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Closed End Municipal Bond Funds Discounts: An Empirical Investigation

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Abstract

This paper examines the behavior of the discount from Net Asset Value (NAV) of closed end municipal bond funds. The average discount across all funds examined is more than 5%. There is a wide range of variability however and strong evidence that in almost all cases, the discounts follow slow mean reverting processes. The time series analysis reveals that the discounts are positively correlated with trading volume and dividend yields and negatively correlated with the returns on the S&P 500. Discounts are correlated across funds, implying that the risk is systematic and therefore priced in the financial markets.

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Keywords: Closed End Municipal Bond Funds, Discount from NAV

1 Introduction

Closed end funds (CEF) issue a fixed number of shares through an Initial Public Offering (IPO). The assets under management may change through time but the asset strategy, i.e., bonds, equity, or international, remains consistent. CEF are publicly traded with prices at a premium or discount from Net Asset Value (NAV). Constituent assets are well known. Aggregate asset values are updated and reported frequently; at least weekly and more often daily. Defying efficient market assumptions, many CEF trade at discounts and even substantial discounts from NAV. Attempts to explain discounts from NAV as they occur in equity, fixed income and international funds have been ongoing. Possible explanations have been based either on traditional approaches that attribute deviations from the Efficient Markets Hypothesis (EMH) to some form of market imperfection or, on behavioral biases on the part of investors. Despite the considerable amount of research into the puzzling behavior of CEF, the results thus far have been mixed. Most of the

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research has focused on equity CEF with fewer studies examining bond CEF. There has been a notable lack of research on municipal bond CEF. This omission is in sharp contrast to the size and importance of the market. For example, as of January 2010, 669 closed end funds (CEF) were actively traded with a NAV of over $192 billion (Closed End Fund Association 2010). Municipal bond funds represent the largest category in terms of assets under management. Closed-end municipal bond funds hold municipal bonds, but they trade like stock CEF. Their prices fluctuate and they may trade at a premium or discount to Net-Asset-Value (NAV).

This paper aims to fill a gap in the literature of CEF by focusing on municipal CEF and the determinants of the associated discounts/premiums. The analysis covers seventy municipal CEF over the last ten years. The average discount of municipal CEF over the last ten years has been around 5.6% with considerable variation. There is evidence of slow mean-reversion in the discount, with very few instances of random walk behavior. Interestingly, discounts across all CEF are highly correlated with the market portfolio suggesting that the presence of systematic risk, similar to what has been observed in the equity CEF. Trading volume and dividend yields are also positively related to the size of the discounts.

The rest of this paper is organized as follows. Section 2 provides a brief review of the literature. Section 3 describes the data and some preliminary findings. Section 4 describes the methodology used and discusses the empirical findings. Section 5 concludes the paper.

2 Preliminary Notes

2.1 Literature Review

Explanations put forward to explain discounts start with hypothesizing that investors discount future high fund fees and subtract the present value of those costs from NAV. The highest management fees are incurred for international stock CEF. Lamont and Thaler (2003) found no support for the discounted fees theory. Actual discounts on country funds were significantly deeper than predicted. Discounts may also be completely uncorrelated to management fees (Gemmil and Thomas 2002).

Another explanation for discounts is that funds hold unrealized capital gains with concomitant tax liabilities. While the gains are incorporated into the NAV, tax liabilities are not (Lee, Shleifer, Thaler 1991). Brickley, Master and Schallheim (1985) and Brauer (1988) found that when CEF announce imminent liquidation of holdings and planned payouts to shareholders, known as "open ending," abnormal returns can be made by buying discounted CEF and holding until payout. If there were tax liabilities accounting for the discounts such arbitrage profits would not be possible since taxes would be due upon liquidation. Similarly Boudreaux (1973) found unrealized appreciation and non-distributed gains explained only a small portion of discount variability.

Noise traders are unsophisticated investors who believe pseudo signals from technical analysts, stockbrokers, or economic consultants (De Long et al. 1990), i.e., they are making trading decisions based on noise in the market place rather than changes in fundamentals. Gemmill and Dylan (2002) and others posit that these "sentiment" traders predominate in CEF trading. They dismiss high agency costs as explanatory on the grounds that changes in discount rates that a rational investor would use to price CEF

NAVs as reflected in interest rates do not explain CEF discounts. Newly issued funds that trade at a premium are even more problematical particularly since the premium decays in short order and these CEF eventually also sell at discounts (Weiss 1989) though bond funds appear to be less impacted by discounting after 120 days with over 50% of new bond issues still selling at a premium instead of a discount. The initial premium is likely the effect of broker fees appended to NAV and accepted by first buyers. Individual investors are the main clientele for small capitalization stocks. Small stock returns are correlatedwith CEF returns supporting the contention that the same clientele trades both securities (Lee, Shleifer and Thaler 1991). Pontiff (1995) found both a January effect for CEF and that discounts from NAV were highly correlated with subsequent returns. These results are comparable to Fama and French's (1992) finding that book to market value ratios predicted returns. Cross sectional premia are weakly related to an index of investor sentiment.

If CEF are mispriced, why don't arbitrageurs take advantage of discounts effectively driving prices toward NAVs? Noise traders are unpredictable and discounts can persist for long periods of time making arbitrage in practice expensive and perhaps unprofitable in most instances. Mean reversion to either NAV (best case) or at least to some steady state discount are needed to make arbitrage profitable. Hughen and Wohar (2006) found trading strategies based on anticipation of mean reversion are very risky. Arbitrage can be difficult and expensive with foreign stocks (Levy-Yeyati and Ubide 2000).

Lee and Moore (2003) noting the lack of research on bond CEF show a significant relationship between bond fund premiums and yield. Investors are willing to pay a premium for higher yields which may be evidence of clientele with a short term investment horizon. Bond CEF discounts may not be explained by the same factors as equity CEF. Municipal bond CEF are excluded by Lee and Moore because their tax free status may cause different trading patterns and municipal bonds cannot be shorted eliminating even the possibility of arbitrage. Both yield and leverage were positively priced; investors were willing to pay a premium over NAV for both. This study found future performance was positively related to fund premiums contrary to findings of equity CEF by Lee, Schliefer and Thaler (1991) and Pontiff (1996); both of these studies used the same sample of CEF exclusive of bond funds. Clientele investing in municipal CEF are interested in tax free monthly income which distinguishes them from equity CEF investors. They may be willing to pay more for leverage that provides that higher income as evidenced from the positive relationship between premiums and yields. With a focus on yield, they may be more willing to pay a higher price for the leverage and bond selection that individuals would find more difficult to replicate than in an equity CEF.

Municipal bond CEF assets may be more thinly and/or infrequently traded than even small stocks. Bid and ask spreads may be wide and largely unknown to bond traders on a timely basis making reported NAVs less certain than those of equity funds. Bond ratings that are reported at the time of issuance are not reliable years from issuance making gauging underlying risk by average CEF portfolio rating virtually useless. Maturity and duration where reported can be useful to determine sensitivity to interest rate changes. If the municipal bond clientele are focused on yield and have a short time investment horizon, changes in the fund's dividend payments could show up in increased volume. Changes in interest rates that increase or decrease NAV would have less of an impact on volume if investors are more concerned about the returns on their initial investment. If the changes in interest rates lead to changes in payouts then those changes may lag increases in volume related to payout changes.

Studies have found some evidence of a regression to a mean discount level (Hughen, Mathew, Ragan 2005) but not a regression to NAV. The null hypothesis of zero structural breaks in discounts from NAV was rejected on a small sample of CEF, the 19 of 516 equity CEF that did not have a unit root, but structural breaks were very infrequent (Hughen and Wohar 2006).

If municipal CEF have a portfolio of assets that would be difficult to replicate, a premium to NAV could result. Premiums have been in evidence in previous research (Weiss 1989) particularly at issuance and the decline in premiums to discounts has been observed to be slower for bond CEF than for equity CEF. Overall, slight premiums of 1% for bond CEF were found over a sample period while equity CEF averaged a 6% discount (Abraham et al. 1993).

At least two events over the last ten years could be important to municipal CEF valuation and discounts from NAV and could be responsible for regime changes in discounts from NAV. The first is the Jobs and Growth Tax Relief and Reconciliation Act of 2003 which reduced the tax rate on capital gains and dividends to 15% through 2010. Municipal CEF could have lost some attraction which can be measured in changes in discounts and volume. The second event was the collapse of the Auction Rate Security market in February 2008. Municipalities accounted for 50% of this $330 billion market while municipal CEF using short term leverage to boost yields accounted for 19% of the market (Lee 2008). Holders of ARS can elect to rollover, sell or buy ARS at each auction. In February 2008 as subprime mortgage defaults rose, more holders of ARS elected to sell at the same time that buyers became scarce. Municipal bond issuers had ARS contracts that imposed penalties in the form of interest rates as high as 20% for failing to conduct a successful auction. CEF issued ARS suffered a similar fate but the penalties in the form of increased interest rates were quite low under contract thereby having only a marginal impact on dividend payouts. The perceived viability of companies that provided default insurance to both ARS and municipal bonds were being called into question since these same insurers were guarantors of subprime mortgage pools. This further reduced the market value of ARS and municipal bonds. NAVs of municipal CEF were hit by concern about possible default of underlying municipal securities or at least a devaluation of assets due to suspect insurance and municipalities paying outstanding ARS paying substantial penalty interest rates as high as 20%.

2.2 Data and Preliminary Findings

All data was obtained from Bloomberg. A screen for closed end municipal bond funds with volume of greater than 1000 shares traded on December 8, 2009 and with holdings greater than 95% invested in municipal bonds constituted the initial sample. Of the 228 funds that passed the initial screen, 70 had daily price data over a ten year period from 12/1/99 to 12/1/09. These constituted the sample of CEF. Daily volume, NAV, and twelve trailing month dividend yields for each of the CEF was downloaded. Daily closing values for the S&P 500 and the Russell 2000 for the same dates were also obtained from Bloomberg as were the Federal Funds rate representing short-term interest rates and the yield to maturity on the constant maturity 10- year Treasury Notes representing long-term interest rates.

Following the convention, we define the discount (premium) from market value (NAV) as follows:

$$Discount_t = 100\ (NAV_t - Price_t)/NAV_t \quad (1)$$

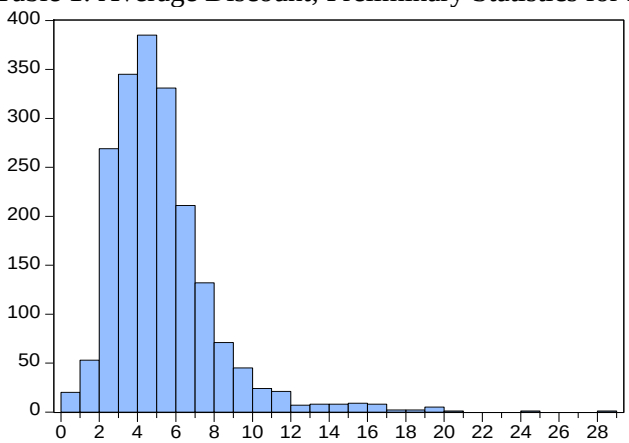
where, NAV_t and $Price_t$ are the net asset value and price of the municipal CEF respectively.

To get a sense of the statistical properties of the average municipal CEF we construct an equally weighted portfolio of all seventy CEF and we calculate some descriptive statistics for the portfolio discount. The results are reported in Table 1. The average discount is above 5% but during the sample period it has gone as high as 28.7% and as low as 0.62%. The associated graph shows the fluctuations of the discount over time. The high of 28.7% was reached during the fall 2008 financial crisis. Before that, the discount was moving between 0% and 10%. The estimates for skewness and kurtosis as well as the Jarque-Bera test suggest that the series is not normal. Likewise, the histogram shows substantial positive skewness.

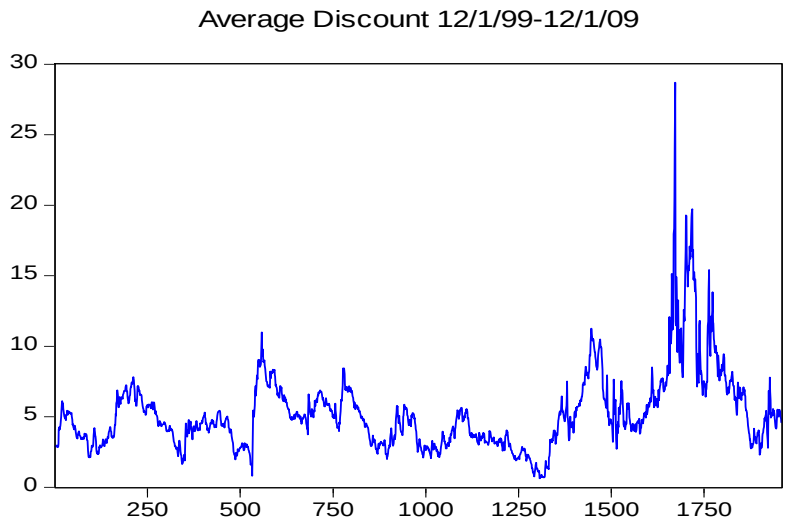
Many studies have found that the discount for equity CEF is mean reverting. To test the hypothesis that the discount is mean reverting we calculated the Phillips-Perron (PP) statistic for both the portfolio and all seventy individual CEF. The PP test is based on the regression

$$discount_t = b_0 + b_1\ (t - T/2) + b_2\ discount_{t-1} + u_{i,t}. \quad (2)$$

Table 1: Average Discount; Preliminary Statistics for Equally Weighted Portfolio



Series: Average Discount	
Sample 12/1/99-12/1/09	
Observations 1959	
Mean	5.217863
Median	4.756582
Maximum	28.70403
Minimum	0.620905
Std. Dev.	2.741694
Skewness	2.129891
Kurtosis	11.35842
Jarque-Bera	7183.734
Probability	0.000000



The null hypothesis is H_0: $b_2 = 1$ vs., H_1: $b_2 < 1$ where, T is the sample size. Acceptance of the null hypothesis would imply that the discounts are non-stationary or, equivalently, there is a unit root in their univariate representation. Alternatively, rejection of the null hypothesis implies that the discounts are mean reverting. The estimated PP statistic for the equally weighted portfolio as well as results for individual CEF are reported on Table 2. The hypothesis that the discount of the equally weighted portfolio is a random walk is decisively rejected at the 1% level of significance at least . This is in agreement with earlier findings on equity CEF. Specifically, Reichert and Timmons (1998), Hughen, Mathew and Ragan (2005) and Lee, Sheifer and Thaler (1991) find that the discounts on equity CEF are mean-reverting. This property violates the Efficient Markets Hypothesis (EMH). Theoretically it may be exploited to generate abnormal profits, e.g., a trading strategy of buying funds with the highest discounts could generate risk free profits. Hughes and Wohar (2006) however reject mean reverting discount trading strategies as too risky.

Table 2: Unit Root Tests.

	Equally Weighted Portfolio	**Average PP for Individual CEF**
PP statistic	-4.8654***	-5.2707***
Standard Deviation of PP for Individual CEF		1.3193
# of Unit Root Rejections		66
# of Unit Root Acceptances		4

Notes: ***, **, and * denote significance at the 1%, 5% and 10% levels respectively. The critical values for the PP test are -3.9627 (at 1%), -3.4121 (at 5%) and -3.1279 (at 10%).

The tests for the individual CEF show that in 66 out of 70 funds the random walk hypothesis is rejected while in 4 out of 70 cases the random walk hypothesis is retained.

3 Main Results

3.1 Time Series Analysis

The time series model we use for each individual CEF is described as follows:

$$Discount_t = b_0 + b_1[Feb2008] + b_2\,[Dec2002] + b_3\, ln\left[\frac{vol_t}{vol_{t-1}}\right] + b_4(tty_t - tty_{t-1}) + b_5 ln\left[\frac{S\&P_t}{S\&P_{t-1}}\right] + b_6 ln\left[\frac{R2000_t}{R2000_{t-1}}\right] + b_6(lr_t - lr_{t-1}) + b_7\,(sr_t - sr_{t-1}) + \varepsilon_t \quad (2)$$

where,

Feb08 = equal to 1 for dates in February 2008 when ARS (auction rate security) market failed,

Dec02 = equal to 1 for dates in December 2002, the month prior to the 2003 tax act going into effect,

vol_t = trading volume on CEF at time *t*,

tty_t = twelve trailing months dividend yield of CEF at time *t*,

$S\&P_t$ = S&P 500 index

$R2000_t$ = Russell 2000 as a proxy for investor sentiment,

lr_t = the yield to maturity on the 10-year gov't note as a proxy for the long term rate,

sr_t = the federal funds rate as a proxy for the short-term rate.

To avoid multicollinearity problems, the variable R2000 is orthogonalized with respect to the S&P 500. Similarly, the short-term rate is orthogonalized with respect to the long-term rate.

Table 3 is a summary table reporting average statistics across the 70 individual regressions.

Table 3: Results of Regressions Run on Seventy Muni CEF Summarized

variable	mean	median	std dev	avg t stat
constant	0.1154	0.0862	0.0900	3.4905***
dummy for Feb 2008	0.0964	0.0914	0.1065	0.5236
dummy for Dec 2001	0.0140	0.0070	0.0728	0.0834
discount lag 1	0.9794	0.9822	0.0122	270.5309***
volume	0.0010	0.0009	0.0005	3.6388 ***
tty	1.9445	1.9762	1.1580	18.6919***
S&P	0.1276	0.1172	0.0444	9.7804***
Russell 2000	0.0337	0.0309	0.0410	1.3629
***l-t* rate**	0.3625	0.3339	0.6828	1.2558
***s-t* rate**	0.0159	0.0146	0.0608	0.2729

Notes: ***, **, and * denote significance at the 1%, 5% and 10% levels respectively.

As can be seen the constant is significant, implying that on average these funds sell at a discount. Also, the lagged value of the discount is highly significant and very close to unity, even though in the overwhelming majority of cases the unit root hypothesis was rejected. Still, the coefficient of the lagged shows a high degree of persistence. On average, trading volume is positively related to the discount and so is the 12-month trailing dividend yield. Interestingly, the coefficient for the S&P 500 is negative and statistically significant. Given the definition of the discount in equation 1, the implication is that the percent change in price (capital gains yield) is positively related to the S&P 500 or, to put it differently, the beta with respect to the market portfolio is positive and statistically significant. Both the long term and the short term interest rates are statistically insignificant.

Examining each fund's regression outcomes by count in Table 4 provides a clearer picture of the impact of the variables on the discount from NAV. The constant is mostly positive and statistically significant (59 out of 70 CEF). This in turn implies that the overwhelming majority of municipal CEF have a positive long-term discount. The dummy variable representing February 2008 when there were major disruptions in the auction rates securities (ARS) markets had a negative impact on discount rates across 59 funds but only one fund's coefficient was statistically significant at the 95% level or better. The other dummy variable representing changes in the tax code to lower rates on dividends and capital gains shows no significant impact. The lagged value of the discount is highly significant (70 out of 70) as is the trading volume (63 out of 70). The signs in both cases are positive. It is not obvious why the trading volume should be positively related to the discount from NAV. It is possible that high volume is associated with a rush to exit the market, akin to a panic that could easily be ascribed as an overreaction common among noise traders. The S&P 500 index is negatively correlated with the discount from NAV for all CEF and significant at better than the 95% level in all regressions. When the S&P index rises the discount to NAV narrows. This reflects a positive exposure to the stock market index, i.e., investors buying municipal CEF driving up prices at the same time as prices are rising for the S&P. When the S&P index increases, the change in the discount rate is negative; prices are rising more rapidly than underlying NAV which is likely due to rising demand for muni funds. In simpler terms, municipal CEF have a positive beta with the market and therefore discounts are positively correlated across funds. Given that the exposure is systemic we conclude that it should also be priced in the markets.

The discounts to NAV are negatively related to the Russell 2000 stock index (57 out of 70) but this relationship is significant in 24 cases. Recalling that the Russell 2000 has been orthogonalized with respect to the S&P 500, we can say that in those 24 cases there significant residual exposure to the Russell 2000. The positive sign implies that the prices of municipal CEF are negatively related to the Russell 2000. Such a finding suggests that municipal CEF and small stocks (represented by the Russell 2000) are substitutes in the portfolios of investors.

This appears to support the clientele hypothesis of Lee, Shleifer and Thaler (1991). Small investors buy Russell Index stocks while selling muni CEF. Selling drives down the price of CEF resulting in a positive change to the discount as buying increases Russell 2000 returns.

For 50 funds, 23 of them statistically significant, increases in *l-t* rates increased the discount from NAV. The sign of the long-term interest rate is positive in 50 cases and negative in 20 cases. The positive occurrences are significant for 23 funds. Such is result

is likely due to both a drop in NAV, i.e., underlying bond valuations held by the CEF fall, and a selloff of the funds in anticipation of further NAV erosion. There are also 9 instances with negative and significant parameters. It is possible that some funds with larger cash positions could benefit from rising rates because of buying opportunities with newly issued municipal debt offering higher yields making them more attractive and raising the NAV to price ratio.

Increases in short-term interest rates were more often associated with declines in the discount from NAV for 42 funds out of the 70 but only significantly in 3 cases. Rising short-term rates make the leverage that most funds employ more expensive. This would have a direct impact on their yield making them less attractive.

Table 4: Count of Muni CEF out of Sample: Sign and Significance by Variable

variable	# of positive coefficients	# of significant positive coefficients	# of negative coefficients	# of significant negative coefficients
constant	68	59	2	0
dummy for Feb 2008	11	0	59	1
dummy for Dec 2002	34	0	36	0
discount lag 1	70	70	0	0
volume	70	63	0	0
tty	66	61	4	1
S&P	0	0	70	70
Russell 2000	57	24	13	0
***l-t* rate**	50	23	20	9
***s-t* rate**	28	0	42	3

Significance counts are based on the 5% level.

4 Conclusion

This paper has examined the behavior of the discount in closed end municipal bond funds. The average discount across all funds examined is more than 5%. There is a wide range of variability however and strong evidence that in almost all cases, the discounts follow slow mean reverting processes. The time series analysis reveals that the discounts are positively correlated with trading volume and dividend yields, and negatively correlated with the returns on the S&P 500. This in turn implies that discounts are correlated across funds, implying that the risk is systematic and therefore priced in the financial markets.

Investor clientele consisting of a coterie of small investors acting as noise traders seems to be supported by the positive relationship between muni bond CEF discount rates and Russell 2000 returns and the negative relationship between discounts and S&P 500 returns. Small investors could be buying small stocks and selling muni bond CEF at the same time. Selloffs in munis drive up the discount rate. Buying of muni CEF and subsequent narrowing of the discount rate seem to coincide with buying in the S&P 500. The strong association between volume and a widening discount rate also supports the noise trading hypothesis posited by Lee, Shleifer and Thaler (1991) and others.

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