfolios being no more than 4 percent of the variance in the return of closed-end funds.

Several subsequent studies investigated this correlation between CEFDs and small firms' returns. The results were mixed. Swaminathan (1996) and Neal and Wheatley (1998) tested whether current investor sentiment can predict future stock returns on the grounds that the individual investor sentiment is mean-reverting. Their results suggest that CEFDs can forecast future excess returns on small firms. They argue that the incremental information extracted from the discount factor beyond the commonly used ones in the stock returns predictability literature is substantial. By contrast, Elton et al. (1998), Zhang *et al.* (2004), and Doukas and Milonas (2004) argued that CEFD cannot explain the size premium in the U.S., Chinese, or Greek markets respectively. In particular, Elton et al. (1998) found that using a five instead of two-index model alters Lee et al.'s main conclusions.[3]

If the discount reflects investors' sentiment then the risk of unpredictable changes in sentiment, measured by the change in discounts, will be a source of systematic risk. Hence, it should be priced in closed-end funds as well as other assets. However, there is little evidence in the literature for this contention. Elton et al. (1998) showed that in the U.S. the sentiment index measured by CEFD, enters the return-generating process only by chance and no more often than other return indices. They also found that firms with high sensitivity to CEFD do not offer higher expected returns. Gemmill and Thomas (2002) argued that discounts in the long run reflect fundamental factors including fees and dividend yield but not noise trader risk.

If the discounts of closed-end funds reflect mispricing and are persistent, then there should be costs that hamper the ability of arbitrageurs to eliminate mispricing. The potential costs of arbitrage are primarily unhedged fundamental risks and noise trader risk. Unhedged fundamental risks stem from the uncertainty of the underlying portfolio composition (or no perfect substitutes for NAV). Funds managers frequently alter the composition of their portfolios. However, they report the changes less frequently and with some considerable delay. Therefore, the detailed list of all component assets is not necessarily available. Arbitrageurs can hedge the risk of NAV with portfolios that are highly correlated to NAV. However, the residual risk (unhedged fundamental risk) imposes costs on arbitrage. Noise trader risk stems from the risk of wider discounts when closing positions are due to unpredictable sentiments.

Most of the studies that investigated these arbitrage costs indicated that discounts reflect mispricing. Pontiff (1996) found that, in the U.S., the absolute values of discounts are larger for (i) funds with higher unhedged fundamental risk,[4] (ii) funds that pay lower dividends,[5] and (iii) funds that have larger bid-ask spreads. Pontiff documented also that discounts are larger during periods characterized by high interest rates. These cost factors can explain a quarter of the cross-sectional discount variation. Using different methods to measure unhedged risk,[6] Dimson and Minio-Kozerski (1999) showed that higher unhedged risks are related to larger discounts for U.K. funds. These findings about the relationship between the magnitude of the discount and arbitrage cost factors support the sentiment explanation. However, these studies did not directly determine whether noise trader risk deters arbitrage. Flynn (2008) refuted the evidence of

[3] Other empirical tests rely on the correlation of fund discounts with other sentiment indicators, but evidence from this perspective is still conflicting. Malkiel (1977) and Lee et al. (1991) find positive correlations between open-end fund net redemptions and CEFD in the US market. Gemmill and Thomas (2002) identify a highly significant relationship between retail flow into open-end funds and CEFD in the U.K. They support the sentiment explanation.

[4] Pontiff (1996) measured the unhedged risk of closed-end funds using residual standard deviation from regressing excess NAV returns on the excess returns of ten open-end mutual funds.

[5] A higher dividend yield on the fund makes arbitrage less costly since it is easier to cover the dividend obligation on the short position in the underlying assets.

[6] Dimson and Minio-Kozerski (1999) used Sharpe's returns-based style analysis to infer the most effective asset mix for hedging underlying assets.

the arbitrage cost identified by Pontiff (1996) by showing that larger mispricing increases the risk-adjusted excess return of arbitrage portfolios. Flynn attributed this excess return to the compensation for bearing noise trader risk.

In conclusion, the literature has not reached an agreement regarding the sentiment hypothesis based on CEFD. We eventually explain this divergence as CEFD is the result of various confounding factors (management fees, distribution policy, tax, performance, sentiment, force of arbitrage, etc) or ultimately of some factors that have yet to be identified. Our paper finds its foundation specifically from this controversy.

3 Data, variables, and pricing factors

3.1 Data sources

Data on Canadian closed-end funds are collected from multiple sources. The main source is Fundata Canada Inc. The latter database reports funds' NAVs and other relevant information, including name, investment objective, distribution, management expense ratio (MER), activation and termination date for each fund. In case required data is not reported on Fundata, we manually collect the missing information from either the System for Electronic Document Analysis and Retrieval (SEDAR) or the fund website.[7] All the non-trading data are merged with fund trading data (trading ticker symbol, CUSIP, price, trading volume, and shares outstanding) from the Canadian Financial Markets Research Center (TSX-CFMRC) database to form a complete set of closed-end funds data.

Historical data on Canadian stock market are extracted from two sources. First, we collect trading data for individual common stocks, T-bills, and various market and industry indices from the TSX-CFMRC database. Second, we extract accounting information on Canadian firms from the Compustat North America database. Accounting data consist mainly of the book value of common equities.

3.2 Sample of Canadian closed-end domestic equity funds

We initially identified 153 Canadian closed-end funds for which we were able to collect both matched trading data and non-trading data.[8] Similar to prior studies, our paper excludes fixed-income and country or global funds. Our final sample after screening includes 111 Canadian closed-end domestic equity funds.[9,10] It covers the period from July 1999 to December 2007 (102 months). There were only 7 funds prior to July 1999.

We should note that some Canadian closed-end funds offer a redemption privilege to shareholders allowing them to redeem fund shares annually at some percentage of NAV, less any reasonable costs associated with the redemption, including brokerage costs, commission, and other costs incurred by funding such redemption. These redemption costs generally exceed the fund discount making this privilege not attractive and very seldom exercised.

Table 1 reports simple annual and grand statistics for the number of sample closed-end funds for each calendar month. It also provides summary statistics on monthly value-weighted return, median market capitalization, and equal-weighted turnover of sample closed-end funds, along with their counterparts of fund NAV or equity market benchmarks. The monotonic increase in the annual mean of the number of

[7] We compiled the list of missing closed-end funds in Fundata by checking the funds against the closed-end fund report in www.globefund.com, which provides an updated list of all extant Canadian closed-end funds. We choose the funds that have disclosed NAV online for more than one year and for which the underlying assets value was over $100 million. The sample of missing funds in Fundata may be survivorship-biased since www.globefund.com reports only extant closed-end funds.

[8] Since Fundata doesn't report funds' trading identifiers (ticker symbol or CUSIP), we matched the data from Fundata with trading data in TSX-CFMRC via fund name.

[9] Many Canadian funds hold income trusts. Since income trusts are exchange-traded securities similar to common stocks, we consider funds holding them as equity funds. We delete the funds that invest primarily in bonds or preferred stocks and keep equity and balanced funds that contain both equity and fixed income securities. Discounts on country funds may reflect change in the domestic price of risk or a change in sentiment in foreign countries, even if the sentiment in Canada remains constant.

[10] Canadian closed-end funds retained in our sample take various organizational structures and issue multiple securities. For reasons of brevity, we use the conventional term "common shares" to denote shares for traditional investment corporations, "capital shares" for split-share corporations, "units" for investment trusts, and "L.P. units" for limited partnerships.

sample closed-end funds over the sample period, from 7 funds in 1999 to nearly 91 funds in 2007, reflects the explosive growth of the Canadian closed-end fund industry in the last ten years.[11] The mean monthly value-weighted return on closed-end funds at 84 basis points (bps) is higher than its counterpart measured from their underlying NAV at 66 bps. This suggests that closed-end funds might be exposed to higher systematic risk than their underlying assets. There is also a pronounced discrepancy between the sample funds and Canadian equity market in the grand mean of monthly equal-weighted turnover and median market capitalization. For instance, closed-end funds are smaller and less liquid than the average Canadian stock equity.

Table 1: Basic characteristics of Canadian closed-end domestic equity funds

This table reports annual and grand descriptive statistics for the basic monthly characteristics of a sample of Canadian closed-end domestic equity funds and their equity market benchmarks. These characteristics are (1) N, the number of closed-end domestic equity funds with non-missing shares outstanding at month end, (2) Monthly value-weighted (VW) average return (in %) for fund shares, for fund NAV, and for the market (all domestic common equities in the TSX), (3) Monthly equal-weighted (EW) average turnover ratio (in %) for fund shares and the market. The monthly turnover ratio is calculated as the ratio of transaction volume each month to the average of shares outstanding at the beginning and the end of the month. (4) Monthly median of size (market capitalization in $millions) for fund shares and the market. The fund sample includes 111 funds over the period July 1999 to December 2007, for a total of 102 months.

Period	Statistic	N	Monthly VW return			Monthly EW turnover		Monthly median market capitalization	
			Fund shares	Fund NAV	Market	Fund shares	Market	Fund shares	Market
1999	Mean	7.00	1.11	0.98	3.49	2.18	5.05	44.025	63.312
	Std. Dev.	0.00	5.67	4.08	4.72	0.72	0.63	2.508	1.827
2000	Mean	8.33	0.77	0.06	0.18	2.20	5.53	48.938	65.584
	Std. Dev.	1.56	2.51	5.69	6.75	0.47	1.68	7.414	3.662
2001	Mean	13.50	1.13	-0.08	-0.89	2.7	5.28	60.638	61.075
	Std. Dev.	1.09	3.10	2.70	5.67	0.53	2.21	4.006	4.205
2002	Mean	20.08	-0.53	-0.11	-0.82	2.51	15.2	73.293	68.769
	Std. Dev.	3.34	1.30	1.79	3.56	0.36	7.14	3.407	5.378
2003	Mean	35.08	1.66	1.74	2.12	2.83	22.07	82.594	81.773
	Std. Dev.	5.68	1.81	2.31	2.51	0.54	14.63	8.262	15.910
2004	Mean	54.92	1.83	1.72	1.11	3.48	5.18	107.538	118.648
	Std. Dev.	6.53	3.1	3.08	2.69	0.44	1.05	6.588	4.395
2005	Mean	76.17	1.59	1.68	1.74	3.69	4.92	106.298	132.177
	Std. Dev.	3.79	4.76	4.96	3.67	0.81	0.66	4.324	4.839
2006	Mean	92.42	-0.05	0.07	0.94	3.54	5.16	91.852	143.610
	Std. Dev.	4.17	4.47	3.71	3.41	1.52	0.98	8.800	5.910
2007	Mean	90.58	0.22	0.06	0.55	3.56	6.19	79.561	132.948
	Std. Dev.	2.15	3.66	3.58	2.83	0.83	0.45	4.886	10.534
1999-2007	Min.	7.00	-12.01	-10.30	-11.80	1.39	3.16	38.764	53.415
	Max	96.00	10.56	10.23	11.78	8.01	62.87	119.667	154.446
	Mean	46.42	0.84	0.66	0.79	3.02	8.48	79.144	98.381
	Std. Dev.	33.19	3.38	3.65	4.18	0.93	8.06	21.563	33.578

3.3 Discounts on sample funds

We calculate the discount on the closed-end fund i at time t (DISC_{it}) as the ratio of the difference between NAV and market price to NAV for funds' "common shares." NAV is reported as the market value of underlying assets, less any liabilities. For funds that issue preferred shares, the NAV of "common shares" is computed as the reported NAV equity less the value of the preferred shares.[12]

[11] The annual growth rate of closed-end funds in Canada since 1998 is over 30% (see the closed-end funds report of Investor Economics, 2006) and, as of May 2008, 239 closed-end funds are traded on the TSX (www.globefund.com).

[12] This process may lead to biases since the NAVs of capital shares are reported as the NAV of the underlying portfolio less the par value, rather than the market value, of preferred shares. In a subsequent statistical analysis, we use a subsample with split-share funds excluded and find similar results.

Apart from the basic information on closed-end funds, we calculate sample statistics on discounts on "common shares" for each fund.[13] The discount ranges from -13.09% for the Energy Split Corp. Inc. fund to 31.92% for the Economic Investment Trust fund. The median discount is 5.22% and its standard deviation is 5.20%. Only three funds are showing premiums over their NAVs.

To eliminate various idiosyncratic effects on the discount of individual funds, we aggregate the discount across funds each month to construct the discount index. As in most prior studies, the value-weighted average discount (VWD) is constructed monthly as follows:

$$\mathrm{VWD}_t = \sum_{i=1}^{n_t} (w_{it} \times \mathrm{DISC}_{it}) \tag{1}$$

where $w_{it} = \mathrm{NAV}_{it} / \sum_{k=1}^{n_t} \mathrm{NAV}_{kt}$, $\mathrm{NAV}_{it} = \mathrm{NAVPS}_{it} \times \mathrm{Shares}_{it}$, t = month-end, n_t =the number of funds with available discount at the end of month t, NAVPS_{it} is the net asset value per "common share" at the end of month t, and Shares_{it} is the number of shares outstanding of "common shares" at the end of month t for fund i.

Lee et al. (1991) propose to use the average change in discounts on closed-end funds to capture the temporal fluctuations of small investor sentiment. We measure the value-weighted average change in discount across funds as follows:[14]

$$\mathrm{VW}\Delta\mathrm{D}_t = \sum_{i=1}^{n_t} \{w_{it} \times (\mathrm{DISC}_{it} - \mathrm{DISC}_{it-1})\} \tag{2}$$

We exclude discounts in the first 180 days (weekends are excluded) of a fund's existence since there is evidence that, during this period, the discount on closed-end funds is affected by arbitrage and by the price-stabilizing actions of investment bankers so it behaves differently from the discounts of other closed-end funds (see Elton et al., 1998).[15]

The grand mean (median) of the discount and change in discount indices as defined in (1) and (2) are 13.94% (10.18%) and 11 (3) bps, respectively. There is a large time series variation in the weighted monthly discount. To illustrate, during the last 3 years of the study period, funds were traded on average at a discount of nearly 7%. The corresponding statistic for the first 3 years of our sample is significantly higher at 27%. Moreover, the value-weighted discount index exhibits high serial correlation, which is consistent with the empirical findings in the U.S. and the U.K. In contrast, the value-weighted changes in discounts show low serial correlations.

3.4 Pricing factors in the Canadian stock market

Fama and French (1993), Carhart (1997) and Jegadeesh and Titman (2001) developed multifactor asset pricing models that includes the classical market factor and three characteristics-based empirical factors (size, book-to-market, and momentum). Empirical tests show that these three factors help explain the cross-sectional variation in stock returns in the U.S. and other international financial markets. There is also evidence to support this model for the Canadian stock market (Liew and Vassalou, 2000; Berkowitz and Qiu, 2001; L'Her et al., 2003). Therefore, we choose these four factors as pricing factors in the Canadian stock market and extract monthly returns of the mimicking portfolios related to these factors over the period from July 1999 to December 2007. We provide details regarding Canadian pricing factor construction in Appendix A.

Table 2 reports the summary statistics for the monthly return of the mimicking portfolios related to the market, size (SMB), book-to-market (HML), and momentum (UMD) factors in the Canadian stock market.

[13] The results are not tabulated but available from the authors upon request.

[14] We also construct equal-weighted discount indices and indices based on the levels of discounts and find that the results are qualitatively similar.

[15] We also construct discount indices using surviving funds for the purpose of eliminating the effect of fund termination on the discount or the change in the discount. However, we find little difference in either, so we do not use such discount indices in this paper.

Panel A presents various univariate statistics on these factors' returns. Momentum portfolio has the highest monthly return at 1.40%. It is followed respectively by the size and book-to-market factors or portfolios at 1.09% and 0.61%. Finally, the market portfolio yields excess return of 0.49% per month. Panel A of Table 2 shows that all factors exhibit little autocorrelation over time. Panel B documents that the correlations among these four factors are low, which is aligned with the way mimicking portfolios are constructed.

Table 2: Summary statistics for monthly returns of the mimicking portfolios of the market, size, book-to-market, and momentum factors in Canadian stock market

The table reports summary statistics on the monthly returns (in %) of the mimicking portfolios we form for market (MKT-Rf), size (SMB), book-to-market (HML), and momentum (UMD) factors in Canadian stock market. Market (MKT) is proxied by all domestic common equities in TSX. Risk-free return (Rf) is measured by one-month Canadian T-bill rate. Size (ME) is defined as the aggregate market capitalization of all classes of common equities issued by a Canadian company. Book value of common equity (BE) is calculated as the Compustat North America book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Momentum is measured by the compounding return over the prior 6 months (the most recent month is excluded). Based on these definitions, the mimicking portfolios related to SMB (Small minus Big) and HML (High minus Low) for Canada are formed along the line of Fama & French (1993) and the mimicking portfolios for UMD (Up minus Down) are developed using the methodology in French's website and in line with Carhart (1997). Panel A reports the univariate statistics on monthly returns of the four factors. Mean (t (mean)) denotes the mean (its t-statistic) for the monthly returns. $\rho 1$, $\rho 3$, and $\rho 6$ are the autocorrelation coefficients of order 1, 3, and 6, respectively. Panel B presents the Pearson correlation matrix of these factors and p-values in parentheses, below the estimates, for the test of the null hypothesis of zero correlation. The sample period span from July 1999 to December 2007 and it is chosen to coincide with the time period of discount indices we construct on Canadian closed-end domestic equity funds.

Panel A: Univariate statistics for four factors in Canadian stock market

	MKT-Rf	SMB	HML	UMD
Mean	0.49%	1.09%	0.61%	1.40%
t (mean)	1.18	2.03	1.11	2.14
Std. Dev.	4.19%	5.43%	5.57%	6.59%
Max.	11.38%	33%	15.40%	26.00%
Min.	-12.23%	-16.90%	-20.40%	-21.60%
$\rho 1$	0.14	0.25	0.31	0.03
$\rho 3$	-0.06	-0.03	0.14	0.14
$\rho 6$	0.11	-0.07	0.10	0.00

Panel B: Correlation matrix of the four factors in Canadian stock market

	MKT-Rf	SMB	HML	UMD
MKT-Rf	1.00			
SMB	0.26 (0.01)	1.00		
HML	-0.50 (0.00)	-0.43 (0.00)	1.00	
UMD	-0.17 (0.08)	0.16 (0.11)	0.25 (0.01)	1.00

4 Empirical methodologies and results

Our empirical investigation for CEFD in Canada relies on standard Fama-MacBeth cross-sectional and Gibbons Ross Shanken (GRS) time-series regressions. We examine whether CEFD has significant incremental explanatory power in cross-sectional and time-series variations of stock returns after controlling for other well known characteristics and risk factors. We also provide a validation of CEFD as a sentiment index in the Canadian context.

4.1 CEFD and standard pricing factors

If CEFD is highly correlated to the constructed four factors then the role of discount in asset pricing may be obscured. For this purpose, we examine the correlation coefficients and the R-squares from regressing the discount on these factors. Most of the correlations are small (all below 0.32) but significant with all but the momentum factor. However, the negligible adjusted R-squares (less than 10%) from the regression of the discount index on four factors indicates that, collectively, the four factors account for little in the variation of the discount index. The evidence of low correlation between CEFD and standard pricing factors suggests that, if we find that CEFD explains securities returns then we should conclude that CEFD represents a new source of systematic risk unrelated to the usual four factors.

4.2 Portfolios formed by sorting on factor loading on CEFD

As a preliminary test, we determine whether portfolios with different sensitivities to our discount index exhibit significantly different average returns. If securities with different sensitivities yield similar average returns, then one can rule out the possibility for CEFD to be a priced factor.

For this purpose, at the beginning of each month, we assign sample stocks into quintile or decile portfolios according to ranked CEFD beta that are estimated from a 60-month (or at least 24-month) time-series rolling regression of excess returns on the five-factor model (FF 3 factors plus momentum and CEFD). Subsequently, we calculate equal-weighted or value-weighted portfolio-level return, CEFD beta, and other characteristics each month and report their time-series averages.

Based on this portfolio-forming procedure, we first calculate CEFD using all sample funds and report corresponding results in Table 3. Results do not show strong support for CEFD to be considered as a priced factor; despite the difference in average return between the two extreme groups (lowest CEFD beta and highest CEFD beta). Indeed, the last column of Table 3 shows that the differential average returns are not significantly different from zero at any acceptable confidence level. Furthermore, there is no evidence of a strictly increasing monotonic relation between CEFD betas and average returns, regardless of whether we split the portfolios into quintile or decile portfolios or use equal or value-weighting procedures.

4.3 Fama-MacBeth cross-sectional regressions

The last finding suggests that CEFD is unlikely to be an important factor in return generating process of Canadian equities. However, the portfolio analyses do not precisely account for other characteristics that may affect stock returns. Moreover, portfolio returns averaged across stocks may hide important elements underlying the data at the individual level and conceal the impact of CEFD. We address these issues herein by performing Fama and MacBeth's (1973) two-pass cross-sectional regressions to determine whether stocks' exposure to CEFD has incremental explanatory power in the cross-sectional variation of average return in Canada.

Our tests are based on individual stocks and on characteristics. The use of firm-specific characteristics for size, book-to-market, momentum, and liquidity, instead of their factor loadings, is intended to sidestep the error-in-variables problem caused by estimating factor loadings in the first-pass time series regression. Since the financial literature has shown that liquidity is an elusive concept with a number of elements captured by different measures, we adopt three popular liquidity measures for our test: relative bid-ask spread (Amihud and Mendelson, 1986), turnover ratio, and Amihud's (2002) illiquidity measure. These controlling characteristics are measured each month and defined in our regression as follows:

Size: natural logarithm of ME, where ME is month-end firm-level market value, which is defined as the aggregate market value of all classes of common shares issued by the firm.

B/M: natural logarithm of the winsorized (at the 0.5^{th} and 99.5^{th} percentile) non-negative ratio of book to market value, which is calculated using FF (1993) approach.

UMD: the compounding return over the past six months (with the most recent month excluded).

Table 3: Average returns of portfolios formed by sorting on the factor loading on CEFD in Canadian stock market

The table reports the average monthly returns (in %) and other key properties of quintile and decile portfolios formed by sorting on the factor loading on CEFD in Canadian stock market. The CEFD is calculated by the NAV-weighted average change in discount on Canadian closed-end domestic equity funds. We calculated CEFD using all funds in our sample. In calculating average change in discount, we exclude discounts in the first 180 days of fund's existence and require at least 5 component funds. The portfolio construction period is 2001.08-2007.12. The portfolios are formed and their properties are then calculated and reported by the following procedure: at the beginning of each month, individual Canadian common stocks are assigned into portfolios according to their CEFD beta estimated from 60 month (at least 24 month) time-series rolling regression of excess returns on five-factor model (Fama & French 3 factors plus momentum ands CEFD). Subsequently, equal-weighted or value-weighted portfolio-level return, CEFD beta, and other characteristics are calculated each month and their time-series averages are reported. We report the following properties or statistics: EW_ret: the time-series average of equal-weighted portfolio return; Avg. Size: the average of equal-weighted portfolio size; Avg. B/M: the time-series average of equal-weighted portfolio book-to-market ratio, which is calculated following Fama & French (1993). Avg. Mom: the time-series average of equal-weighted portfolio compounding return over prior 6 months (the most recent month is excluded). Avg. No.: the time-series average of the number of component securities in portfolios. High-Low: the portfolio in which stocks with highest CEFD beta are bought and stocks with lowest CEFD beta are shorted; t-stat: Newey-West adjusted t-statistics for the average return of the High-Low portfolio.

Portfolios	Low	2	3	4	5	6	7	8	9	High	High-Low	t-stat
EW_ret	1.71	1.66	1.23	1.26	2.28						0.57	0.87
β_{CEFD}	-2.92	-0.98	-0.19	0.66	3.39							
VW_ret	0.82	1.17	1.02	1.13	0.98						0.16	0.35
β_{CEFD}	-2.26	-0.93	-0.18	0.64	2.35							
Avg. Size	949.09	1840.40	2367.35	2493.05	715.56							
Avg. B/M	1.06	1.47	1.73	1.61	1.06							
Avg. Mom	13.95	8.79	8.38	7.92	10.75							
Avg. No.	148.10	152.82	152.38	152.31	149.53							
EW_ret	2.00	1.44	1.67	1.66	1.24	1.21	1.23	1.29	1.76	2.80	0.80	0.66
β_{CEFD}	-3.99	-1.85	-1.19	-0.77	-0.37	-0.01	0.39	0.93	1.82	4.94		
VW_ret	0.40	1.01	1.43	1.03	0.84	1.18	1.19	1.00	1.13	0.58	0.18	0.24
β_{CEFD}	-3.28	-1.81	-1.19	-0.76	-0.36	-0.01	0.40	0.88	1.74	3.90		
Avg. Size	569.24	1318.7	1572.26	2107.73	2314.98	2418.56	2487.31	2498.85	1037.26	393.47		
Avg. B/M	0.97	1.14	1.35	1.59	1.80	1.67	1.44	1.78	1.08	1.04		
Avg. Mom	17.08	11.00	8.85	8.74	8.27	8.45	7.28	8.54	8.92	12.60		
Avg. No.	72.66	75.44	76.40	76.42	75.95	76.43	76.47	75.84	75.12	74.42		

TRNV: the winsorized (at the 0.5^{th} and 99.5^{th} percentile) value of the average of monthly turnover over the past six months. Monthly turnover is calculated as monthly trading volume scaled by the average of the number of shares outstanding at the beginning and the end of the month.

Amihud: The winsorized (at the 0.5^{th} and 99.5^{th} percentiles) illiquidity measure of Amihud (2002). We estimate this measure each month as the average of daily |r|/DVOL over the past six months. Dollar volume is calculated as daily trading volume multiplied by the average of the opening and closing price.

SPR: The winsorized (at the 0.5^{th} and 99.5^{th} percentiles) value of the average of daily relative bid ask spread (%) over the past six months. We estimate the daily relative bid ask spread as the difference between the closing ask and the closing bid, scaled by their midpoint.

In the first pass of our regression, for each eligible Canadian common stock and each month, we run a multivariate time series regression of the realized equity return over the past 60 months (with at least 24 months of data available) on five factors (the three FF factors, the momentum factor, and CEFD) to estimate the factor loadings related to market and the CEFD factor. The CEFD factor is the NAV-weighted average change in discount on all sample closed-end domestic equity funds.

In the second step, we run month by month cross-sectional regressions on the realized equity return on market beta and the CEFD beta estimated earlier and on firm-specific characteristics. Panel A of Table 4 reports the time-series means of slopes from these regressions along the Newey-West adjusted t-statistics.

Table 4: Results of monthly Fama-MacBeth cross-sectional regression on beta of CEFD and on other controlling variables in Canadian stock market

This table summarizes results of the monthly Fama-MacBeth (1973) cross-sectional regression of excess return (in %) on CEFD beta, controlling for other variables hypothesized to explain average return, for Canadian stocks over 77 months (2001.08-2007.12). The CEFD is calculated as the NAV-weighted average change in discount on Canadian closed-end domestic equity funds. The controlling explanatory variables in Fama-MacBeth regression include market beta, size, book-to-market, momentum, and three measures of liquidity (turnover, relative bid-ask spread as in Amihud & Mendelson (1986), and Amihud (2002)). Their construction is provided in the text. We estimate market beta and CEFD beta for individual stocks through two approaches and report the corresponding regression results in panels A and B respectively. In the first approach, we directly estimate market and CEFD betas for individual stocks using 60 month (at least 24 month) rolling regressions of excess returns of individual stock on five-factor model in Canada (Fama & French 3 factor plus momentum plus CEFD). In the second approach, we follow Fama & French (1992) to mitigate the error-in-variable problem by using portfolio beta as a beta proxy for each stock within the portfolio. Based on the full-sample post-ranking monthly return, portfolio CEFD beta or market beta is estimated using regression on the five-factor model and then are assigned to each stock in the portfolio. The definitions of explanatory variables in panel A are as follows: β_{MKT} is the market beta for individual Canadian stock. β_{CEFD} is the CEFD beta for individual Canadian stock; The values in the first row for each explanatory variable are the time series averages of coefficients obtained by the month-by-month cross-sectional regression and the second row for each explanatory variable reports corresponding Newey-West adjusted t-statistics. Coefficient significantly different from zero at significance level of 1%, 5%, and 10% are denoted by ***, **, and *, respectively. Adj R^2 is time-series average of adjusted R-squared for cross-sectional regression and Nb. Obs is time-series average of the number of firms used in cross-sectional regression. In panel B, $\beta_{\text{MKT\_Port}}$ and $\beta_{\text{CEFD\_Port}}$ aree post-ranking portfolio betas for market and CEFD respectively and the other variables or statistics are the same as in panel A.

Panel A: With market and CEFD betas of individual stocks												
Model	Sole explanatory variable					Multi explanatory variables						
Intercept	0.983*	2.037	1.225*	0.909	1.073*	0.982**	1.957*	1.837*	1.957*	2.048*	1.345	0.413
	-1.95	-1.63	-1.94	-1.43	-1.72	-2.00	-1.83	-1.74	-1.84	-1.94	-1.23	-0.47
β_{MKT}	0.090					0.102	0.027	0.064	0.029	0.051	0.061	0.005
	-0.37					-0.36	-0.10	-0.25	-0.11	-0.21	-0.23	-0.02
Size		-0.184					-0.172	-0.131	-0.176	-0.174	-0.094	0.018
		-1.43					-1.46	-1.18	-1.60	-1.54	-0.86	-0.20
B/M			0.458*					0.402*	0.332	0.326	0.325	0.328
			-1.98					-1.77	-1.53	-1.54	-1.52	-1.56
Mom				0.011**					0.014***	0.014***	0.014***	0.014***
				-2.41					-3.45	-3.45	-3.43	-3.50
Trnv										-0.022		
										-0.56		
Amihud											0.000	
											-1.66	
Bas												0.192**
												-2.39
β_{CEFD}					-0.001	0.020	-0.004	0.024	0.045	0.043	0.032	0.042
					-0.02	-0.24	-0.05	-0.31	-0.59	-0.57	-0.42	-0.55
Adj. R^2	0.008	0.01	0.006	0.013	0.005	0.015	0.024	0.029	0.04	0.046	0.048	0.045
Nb. Obs	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42
Panel B: With post-ranking portfolio market and CEFD betas as beta proxy for individual stocks												
Intercept	0.983*	2.037	1.225*	0.909	1.135*	1.386**	2.358**	2.327**	2.472**	2.566**	1.763	0.985
	-1.95	-1.63	-1.94	-1.43	-1.86	-2.45	-2.09	-2.09	-2.20	-2.30	-1.62	-1.13
$\beta_{\text{MKT\_Port}}$	0.090					-0.240	-0.270	-0.287	-0.351	-0.346	-0.182	-0.347
	-0.37					-0.49	-0.56	-0.59	-0.72	-0.72	-0.43	-0.72
Size		-0.184					-0.178	-0.146	-0.185	-0.189	-0.112	-0.001
		-1.43					-1.44	-1.24	-1.61	-1.56	-0.94	-0.01
B/M			0.458*					0.360	0.308	0.302	0.298	0.307
			-1.98					-1.59	-1.40	-1.41	-1.37	-1.43
Mom				0.011**					0.012***	0.012***	0.012***	0.012***
				-2.41					-3.09	-3.12	-3.10	-3.15
Trnv										-0.013		
										-0.31		
Amihud											0.000	
											-1.66	
Bas												0.180**
												-2.28
$\beta_{\text{CEFD\_Port}}$					0.253	0.266	0.125	0.187	0.214	0.226	0.183	0.198
					-0.74	-0.77	-0.42	-0.63	-0.73	-0.80	-0.63	-0.69
Adj. R^2	0.008	0.010	0.006	0.013	0.004	0.009	0.018	0.024	0.034	0.041	0.042	0.039
Nb. Obs.	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42	649.42

Results show that most firm characteristics, especially book-to-market and momentum, exhibit significant time-series means of regression slopes. The signs of the time-series means for all firm characteristics are also consistent with findings of previous finance literature. By contrast, when it is used as a sole factor or tested along with other variables, CEFD beta shows a negligible and insignificant time-series average return.

Specifically, the largest average return for CEFD beta is less than 0.6% per annum, and the largest Newey-West adjusted t-statistic is only 0.57, suggesting that CEFD is not an important pricing factor.

Since the factor loadings related to market and CEFD estimated in the first-pass time-series regression for individual stocks are subject to estimation errors, we follow FF (1992) and mitigate the problem by using portfolio factor loading as a factor-loading proxy for individual stocks in each portfolio. For this purpose, at the beginning of each month, we assign sample Canadian stocks into 25 portfolios ranked by CEFD beta or market beta. We then calculate equally-weighted monthly returns on these portfolios. Based on the full-sample post-ranking monthly return, the portfolios' CEFD and market betas are estimated using regression on the five-factor models. We then assign the portfolios' betas to the individual stocks forming those portfolios. Using these post-ranking portfolio factor loadings for market and CEFD, we run the Fama-MacBeth regression again. We report the results in panel B of Table 4. We find that even when post-ranking portfolio factor loading increases the magnitude of the average return and its t-statistics, the average return of CEFD beta is still not significantly different from zero at any acceptable significance level.

4.4 Time-series analysis

If the sentiment of small investors as proxied by the average change in discounts on closed-end funds is a pervasive factor, then it should provide marginal explanatory power of the securities' returns. The latter provide preferred "habitats" for retail investors and so are affected by the same sentiment. Following Lee et al. (1991) and Elton et al. (1998), we test this proposition using size sorted portfolios. As smaller stocks are more likely to be held by small investors, they are more likely to be affected by the small investor sentiment. Moreover, if the sentiment hypothesis holds, as the size of stocks increases, the marginal explanatory power of sentiment in their returns decreases.

To test this pattern, we run time-series regressions of the monthly excess returns of Canadian size-decile portfolios on CEFD and the usual standard pricing factors.

Table 5 presents the beta coefficients for CEFD from the ten time-series regressions for two alternative specifications. For the first specification and as in Lee et al. (1991), we use the market premium and the CEFD as the sole pricing factors. Our results support those of Lee et al. There is no discernible pattern for the slopes on CEFD across size categories. Small (large) companies tend to have positive (negative) coefficients which contradicts the implication of the sentiment hypothesis that portfolios affected by small investors' sentiment do well (poorly) when investors become more optimistic (pessimistic) or when discount is small (large). Furthermore, most of the regression coefficients are not significant, even for the portfolio of small firms. The second specification which relies on a more general multi-factor model (FF3+Momentum) reports similar findings. As expected, adding these factors increases the global goodness of fit as measured by adjusted R^2.

Panel A in Table 6 reports the intercepts (alpha) from the time-series regressions of the Canadian size-decile portfolios on different combinations of explanatory variables. Our alpha estimates indicate that adding the CEFD factor does not significantly decrease the magnitude of the intercept. Such evidence does not support the sentiment hypothesis. The second column reports the average return for the ten size portfolios and one differential (smallest-biggest) portfolio. As reported in the literature, we find a significant positive average alpha for the differential portfolio and that the addition of standard pricing factors including SMB decrease abnormal return. Specifically, adding size and book-to-market factors greatly decreases the magnitude of the market alpha on the differential portfolio, from 4.38% per month to 2.98% per month, and the significance (Newey-West t value) from 1.79 to 0.88. However, a comparison of the alphas for models with and without the discount index indicates that, for any given standard factor(s), adding this new factor into the time-series regression does not significantly affect the alphas.

Further, following FF (1993), we provide a comparison of model fit by calculating the statistic of Gibbons, Ross, and Shanken (GRS) (1989) based on the Canadian size-decile portfolios. The GRS statistic is distributed as an F (N, T–N–K) where N is the number of portfolios, K is the number of factors, and T is the number of observations. The associated null hypothesis is that all alphas for the Canadian size-decile portfolios are jointly zero.

Table 5: Slope coefficients on CEFD from time-series regression of returns of Canadian size-decile portfolios on CEFD and other controlling variables

The table summarizes the results of time-series regression of monthly value-weighted return of Canadian size-decile portfolios against the change in discount index and other controlling variables over 101 months (August 1999 to December 2007). For the size-decile, membership in each decile is determined by firm size at the beginning of each month and investment companies are excluded. In calculating average change in discount, we exclude discounts in the first 180 days of fund's existence and require at least 5 component funds. The 2-factor model includes excess return of value-weighted Canadian stock market index and the discount index VWΔD. The 5-factor model includes the four standard factors and the discount index VWΔD. β is the estimated regression coefficient for the change in discount index, t-stat is the corresponding t-statistic, and Adj. R^2 is the adjusted R^2 of the regression.

Pricing model with	2-factor model			5-factor model		
VWΔD/portfolios	β	t-stat	Adj. R^2	β	t-stat	Adj. R^2
Smallest	2.68	1.37	0.08	2.05	1.07	0.15
2	0.76	1.31	0.28	0.17	0.46	0.70
3	-0.03	-0.07	0.42	-0.36	-1.85	0.85
4	0.01	0.04	0.44	-0.17	-0.82	0.79
5	0.42	1.20	0.44	-0.01	-0.09	0.89
6	0.19	0.72	0.51	-0.02	-0.13	0.84
7	0.07	0.27	0.60	-0.18	-1.04	0.82
8	0.27	1.21	0.61	0.16	0.85	0.74
9	-0.04	-0.23	0.62	-0.03	-0.17	0.76
Largest	-0.04	-0.64	0.95	-0.01	-0.10	0.96

The models we compare are FF3, FF3+VWΔD, FF3+UMD, and FF3+UMD+VWΔD. If the sentiment hypothesis on closed-end funds holds and, therefore, the sentiment risk is systematic, the discount index should enhance the model fit and we would observe decreased GRS F-statistics when the discount index is added to standard pricing models. Panel B in Table 6 reports the GRS F-statistic and corresponding p-value for these models. Our results again do not support the sentiment hypothesis. Regardless of whether FF3 or FF3+UMD is used as the base specification, the addition of the discount index results in negligible change in the GRS F-statistic.

In sum, consistent with the finding in Elton et al. (1998) in the U.S., our investigation in the relationship between size and CEFD in the Canadian context refutes the proposition that the discount on closed-end funds can explain the return of smaller stocks due to the same small investor sentiment.

4.5 The lead/lag correlation between CEFD and stock market

Qiu and Welch (2006) stated that investor sentiment should not fall like "manna from heaven". The common sentiment in noise traders should be influenced by prior returns of the overall stock market and may exert persistent influence on future stock returns. Therefore, we should be able to see persistent correlations between the sentiment proxy and stock market returns at different lags. Hence, investigating these correlations can provide a mild validation tool for our discount indices.

Our empirical results, reported in Table 7 show that most of the correlation coefficients are not significantly different from zero. We conclude that the change in discount on Canadian closed-end funds is not influenced by the lagged stock return, nor does it influence future stock returns. In parallel to Qiu and Welch (2006), we argue that sentiment might not be the underlying driving force for changes in discounts in Canadian closed-end funds.

4.6 Sentiment and expected returns of closed-end funds

Elton et al. (1998) disprove the applicability of discount on U.S. closed-end funds as a proxy for systematic sentiment risk by showing that adding discount indices into standard asset pricing models fails to reduce the

Table 6: Intercepts (Alphas) from time-series regressions of return of Canadian size-decile portfolios on CEFD and other controlling factors

The table reports the intercepts (in %) estimated from the time-series regressions of value-weighted return of Canadian size-decile portfolios on various factor models and also the results of GRS-test for these intercepts over 101 months (August 1999 to December 2007). For the size-decile, membership is determined by firm size at the beginning of each month and investment companies are excluded. 1-factor refers to the one-factor CAPM model. 3-factor refers to the model with the 3 FF factors. 4-factor refers to the 3-factor model plus momentum. 2-factor, 4-factor, and 5-factor refer to the previous models augmented with the change in discount index. Panel A reports the intercepts estimated from time-series regressions, together with their Newey-West t-statistics (in parentheses), for each portfolio. Intercept significantly different from zero at significance levels of 1%, 5%, and 10% are denoted by ***, **, and *, respectively. Panel B reports the GRS-test result for the null hypothesis, that the alphas for the Canadian size-decile portfolios are jointly zeros, for different pricing models. The F-statistic and the corresponding p-value are computed based on Gibbons, Ross, and Shanken (1989).

Panel A: Alphas for Canadian size-decile portfolios

Decile portfolios	Avg. ret.	Basic models			Augmented models with CEFD		
		1-factor	3-factor	4-factor	2-factor	4-factor	5-factor
Smallest	5.24*	4.32*	3.05	3.48	4.16*	2.99	3.45
	(1.89)	(1.76)	(0.90)	(0.90)	(1.76)	(0.90)	(0.90)
2	2.52**	1.94**	0.44	0.47	1.89**	0.44	0.47
	(2.21)	(2.12)	(0.87)	(0.92)	(2.13)	(0.86)	(0.92)
3	1.29	0.77	-0.46	-0.35	0.78	-0.44	-0.34
	(1.66)	(1.32)	(-1.66)	(-1.36)	(1.34)	(-1.65)	(-1.35)
4	1.03	0.56	-0.55**	-0.44*	0.56	-0.54**	-0.43*
	(1.47)	(1.04)	(-2.03)	(-1.76)	(1.04)	(-2.00)	(-1.74)
5	1.31*	0.81	-0.10	-0.10	0.79	-0.10	-0.10
	(1.88)	(1.60)	(-0.55)	(-0.52)	(1.56)	(-0.54)	(-0.52)
6	0.68	0.25	-0.61***	-0.56***	0.24	-0.61***	-0.56***
	(1.23)	(0.62)	(-2.67)	(-2.66)	(0.59)	(-2.64)	(-2.64)
7	0.88	0.37	-0.23	-0.20	0.37	-0.22	-0.19
	(1.53)	(1.01)	(-0.81)	(-0.71)	(0.99)	(-0.80)	(-0.70)
8	0.97**	0.52*	-0.01	0.03	0.51*	-0.02	0.03
	(2.08)	(1.92)	(-0.07)	(0.14)	(1.82)	(-0.10)	(0.13)
9	0.86**	0.46	-0.03	0.05	0.47	-0.02	0.05
	(1.99)	(1.43)	(-0.11)	(0.24)	(1.45)	(-0.11)	(0.25)
Biggest	0.43	-0.07	0.07	0.07	-0.06	0.07	0.07
	(0.95)	(-0.80)	(0.75)	(0.66)	(-0.78)	(0.75)	(0.66)
1-10	4.81*	4.38*	2.98	3.41	4.22*	2.92	3.38
	(1.81)	(1.79)	(0.88)	(0.88)	(1.80)	(0.88)	(0.88)

Panel B: GRS test for Canadian size-decile portfolios

Pricing models	FF3		FF3+VWΔD		FF3+UMD		FF3+UMD+VWΔD	
Null Hypothesis (H0): Alphas for size-decile portfolios are jointly zeros	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value	F-statistic	p-value
	1.690	0.094	1.687	0.096	1.571	0.129	1.571	0.129

abnormal return (alpha) of closed-end funds. Following their study, we estimate the alpha from time-series regressions of the excess return of individual sample Canadian closed-end funds on various factor models. If a change in the discount on closed-end funds represents a systematic risk, as Lee et al. (1991) claimed, we should observe a decrease in the alpha because of Lee at al.'s hypotheses that sentiment risk has a nonzero price and that closed-end funds have a larger-than-average sensitivity to this source of risk. The results of alphas for our sample funds are summarized in Table 8.

Table 7: Lead/lag correlation between CEFD and stock returns

The table reports the lead/Lag (up to 5 leads or lags) *Pearson* correlation coefficients (with corresponding p-values in parentheses below the estimates), between the monthly discount index and the monthly return on two stock portfolios. The discount index is defined as follows: NAV-weighted average change in discount on all sample closed-end funds (VWΔD). The two stock portfolios are value-weighted portfolio of all Canadian stocks in TSX and size spread (smallest-biggest) portfolio and their correlations with discount index are reported. The sample period is the past 101 months (August 1999 to December 2007).

Lead/lag variables	-5	-4	-3	-2	-1	0	1	2	3	4	5
VWΔD &	0.16	0.20	-0.22	-0.12	0.03	0.32	0.12	0.17	-0.02	0.10	-0.08
TSX market return	(0.11)	(0.05)	(0.03)	(0.24)	(0.73)	(0.00)	(0.22)	(0.08)	(0.88)	(0.34)	(0.46)
VWΔD & return of size spread	-0.04	0.01	-0.08	-0.17	0.16	0.17	0.14	0.08	-0.00	0.01	-0.03
(smallest - biggest) portfolio	(0.68)	(0.94)	(0.44)	(0.10)	(0.11)	(0.08)	(0.17)	(0.43)	(0.97)	(0.91)	(0.81)
	Sentiment predicts return						Return predicts sentiment				

Our findings provide additional evidence against the sentiment hypothesis. We find that none of the alphas estimated from standard pricing models (FF3 plus momentum) are significantly different from zero at the 5% level, suggesting that we do not need to resort to the sentiment factor to explain the returns of Canadian closed-end funds.[16]

In summary, our finding for closed-end funds suggests that the discount on Canadian closed-end funds may be driven by rational factors, rather than sentiment.

Table 8: Intercepts (alphas) from time-series regressions of return of individual Canadian closed-end funds on CEFD and other controlling factors

The table summarizes the intercepts (in %) estimated from the time-series regressions of the excess return of individual sample Canadian closed-end funds on various factor models over 101 months (August 1999 to December 2007). Basic models refer to the one-factor CAPM and 4-factor models (Fama-French 3 factors: MKT SMB and HML, and the UMD factor). The augmented models refer to basic models augmented with the change in discount index. We report the following statistics: the average, the median, and the standard deviation of alphas estimated; the percentage of significant alphas at 10%, 5%, and 1% respectively. In time-series regression for individual funds, we require fund to have more than 50 observations.

CEFs	Alpha	Pricing models			
		Basic models		Augmented models with VWΔD	
		1-factor	4-factor	2-factor	5-factor
All funds	Average	0.37	0.13	0.36	0.14
	Median	0.32	0.10	0.26	0.11
	Std. Dev.	0.76	0.48	0.77	0.45
	% sig. (10%)	27.03	10.81	29.73	10.81
	% sig. (5%)	18.92	0.00	18.92	5.41
	% sig. (1%)	2.70	0.00	5.41	0.00

4.7 Robustness checks

In this section, we investigate if our evidence against CEFDs as a priced factor in the Canadian stock market can survive a variety of robustness checks.[17]

[16] The results of the FF3 alphas for Canadian closed-end funds are similar to those of FF3 plus momentum alpha and so are not reported.

[17] All unreported results in this section are readily available from the authors upon request.

4.7.1 Fama-MacBeth regressions revisited

One of the potential problems inherent in the Fama-MacBeth regressions in Section 4.3 is that we directly use firm-characteristics rather than the factor loadings on the underlying risk factors. To address the problem, we rerun the Fama-MacBeth regressions on various factor loadings on risk factors. Specifically, in the first pass of our regression, we estimate full-sample post-ranking portfolio factor loadings on risk factors, including market, size, book-to-market, momentum, and CEFDs, and then assign the post-ranking portfolio factor loadings to each stock in the portfolio. Based on these estimated factor loadings, in the second step, we re-estimate the Fama-MacBeth regressions. The untabulated results show that the main conclusions remain unchanged. Specifically, regardless of being used as sole independent variable or tested along with any other variables, factor loading on CEFD shows negligible and insignificant time-series average return.

4.7.2 CEFD and turnover

One common feature in the literature is to investigate the relationship between the return of small-size stocks and the discount on closed-end funds. Small investors invest heavily in closed-end funds and small stocks. These investors as opposed to the more sophisticated investors like institutions are more likely to trade on noise. However, firm size may be a noisy proxy of the degree of institutional ownership. Since information on direct stock ownership in Canada is not available, we use liquidity, measured by turnover, as an alternative proxy and test for the relationship of size and closed-end funds. There is evidence that illiquid stocks are mainly held by small investors and hence our alternative approach is justified. Moreover, illiquidity implies that mispricing cannot be easily arbitraged by more sophisticated investors.

We estimate the alphas from the time-series regressions of excess return of Canadian value-weighted turnover-decile portfolios on various pricing models. Turnover-decile portfolios are monthly constructed based on the average of monthly turnover over the preceding six months. Portfolios are rebalanced monthly.

Unreported results show that adding discount indices into the pricing model does not materially decrease the alphas of the stocks with the smallest turnover. Since turnover is a proxy for liquidity, and liquidity is a mild measure of investor ownership, we argue that our finding on turnover-decile portfolios provides some evidence against the sentiment hypothesis as it relates to closed-end funds.

4.7.3 GRS tests revisited

Following the recommendations of Lewellen et al. (2010), we extend the same GRS tests to book-to-market-decile, momentum-decile, and 10 industry portfolios. The unreported results are not qualitatively different from those when using size-decile portfolio. Again for both the three and four factors specifications, the inclusion of the CEFD factor fail to significantly reduce the GRS F-statistics as implied by the sentiment hypothesis.

5 Conclusion

The sentiment of small investors has been proposed as an explanation for both the existence and the behavior of discounts on closed-end funds (CEFD). However, the empirical results related to the sentiment hypothesis in the U.S. and international financial markets have been equivocal. In addition, most of the empirical tests outside the U.S. have not been robust in the sense that they have not controlled well for other firm characteristics and risk factors that may explain stock return, nor have they provided a formal cross-sectional test of the link between CEFD and stock returns.

This paper provides an out-of-sample test of the theory in Canada by empirically assessing the role of CEFD in asset pricing in cross-sectional and time-series frameworks. It also presents a weak validity test of the CEFD as a sentiment index. Our empirical results find no support for CEFD as a priced factor. Specifically, the stocks with different exposures to CEFD do not have significantly different average returns, nor does CEFD provide significant incremental explanatory power in cross-sectional and time-series variations of stock returns over the well known firm characteristics and risk factors. This evidence, together with the

findings from our direct test of CEFD as a sentiment index, suggests that CEFD is unlikely to be driven by sentiment in Canada.

Appendix A: Pricing factors construction

Following prior studies, we define or calculate the firm characteristics as follows: market value of common equity (ME) or firm size is defined as the aggregate market value of all classes of common equities issued by a company; book value of common equity (BE) is calculated as the Compustat North America book value of stockholders' equity, plus balance-sheet deferred taxes and investment tax credit (if available), less the book value of preferred stock;[18] and momentum (prior performance) is gauged by compounding return over prior six months with a one-month lag.[19] Our sample consists of 1074 Canadian common stocks with required characteristics at each month, so it provides a reliable and comprehensive dataset with which to construct mimicking portfolios.

Our procedure for developing the mimicking portfolios related to ME, BE/ME, and momentum is based on three independent sorts, followed by an orthogonalization of BE/ME and momentum with ME.[20] Along the lines of FF (1993), we construct portfolios that mimic the underlying risk factors in returns related to ME and BE/ME. For each June of year y, we rank all eligible common stocks in the TSX by ME to calculate a 50% breakpoint for ME and also independently rank positive BE/ME (companies that report their asset values as market value are excluded)[21] to extract 30% and 70% breakpoints for BE/ME. The common shares above the 50% firm size breakpoint are designated by B (Big), and the remaining 50% are designated by S (Small). Independently, the firms above the 70% BE/ME breakpoint are designated by H (High), the middle 40% are designated by M (Medium), and the firms below the 30% BE/ME breakpoint are designated by L (Low). Based on these attributes, the common shares in the TSX are assigned into one of the six intersectional portfolios: S/L, S/M, S/H, B/L, B/M and B/H. Using these component common shares, we calculate monthly value-weighted returns of these six intersectional portfolios from July of year y to June of year y+1 and then rebalance the portfolios. As in FF (1993), the BE/ME of a company at June of year y is the ratio of BE at the end of fiscal year y-1 to ME at the end of calendar year y-1.

The momentum factor is constructed using the approach in Kenneth French's website. At the beginning of month t, we identify the common shares in TSX with poor prior performance (Down) and with good prior performance (UP) based on the breakpoints for the bottom and top 30% of the ranked values of the prior compounding return from month t-7 to month t-2. We also independently split the common shares in the TSX into big and small ME groups using the 50% breakpoint for ME. Using these attributes, we assign the common shares in TSX to one of the four intersectional portfolios-S/D, S/U, B/D, and B/U-to calculate value-weighted returns at month t for these portfolios, and the mimicking portfolios are rebalanced monthly.

Using the monthly returns of these ten intersectional portfolios, we calculate the monthly returns of three mimicking portfolios for the underlying risk factors with the following formulas:[22]

$$\text{SMB} = \frac{(\text{S/H} - \text{B/H}) + (\text{S/M} - \text{B/M}) + (\text{S/L} - \text{B/L})}{3} \tag{3}$$

$$\text{HML} = \frac{(\text{S/H} - \text{S/L}) + (\text{B/H} - \text{B/L})}{2} \tag{4}$$

$$\text{UMD} = \frac{(\text{S/U} - \text{S/D}) + (\text{B/U} - \text{B/D})}{2} \tag{5}$$

[18] Many Canadian companies issue multiple classes of common shares, normally with different voting rights. Our definition of size and book-to-market implies that different classes of common shares of a company have the same size and book-to-market ratio.

[19] This definition implies that different classes of common shares for a company might have different momentums. Furthermore, we use a one-month lag to measure momentum because the bid-ask bounce can attenuate the continuation effect (Jegadeesh and Titman, 1993, 1995; Moskowitz and Grinblatt, 1999; Jegadeesh and Titman, 2001).

[20] We also construct the three factors by orthogonalizing each term with the others for the purpose of better disentangling the effects of these factors, and we find similar results.

[21] The companies that report their asset values as market values (e.g., ETFs, closed-end funds, etc) are excluded because their book-to-market ratios are not available or, if available, they do not reflect the same information as those of ordinary companies.

[22] The monthly returns of the 10 intersectional portfolios and 3 mimicking portfolios related to size, book-to-market, and momentum factor in Canada over July 1999 to December 2007 are not presented but are available from the authors.

where SMB (small minus big) denotes the return of a zero-investment portfolio in which small-size stocks are bought and big-size stocks are shorted; HML (high minus low) is the return of a zero-investment portfolio in which stocks with high book-to-market ratio are bought and stocks with low book-to-market are shorted; And UMD (up minus down) represents the return of a zero-investment portfolio in which stocks with good prior performance are bought and stocks with poor prior performance are shorted.

References

[1] Amihud, Y., 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31–56.

[2] Amihud, Y. and H. Mendelson, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics* 17, 223–249.

[3] Berkowitz, M. K. and J. Qiu, 2001, Common risk factors in explaining Canadian equity returns, Working paper (University of Toronto).

[4] Black, F., 1985, Noise, *Journal of Finance* 41, 529–543.

[5] Bodurtha, J., E. Kim and C. Lee, 1993, Closed-end country funds and US market sentiment, *Review of Financial Studies* 8, 879–918.

[6] Brauer, G. A., 1984, Open-ending closed-end funds, *Journal of Financial Economics* 13, 491-507.

[7] Brauer, G. A., 1988, Closed-end fund shares' abnormal returns and the information content of discounts and premiums, *Journal of Finance* 43, 113–127.

[8] Brauer, G. A., 1993, Investor sentiment and the closed-end fund puzzle: A 7 percent solution, *Journal of Financial Services Research* 7, 199–216.

[9] Brickley, J. A., S. Manaster, and J. Schallheim, 1991, The tax-timing option and the discounts on closed-end investment companies, *Journal of Business* 64, 287–312.

[10] Carhart, M., 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57–82.

[11] Chen, N-F, R. Kan, and M. Miller, 1993, Are the discounts on closed-end funds a sentiment index? *Journal of Finance* 48, 795–800.

[12] Chen, G-M, O. Rui, and Y-X. Xu, 2004, Understanding the closed-end fund puzzle from the Chinese experience, Working paper (University of Texas at Dallas).

[13] Chopra, N., C. M. C. Lee, A. Shleifer, and R. H. Thaler, 1993, Yes, discounts on closed-end funds are a sentiment index, *Journal of Finance* 48, 801–808.

[14] Delong, J. B., A. Shleifer, L. H. Summers, and R. J. Waldmann, 1990, Noise trader risk in financial markets, *Journal of Political Economy* 98, 703–738.

[15] Dimson, E. and C. Minio-Kozerski, 1999, The closed-end fund discount and performance persistence, Working paper (London Business School).

[16] Doukas, J. A. and N. T. Milonas, 2004, Investor sentiment and the closed-end fund puzzle: Out-of-sample evidence, *European Financial Management* 10, 235–266.

[17] Elton, J. E., M. J. Gruber, and J. A. Busse, 1998, Do investors care about sentiment? *Journal of Business* 71, 477–500.

[18] Fama, E. F., 1970, Efficient capital markets: A review of theory and empirical work, *Journal of Finance* 25, 383–417.

[19] Fama, E. F. and K. R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427–465.

[20] Fama, E. F., and K. R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

[21] Fama, E. F. and J. D. MacBeth, 1973, Risk, return and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607–636.

[22] Gemmill, G. and D. C. Thomas, 2002, Noise trading, costly arbitrage, and asset prices: Evidence from closed-end funds, *Journal of Finance* 6, 2571–2594.

[23] Gibbons, M. R., S. A., Ross, and J. Shanken, 1989, A test of the efficiency of a given portfolio, *Econometrica* 57, 1121–1152.

[24] Jegadeesh, N. and S. Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65–91.

[25] Jegadeesh, N. and S. Titman, 1995, Short horizon return reversals and the bid-ask spread, *Journal of Financial Intermediation* 4, 116–132.

[26] Jegadeesh, N. and S. Titman, 2001, Profitability of momentum strategies: An evaluation of alternative explanations, *Journal of Finance* 56, 699–720.

[27] Kim, C-S., 1994, Investor tax-trading opportunities and discounts on closed-end mutual funds, *Journal of Financial Research* 17, 65–75.

[28] L'Her, J-F., T. Masmoudi, and J-M. Suret, 2004, Evidence to support the four-factor pricing model from the Canadian stock market, *Journal of International Financial Markets, Institutions and Money* 14, 313–328.

[29] Lee, M. C., A. Shleifer, and R. H. Thaler, 1990, Anomalies: Closed-end mutual funds, *Journal of Economic Perspectives* 4, 153–164.

[30] Lee, M. C., A. Shleifer, and R. H. Thaler, 1991, Investment sentiment and the closed-end fund puzzle, *Journal of Finance* 46, 76–110.

[31] Lewellen, J., S. Nagel, and J. Shanken, 2010, A Skeptical appraisal of asset-pricing tests, *Journal of Financial Economics* 96, 175–194.

[32] Liew, J. and M. Vassalou, 2000, Can book-to-market, size and momentum be risk factors that predict economic growth? *Journal of Financial Economics* 57, 221–245.

[33] Malkiel, B. G., 1977, The valuation of closed-end investment company shares, *Journal of Finance* 32, 847–859.

[34] Malkiel, B. G., 1995, The structure of closed-end fund discounts revisited, *Journal of Portfolio Management* 21, 32–38.

[35] Moskowitz, T. J. and M. Grinblatt, 1999, Do industries explain momentum, *Journal of Finance* 54, 1249–1290.

[36] Neal, R. and S. M. Wheatley, 1998, Do measures of investors' sentiment predict returns? *Journal of Financial and Quantitative Analysis* 33, 523–547.

[37] Pontiff, J., 1996, Costly arbitrage: Evidence from closed-end funds, *Quarterly Journal of Economics* 111, 1135–1151.

[38] Pontiff, J., 1997, Excess volatility and closed-end funds, *American Economic Review* 87, 155–169.

[39] Qiu, L. and I. Welch, 2006, Investor sentiment measures, Working paper (NBER).

[40] Ross, S., 2005, *Neoclassical finance*, (Princeton University Press, Princeton, NJ).

[41] Seyhun, H. N. and D. J. Skinner, 1994, How do taxes affect investors' stock market realizations? Evidence from tax-return panel data, *Journal of Business* 67, 231–262.

[42] Shleifer, A. and R. W. Vishny, 1997, The limits of arbitrage, *Journal of Finance* 52, 35–55.

[43] Swaminathan, B., 1996, Time-varying expected small firm returns and closed-end fund discounts, *Review of Financial Studies* 9, 845–887.

[44] Zhang, T., J. Li, and P. Malone, 2004, Closed-end fund discounts in Chinese stock markets, *Chinese Economy* 37, 17–38.