

# Another kind of “weekend effect” in financial markets

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## Abstract

International mutual funds that make ad hoc fair value adjustments are much less likely to do so on Fridays, despite the fact that there is actually more need to fair value on Friday and that fair valuation would prevent arbitrage that currently costs long-term shareholders about 1 percent of assets per year.

## 1 Introduction

The common practice of pricing international mutual funds using stale closing prices from overseas markets allows market timers to earn abnormal returns at the expense of long-term shareholders.<sup>1</sup> This prompted the SEC to issue a letter on April 30, 2001, encouraging funds to price using “fair value” prices, prices that have been updated to reflect market movements since the overseas close.

As of the Summer of 2002, a small number of funds have responded by fair value pricing their funds. A very small number of funds fair value systematically. For example, Rydex Japan updates its prices using the Nikkei future contract, which trades during U.S. trading

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<sup>1</sup>This has been documented in a series of recent papers: Bhargava, Bose, and Dubofsky (1998), Chalmers, Edelen, and Kadlec (2001), Goetzmann, Ivkovic, and Rouwenhorst (2001), Greene and Hodges (2002), Zitzewitz (2000 and 2002), and Boudoukh, Richardson, Subrahmanyam, and Whitelaw (2002).

hours on the Chicago Mercantile Exchange. Most of the funds that do fair valuing do so on more ad hoc basis: if the U.S. market has moved by a large amount or some other significant event (e.g., an earthquake) has occurred since the close of overseas markets, a valuation committee is convened which determines how much to adjust the value of the portfolio. This committee must work quickly: U.S. markets close at 4 PM Eastern Time (ET) and fund net asset values (NAVs) need to be submitted to the newspapers by 5:45 PM to be included the next day.

This paper documents that ad hoc fair value adjustments are extremely unlikely to occur on Fridays. This is despite the fact that international markets are more correlated over the weekend than on weekdays, increasing the need for fair value pricing. It is also despite how important fund valuation is to fund companies and their shareholders. Greene and Hodges (2001) and Zitzewitz (2002) estimate that the average international fund lost to market timers about 50 basis points per year in 1998-99 and 100 basis points in 2001, respectively. Even though management companies might not care dollar-for-dollar about shareholders' assets, a back-of-the-envelope calculation suggests that they should care about 10-20 cents on the dollar.<sup>2</sup> So for the average \$400 million international fund, shareholders are losing \$4 million per year to market timers, and fund companies are losing \$400-800 thousand. Fair valuing consistently would eliminate these losses.

This result is consistent with the cost of effort being higher on Friday evenings than on weekdays, and with the cost of effort being an important determinant of the decision to fair value. This interpretation is made more plausible by the fact that results are strongest for Japan and Pacific Stock funds. Asian funds have the greatest need for fair valuation (since closing prices are 12-14 hours old by 4 PM ET), and also have the greatest variation through the week in the cost of effort. Asian fund managers, whose input is necessary for making an ad hoc fair valuation adjustment, have reason to be at the office in advance of the Asian market openings (usually 8-9PM ET) Monday-Thursday but not on Friday.

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<sup>2</sup>Recent research on the impact of mutual fund performance on future inflows suggests a long-run slope of about 1, so a \$1 lost to arbitrage reduces the future size of the fund by \$2. Money in a fund generates a stream of flow profits to a management company, if we assume a profit margin of 80 basis points (the value-weighted average expense and fees of 115 basis points less an assumed marginal cost of 35 basis points) and a discount rate of 10 percent (capital cost less growth rate in perpetuity), reducing the size of the fund by \$2 has an NPV cost of 16 cents.

Two aspects of this result are interesting, for different reasons. First, it provides an example of within-week variations in the cost of effort affecting even those decisions with relatively large stakes, and thus complements the results of Baker, Chandra, and Dickert-Conlin (2002), who find that obstetricians induce labor to avoid weekend births, with adverse consequences for infant mortality. Second, it also may shed light on the mystery of why funds allow such large-scale arbitrage. If the cost of effort is so important for determining when funds fair value, effort costs and related agency problems may also help explain why they fair value so infrequently in the first place.

## 2 Data

This paper uses daily fund returns downloaded from Yahoo for the period January 1, 1997 to July 31, 2002. This data is described in more detail in Zitzewitz (2002); the most important issue to mention here is that the Yahoo data sometimes misses distributions, so I matched monthly returns with the CRSP mutual fund data and discarded months where CRSP and Yahoo returns differed by more than 5 percent.

Our sample includes funds in four Morningstar categories: Europe Stock, Foreign Stock, Japan Stock, and Pacific Stock (defined as Asia-Pacific excluding Japan). I focus on these categories since they have the highest arbitrage returns, and thus the greatest need for fair valuation. Of the 1072 non-exchange traded funds in these categories with ticker symbols, 995 have data available on Yahoo (143, 716, 47, and 87, in the four categories, respectively).<sup>3</sup>

This paper considers January 1997 - December 1999 to be the pre-fair value period, and January 2001 - July 2002 to be a period in which one should expect to observe some fair valuation. This treatment is motivated by the history of the SEC's position toward fair value and our understanding of industry practice. Fidelity fair valued its Asian funds on October 28, 1997, an extreme move day during the Asian crisis, but the SEC's initial response was to

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<sup>3</sup>The Yahoo data includes only surviving funds, although we mitigate this problem by merging data downloaded at four different times: December 1999, August 2000, October 2001, and August 2002. Since we are interested in daily return autocorrelations over a relatively short time window, however, the effect of survivorship bias on the results is very small. For example, in CRSP data, controlling for survivorship bias in a 1997-2001 sample changes the monthly autocorrelation coefficient by 0.002; the bias in daily autocorrelations should be smaller by a factor of about  $\sqrt{21}$ .

investigate Fidelity for wrong doing in response to complaints from investors (presumably arbitrageurs). The SEC subsequently determined that Fidelity's action was desirable, and clarified its position in letters to the Investment Company Institute in December 1999 and April 2001, stating in the second letter that funds were responsible for monitoring for significant events that would require fair value pricing.

The simplest way of testing whether fair valuation practices differ on Fridays is to examine the predictability of next-day fund returns. Table 1 presents regressions that predict next-day fund returns based on current-day S&P 500 returns. Returns are predicted for both funds and for the MSCI index that most closely matches their category, for both the pre-fair value and more recent period, and for both Monday - Thursday and Friday.

Predictability coefficients are higher on Fridays in both periods; this part of the international version of the weekend effect, as documented Jaffe and Westerfield (1985). In the pre-fair value period, funds and indexes have roughly the same relative amounts of predictability regardless of the day of the week. This changes in 2001-02. Funds display about 15 percent less predictability than the MSCI indices on weekdays, but more predictability on Fridays, especially for Asian funds. In this setup, however, it is not clear that these differences are statistically significant, and so the next section switches to a methodology more precisely targeted at detecting fair valuation.

### 3 Testing for fair valuing

The fair value of an asset is usually defined as the price that would prevail in a liquid market at the time of valuation. Combining this concept with market efficiency, one can define a fair value price at 4PM ET as the price from which future changes cannot be predicted given information available at 4 PM. One can then test for fair valuing by testing the extent to which funds are removing the predictability from their future NAV changes.

The simplest way to test for fair valuation is to estimate the model:

$$dNAV_t = \beta_1 \cdot dStale_t + \beta_2 \cdot [E(dStale_{t+1}|I_t) - E(dStale_t|I_{t-1})] + e_t, \quad (1)$$

where  $dNAV_t$  is the change in a fund's NAV on day  $t$ ,  $dStale_t$  is the change in the stale prices of the funds assets, and  $I_t$  is information available at 4 PM ET. If a fund is not fair valuing, then its NAV change should only reflect changes in the stale prices of its assets,

and so one should find  $\beta_1 = 1$  and  $\beta_2 = 0$ . If a fund is fully fair valuing, then its NAV change on day  $t$  should reflect the change in the stale prices that could not be anticipated at 4 PM on day  $t - 1$  plus the future change in stale prices that can be predicted at 4 PM, so  $\beta_1 = \beta_2 = 1$ .

One might expect to find that funds are partially fair valuing. For example, if international funds price holdings with American Depository Receipts (ADRs) using the ADR prices from the U.S. exchanges, this will remove some but not all of the predictability in next-day returns.<sup>4</sup> Funds also may undercorrect for post-close market movements in order to be conservative (I am aware of one fund family that consciously does this), or they may fair value only on days with extreme market movements. One can measure the extent to which funds fair value by examining the ratio  $\frac{\beta_2}{\beta_1}$ .

In order to estimate (1), one needs measures of  $dStale_t$  and  $E(dStale_{t+1}|I_t)$ . Since so many funds track the relevant MSCI index fairly closely, I use the change in the MSCI index as a measure of  $dStale_t$ , since MSCI indices use stale foreign closing prices that they currently do not attempt to update to reflect post-close market movements. I estimate  $E(dStale_{t+1}|I_t)$  by regressing the next-day change in each MSCI index on the post-close changes in CME-traded S&P future and the difference between the Nikkei's closing value and its CME-future price at 4 PM.<sup>5</sup> To avoid a data-snooping bias, for each  $t$  I estimate a regression using all observations except  $t$ , and then predict  $E(dStale_{t+1}|I_t)$  using the coefficients given.

To measure the extent to which valuation practices differ on Fridays, I replace  $\beta_2 \cdot E(dStale_{t+1}|I_t)$  with  $[\beta_2 + \beta_3 \cdot \Phi(t \in \{Fridays\})] \cdot E(dStale_{t+1}|I_t)$  and  $\beta_2 \cdot E(dStale_t|I_{t-1})$  with the analogous expression. I also allow  $\beta_1$  to vary depending on whether it is Friday in a similar fashion to avoid having differences in the extent to which funds are correlated with the MSCI index on Friday contaminate the results.

Table 2 presents estimates of (1) with the Friday interaction terms. These estimates provide no evidence of either fair valuation or day-of-the-week variation in fair valuation in

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<sup>4</sup>Most ADRs are illiquid enough that their prices do not fully reflect current-day U.S. market movements (see Zitzewitz, 2002, Table 9).

<sup>5</sup>We treat 4 AM ET as the closing time for Asian markets (by which time Japan, Korea, Taiwan, and Hong Kong are closed) and 11:30 AM ET as the closing time for Europe (almost all European markets close at 11:00 or 11:30 AM, except Germany which closes at 2 PM).

the 1997-99 period. This is consistent with the SEC's position on the issue at the time. In 2001-2, however, it appears that Foreign Stock funds and Asian funds were fair valuing, with  $\frac{\beta_2}{\beta_1}$  equal to seven percent and 18 percent, respectively, on Monday-Thursday. These funds did significantly less fair valuing on Fridays, however, and one cannot reject the hypothesis that they did no fair valuing at all.<sup>6</sup>

The difference in apparent fair valuation between Monday-Thursday and Friday is stronger in the subsample of funds that appear to be using ad hoc fair valuation. I estimate (1) for each fund without the Friday interaction term and obtain a fund-level measure of  $\hat{\beta}_2$  that captures the average extent that a fund's fair values throughout the week.<sup>7</sup> The 75 percent of funds with  $\hat{\beta}_2$  less than 0.1 are probably not fair valuing very often, and thus one should observe little difference on Fridays. One should likewise expect little variation for the international funds of the two fund families, Rydex and Profunds, that target high-frequency traders and state in their prospectuses that they fair value systematically. Not all of the remaining funds are necessarily practicing ad hoc, as opposed to systematic, fair valuation, but ad hoc fair valuation should be concentrated in this group. When I repeat the analysis in Table 2 for these three groups of funds, I find  $\beta_2$  and  $\beta_3$  of -0.05 (0.02) and -0.06 (0.05) for the non-fair valuers, 0.32 (0.03) and -0.21 (0.06) for the fair valuers other than Rydex or ProFunds, and 1.91 (0.12) and 0.01 (0.27) for Rydex and ProFunds (the standard errors given in parenthesis are adjusted for heteroskedasticity, serial correlation with one lag, clustering on days, and the use of predicted values on the right-hand side).

I considered several alternative explanations for the results. Some fund partially fair value by holding ADRs. If the extent to which illiquid ADR prices captured current-day U.S. market movements was lower on Friday, then this might be contributing to our results. I checked for this by running the regressions in Table 2 on an equal-weighted portfolio of the ADRs available on CRSP, but I found no significant difference in the amount of passive fair valuation provided by ADRs on Fridays. Some funds may hold small-cap foreign stocks

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<sup>6</sup> After I circulated a first draft of this paper among some industry participants, one employee of a large fund family confirmed via email that while they normally fair-valued their Japanese equities, they only fair-valued on two Fridays from January-June 2002. Regressions for this family's Asian funds are consistent with this comment.

<sup>7</sup> This ratio is meaningful for the entire sample: the lowest  $\hat{\beta}_1$  estimated for any of the 995 funds is 0.12; 80 percent have a  $\hat{\beta}_1$  between 0.7 and the maximum, 1.43.

that do not fully reflect current-day changes in their regional MSCI index, and this may be true to a different degree on different days of the week, but including two additional lags of the MSCI index change did not affect the results. The change in MSCI index may be a poor proxy for the change in stale prices for funds that do not track the index closely, but I found similar results when I restricted the analysis to the 12 percent of funds that track the MSCI indices closely (defined as funds where the Index change explains at least 80 percent of the variation in returns and where the estimated  $\beta_1$  is between 0.9 and 1.1). Day of the week effects in the levels of returns are partly explained stocks being more likely to close at the ask on Friday (Keim and Stambaugh, 1984), but since both funds and MSCI indices use closing prices, this effect should get absorbed by the  $\beta_1 \cdot dStale_t$  term, especially for funds with  $\beta_1$  close to one.

## 4 Conclusion

This paper has outlined a methodology for measuring the degree to which international mutual funds are updating foreign-market closing prices to reflect market movements as of 4 PM ET. Using this methodology, it finds that funds fair value significantly less on Friday evenings, and that this behavior is concentrated among Japan and Pacific Stock funds, for whom the extra effort cost of fair valuation on Fridays should be highest. Day of the week variation in fair valuing seems absent from funds that systematically fair value. One interpretation of these results is that funds are exercising discretion in when to fair value, and that variations in the cost of effort are an important component of this decision.

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**Table 1. Predictability of next-day returns**

Coefficient from regressing next-day fund or index returns on the change in the S&amp;P 500

	1997 - 99		1/2001 - 7/2002	
	M - Th	Fri	M - Th	Fri.
Foreign Stock funds	0.319 (0.031)	0.521 (0.058)	0.286 (0.036)	0.444 (0.135)
MSCI EAFE	0.319 (0.041)	0.595 (0.087)	0.345 (0.046)	0.438 (0.162)
Europe Stock funds	0.330 (0.035)	0.500 (0.064)	0.337 (0.046)	0.428 (0.165)
MSCI Europe	0.453 (0.060)	0.632 (0.115)	0.403 (0.062)	0.436 (0.231)
Japan Stock funds	0.313 (0.054)	0.574 (0.101)	0.192 (0.064)	0.570 (0.168)
MSCI Japan	0.298 (0.079)	0.707 (0.147)	0.223 (0.066)	0.535 (0.191)
Pacific Stock (excl. Japan)	0.465 (0.072)	0.670 (0.128)	0.324 (0.055)	0.516 (0.107)
MSCI Pacific Free ex. Japan	0.586 (0.089)	0.813 (0.140)	0.393 (0.048)	0.464 (0.074)
Fund-to-Index coefficient ratio				
Foreign Stock	1.00	0.88	0.83	1.01
European Stock	0.73	0.79	0.84	0.98
Japan Stock	1.05	0.81	0.86	1.07
Pacific Stock	0.79	0.82	0.82	1.11

Each coefficient is from a separate, uni-variate regression. Newey-West standard errors are in parenthesis. Returns for funds are for an equal weighted portfolio of funds from the Morningstar category given.

**Table 2. Testing for fair valuing**

Dependent variable: Average fund NAV change

	MSCI index change	(MSCI index change)*Friday	FV adj(t) - FV adj(t-1)	[FV adj]*Friday](t) - [FV adj]*Friday](t-1)
1997-99				
Foreign Stock	0.838* (0.009)	0.009 (0.031)	0.013 (0.032)	0.001 (0.061)
Europe Stock	0.630* (0.018)	0.013 (0.040)	-0.048 (0.028)	-0.062 (0.076)
Japan Stock	0.887* (0.016)	-0.013 (0.033)	-0.130* (0.048)	-0.021 (0.126)
Pacific Stock	0.882* (0.027)	-0.038 (0.050)	0.041 (0.038)	0.053 (0.080)
1/2001 - 7/2002				
Foreign Stock	0.817* (0.012)	0.013 (0.028)	0.058* (0.018)	-0.107* (0.036)
Europe Stock	0.613* (0.026)	-0.042 (0.065)	0.058 (0.043)	-0.103 (0.110)
Japan Stock	0.900* (0.018)	0.029 (0.031)	0.162* (0.048)	-0.209* (0.107)
Pacific Stock	0.874* (0.047)	0.010 (0.089)	0.159* (0.048)	-0.206* (0.102)

Notes:

1. Each row is a regression of fund NAV changes on the current-day change in the relevant MSCI index and the difference between today's FV adjustment and yesterday's. FV adjustment is defined as the predicted next-day return in the MSCI index based on changes in S&P and Nikkei futures since the overseas closing time. In order to test if fair valuation policies are different on Friday, FV adjustment is interacted with a dummy variable for whether the adjustment is being made on a Friday.
2. Standard errors are heteroskedasticity and serial correlation robust, and are adjusted for clustering on trading days and the fact that FV adj is a predicted variable.
3. Asterisks indicate significance at the 5% level.