

“ NAV (Net Asset Value) per share is computed once a day based on the closing market prices of the securities in the fund's portfolio. All mutual funds' buy and sell orders are processed at the NAV of the trade date. However, investors must wait until the following day to get the trade price.”

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PREDICTING THE DAILY NAV FOR CLOSED END FUNDS



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ABSTRACT

Closed end funds (CEFs) generally do not announce their NAVs until after the market closes. Thus those who wish to trade CEF shares during the day, will only have access to day old NAVs. Exchange traded funds' benchmark indexes are available continuously and mutual fund investors can redeem their shares at their end of the day NAVs. Supply and demand forces, however, determine CEF share prices, usually not at their NAV levels. While real time changes in closed end fund NAVs are not publicly available, they can be estimated (with error) using the funds' reported (quarterly) holdings' real time prices. Two key questions are addressed article: 1. Can the reported NAVs be accurately predicted? 2. Can such estimated NAVs be utilized to forecast subsequent returns? The authors' tentative answer to both questions is: Yes.

CLOSED END FUNDS

While a much smaller factor for individual investors than mutual or exchange traded funds, closed end funds are none the less a significant component of the financial market place. And their primary appeal is to individual investors. Accordingly, information on how they trade should be of interest both to individual investors and the financial planners who many such investors look to for help.

Since closed end funds (CEFs) generally announce their NAVs after the market close, potential; traders, will only have access to day old NAVs. Supply and demand determine CEF share prices, usually not at their NAV levels. Real time changes in closed end fund NAVs are not publicly available. They can, however, be estimated (approximated) using the funds' reported (quarterly) holdings' real time prices. Herein we explore two key questions: 1. Can the NAVs be predicted with a reasonable degree of accuracy? 2. Can such estimated NAVs be utilized to forecast subsequent returns?

LITERATURE REVIEW

Many researchers have attempted to explain why CEF shares typically sell at below their NAVs, the so called closed end puzzle. Dimson and Minio-Paluello (2002) explored whether the fund's discount results from overestimated or biased NAVs. Malkiel (1977) investigators have noted that the dead weight loss of management fees and expenses could account for the discount. Similarly, agency costs could help explain the discount in cases where management charges unjustifiably high fees. Tax timing represents another possibility (Seyhun and Skinner (1994)). Also explored is the relationship between managerial stock ownership and the fund's discount or premium – the greater the stock ownership, the greater is the likely discount (Barone-Adesi and Kim (1999), Barclay (1993), Dimson and Minio-Paluello (2002), Richard and Wiggins (2000) and Malkiel (1995)). The impact of the listing exchange has even been considered. Funds traded on the New York Stock Exchange tend to show a higher persistence of strong NAV and market price performance (Bers and Madura (2000)). Additionally, researchers have found that closed-end fund premiums (discounts) forecast higher (lower) future NAVs ((Chay and Trzcinka (1999) and Thompson (1978))).

Many researchers contend that investor sentiment is a major cause of CEF discounts. Researchers also look at how domestic vs. international investor sentiment may impact fund premium/discounts. Some studies find that the existence of “noise” traders helps explain why many CEFs trade at a discount (Chen, Kan and Miller (1993), De Long and Shleifer (1992), Lee, Shleifer and Thaler (1991), Simpson and Ramchander (2002), Gemmill and Thomas (2000), Garay (2000) and Richard and Wiggins (2000)). (These are investors who make decisions regarding buy and sell trades without using fundamental data.)

Some scholars have explored the mean-reversion theory (eventual move back towards the mean) of the discount by utilizing co-integration procedures that examine bond and equity CEFs which “exhibit stationary time-series properties”. They find statistically significant error correction terms that quantify the speed of mean reversion. The results from this observation show that mean reversion is caused by changes in both the market price and NAV (Arora, Ju and Ou-Yang (2002), Gasbarro, Johnson and Zumwalt (2003), and Gasbarro and Zumwalt (2003)). Some studies explore efforts to exploit risk arbitrage as contributing to fund mis-pricing or the elimination thereof (Pontiff (1996) and Gemmill and Thomas (2000)). (These are relatively low risk trading strategies.)

Still other researchers have analyzed the relationship between CEF pricing, and liquidity and liquidity risk. Two main hypotheses have been tested: 1. that CEF discounts are related to liquidity differences between the CEF and its underlying portfolio, and 2. That CEF discounts are related to differences in liquidity risk between CEFs and their portfolios (Cherkes, Sagi and Stanton (2005) and Manzler (2005)). Another study examines how investors' abilities to access and process relevant information about the funds that they like differ.

Thus a fund's discount/premium may depend significantly on the quality of private information (Grullon and Wang (2001)).

Several studies using weekly data found that funds with large discounts tend subsequently to generate abnormal returns (Thompson (1978), Richards, Fraser and Groth (1980) and Anderson (1986)). A more recent study using daily data found funds whose discounts had widened substantially would have been profitable to buy (Hughen, Mathew and Ragan (2005)). Several of these studies took account of transactions costs ((Cakici, Tessitore, and Usmen (2000)). One study looked at how those mutual funds which use stale prices to compute their NAVs have created potentially profitable trading opportunities (Boudoukh, Richardson, Subrahmanyam and Whitelaw (2002)).

As the above discussed literature makes clear, the price behavior of CEFs' shares is closely related to the behavior of their NAVs. Our current study seeks to expand our knowledge of the nature of that relationship. We are particularly interested in exploring how one might forecast the end of the day NAV report.

CEFs generate two-value measures on a continuous basis: the accounting value of its assets and the market determined price of its stock. The market price does not and indeed cannot track the CEF's NAV to the penny. None the less, the fund's NAV should be a useful estimate of the CEF's liquidation value as well as an anchor on its market value. Clearly the two "values" are related. Our concern is a matter which has here to fore not been studied: Can changes in the fund's daily NAV be predicted using publically available information?

PREDICTING THE NAV

Notwithstanding fluctuations in their discount or premium, by far the largest factor explaining movements in a CEF's market price is the change in its share's underlying NAV. Those funds whose discounts grow particularly large are likely to attract potential acquirers who pressure the fund's management either to convert to mutual fund status or self tender for enough shares to drive the market price closer to its NAV.

Most CEFs compute and then announce their NAVs after the market closes but before trading begins on the following day. As a result, participants will have access to the fund's prior day closing NAV when the market opens but will not see another NAV announcement until after that day's trading ends. Unlike exchange traded funds (whose NAVs closely track the market movements of their chosen index); CEF investors will not (reliably) know how their funds' NAVs are changing throughout the day. And unlike mutual funds, they can not cause the fund to redeem their shares at the end of the day NAV level. Those wishing to trade CEF shares must buy and sell in a marketplace where the forces of supply and demand determine the price, often at a level well below their NAVs.

While precise real time knowledge of a CEF's NAV is not publicly available, those who trade CEFs will usually know or at least be able to access information on the fund's portfolio composition. Thus one can use knowledge of the publically available real time market prices of the securities that the fund is thought to be holding to estimate changes in its NAV. For example, an investor focusing on an energy fund could reasonably conclude that when most energy stocks are up (down), energy funds' NAVs would also be up (down). Indeed a well informed investor is likely to be able to form a real time estimate of what is happening to the NAVs of any fund that he or she follows. Thus, CEF investors can and in many cases probably do forecast (with better than random accuracy) the intraday movements in their funds' NAVs when they are trading. But whatever NAV change predictions they make are likely to be no more than very rough approximations to the actual changes.

Quite possibly, reliable real time knowledge of a CEF's intraday NAV could be useful to one contemplating trading its shares. Thus the trading implication when both the fund's share price and the value of its portfolio holdings move (more or less proportionately) in the same direction will be very different from a situation where the two values are moving apart. If, for example, the NAV was moving up and the stock price was moving down, one would be inclined to buy. If, however, the shares were moving up and the NAV down, a sell might be indicated. The funds themselves could compute real time intraday NAV values and perhaps some do. But as far as we know, none release that information publicly. Similarly, someone having complete up to date information on a fund's portfolio composition could compute real time NAVs.

CEFs report their portfolio compositions quarterly. While quickly becoming at least somewhat dated, the information may, none the less, be sufficiently current for meaningful real time NAV estimation. Two interesting questions addressed herein are: 1. how accurately can one predict the reported daily NAV of closed end funds by using the incomplete (i.e. past quarterly) information available on its portfolio composition? ; 2. Can such estimated NAVs be used to forecast subsequent returns? If so, can the forecast be utilized to implement an effective trading strategy? This latter question turns on another question: Is the NAV estimate that can be generated from public information in real time closer to the actual NAV than the ad hoc expectation reflected in the market price? While that question cannot be answered directly, an answer may be implied by an answer to the second question above.

Estimating a CEF's NAV based on its end-of-prior-quarter portfolio composition gives rise to several sources of error. First, the portfolio's composition is likely to be changing throughout the quarter. Using out-of-date information to estimate the current NAV introduces an error whose magnitude depends upon the extent to which the sold assets move differently from those that are purchased. If the fund has a relatively low turnover and/or the two sets of assets tend to move similarly, the error from this source is likely to be small. Note, however, that the transactions costs of a fund's trading introduce an

additional estimation error. A purchase will cost the fund the market price plus an amount that reflects the cost of the trade (commissions, bid/ask spread). But the value reflected in the end of the day portfolio will be the closing price shorn of the trading costs. Similarly, sales will generate consideration which has the cost of the trade deducted from the proceeds. Accordingly, the fund's NAV will be bled by these trading costs.

The NAV impact of these trading costs will vary with the level of trading which will not be publically known. Second, the fund will periodically extract its management fees and expenses. If for example, the fund is charged a management fee on a particular day of the week or month, the NAV will thereby be reduced below what would be forecast if one just considered the impact of changes in the value of its portfolio. Unless one can take account of the schedule and amounts of these charges, their impact will introduce additional noise. Third, the fund's holdings will generate periodic income payments (dividends, coupon payments etc.). These typically quarterly payments, will also tend to be concentrated on specific days. Unless one adjusts for their timing, further noise will be introduced. Similarly, one needs to know how the fund deals with accrued but unpaid dividends. Fourth, the fund's portfolio is likely to include cash, earning a return the level and timing of which is unknown. Fifth, funds may earn stock loan fees the extent and timing of which will be unknown to those outside of the fund.

Each of these factors introduce noise into any effort to estimate how the NAV is changing. Some of the factors will have a positive impact on the NAV (income receipts, stock loan fees), while others will have a negative impact (transactions costs, management fees), while others could have either a positive or negative impact (changes in portfolio composition) Thus the overall effect will be a result of factors which will be to at least some degree offsetting. How much noise the above-discussed errors introduce is an empirical matter to which we now turn.

DATA

Seeking to avoid both the non synchronous trading issue that arises with international funds and the difficulty of obtaining reliable price information on debt securities, our sample contains 20 domestic stock funds. We obtained their end of quarter portfolio compositions from *Morningstar Direct* and the prices of their stocks from CRSP. Their daily NAVs are the sums of the products of portfolio compositions and corresponding daily stock prices.

Our time period runs from quarter one 2006 and to quarter two of 2007, thereby yielding about 375 trading days and 7,300 observations. Notwithstanding its small size, we do find that our limited sample's estimated NAV values are relatively accurate proxies for the actual NAVs, and these estimated NAVs are able to predict subsequent returns.

METHODOLOGY

We use a fund's beginning of the quarter portfolio composition to estimate its daily closing NAV. We multiplied the number of shares held in each position times its per share closing price and summed over the portfolio. We reduced the fund's estimated NAV by the amount of any distribution on its ex-date—the date when the seller, but not the buyer, of a share will be entitled to a dividend. We estimated the NAV return as its percentage change from the prior day. We then used our estimated and actual NAVs to perform a number of tests designed to address our main questions: 1. How well can we estimate the change in the daily NAV using our estimates? 2. Can our estimated NAV changes be used to predict returns?

RESULTS AND ANALYSIS

We began our analysis by comparing our estimate with the actual NAV returns. Three such comparisons are useful. First we computed the correlation between the daily returns for the estimated and actual NAVs on a fund-by-fund basis (Exhibit 1 below).

EXHIBIT 1 CORRELATIONS BETWEEN THE ESTIMATED AND ACTUAL NAV RETURNS

	Fund Symbol	1Q 2006	2Q 2006	3Q 2006	4Q 2006	1Q 2007	2Q 2007	1Q 2006-- 2Q 2007
			0.995		0.935			
1	ADX	0.9935	2	0.9965	8	0.9835	0.9953	0.9872
			0.997		0.984			
2	ASG	0.9903	7	0.9931	7	0.9922	0.9911	0.9923
			0.996		0.987			
3	BDJ	0.9940	2	0.9834	6	0.9946	0.9917	0.9914
			0.996		0.998			
4	BDT	0.9956	2	0.9947	4	0.9805	0.9991	0.9936
			0.985		0.996			
5	BDV	0.9968	3	0.9911	9	0.9985	0.9966	0.9935
			0.991		0.987			
6	BLU	0.9916	8	0.9914	6	0.9929	0.8363	0.9634
			0.994		0.974			
7	DPD	0.9966	5	0.9932	3	0.9961	0.9949	0.9909
			0.998		0.998			
8	DVM	0.9970	8	0.9980	0	0.9993	0.9883	0.9959
			0.981		0.977			
9	EOI	0.9369	0	0.9808	6	0.9911	0.9860	0.9768
			0.989		0.984			
10	EOS	0.9398	4	0.9847	2	0.9885	0.9717	0.9784
			0.970		0.911			
11	ETB	0.6301	6	0.9347	2	0.9584	0.8991	0.8744
12	ETV	0.9496	0.975	0.9205	0.868	0.9671	0.9120	0.9362

			4		4			
			0.985		0.982			
13	FFA	0.9732	3	0.9917	5	0.9811	0.9649	0.9795
			0.993		0.979			
14	FVL	0.9831	5	0.9733	2	0.9806	0.9757	0.9817
			0.999		0.996			
15	JHFT	0.9982	2	0.9968	7	0.9989	0.9966	0.9980
			0.969		0.914			
16	JPG	0.9452	4	0.9412	5	0.9683	0.9438	0.9469
			0.945		0.728			
17	JPZ	0.8711	1	0.9045	5	0.9302	0.8250	0.8810
			0.952		0.722			
18	JSN	0.8880	6	0.9206	6	0.9342	0.8356	0.8859
			0.940		0.964			
19	MSP	0.9632	8	0.9361	8	0.9626	0.9644	0.9399
			0.998		0.990			
20	PEO	0.9988	2	0.9989	5	0.9974	0.9986	0.9970
			0.9516		0.944			
	Average		8	0.9713	2	0.9798	0.9533	0.9642

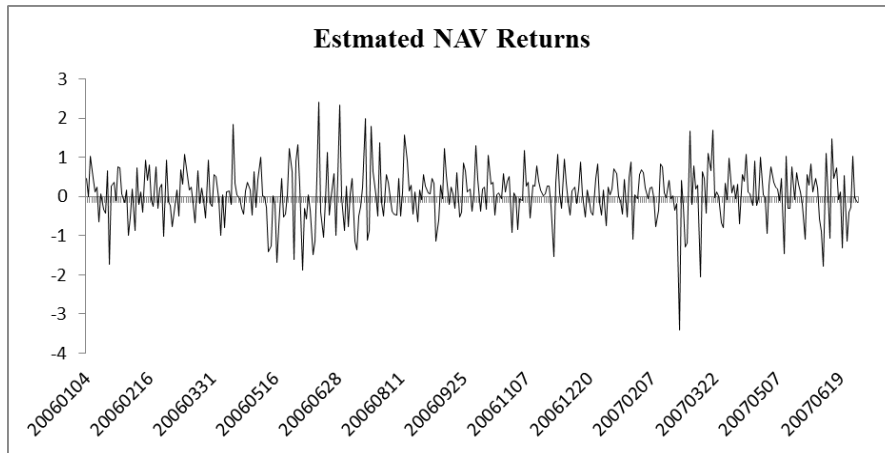
This table reports the correlations of the daily estimated NAV returns and actual NAV returns for each of the 20 funds in each of the 4 quarters in 2006 and the first 2 quarters in 2007 as well as in the 6 quarters. The estimated NAV for each fund is calculated by multiplying the number of shares held in each portfolio composition at the beginning of the quarter times its per share closing price and summed over the portfolio. The name of each fund is provided in the table in Appendix.

Second, we correlated the daily averages of both the estimated and actual NAV returns across our sample (Exhibit 2 below).

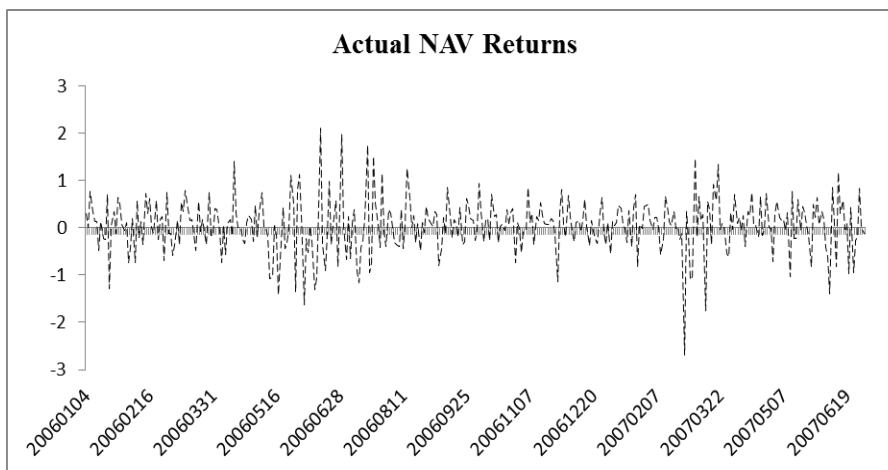
EXHIBIT 2: CORRELATIONS BETWEEN THE AVERAGE ESTIMATED AND ACUTAL NAV RETURNS, AVERAGED ACROSS FIRMS

	Daily Average Est. NAV Return	Daily Average Actual NAV Return
Mean	0.0521	0.0450
Std. Dev.	0.6936	0.5534
Daily Average Est. NAV Return	1	0.9953
Daily Average Actual NAV Return		1

This table provides the mean and standard deviation for the daily averages of both the estimated and actual NAV returns as well as the correlation between the daily averages of both the estimated and actual NAV returns from the 1st quarter 2006 to the 2nd quarter 2007.



The above figure shows the daily averages of the estimated NAV returns from the 1st quarter 2006 to the 2nd quarter 2007.



The above figure shows the daily averages of the actual NAV returns from the 1st quarter 2006 to the 2nd quarter 2007.

The table below reports the correlations of the daily estimated NAV returns and actual NAV returns for each of the 20 funds in each of the 4 quarters in 2006 and the first 2 quarters in 2007 as well as in the 6 quarters. The estimated NAV for each fund is calculated by multiplying the number of shares held in each portfolio composition at the beginning of the quarter times its per share closing price and summed over the portfolio. The name of each fund is provided in the table in Appendix.

20	PEO	0.9988	0.998	0.9989	0.990	0.9974	0.9986	0.9970
	Average	0.9516	0.982	0.9713	0.944	0.9798	0.9533	0.9642

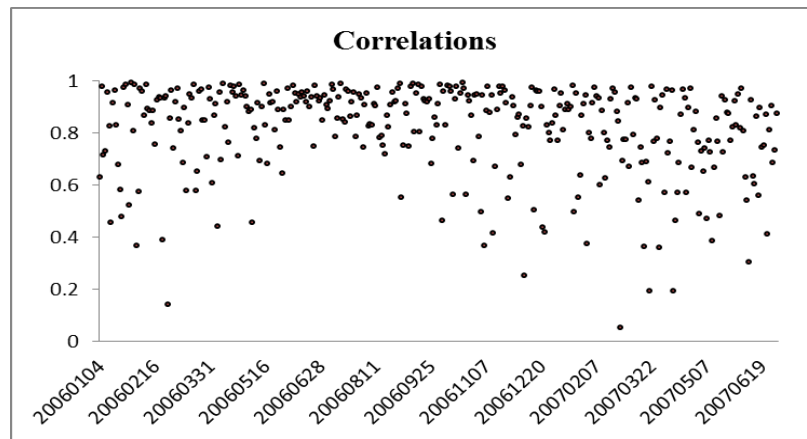
Third, we calculated separate correlations by funds for each day and then averaged the results shown below in Exhibit 3.

EXHIBIT 3: CORRELATIONS BETWEEN THE AVERAGE ESTIMATED AND ACUTAL NAV RETURNS

Mean	0.816	Median	0.876
Std. Dev.	0.172	Minimum	0.05
Maximum	0.993	5 Percentile	0.454
95 Percentile	0.98		

The above table provides the statistical description of the daily correlations between the average estimated and actual NAV returns average across days from the 1st quarter 2006 to the 2nd quarter 2007.

The figure below provides the daily correlation between estimated and actual NAV returns from the 1st quarter 2006 to the 2nd quarter 2007



All three exhibits show a positive correspondence between the actual NAV return and that computed from our estimated NAV. The individual fund correlations are mostly in the .90s to high .90s range. The average correlation across all funds and days is over .96. The results using the daily averages across funds are even more supportive, with a correlation of 0.992. Averaging across days produced a somewhat lower correlation of .81.

Thus, we find that the NAV return is positively correlated with that computed from our estimated NAV, which leads us to believe that the daily NAV of CEFs is likely to be predictable from publicly available information. One does not, however, know the new quarter's compositions until some days into the

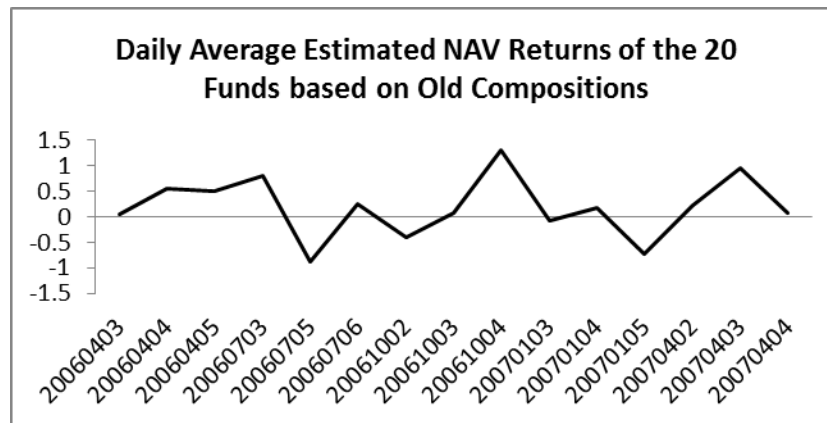
quarter. Can the preceding quarter's portfolio composition continue to be relied upon until the new quarter's composition becomes available? To address this question, we explored the relationship between the estimated NAV returns for the first 3 trading days at each quarter based on the old and new portfolio compositions. First, we calculated the daily average estimated NAV returns across our sample of funds using both the old and new compositions shown below in Exhibit 4.

EXHIBIT 4: DAILY AVERAGE ESTIMATED RETURNS BASED ON OLD AND NEW COMPOSITIONS

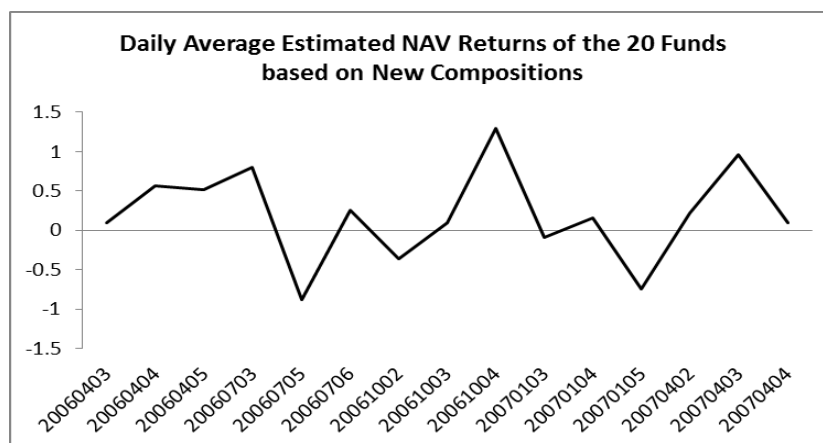
	Daily Average EstNAVRet_New	Daily Average EstNAVRet_Old
Mean	0.1990	0.1939
Std. Dev.	0.5910	0.5940
Daily Average EstNAVRet_New	1	0.9997
Daily Average EstNAVRet_Old		1

The above table shows the mean and standard deviation of the daily average estimated NAV returns for the first 3 trading days at each quarter based on the old and new portfolio compositions as well as the correlation between the two estimated returns. The new portfolio composition is the positions held by a fund at the beginning of each quarter. The old portfolio composition is the positions held by a fund at the beginning of previous quarter.

The figure below presents the daily average estimated NAV returns for the first 3 trading days at each quarter based on the old portfolio compositions.



The figure below presents the daily average estimated NAV returns for the first 3 trading days at each quarter based on the new portfolio compositions.



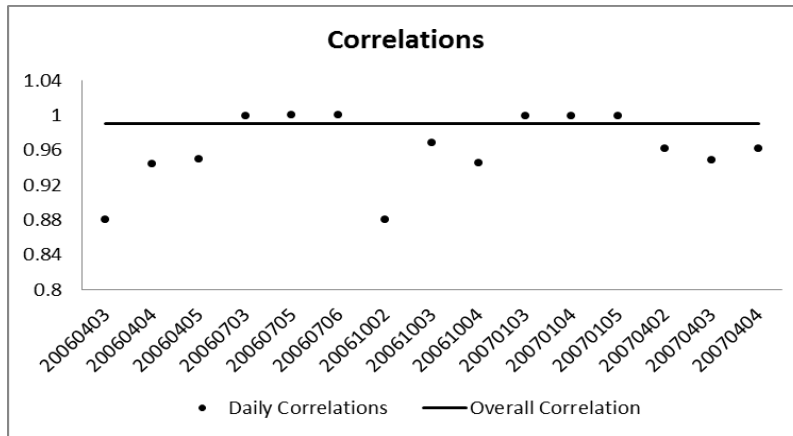
Clearly, the daily averages based on the two compositions are quite similar. Next, we computed the correlations across funds for each day and then the overall correlation for the 20 funds in the 15 transition days in our 5 quarters shown below in Exhibit 5.

EXHIBIT 5: DAILY AND OVERALL CORRELATIONS BETWEEN THE ESTIMATED NAV RETURNS BASED ON OLD AND NEW COMPOSITIONS

Mean	0.963	Median	0.962
Std. Dev.	0.01	Minimum	0.88
Maximum	0.9999	5 Percentile	0.88
95 Percentile	0.999		

The table above reports the statistical description of the daily correlations between the estimated NAV returns for the first 3 trading days at each quarter based on the old and new portfolio.

The figure below shows the daily and overall correlations between the estimated NAV returns based on old and new compositions for the first 3 trading days at each quarter.



We see that the estimated NAV return based on the old composition is highly correlated with that based on new compositions. The overall correlation is .99 and the mean of all the daily correlations is .96. Two daily correlations are a bit below .90, while the rest are above .94, with a maximum near 1. Thus the old and new portfolio compositions provide very similar estimated NAV return results. This finding implies that quarterly changes in portfolio composition do not have much impact on the NAV return for our sample and time period.

Next, we explored relations between our estimated NAV and actual returns for the fund’s owners. Our goal is to see if our estimated NAVs provide useful information which may facilitate profitable trading. Exhibit 6 below contains six sets of correlations on a fund-by-fund basis.

EXHIBIT 6: CORRELATIONS BETWEEN ESTIMATED NAV RETURNS AND VARIOUS ACTUAL RETURNS

	Fund Symbol	EstNAVret and Pret_CC	EstNAVret and Pret_ON	EstNAVret and Pret_ID	lagEstNAVret and Pret_CC	lagEstNAVret and Pret_ON	lagEstNAVret and Pret_ID
1	ADX	0.8894 ***	0.4061 ***	0.7617 ***	0.0394	0.0076	0.0397
2	ASG	0.6928 ***	0.0983 *	0.5985 ***	0.2096 ***	0.0449	0.1707 ***
3	BDJ	0.3376 ***	0.1218 **	0.2726 ***	0.0468	-0.06	0.0771
4	BDT	0.6013 ***	0.1352 ***	0.5034 ***	0.0552	0.0891 *	-0.0033
5	BDV	0.5717 ***	0.1194 **	0.4894 ***	0.0424	0.0558	0.0068
6	BLU	0.3795 ***	0.1129 **	0.3022 ***	0.0674	0.0555	0.0280
7	DPD	0.4028 ***	0.0705	0.3642 ***	0.1136 **	-0.0064	0.1169 **
8	DVM	0.7219 ***	0.1934 ***	0.6543 ***	0.0643	0.0560	0.0331
9	EOI	0.4751 ***	0.2607 ***	0.3376 ***	0.1303 **	0.0493	0.1048 **
10	EOS	0.4121 ***	0.0301	0.3827 ***	0.0951 *	0.0173	0.0821
11	ETB	0.1893 ***	0.1068 **	0.1353 ***	0.0218	0.0172	0.0133
12	ETV	0.3169 ***	0.0929 *	0.2606 ***	0.0608	0.0716	0.0159
13	FFA	0.3643 ***	0.1817 ***	0.2315 ***	0.1617 ***	0.0938 *	0.0941 *
14	FVL	0.7366 ***	0.2523 ***	0.6935 ***	0.2078 ***	0.0946 *	0.1798 ***
15	JHFT	0.5550 ***	0.1079 **	0.4692 ***	0.0688	0.0606	0.0193
16	JPG	0.4206 ***	0.2123 ***	0.2692 ***	0.0598	0.0107	0.0501
17	JPZ	0.3663 ***	0.0487	0.3069 ***	0.1341 **	0.0309	0.1046 **
18	JSN	0.2573 ***	0.0767	0.1977 ***	0.0794	0.0022	0.0743
19	MSP	0.3612 ***	0.1180 **	0.3050 ***	0.0075	0.0647	-0.0265
20	PEO	0.9166 ***	0.2787 ***	0.8427 ***	0.1073 **	0.1821 ***	0.0148
Overall		0.5384 ***	0.1526 ***	0.4484 ***	0.0975 ***	0.0584 ***	0.0619 ***
		ActNAVret and Pret_CC	ActNAVret and Pret_ON	ActNAVret and Pret_ID	lagActNAVret and Pret_CC	lagActNAVret and Pret_ON	lagActNAVret and Pret_ID
Overall		0.5567 ***	0.1551 ***	0.4644 ***	0.1055 ***	0.0582 ***	0.07 ***

The above table reports the correlations between 5 NAV returns on a fund-by-fund basis and across the 20 funds. EstNAVret is the estimated NAV return. Pret_CC is the actual close-to-close NAV return. Pret_ON is the overnight (previous close-to-next-day-open) return. Pret_ID is the intraday (open-to-close on the following day) returns. lagEstNAVret is the lagged estimated NAV return. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

First, the estimated NAV return is correlated with the contemporaneous daily returns on the fund's shares as well as that return divided into two pieces: 1. the overnight (previous close-to-next-day-open return) and 2. The intraday (open-to-close on the following day) returns. Finally, the lagged estimated NAV return is correlated with each fund's next day close-to-close, overnight and intraday returns.

Clearly, our estimated daily NAV returns are highly correlated with the contemporaneous stock price returns for most of the funds of our sample. The correlations for the individual funds range between .92 and .19 with an average value of .54. Thus the market price of the fund's shares tends to move in tandem with its contemporaneous estimated NAV.

This result is not unexpected. Investors are likely to take account of the performance of each funds' portfolio holdings in real time. Dividing, the return into its overnight and intraday components reveals that most of the association is with the intraday return. That is, as the day goes by, the change in the price of the fund from open-to-close is positively correlated (.45) with our estimated NAV return. The correlation between our estimated NAV return and the overnight return (.15) is positive but lower. This positive correlation is encouraging. It suggests that our estimated NAV contains some potentially useful information not reflected in the contemporaneous market price.

Clearly, our estimated NAV return is capturing a significant part of whatever is causing the CEF's intraday returns. Since investors do not know the actual NAV return until after the markets closes, the market price the next day should also react to the new information contained in the report of the prior day's closing NAV.

One would not know the new NAV report in time to trade on it before the market closed. But one could estimate the NAV throughout the day and near the market's close and utilize that estimate to trade while the market remains open. So the relevant question that arises is: Do our estimated NAVs help explain subsequent returns? Accordingly, our next three correlations explore how effectively our estimated NAV is able to forecast the returns.

First, we report the correlation between our estimated NAV returns lagged one day and the following day's actual return on the fund's shares. While the correlations are much lower than for the contemporaneous returns, they remain

positive throughout. For the individual funds they range from .21 down with an average value of .10.

We also split the daily return into the overnight and intraday return. We suspect that because the market will know the actual NAV return at the opening, the lagged estimated NAV return, which is designed to proxy for the actual NAV return, will largely impact the following day's overnight return, rather than its intraday return.

Curiously, we find that the correlations between the lagged estimated NAV returns for both the overnight and the intraday returns are similar and both generally positive. The average correlations with the following day's overnight and intraday returns are both .06. Upon reflection, we suspect that the ability of our estimated NAV return to predict the subsequent intraday return may be due to order imbalance induced opening mispricing which are rectified in later trading. That is, as Branch et al have found (*Financial Management*), CEF shares that trade down (up) overnight tend to rise (fall) during the following day. They reason that the specialist will set the opening price in the direction of the order imbalance in order either to sell at a higher price if the orders to buy predominate and buy at a lower price if orders to sell exceed those to buy. If this opening has set the price too low (high) relative to the stock's intrinsic value, the price will tend to rise (fall) as the day continues.

In order to explore how our the explanatory power of our estimated NAV returns compare with those of the actual NAV returns, we re estimate the entries of Exhibit 6 using actual NAV returns. The overall results are reported at the bottom of Exhibit 6. Not surprisingly, the actual NAV returns outperform our estimates. But the differences are small. For example, the correlations between the actual NAV return and the contemporaneous stock's close-to-close return is .557 compared to .539 for our estimated NAV return. Similarly the correlations between the actual NAV returns and the overnight and intraday returns are .155 and .464 respectively compared with .152 and .448 for the estimated NAV return. The correlations with the lagged values are similarly close.

We see that our estimated NAV return is almost as highly correlated with the stock's returns as is the actual NAV return. Thus, most of the relevant information contained in the actual NAV announcement seems to be embedded in our estimates. Note that all of the overall correlations are highly significant at the .99 level. These results suggest that one could use our approach to estimate the NAV throughout the day to uncover situations where the market price of particular CEFs is not accurately reflecting their changing NAVs and then trade accordingly.

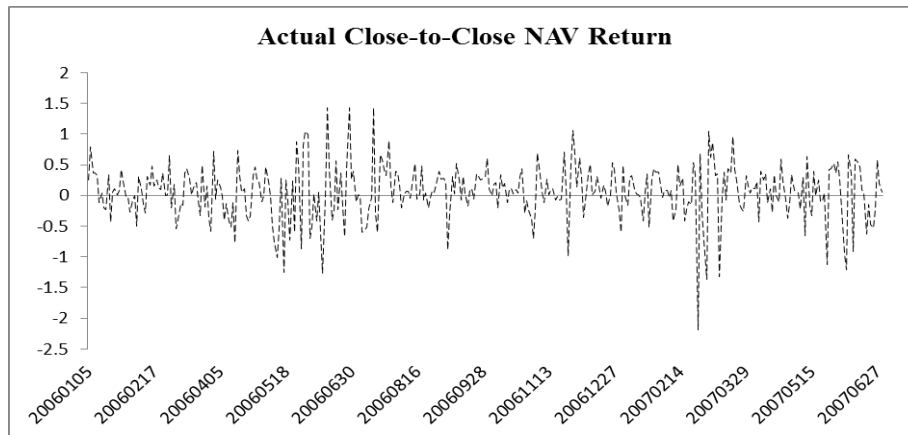
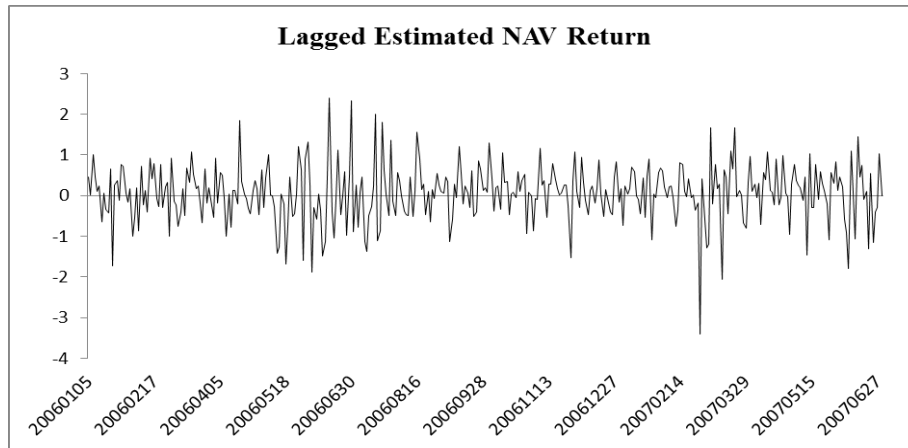
Next, we compute the daily average of our variables across all funds and compute correlations between the lagged estimated NAV returns and the following day's close-to-close return, overnight and intraday returns shown below in Exhibit 7.

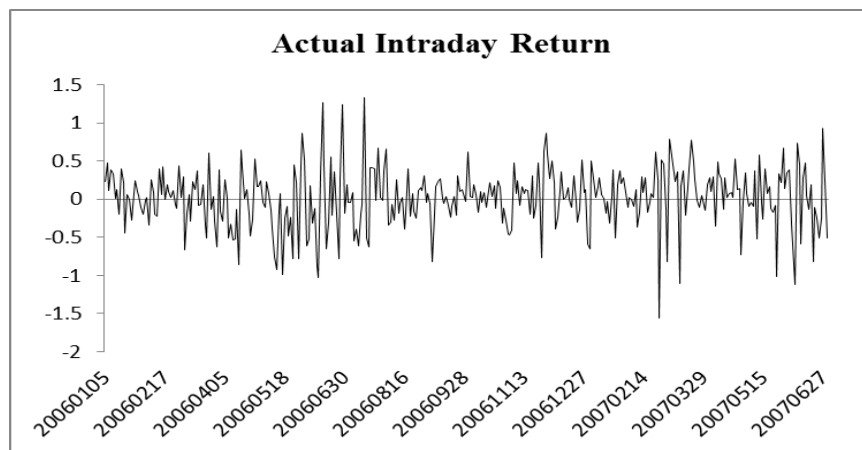
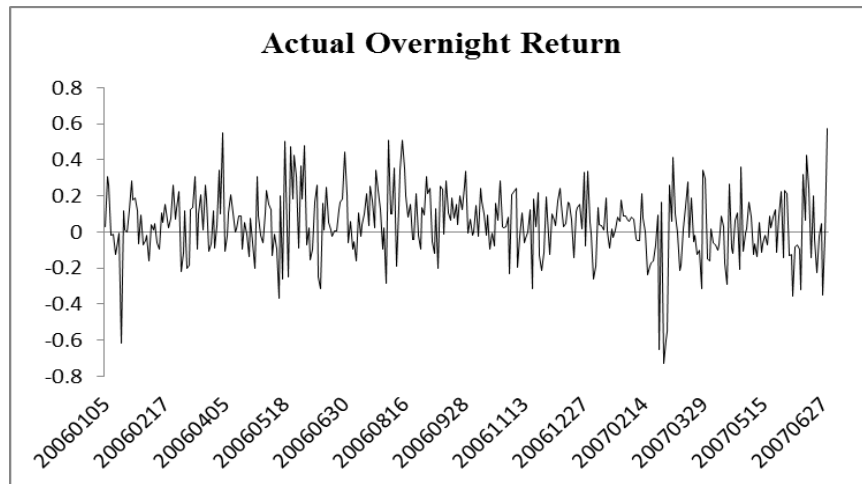
EXHIBIT 7: CORRELATIONS FOR DAILY AVERAGES

	lagEstNAVret	Pret_CC	Pret_ON	Pret_ID
Mean	0.0566	0.0554	0.0442	0.0122
Std. Dev. of Daily Average	0.6983	0.4418	0.1856	0.3872
lagEstNAVret	1	0.1316	0.1024	0.1009
Pret_CC		1	0.4871	0.9081
Pret_ON			1	0.0766
Pret_ID				1

The above table provides the mean and standard deviation of the daily averages for 4 NAV returns and the correlations between the daily averages. lagEstNAVret is the lagged estimated NAV return. Pret_CC is the actual close-to-close NAV return. Pret_ON is the overnight return. Pret_ID is the intraday returns.

The following 4 figures show the daily average of lagged estimated returns, actual close-to-close NAV returns, actual overnight returns, and actual intraday returns, respectively.





We see from the above that the prior day's estimated NAV return is positively correlated with the following day's close-to-close return (.13) as well as its overnight (.10) and intraday (.10) returns. In other words, publicly available information on the performance of the components of CEFs coupled with publicly available information on their quarter end holdings can be used to forecast their next day returns with greater than random accuracy. Thus, investors should be able to use this information to trade effectively.

According to the semi strong form of the efficient market hypothesis, one should not be able to use publically available information to forecast returns. We find, for our admittedly small sample covering only a short time frame, that the estimated NAV return which we can compute using known fund composition and closing market price data is positively correlated with the subsequent close-to-close (.13), overnight (.10) and intraday returns (.10).

In prior work, Branch, Ma and Sawyer found a powerful negative relation between the prior day's intraday return and the adjacent overnight return (Branch, Ma and Sawyer, *Financial Management*). We now explore whether the

positive relation between the lagged predicted NAV return and subsequent returns found herein and the negative relation between overnight and intraday returns discovered earlier can be used jointly to predict closed end returns. As a first step, Exhibit 8 below contains correlations for various return calculations using our sample.

EXHIBIT 8: CORRELATIONS FOR VARIOUS RETURN CALCULATIONS

	lagEstNAVret	lagIDret	lagONret	Pret_ID	Pret_ON
Mean	0.0566	0.0204	0.0370	0.0122	0.0442
Std. Dev.	0.7717	0.7525	0.4584	0.7512	0.4626
lagEstNAVret	1	0.4486	0.1629	0.0614	0.0586
lagIDret		1	-0.2890	0.0351	-0.0933
lagONret			1	-0.0555	0.1216
Pret_ID				1	-0.2988
Pret_ON					1

The above table provides the mean and standard deviation of 5 NAV returns and the correlations between the 5 NAV returns. lagEstNAVret is the lagged estimated NAV return. lagIDret is the lagged actual intraday return. lagONret is the lagged actual overnight return. Pret_ID is the actual intraday returns. Pret_ON is the actual overnight return.

One correlation jumps out at us: -.30 for the overnight and intraday returns. While below the -.52 correlation of Branch et al’s much larger sample, -.30, still quite high. Also noteworthy are the correlations between the lagged estimated NAV returns and the following day’s overnight and intraday returns at .059 and .061 respectively. Apparently both the prior day share returns and the prior day estimated NAV returns have some predictive value.

We shall now explore whether these two sets of relationships can be combined effectively. That is, could one use both the negative auto correlation between intraday and overnight returns coupled with the positive correlation between the estimated NAV returns and the subsequent closed end fund share returns to predict subsequent returns more accurately than by using either relationship alone? One way to explore this question is to generate cross tables with the two independent variables on the rows and columns and the average value of the independent variable reported in each cell. This we have done for three sets of variables in Exhibit 9 below.

EXHIBIT 9: RETURNS CROSS TABLES

Panel 1: Average Overnight Returns

	lagIDret - Up	lagIDret - Down
lagEstNAVret - Up	0.0167	0.1076
lagEstNAVret - Down	-0.0044	0.0545

Panel 2: Average Close-to-Close Returns

	lagIDret - Up	lagIDret - Down
lagEstNAVret - Up	0.1104	0.0934
lagEstNAVret - Down	-0.0568	0.0203

Panel 3: Average Intraday Returns

	Pret_ON - Up	Pret_ON - Down
lagEstNAVret - Up	-0.0912	0.1967
lagEstNAVret - Down	-0.1905	0.1025

The above three tables report the average overnight returns, close-to-close returns, and intraday returns under different combinations of lagged returns. lagEstNAVret is the lagged estimated NAV return. lagIDret is the lagged actual intraday return. lagONret is the lagged actual overnight return.

The first cross table reports the average overnight return as a function of the lagged estimated NAV and lagged intraday returns. We expect that when the lagged estimated NAV return is positive (negative) and the lagged intraday return is negative (positive), the overnight return will be positive (negative). Our results are in line with our expectations (.108 and -.004). The values in the off diagonal cells (when the two forces are in conflict) are both positive and smaller than the cell where the lagged intraday return is negative and the lagged estimated NAV return is positive. Note, however, that where the lagged NAV return is negative, the off diagonal return is a positive .05. Thus the negative autocorrelation of returns shows up as powerful even when the estimated NAV return is negative.

Second, we use the same set of independent variable and the close-to-close return as the dependent variable. We have a similar set of expectations which are again found. Indeed the average cell values are stronger for the close to close returns than for the overnight returns (.093 and -.057). The behaviors of the off diagonal cells are interesting. Specifically when the lagged estimated NAV return is positive, the average close to close return is positive (.110 and .093), regardless of whether or not the lagged intraday return is positive or negative. Clearly the lagged estimated NAV return (which proxies for the lagged actual NAV return) has a powerful influence on subsequent returns.

Finally, we look at the intraday return as explained by the preceding overnight and lagged NAV returns. Again we find the expected pattern for the diagonal (.197 and -.191). The off diagonal terms for the cross table where the intraday return is the dependent variable are also smaller than the diagonal terms.

Each of these cross table results suggests that both the estimated NAV returns and the prior partial day returns are associated with subsequent returns as expected. While these univariate results are illustrative, a multivariate analysis can provide a more refined view. Accordingly, we estimate regressions for the three dependent variables, overnight, intraday and close-to-close returns, using only the independent variable whose values would be known prior to the beginning of the return to be estimated in Exhibit 10 below.

EXHIBIT 10: FAMA-MACBETH REGRESSION RESULTS FOR EXPLAINING RETURNS

	α	lagActNAVret	lagEstNAVret	lagIDret	Pret_ON	lagONret	lagCCret	R ²
Pret_ON	0.0683 (3.78)		0.0843 (3.53)	-0.1024 (-10.30)				0.1605 (21.98)
Pret_ID	0.0228 (0.76)		0.1012 (2.78)	-0.0435 (-2.86)	-0.6943 (-29.23)			0.3415 (36.27)
Pret_CC	0.0579 (1.88)		0.1418 (3.84)	-0.0884 (-5.27)		-0.0843 (-3.32)		0.2255 (27.66)
Pret_CC	0.0483 (1.59)		0.15 (4.10)				-0.0882 (-5.43)	0.1672 (22.36)

More regression results

	α	lagActNAVret	lagEstNAVret	lagIDret	Pret_ON	lagONret	lagCCret	R ²
Pret_ON	0.0683 (3.78)		0.0843 (3.53)	-0.1024 (-10.30)				0.1605 (21.98)
Pret_ON	0.093 (7.08)	0.0798 (3.30)		-0.994 (-9.90)				0.1687 (22.19)
Pret_ON	0.0507 (2.91)	0.041 (0.82)	0.0533 (1.17)	-0.1022 (-10.03)				0.2273 (27.97)
Pret_ID	0.0228 (0.76)		0.1012 (2.78)	-0.0435 (-2.86)	-0.6943 (-29.23)			0.3415 (36.27)
Pret_ID	0.0018	0.1467		-0.0604	-0.6824			0.3447

	(0.08)	(4.23)		(-3.97)	(-29.94)	(36.49)
Pret_ID	0.0388	0.191	-0.057	-0.0557	-0.6899	0.3939
	(1.27)	(2.35)	(-0.76)	(-3.60)	(-30.23)	(41.76)
Pret_CC	0.0579		0.1418	-0.0884	-0.0843	0.2255
	(1.88)		(3.84)	(-5.27)	(-3.32)	(27.66)
Pret_CC	0.0409	0.1941		-0.105	-0.0903	0.2327
	(1.66)	(5.44)		(-6.30)	(-3.57)	(28.51)
Pret_CC	0.0569	0.222	-0.0395	-0.1064	-0.1029	0.2916
	(1.79)	(2.69)	(-0.52)	(-6.29)	(-4.01)	(33.90)
Pret_CC	0.0483		0.15		-0.0882	0.1672
	(1.59)		(4.10)		(-5.43)	(22.36)
Pret_CC	0.0345	0.2083			-0.1039	0.1756
	(1.45)	(5.90)			(-6.47)	(23.08)
Pret_CC	0.0456	0.25	-0.0551		-0.1091	0.2367
	(1.49)	(3.01)	(-0.71)		(-6.63)	(28.49)

Note: t Values are inside parentheses

The table above provides the results of Fama-Macbeth regressions of the overnight returns, close-to-close returns, and intraday returns on different lagged returns and the actual overnight return. Pret_ON is the actual overnight return. Pret_ID is the actual intraday (open-to-close on the following day) returns. Pret_CC is the actual close-to-close NAV return. lagEstNAVret is the lagged estimated

Clearly, our univariate relations continue to hold in a multivariate context. Our simple model explaining overnight return has an R square of .16. Both independent variables are highly significant with the expected signs. Results for the intraday return are even stronger with an R square of .34. The two more important variables have the proper sign and are highly significant statistically. The third independent variable, the lagged intraday return has an unexpected negative sign and is also significant. Finally, our regressions where the dependent variable is the closed-to-close return have R squares of .22 and .17. Again the independent variables are well behaved. In the first of these regressions, the two components of the daily return are entered separately whereas in the second, the close to close return is entered in their place.

These results indicate that one may use publicly available information to forecast daily returns on CEF shares with better than random accuracy. The return advantages derived from our limited study, if it persists, is small but not trivial. Accordingly, these results may be useful for those seeking to time trades that are already indicated on other grounds.

CONCLUSION

We have explored the possibility of predicting the daily NAV of CEFs using their last reported portfolio compositions and the closing prices of the relevant components. Our approach, which uses only publicly available information, appears to do a creditable job of predicting the daily NAV.

Both univariate and multivariate analysis were used to explore the relationships. While we list a number of factors that introduce noise into our estimates, we note that they are at least somewhat offsetting and on balance do not appear to bias our estimates very much. We also explore whether our estimated NAVs can be used to help predict subsequent returns. Our findings suggest that they can.

Drawing from some prior work, we explore whether predictable behavior in overnight returns can be used to supplement our results on NAV predictability in a way that enhances one's potential to trade effectively. We believe that our findings would be quite useful for those who are inclined to trade CEFs. That is, one who is planning or considering buying or selling a CEF could use our approach to estimating their NAVs throughout the day in order to assess whether the market price movement relative to the NAV which makes a trade more or less attractive. In situations where the discount of the actual NAV is wide and increasing, a buy may be indicated. When the discount is narrow and/or declining or the premium is positive and perhaps increasing, a sell may become more attractive.

Our study breaks new ground and in the process opens up avenues for additional research. For example we only look at domestic stock funds. Similar work could explore the issues with international and bond funds. We do not take transactions costs into consideration. They could be. We only look at a short time period. One could study a much longer period with both up and down markets.

BIBLIOGRAPHY

- Anderson, S. C., 1986, "Closed-end funds versus market efficiency," *Journal of Portfolio Management*, 13 (1), 50-55.
- Anderson, S. C., B. J. Coleman and J. A. Born, 2001, "A closer look at trading strategies for U.S. equity closed-end investment companies," *Financial Services Review*, 10 (1-4), 237-248.
- Arora, N., N. Ju, and H. Ou-Yang, 2002, "Closed-End Funds: A Dynamic Model of Premiums and Discounts," University of North Carolina working paper.
- Barclay, M. J., and T. Hendershott, 2004, "Liquidity Externalities and Adverse Selection: Evidence from Trading after Hours," *The Journal of Finance*, 59 (2), 681-710.
- Barclay, M. J., and T. Hendershott, 2003, "Price Discovery and Trading after Hours," *Review of Financial Studies*, 16 (4), 1041-1073.
- Barclay, M.J., C.G. Holderness and J. Pontiff, 1993, "Private Benefits from Block Ownership and Discounts on Closed-End Funds," *Journal of Financial Economics* 33 (3), 263-291.
- Barone-Adesi, G. and Y. Kim, 2002, "Incomplete Information and the Closed-End Fund Discount," 9th Symposium on Finance, Banking, and Insurance, University Karlsruhe (TH), Germany.
- Ben Branch, Aixin Ma and Jill Sawyer, "Closed End Fund Performance on A Daily Basis: the Discovery of A New Anomaly" (with Axin Ma and Jill Sawyer), *Financial Management*, Autumn 2010, Vol. 39, No 3, p. 1177-1196.
- Bers M. and J. Madura, 2000, "The Performance Persistence of Closed-End Funds," *The Financial Review* 35 (3), 33-52.
- Boudoukh, J., M. Richardson, M. Subrahmanyam, and R. F. Whitelaw, 2002, "Stale Prices and Strategies for Trading Mutual Funds," *Financial Analysts Journal* 58 (4), 53-71.
- Cakici, N., Tessitore, A., and Usmen, N., 2000, "Closed-end equity funds: Betting on discounts and premiums," *Journal of Investing*, 9 (4), 83-92.
- Chan, K., M. Chockalingam and K.W.L. Lai, 2000, "Overnight information and intraday trading behavior: evidence from NYSE cross-listed stocks and their local market information," *Journal of Multinational Financial Management* 10 (3-4), 495-509.

- Chay, J., and C. Trzcinka, 1999, "Managerial Performance and the Cross-Sectional Pricing of Closed-End Funds," *Journal of Financial Economics* 52, 379-408.
- Chen, N.F., R. Kan and M. Miller, 1993, "Are the Discounts on Closed-End Funds A Sentiment Index?" *The Journal of Finance* 48 (2), 795-800.
- Cherkes, M., J. Sagi and R. Stanton, 2005, "Liquidity and Closed-End Funds," Princeton University working paper.
- De Long, J. and A. Shleifer, 1992, "Closed-End Fund Discounts," *Journal of Portfolio Management* 18 (2), 46-53.
- Dimson, E. and C. Minio-Paluello, 2002, "The Closed-End Fund Discount," London Business SSRN working paper.
- Garay, U., 2000, "The Closed-End Domestic Fund and Closed-End Country Fund Discount Puzzles: A Review of the Literature," IESA Business School working paper.
- Gasbarro, D. and J. Zumwalt, 2003, "Time-Varying Characteristics of Closed-End Fund Discounts," FMA Conference Paper.
- Gasbarro, D., R. Johnson and J. Zumwalt, 2003, "Evidence on the Mean-Reverting Tendencies of Closed-End Fund Discounts," *The Financial Review* 38 (2), 273-291.
- Gemmill, G. and D. Thomas, 2000, "Sentiment, Expenses and Arbitrage in Explaining the Discount on Closed-End Funds," Cass Business School working paper.
- J. T. Greene and S. G. Watts, 1996, "Price Discovery on the NYSE and the NASDAQ: The case of Overnight Daytime News Releases," *Financial Management* 25(1), 19-42.
- Grullon, G. and F. Wang, 2001, "Closed-End Fund Discounts with Informed Ownership Differential," *Journal of Financial Intermediation* 10, 171–205.
- Hugh, J. C., P. G. Mathew and K. P. Ragan, "A NAV a Day Keeps the Inefficiency Away? Fund Trading Strategies using Daily Net Asset Values," *Financial Services Review* 14, 213-230.
- Kalev, P. S., Liu, W.-M., Pham, P. K., and E. Jarnecic, 2004, "Public Information Arrival and Volatility of Intraday Stock Returns," *Journal of Banking and Finance* , 28 (6), 1441-1467.
- Lee, C., A. Shlerfer and R. Thaler, 1991, "Investor Sentiment and the Closed-

- End Fund Puzzle,” *The Journal of Finance* XLVI (1), 75-109.
- Malkiel, B., 1977, “The Valuation of Closed-End Investment Company Shares,” *The Journal of Finance* 32 (3), 847-859.
- Malkiel, B., 1995, “The Structure of Closed-End Fund Discounts Revisited,” *Journal of Portfolio Management* 21 (4), 32-38.
- Madhavan, A., and V. Panchapagesan, 2000, “Price Discovery in Auction Markets: A Look inside the Black Box,” *Review of Financial Studies* , 13 (3), 627-658.
- Madhavan, A., and V. Panchapagesan, 2002, “The First Price of the Day,” *Journal of Portfolio Management* , 28, 101-111.
- Manzler, D., 2005, “Liquidity, Liquidity Risk and the Closed-End Fund Discount,” SSRN Working Paper.
- Pontiff, J., 1996, “Costly Arbitrage: Evidence from Closed-End Funds,” *The Quarterly Journal of Economics* 111 (4), 1135-1151.
- Richard, J. and J. Wiggins, 2000, “The Information Content of Closed-End Country Fund Discounts,” *Financial Services Review* 9, 171–181.
- Richards, R. M., Fraser, D. R. & Groth, J. C., 1980, “Winning strategies for closed-end funds,” *Journal of Portfolio Management*, 7 (1), 50-55.
- Roll, R., 1984, “A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market,” *Journal of Finance*, 39, 1127–1139.
- Seyhun, H. Nejat and D. Skinner, 1994, “How do Taxes Affect Investors’ Stock Market Realizations?” *The Journal of Business* 67 (2), 231-262.
- Simpson, M., and S. Ramchander, 2002, “Is Differential Sentiment A Cause of Closed-End Country Fund Premia? An Empirical Examination of the Australian Case.” *Applied Economics Letters* 9, 615-619.
- Taylor, N., 2007, “A Note on the Importance of Overnight Information in Risk Management Models,” *Journal of Banking and Finance*, 31 (1), 161-180.
- Thompson, R., 1978, “The Information Content of Discounts and Premiums on Closed-End Fund Shares,” *Journal of Financial Economics* 6 (2-3), 151-186.

Note: Title graphic is by Carole E. Scott

APPENDIX

APPENDIX 1: FUND NAMES AND FUND TICKERS

Fund Name	Ticker
Adams Express	ADX
Liberty All-Star Growth	ASG
American Strat Income	ASP
BlackRock Enhanced Dividend Achievers	BDJ
BlackRock Strategic Dividend Achievers	BDT
BlackRock Dividend Achievers	BDV
Blue Chip Value	BLU
Dow 30 Premium & Dividend Income	DPD
Cohen & Steers Dividend Majors	DVM
Eaton Vance Enhanced Equity Income	EOI
Eaton Vance Enhanced Equity Income II	EOS
Eaton Vance Tax-Managed Buy-Write Income	ETB
Eaton Vance Tax-Managed Buy-Write Opp	ETV
First Trust Enhanced Equity Income	FFA
First Trust ValueLine 100	FVL
John Hancock Financial Trends	JHFT
Nuveen Equity Premium and Growth	JPG
Nuveen Equity Premium Income	JPZ
Nuveen Equity Premium Opportunity	JSN
Madison Strategic Sector Premium	MSP
Petroleum & Resources	PEO

