

Is Fair Value Needed for Small Cap Funds?

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Introduction

It is widely accepted and, using techniques outlined in this paper, easy to verify that mutual funds primarily holding international equity securities (hereinafter, International Funds) valued at the time of the local market close are susceptible to simple arbitrage strategies yielding profits of approximately 40%. Zitzewitz (2003) It is also easy to verify that International Funds employing an effective fair value pricing methodology can virtually eliminate this arbitrage opportunity.

In light of the arbitrage opportunity in International Funds, a naturally ensuing question is: are mutual funds investing in other asset classes also susceptible to arbitrage? Arbitrage profits with International Funds result from using stale prices, due to time zone differences, to value those funds. For example, when prices from the London Stock Exchange, which closes at 11:30 a.m. Eastern Time (ET), are used to calculate the net asset value of a U.S. mutual fund at 4:00 p.m. ET, these prices are four and a half hours old. Market timers can easily exploit this time lag. In theory, a similar situation exists with mutual funds holding U.S. small capitalization equity securities. Such securities are often traded less frequently than large capitalization stocks, once again creating a potential for time lag. Consider a small cap stock that last traded at 2:00 p.m. ET. When this last trade is used to value a mutual fund at 4:00 p.m. ET, it is two hours old.¹

This suggests that mutual funds investing primarily in small cap stocks (hereinafter, Small Cap Funds) may also be susceptible to arbitrage. In fact, some academics who researched arbitrage in International Funds also report that Small Cap Funds are arbitrageable. Chalmers, Edelen and Kadlec (2001), discuss the positive autocorrelation in Small Cap Fund returns, and Zitzewitz (2003) estimates that the excess returns from a small cap arbitrage strategy from 1998-01 would be in the double digits. While this is less than the 40% profits then available in International Funds arbitrage, it is certainly noteworthy today when International Funds are employing fair valuation techniques more frequently and arbitrageurs need to look elsewhere for alpha. This paper asks: are arbitrage profits in Small Cap Funds still available today? If so, are fair valuation techniques needed?

¹ But there's an important difference between International Funds and Small Cap Funds that is discussed later in this paper. With international equity securities, the lack of a current market price is related to hours of operation of the local market and time zone differences with the U.S. By contrast, with small cap stocks, the lack of a current market price is related to a lack of liquidity in the market for particular stocks and, in theory, can be reduced if the securities trade more often and nearer to 4:00 p.m. ET.

WHITE PAPER #9 (CONTINUED)

Strategy and Data Sets

To answer these questions, we estimated the returns from simple market timing strategies in 150 randomly selected Small Cap Funds from January 2000 until September 2004.

We analyzed two strategies. For each strategy, we assumed that an arbitrageur would buy the Small Cap Fund on days when the S&P 500 Index rises between 2:00 and 3:55 p.m. ET. The difference is that one strategy, called Fund_Cash, is invested in cash on the other days, while the second strategy, called Fund_S&P, is invested in an S&P 500 Index fund on the other days.²

The potential arbitrage profit, or excess returns, for Fund_Cash was measured as the difference between the return from this strategy of being in the funds only on days following a positive signal less the returns to a buy-and-hold strategy with equal average ex-post exposure to the Small Cap Fund and cash. For example, if the signal was positive on 55% of the days, then the benchmark return was 0.55 times the return of the fund over the period plus 0.45 times the cash return. This approach, also adopted by Zitzewitz (2003), assures that the arbitrage and benchmark strategies have equivalent average exposure to market returns, so results are not affected by whether the market was up or down in the period analyzed (See Zitzewitz, 2003, or White Paper #3 for details).

Excess profits for Fund_S&P were similarly defined, except that the benchmark strategy above would be 55% in the Small Cap Fund and 45% in an S&P 500 Index Fund. In addition to ensuring equal market exposure, switching to the S&P 500 Index Fund leaves the beta of the strategy approximately constant. The results are then less affected by whether the strategy happened to be long on a particularly good or bad day for the market.³

	Excess Return 0 bp Trigger	T-stats	Excess Return 40 bp Trigger	T-stats
2000	20.6%	3.69	21.0%	4.07
2001	14.5%	2.08	15.5%	1.83
2002	-10.9%	-0.52	-1.4%	0.24
2003	7.4%	2.01	9.8%	2.10
2004	-15.1%	-0.58	-5.8%	-0.26
Avg 2000-01	17.5	4.51	18.3	4.36
Avg 2002-04	-6.2	1.04	1.2	.90

Table 1: Excess Returns from the Fund_Cash Strategy

² We used the S&P 500 Index change from 2 pm to the close of the NYSE at 4:00 p.m. as the trading signal primarily for consistency with other academic research on this subject. We also analyzed windows beginning at 9:30 a.m., 3:00 p.m., and 3:30 p.m. ET and, for 2002-04, a strategy based on the iShares Russell 2000 Index Fund (AMEX: IWM) as a signal. In general, we found slightly higher arbitrage returns using the IWM or windows starting at 3:00 or 3:30 p.m. ET, especially for 2002-04.

³ We measured next-day returns using published net asset values (NAVs), thus our next-day returns are close-to-close, which increases the possibility that chance will affect the results in a small sample. Fortunately, switching between the Small Cap Fund and the S&P 500 Index helps control for this issue. One can refine things even further by simulating a strategy of switching from the Small Cap Fund to an equal-beta mixture of an S&P 500 Index fund and cash (or, if the Small Cap Fund's beta is greater than one, to an S&P 500 Index Fund plus a futures position). Making this additional refinement yielded results that were reasonably consistent with Fund_S&P, so we omitted it from this paper.

WHITE PAPER #9 (CONTINUED)

Results from the Fund_Cash Strategy

The most commonly researched strategy is Fund_Cash. At least two academic studies, CEK (2001) and Zitzewitz (2003), found the S&P 500 Index change between 2:00 p.m. and 3:55 p.m. ET (hereinafter, SP2_4) to be a profitable trading signal.

We replicated those results and found average excess returns of 17.5% in 2000 and 2001. These excess returns persisted even when arbitrageurs required a large market move before trading. If we assume that the arbitrageur waits for a 40 basis point move before trading, excess returns are 18.3%.

From 2002 through 2004, however, the annual excess returns were negative 6.2%. Does this mean that market timing Small Cap Funds is no longer possible?

Results from the Fund_S&P Strategy

To answer this question, we analyzed switching between the Small Cap Fund and an S&P 500 Index Fund. As mentioned, this helps control for unexpected next-day S&P 500 Index changes and yields less noisy results in a sample over a short period of time.

Table 2 shows that with the Fund_S&P strategy excess returns are stable and positive. Lower returns in 2004 are partly due to lower market volatility. They may also be partly due to a reduction in the underlying predictability of small cap returns, but with only nine months of data, it is difficult to draw firm conclusions.

	Excess Return trading at 1 bp	t-value	Excess Return trading at 40 bps	t-value
2000	18.0%	4.46	20.5%	4.85
2001	12.6%	3.27	15.9%	3.18
2002	13.1%	3.11	10.4%	1.75
2003	20.4%	5.37	10.3%	3.85
2004	4.5%	1.39	0.6%	1.28
Avg 2000-01	15.3	5.79	18.2	5.90
Avg 2002-04	12.4	4.39	7.1	3.45

Table 2: Excess Returns from the Fund_S&P Strategy

A reconciliation between these two apparently conflicting sets of results is that during 2002-04, market movements from 2:00 to 4:00 p.m. ET tended to be followed by movements in the opposite direction the next day. This relationship was not statistically significant, and thus it seems reasonable to interpret it as a random feature of the 2002-04 sample period and not a new and likely persistent indicator of market inefficiency. However, it is important to note for our purposes in that, if we fail to control for it, our results can be misleading.

The broader lesson here is that when analyzing arbitrageability over a short period of time, it is very important to control the model for noise to the extent possible.

Correlations

As a check on the results above, we also examined correlations. Under some standard assumptions, correlations are a slightly more statistically efficient method to measure the predictive relationships between trading signals and next-day returns.⁴ Since SP2_4 is a signal for next day's profits in the Small Cap Fund, we would expect the correlation between the signal and the next day's Small Cap Fund move to be positive. This positive correlation occurs in both periods, although, again consistent with the results above, it has decreased during the last three years.⁵ Also consistent with the results above, the correlation between the signal and the next day's S&P 500 Index change has been negative in the last two to three years.

If we examine the correlation between today's signal and tomorrow's Small Cap Fund minus S&P 500 Index returns, we find a more consistent correlation coefficient. Using Small Cap Fund minus S&P 500 Index roughly corrects for any autocorrelation in the S&P 500 Index returns. Again, this is consistent with the conclusions above.

	Autocorrelation of 150 funds	Correlation SP2_4 to Fund4_4nextday 150 funds	Correlation SP2_4 to SP4_4nextday	Correlation SP2_4 to (Fund4_4nextday - next days S&P)
2002-01	.13	.184	.044	.247
2002-04	.01	.053	-.064	.223

Table 3: Correlations decreased only marginally when controlling for next day's S&P 500 Index movements

What's the source of these excess profits?

In summary, once we control for next-day S&P 500 Index returns by examining a Fund_S&P strategy, we find excess profits available in Small Cap Funds from 2002-04. While excess returns are modestly less than those available in 2000-01, 15.3% to 12.3% respectively, the returns are arguably still significant from the perspective of an arbitrageur. This leads to at least two questions. What's the source of these profits? And, why have they decreased?

The most obvious source of profit predictability is a lack of liquidity. With International Funds, non-trading is the primary source of predictable profits. But another source, which is especially important for Small Caps Funds, is that bid and ask prices may not fully reflect recent market movements. Ahn, Boudoukh, Richardson, and Whitelaw (2002) call this "partial adjustment." For securities with wide bid-ask spreads, like most small cap stocks, partial adjustment does not create arbitrage opportunities in the stock market; however, calculating the NAV of a mutual fund using either last traded prices or bid-ask midpoints does.

⁴ Trading strategy returns are a measure of the correlation between next-day returns and the *sign* of the trading signal today. If the predictive relationship is linear, then it is more efficient to estimate a linear statistical relationship like the one implied by a correlation coefficient. Note you can have positive strategy returns but a negative correlation, for example, if days with marginal trading signals were generating most of your strategy profits. Under these circumstances, the negative correlation might lead one to doubt whether the strategy profits would persist.

⁵ Likewise, auto-regressive correlations for the Small Cap Funds have fallen.

WHITE PAPER #9 (CONTINUED)

To separate how much excess profits might come from non-trading versus partial adjustment, ABRW (2002) examined the difference between the spot and the futures autocorrelation on various indices. Because there should be no arbitrage, within the bounds of trading costs, between the spot and the future, these autocorrelations should be about equal. The argument is that if prices only partially reflect available information then both the spot and the future should be equal. ABRW (2002) found that in 1999, the 6-year autocorrelation on the Russell 2000 Index was .22; while on the Russell 2000 Index future it was .07, a difference of .15. So, ABRW (2002) concluded that until 1999, non-trading was the major factor.

When we replicated the ABRW (2002) analysis for a 6-year period ending in 2004, we found that the difference between the autocorrelation coefficients for the Russell 200 Index futures and spot have fallen by about two-thirds. This suggests a decline in the share of predictability explained by this factor.

In addition, tick-by-tick trading data reveals that stocks in a given capitalization decile are trading more frequently and closer to 4:00 p.m. ET in 2003-04 than they did prior to 2002. This is also consistent with a greater share of predictability being due to partial adjustment.

Conclusion

Based on an analysis of 2000-04 data, we find that excess profits in Small Cap Funds exist throughout the period when we control for the next day's S&P 500 Index change. Potential arbitrage profits in 2002-04 are modestly smaller than in 2000-01, but still significant.

Correlations and autocorrelations have clearly dropped during this period, but when we control for the next-day S&P 500 Index change, the drop has been modest.

It appears that non-trading is a smaller source of potential excess profits than partial adjustment. The drop in spread between the Russell 2000 Index spot autocorrelation and futures autocorrelation supports this, as does the fact that many stocks are trading between 3:00 and 4:00 p.m. ET.

Based on our research, our answer to the question whether fair valuation is needed for Small Cap Funds is "Yes." The question remains whether to correct for only stale pricing, or for both stale pricing and partial adjustment. In theory, our answer is: correct for both.

In calculating the NAV of a mutual fund, it is important to value assets in a way that captures their current value. Clearly, if the last trade price is a few hours old and the markets have moved significantly in the meantime, that last trade price is not a good indicator of current value for the same reasons that a closing price from London would not be a good indicator.

Likewise, if significant late market movements are systematically under-reflected, or partially adjusted, in the last trade price or bid-ask midpoint for a small cap stock, then those prices also are not the best available indicator of the value of that stock. Consequently, we believe that fair valuation would be helpful under these circumstances as well, but acknowledge that the case is not as clear cut as for removing predictability arising from non-trading.

WHITE PAPER #9 (CONTINUED)

References

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