WHITE PAPER #11

Holiday Arbitrage; Exposing the Risks of Stale Prices with Public NAV Data

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Introduction

It is well documented that U.S.-domiciled mutual funds holding non-U.S. securities were vulnerable to arbitrage profits of up to 40% annually from 1998 to 2001.[1] Market timers were capitalizing on mutual funds calculating their net asset values (NAVs) based on stale prices. For example, in Japan, there exists a period of up to 15 hours between the time Japanese markets close and 4:00 p.m. Eastern Time, when a fund's NAV is typically calculated in the U.S. If NAVs are calculated with closing prices, arbitrageurs can potentially use information from the period after foreign market close to exploit staleness in fund pricing. As demonstrated over the past few years, employing fair valuation methodologies when market quotations are not readily available or are unreliable can dramatically reduce the opportunity for arbitrage profits.[2]

A similar situation exists with European-domiciled funds holding non-European securities; however, there are differences between the operation of European and U.S. funds. For example, in the U.S., rules under the Investment Company Act of 1940 generally require that all orders to buy or redeem mutual fund shares be effected based on the next calculation of a fund's NAV after the order is received. In effect, this means that the order cut-off time in general, is virtually simultaneous with the time the fund determines its NAV. In Europe, however, the order cut-off time can often be a number of hours before the NAV is calculated, providing a deterrent to market timers. For example, a European-domiciled fund holding Japanese equities with an order cut-off time of 12:00 p.m. GMT and a NAV calculation time of 5:00 p.m. GMT would have a window of up to six hours after the Japanese markets closed, as opposed to eleven if trading occurred up to the NAV valuation point. Although this reduces the profit potential of market timers, order cut-off times may not entirely protect the fund from the risks of stale prices, especially during market holidays. Market holidays effectively elongate the time in which prices may be stale. In this study, we focus on the risks of using local closing prices in NAVs during market holidays.

Test Methodologies and Constructing an Unbiased Sample

We created an equal-weighted portfolio from European-domiciled funds whose primary holdings are Japanese Equities.[3] To reduce bias, we selected 100 funds with the highest correlation to the Nikkei 225 Index from January 2003 to June 2005, and named this portfolio, "Top100." Then, we created a dynamic trading signal from the movements of the Nikkei 225 Index/Index Futures and the S&P 500 Index Futures, between market close and an order cut-off time of 12:00 p.m. GMT.[4] These two movements are connected through simple

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[1] Eric Zitzewitz, *Who Cares About Shareholders? Arbitrage-proofing Mutual Funds*, Journal of Law, Economics and Organization (2003).

[2] See e.g. Peter Ciampi and Robert Haddad, *White Paper #10, Using NAV to Measure the Effectiveness of a Fair Value Methodology* (2005).

[3] Data provided by MoneyMate® assisted in this classification process.

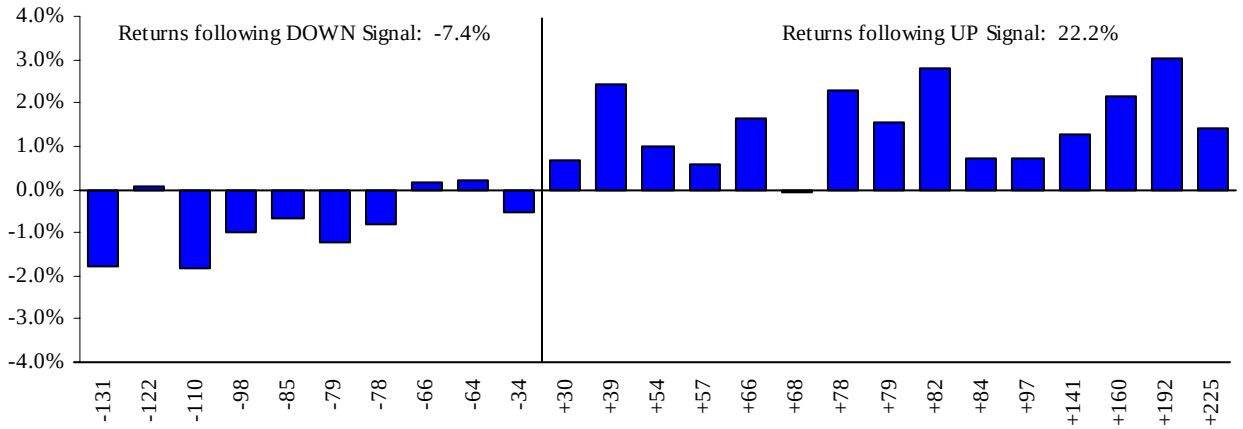
[4] While Nikkei 225 Index Futures data was preferred, the S&P 500 Index Futures were used in addition to the Nikkei 225 Index Futures because historical snap data for the Nikkei contract during the last fifteen hours prior to 12:00 GMT was unavailable for this study. Both futures contracts trade on GLOBEX.

addition.[5] Next, we examined the potential arbitrage returns present within Top100 from January 2003 to June 2005. We assumed a market timer completed a round-trip in this hypothetical fund the next day, and calculated the potential returns from trading only on holidays if the signal exceeds 25 basis points (bps). This simplified strategy allows us to better measure the predictability of the movements of Top100 the next day, and reduces the potential for variability in returns from holding the fund until another trading signal is exceeded. On consecutive holidays, we traded on the last holiday in the sequence.

Daily Dynamics of Top100

Chart 1 provides insight into the daily dynamics of Top100 by showing the daily movements from Japanese market holiday to the next day close following days when the trading signal changes by more than 25 bps. The results are clear: the movements of Top100 frequently follow the signal's direction (21 out of 25 times). The potential absolute arbitrage returns over the period are 29.6%, corresponding to an annualised risk-adjusted excess return of 7.1%. Moreover, the correlation between Top100 and our trading signal is 0.81, which indicates a strong statistical relationship. This shows predictability in price movements following periods of prolonged staleness.

Chart 1: Top100 Returns on Japan Holiday Trading, January 2003 - June 2005



Trading Signals in bps; Linear Combination of Nikkei 225 Index to Futures movements and S&P 500 Futures movements

Summary

Historical evidence has shown that NAVs calculated with stale prices allow the potential for market timing arbitrage. In this study, we examined arbitrage opportunities in European-domiciled funds holding Japanese equities by creating a portfolio from 100 funds with the highest correlation to the Nikkei 225 Index. We focused on the predictability of this portfolio during market holidays, which can cause prolonged periods of staleness in market prices. Our results support the proposition that order cut-off times do not entirely eliminate the potential for arbitrage profits, especially during market holidays.

[5] This method of equal-weighting the two movements to form the dynamic signal was chosen for simplicity, and implicitly assumes the beta of the Nikkei portion of the signal forecasting Top100 is equal to that of the beta of the S&P 500 portion of the signal forecasting Top100. Although the results should be very similar, a more precise approach would be to weight each portion of the signal by their respective betas with Top100, based on a 2-factor regression model.

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