

Using NAV to Measure the Effectiveness of Fair Value Methodologies

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Introduction

During the last two years, many fund families have increased their use of systematic fair valuation procedures for international equity securities. As suggested by the Securities and Exchange Commission (SEC), funds are also regularly testing the effectiveness of their fair value methodology by comparing their fair value prices to the next day's local opening prices.¹ One rationale for using the next day's local opening prices as a comparison is that they are the next available market price.

Without knowing a fund's precise holdings, however, one cannot calculate a fund's net asset value at the time of the next day's local market opening. Thus, the next best method available to outsiders (such as journalists, financial advisors, academics, and regulators, as well as any lingering stale price arbitrageurs) is to assess a fund's fair valuation methodology using the next available price for the fund, i.e., the next-day's NAV.

In this paper, we argue that funds should also consider monitoring the effectiveness of their fair value methodology by measuring changes in their NAVs. We suggest a simple and intuitive methodology for doing so, and then report the results for a set of hypothetical funds.

Two characteristics of a properly constructed fair value methodology, described in White Paper #8, were that: 1) it should be closer to the next day's opening price than the previous day's closing price and 2) the fair value estimates produced should not be systematically biased.²

For the reason stated above, the first test is difficult to apply using only publicly available NAV data. We therefore focused our attention on the second test, which has the added benefit of examining the driving force behind arbitrage profits - predictability in NAVs. For instance, if fair value estimates were always closer to the next day's opening prices by 50%, but still did not fully incorporate today's market movements, a timer's profits, though reduced, could still be significant.

Although it's true that measuring the effectiveness of a fair value model using NAV comparisons adds noise to the results, it's still feasible using a larger sample size to get meaningful output. In addition, under the market efficiency hypothesis, this noise should not bias the results. The reason is that market efficiency requires that future security price changes be uncorrelated with information that is publicly known today, so the next-day opening price to closing price change should not be correlated with information used to fair value a fund the previous day. While not everyone subscribes to the market efficiency hypothesis, it is generally accepted that anomalies large enough to significantly bias the results of the tests we outline here do not exist, especially in large-cap stocks at a daily frequency.³

¹ Letter from Douglas Scheidt, Associate Director and Chief Counsel, Division of Investment Management, SEC to Craig S. Tyle, General Counsel, Investment Company Institute (April 30, 2001).

² White Paper #8: "Characteristics of Estimates from a Fair Value Methodology; Comparing Alternative Models," Peter Ciampi, Interactive Data Pricing and Reference Data, Inc.

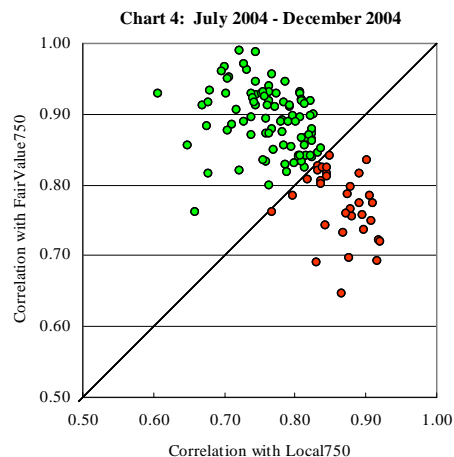
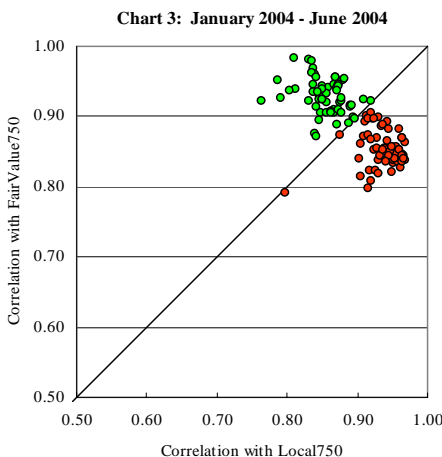
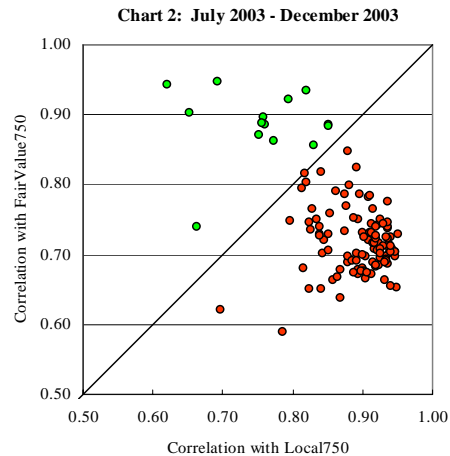
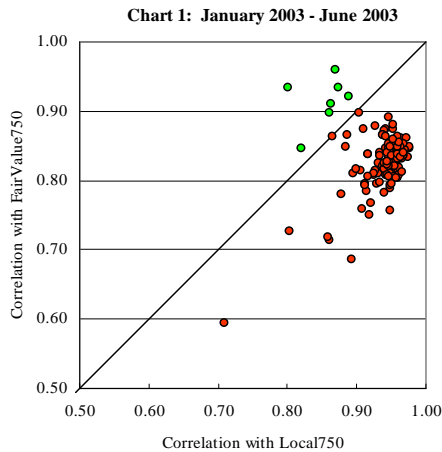
³ White Paper #3: "Arbitrage Opportunities Do Not Exist in Liquid Markets," Peter Ciampi, Interactive Data Pricing and Reference Data, Inc., Eric Zitzewitz, Stanford University Graduate School of Business.

WHITE PAPER #10 (CONTINUED)

Categorizing whether funds are using local closing prices or fair value estimates

Before applying this test it's important to know which funds are actively using a systematic fair value methodology for international equities. To answer this question, we created two time series for a capitalization-weighted portfolio of the largest 750 non-U.S. stocks – one using local closing prices, called Local750, and the other using fair value evaluations from Interactive Data Pricing and Reference Data's Fair Value Information Service, called FairValue750. We then selected 123 mutual funds primarily investing in international equities and classified by Morningstar as large-blend style, and measured the correlation between their NAVs, adjusted for dividends, and our two series.⁴ We assume that in 2003 correlation would be highest with Local750 (because most funds were not frequently using a systematic fair value methodology for international equities at that time), but would shift, becoming higher with FairValue750 as time progressed.

The charts below are scatter plots of the 123 funds; the x-axis represents correlation with Local750 and the y-axis represents correlation with FairValue750. They show the expected trend. In Chart 1, the first 6 months of 2003, most points are closer to the x-axis (higher correlation with Local750, the red dots). In Chart 4, the last 6 months of 2004, most points are closer to the y-axis (higher correlation with FairValue750, the green dots).



⁴ This “horserace” method of comparing two correlations can be done more formally in a regression context. For an example, see Zitzewitz, “Another Kind of ‘Weekend Effect’ in Financial Markets,” Stanford University memo, August 2002 (available at <http://faculty-gsb.stanford.edu/zitzewitz>).

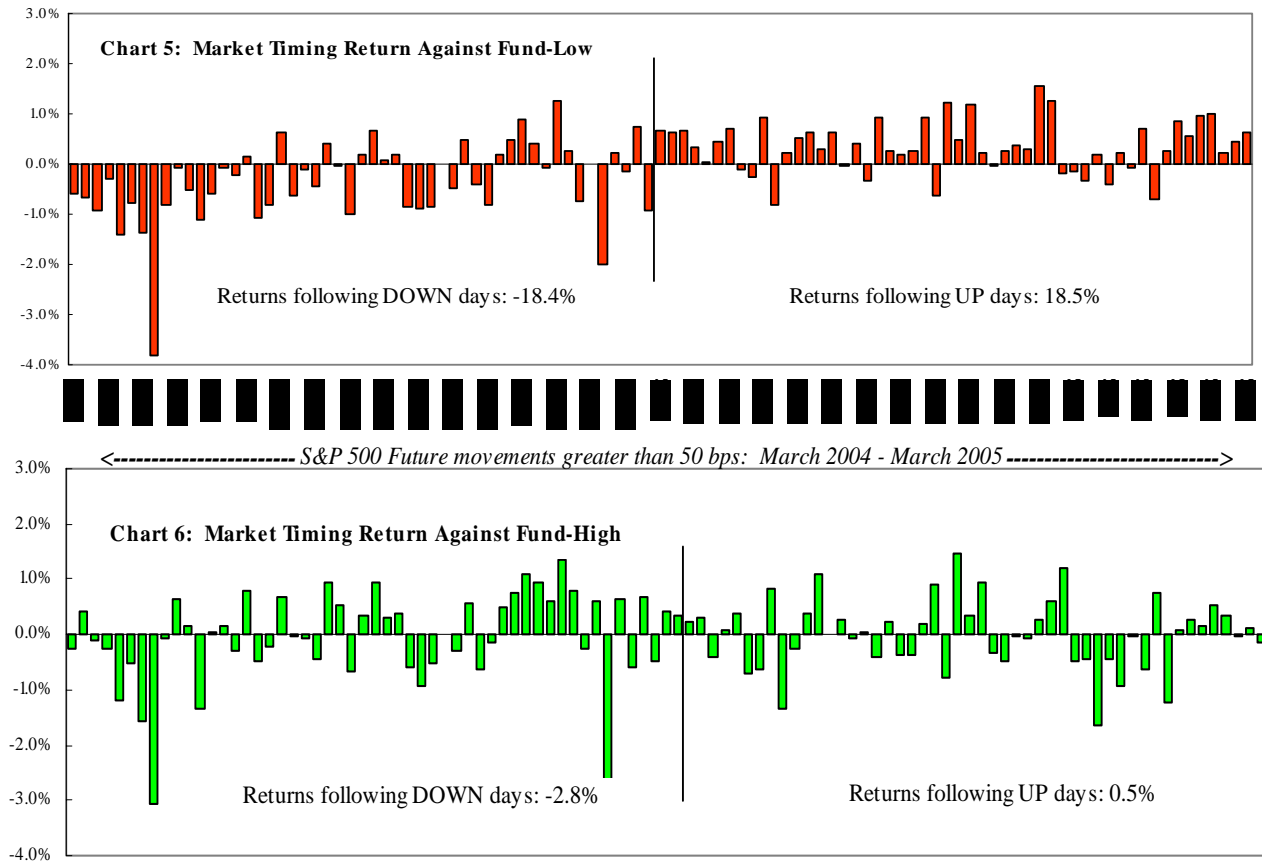
WHITE PAPER #10 (CONTINUED)

While each correlation point summarizes the relation between the Local750 series and the FairValue750 series, examining the series in detail provides insight into the daily dynamics. To do this, we created three hypothetical funds from the 123 funds: 1) Fund-High was an equal weighted fund from the five funds most correlated to FairValue750; 2) Fund-Average was an equal weighted fund from the five funds in the middle; and 3) Fund-Low was an equal weighted fund from the five funds with lowest correlation to FairValue750.

Charts 5 and 6 show the daily NAV move following 0.5% moves in the S&P 500 Future between 4 a.m. and 4 p.m. Eastern Time (ET) for the one year period between March 15, 2004 (the Ides of March) and March 15, 2005. The x-axis is the ordered signal changes; the y-axis is the next day's NAV change.⁵

Chart 5 shows a market timer's profits with Fund-Low. Most down-signals are followed by negative fund returns, so a market timer profits from being out of the fund. Most up-signals are followed by positive fund returns, so the market timer profits from being in the fund. The difference between returns following up and down days is 36.9%, and the excess return, adjusted for the inability to short mutual funds, is 18.7%.⁶

Chart 6 tells a different story with Fund-High. The next day's fund return shows no pattern with positive or negative signals. The difference in returns following up and down days is 3.3%; risk-adjusted returns would be 1.6%.



⁵ At moves less than 0.5% the same pattern exists but isn't as clear because of noise.

⁶ For additional information, see White Paper #3, "Arbitrage Opportunities Don't Exist in Liquid Markets," which contains a detailed review of predictability; see also Zitzewitz, "Who Cares About Shareholders? Arbitrage Proofing Mutual Funds," *Journal of Law, Economics, and Organization*, October 2003.

Measuring lack of bias and predictability

The correlation between a fund's NAV and FairValue750 allows us to rank funds by "degree of fair valuation" and test our main hypothesis – funds highly correlated with FairValue750 are effectively using a fair valuation methodology and should therefore do well on the bias test.

If the fair value estimates used in their NAVs are unbiased, the returns following "up days" should be no different from the returns following "down days." Our bias measure captures the extent to which this is not true. As mentioned above, since we're using the next day's NAV, our bias measure is also a measure of whether market timers can earn excess returns. To help calibrate our results, we express our bias measure in terms of the risk-adjusted excess returns that can be earned by market timers over buy-and-hold shareholders.

At the ICI Mutual Funds and Investment Management Conference on March 15, 2005, Douglas Scheidt, Associate Director and Chief Counsel in the SEC's Division of Investment Management suggested that a mutual fund consider triggers most correlated with the fund's holdings.⁷ Motivated by this suggestion, we ran our tests using 6 possible signals, rather than the more commonly used Change in the S&P 500 Index from 11 a.m. to 4 p.m. ET:

- 1) Change in the S&P 500 Future between 4 a.m. and 4 p.m. ET
- 2) Change in the SPDR (Amex: SPY) between 11 a.m. and 4 p.m. ET
- 3) Change in the SPDR (Amex: SPY) between 4 p.m. ET Day 1 and 4 p.m. ET Day 2
- 4) Change in the Nikkei 225 Future between 4 a.m. and 4 p.m. ET
- 5) Change in the Euro between 11 a.m. and 4 p.m. ET
- 6) Change in the iShares MSCI EAFE Index Fund (Amex: EFA) between 11 a.m. and 4 p.m. ET

To assess whether the excess return in column 6 is significant or what might occur from random coin tosses, we regressed the daily fund return on the previous day's signals. T-stats from this regression indicate the statistical significance of the excess return. T-stats greater than approximately 2.63 mean the excess return is significant at the 99% level (** in column 5), between 1.99 and 2.63 at the 95% level (*).

⁷ Mr. Scheidt noted that his remarks were on his own behalf and do not necessarily represent the views of his colleagues at the SEC or of the SEC itself.

WHITE PAPER #10 (CONTINUED)

Portfolio	Signal	Trigger level ⁸	Trades	T-Value	Excess Return
Fund-High	S&P Fut 4am to 4pm	0.5%	90	0.76	1.6%
Fund-High	SPY 11am to 4pm	0.5%	66	0.02	0.0%
Fund-High	SPY 4pm to 4pm	0.5%	91	0.65	1.4%
Fund-High	Nikkei Fut 4am to 4pm	0.5%	88	-0.52	-3.7%
Fund-High	Euro 11am to 4pm	0.25%	65	0.68	5.7%
Fund-High	EFA 11am to 4pm	0.5%	54	0.51	0.8%
Fund-Average	S&P Fut 4am to 4pm	0.5%	90	3.41**	11.1%
Fund-Average	SPY 11am to 4pm	0.5%	66	2.36*	6.9%
Fund-Average	SPY 4pm to 4pm	0.5%	91	2.51*	8.9%
Fund-Average	Nikkei Fut 4am to 4pm	0.5%	88	1.64	4.8%
Fund-Average	Euro 11am to 4pm	0.25%	65	0.49	4.8%
Fund-Average	EFA 11am to 4pm	0.5%	54	2.85**	7.7%
Fund-Low	S&P Fut 4am to 4pm	0.5%	90	5.97**	18.7%
Fund-Low	SPY 11am to 4pm	0.5%	66	4.53**	13.1%
Fund-Low	SPY 4pm to 4pm	0.5%	91	4.61**	15.7%
Fund-Low	Nikkei Fut 4am to 4pm	0.5%	88	3.55**	11.5%
Fund-Low	Euro 11am to 4pm	0.25%	65	0.61	5.9%
Fund-Low	EFA 11am to 4pm	0.5%	54	4.23**	11.1%

Table 1: Excess Return (Bias) using 6 timing signals

Fund-High does not demonstrate statistically significant profits with any of the signals. Fund-Average demonstrates statistically significant profits with four of the signals. At the other extreme, Fund-Low demonstrates significant (at the 1% level) profits with every signal except the change in the Euro.

The average excess returns tell a similar story. Against all signals, the Fund-High average is 0.97%, Fund-Median is 7.37% and Fund-Low is 12.67%. It's worth noting that potential excess returns depend on volatility, and the excess returns of 12.67% in Fund-Low are measured during one of the lowest periods of volatility in recent history. If volatility in this period had been at the average level over the last 20 years, we estimate that excess profits would have been about 100% higher.

⁸ We selected a trigger level of 0.5% to reduce the number of trades.

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Summary

We hypothesized that the next day's NAV could be used to measure the efficacy of a systematic fair value methodology. To test this, we first constructed a cap-weighted portfolio of 750 foreign stocks and built a time series of NAVs with local closing prices and a time series of NAVs using Interactive Data Pricing and Reference Data's Fair Value Information Service evaluations. We assumed that funds with high correlation to our fair value series were using an effective fair valuation methodology while those with a low correlation were not.

Next, we applied six market timing strategies to hypothetical fund groups having high, medium and low correlation with the fair value time series. The high correlation group demonstrated an average return of only 0.97% against all signals, implying that their fair value estimates were very efficient. The medium correlation group demonstrated an average return of 7.37%. The low correlation group demonstrated highly significant profits with an average excess return of 12.67%, implying that either they were not using their fair value methodology with sufficient frequency, or that their fair value estimates were inefficient.

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