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Index tracking in Australian equities

There has been growth in the passive investment management sector, and **ALEX FRINO**, **DAVID GALLAGHER** and **TEDDY OETOMO** provide some new evidence on its performance in terms of index tracking.

The growth in passive investment management has been significant over the last decade. Total assets benchmarked to the S&P 500 index exceed US\$1 trillion, and a similar experience of investors embracing indexing have been recorded across other Western countries, including the UK, Canada and Australia.

The substantial growth has, in part, arisen due to the global evidence that actively managed mutual funds (on average) underperform the market after costs.¹ The purpose of our study is to provide attention to the trading and index replication strategies of passively managed funds. We examine these issues employing a unique and high frequency dataset containing the portfolio holdings and transactions data of a sample of passive managers.

Accordingly, this research compares and contrasts the index tracking strategies of two types of passive funds: index and enhanced index equity funds. Index funds aim to deliver performance (and risk) that is in line with the underlying benchmark, whereas enhanced index funds implement a similar investment strategy that also relies on the use of limited (risk-controlled) active strategies that offer return enhancements relative to the benchmark.

Three dimensions of return enhancements that are typically implemented by enhanced index equity funds are considered in our analysis. Firstly, enhanced index funds purchase (sell) candidate stocks for index inclusions (exclusions) long before the effective date whereas index funds follow a more rigid rebalancing strategy. Secondly, enhanced index funds

employ a more patient trade execution strategy than index funds in order to minimise execution costs. Finally, enhanced index funds may allocate a small fraction of their portfolios to non-index stocks, while index fund portfolios should only be comprised of benchmark constituent securities.

A comparison of both the investment strategies and performance of index and enhanced index funds is important for a number of reasons. First, enhanced portfolios provide investors with potential strategies that have the opportunity of providing (small) excess returns to the market. Second, a study of enhanced index management enables researchers to consider the potential benefits of an index-oriented investment process which implements less rigid index replication strategies.² Third, the analysis presents the first empirical examination of passive funds' actual behaviour surrounding constituent changes in the benchmark.

SAMPLE

The sample consists of the daily holdings and trade data of five index funds and three enhanced index funds that are offered by five different institutional providers contained in the Portfolio Analytics Database between 1 January 1999 and 31 December 2001.³ The sample captures around 76.2 percent of the total size of Australian index equity fund assets, and comprises 19,645 trades by index funds and 14,993 trades by enhanced index funds.

Stock information is obtained from the Securities Industry Research Centre of Asia-Pacific (SIRCA). The sample captures two index regimes, pre- and post- to the index reconstruction – from the Australian All Ordinaries Index

ALEX FRINO PhD
Finance Discipline,
School of Business,
The University of
Sydney

DAVID R. GALLAGHER PhD
School of Banking
and Finance,
University of New
South Wales

TEDDY N. OETOMO
PhD candidate
Finance Discipline,
School of Business,
University of Sydney



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TABLE 1 PERFORMANCE COMPARISON BETWEEN INDEX AND ENHANCED INDEX FUNDS

	Index	Enhanced Index	Enhanced Index - Index
Panel A: Fund Descriptive Information			
Number of Funds	5	3	
Average Fund Size	1.30 bn	1.11 bn	
Panel B: Fund Performance			
Average Monthly Return	0.90%	0.97%	0.07% *
Average Monthly Excess Return	0.01%	0.09%	0.08% **
Alpha (per month)	0.01	0.03	
Beta	0.99	1.01	
Panel C: Tracking Error Measures			
Average Monthly Abs Tracking Error	0.05%	0.18%	0.13% *
Average Monthly SD Tracking Error	0.06%	0.21%	0.15% *

The difference between the Variance of absolute deviation from benchmark of index and enhanced index funds are tested using variance ratio. All other comparisons are performed based on the t-test. *, **, *** denote significant at 5, 1 and 0.1 percent levels of significance, respectively.

(AOI) to the Standard & Poor's (S&P) ASX indices.⁴

Table 1 compares the descriptive statistics of index and enhanced index funds. The results demonstrate that enhanced index funds' monthly returns are, on average, 7 basis points higher than those of the index funds and 9 basis points higher than the benchmark. Both the absolute difference (absolute tracking error) and the variability of the arithmetic difference (standard deviation

of tracking error) between funds' returns and benchmark's returns are lower for index than enhanced index funds.

TRADE TIMING DURING INDEX REVISIONS

The timing ability is identified by examining the funds' $\%Trade_{i,t}$ and $\%Cum_{i,t}$. $\%Trade_{i,t}$ denotes the ratio between the daily traded volume and net purchases (sales) on the revised stock during index revision periods. Index

revision period is defined as a 30-day window on either side of index revision date. $\%Cum_{i,t}$ denotes the cumulated $\%Trade_{i,t}$ throughout index revision periods.

Figure 1 demonstrates that enhanced index funds' trading activities during the index inclusion periods are spread out over a longer time interval. Enhanced funds significantly increased their trading activities from as early as $t = -15$. Index funds, however, commenced their trading activities at $t = -5$ and more than 50 percent of purchases are executed between $t = -1$ and $t = 0$. Figure 2 depicts that, with respect to index exclusions, index funds exhibit significant trading activities from $t = -7$, while enhanced index funds exhibit significant trading activities from $t = -15$.

TRADE EXECUTION STRATEGIES

Given that institutional orders are typically large, they are often broken up into smaller transactions in order to minimise execution costs. Hence, the methodology of Chan and Lakonishok (1995) is used. If a sequence of transactions are (1). executed by the same account, (2). in the same direction (e.g. buy trades), and (3). executed consecutively without a 5-day trading break, then they are considered part of the same order. The package

FIGURE 1 INDEX REVISIONS (INCLUSION)

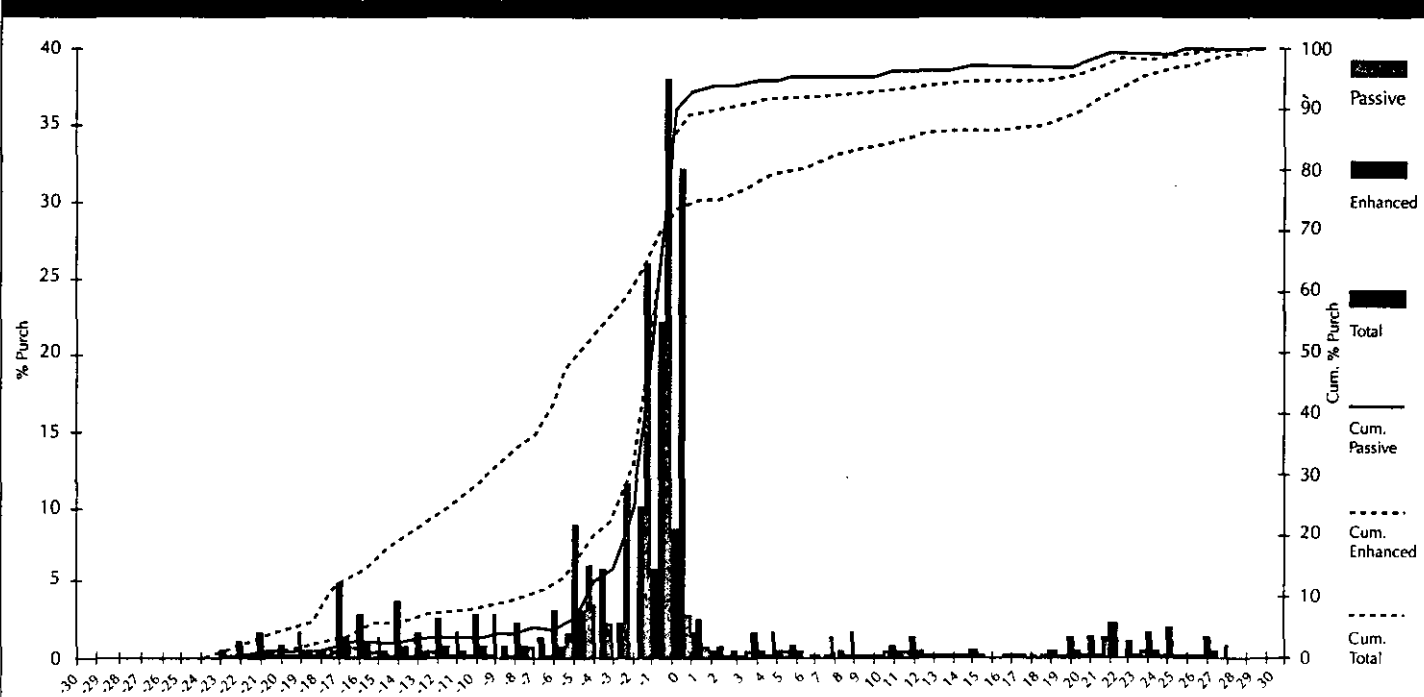
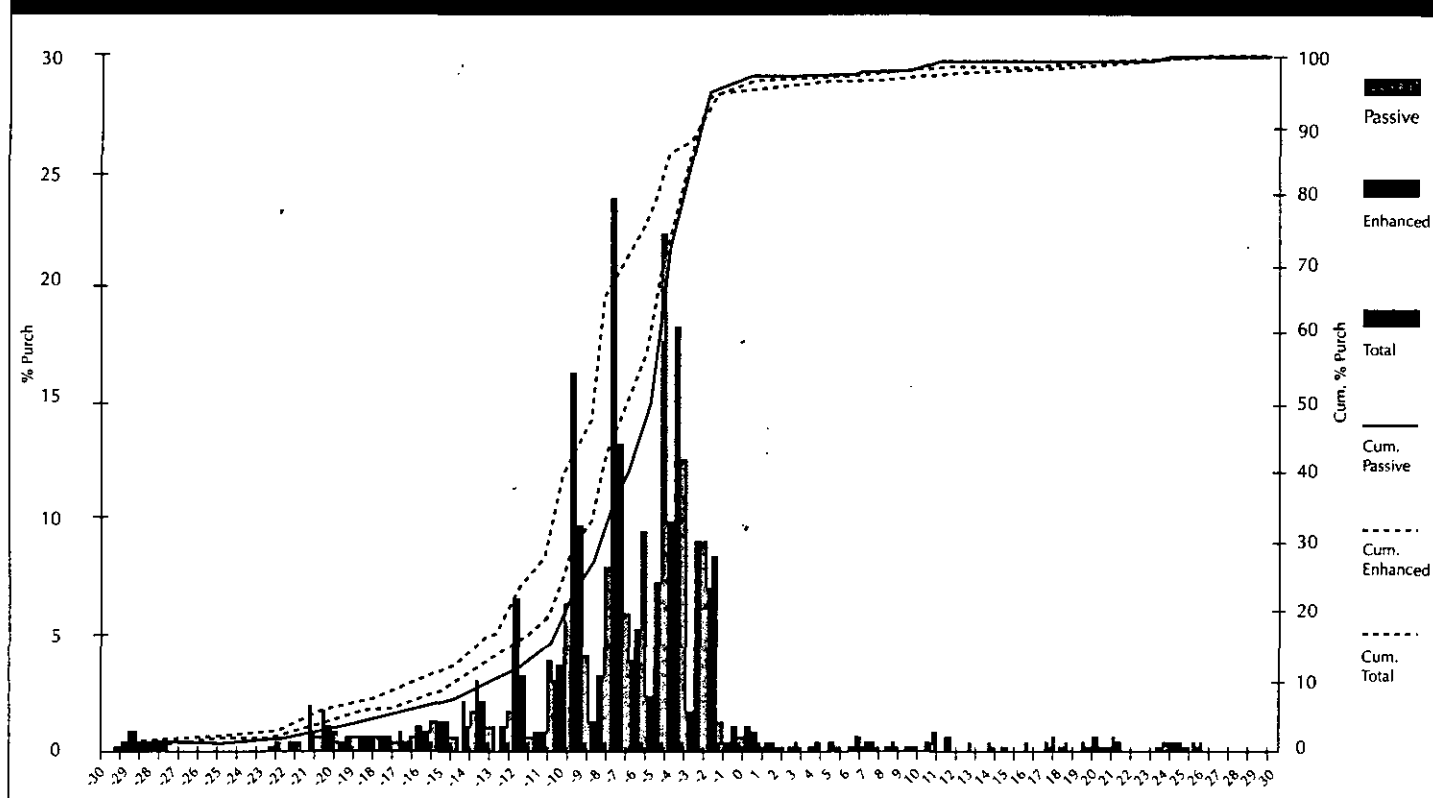


FIGURE 2 INDEX REVISIONS (EXCLUSION)



ends when (1) the direction of trade from an account changes (e.g. buy to sell), and (2) an account remains inactive for one trading day.

Figure 3 illustrates that index funds employ more aggressive trading strategies compared to enhanced index funds. Enhanced index funds are found to split their trade packages into smaller parcels and allow a longer time for completion of their trade packages in an attempt to minimise market impact costs. Enhanced index funds' trade packages comprised of 1.40 trades and were completed in 1.26 days whereas index funds' trade packages consisted of 1.35 trades and were completed within 1.14 days. This is

consistent with the more rigid investment strategy followed by index funds which require these funds to undertake a timelier rebalancing.

A greater degree of trading difficulty is documented during index revision periods. Trade packages executed by both fund types during index revision periods exhibit a higher number of trades per package, a smaller dollar value per trade and longer completion time. However, enhanced index funds' trades are still executed more patiently than index funds trades during index revision periods.

Three measures of execution costs are used in this article. First, the temporary measure represents the return between

the traded price and the closing price on the day the package ends. Second, the permanent measure, which denotes the return between the opening price on the day the package starts and the closing price on the day the package ends. Third, the total measure represents the added sum of the temporary and permanent measure. The temporary and permanent measures captures the liquidity and adverse selection costs components of execution costs, whereas total measure aggregates the temporary and permanent component of execution costs. All three measures are reported in cost terms and thus are multiplied by 1 for buy packages and -1 for sell packages.

FIGURE 3 EXECUTION STRATEGIES OF INDEX AND ENHANCED INDEX FUNDS

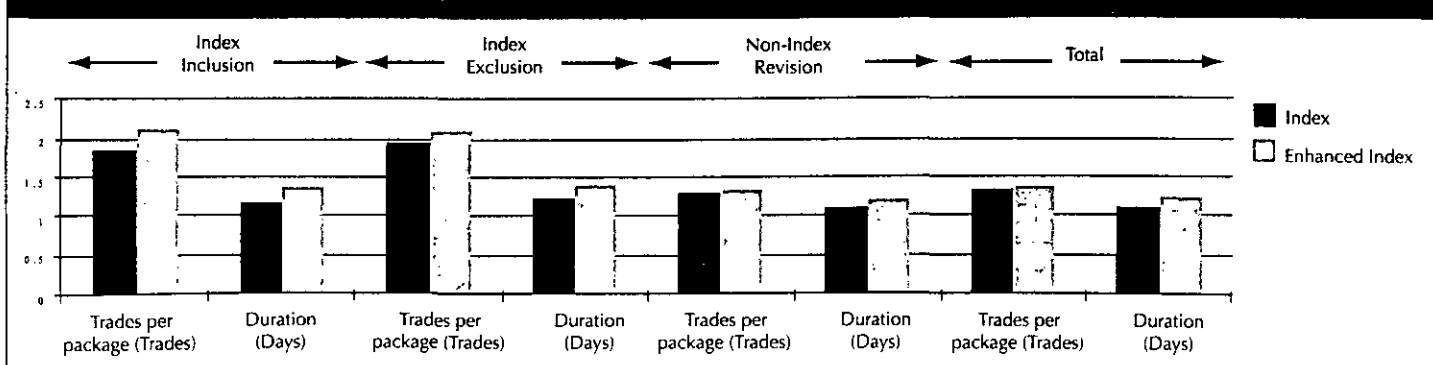
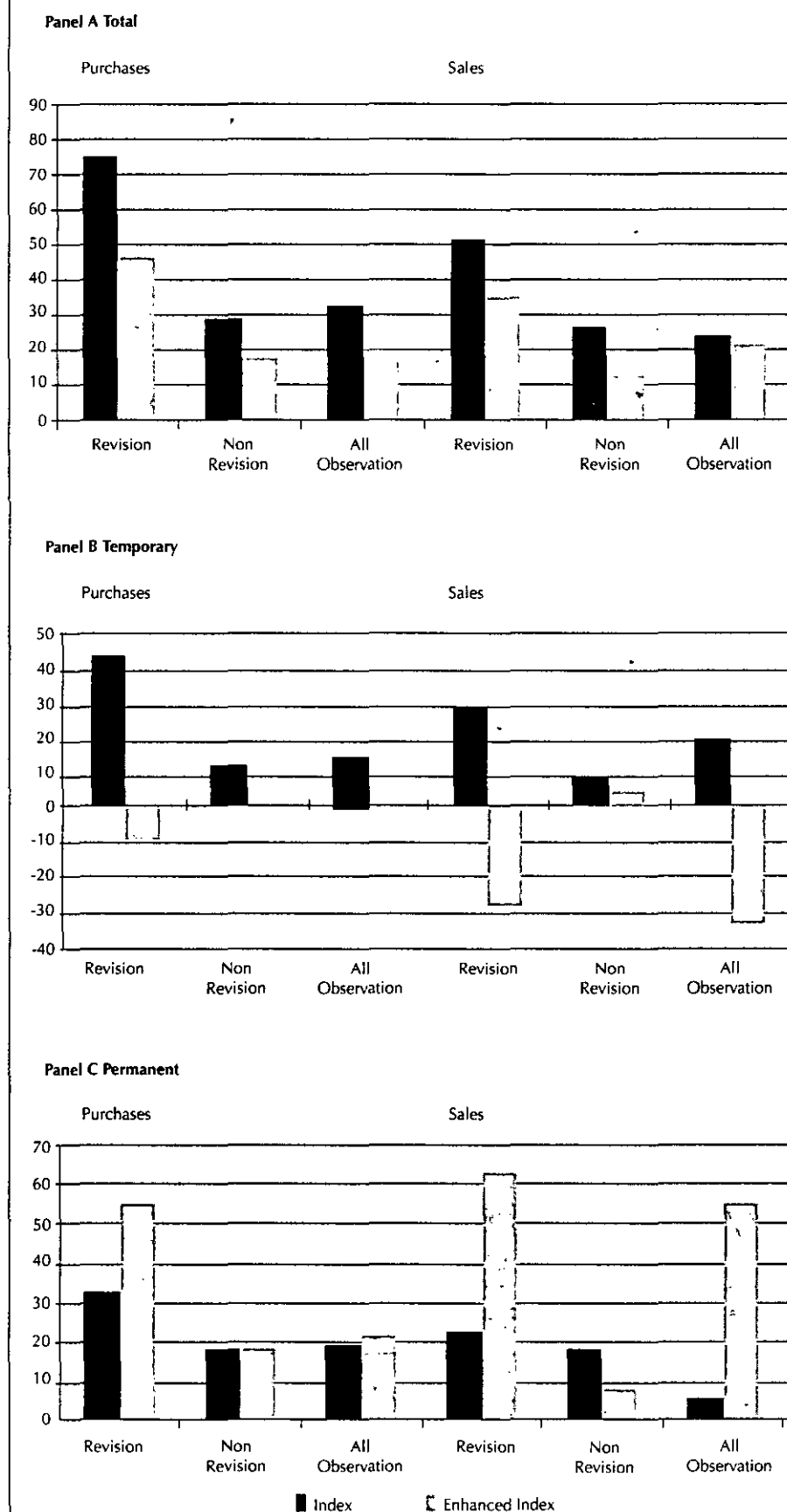


FIGURE 4 EXECUTION COSTS



Consistent with the more patient trading strategies employed by enhanced index funds, these funds are found to incur lower execution costs than index funds in both index revision and non-index revision periods. Figure 4 demonstrates that the total and liquidity costs incurred by enhanced index funds are lower than those incurred by index funds. Reflecting the higher difficulty associated with trading stocks that are involved in index revisions, the results presented in Figure 4 demonstrate that trade packages executed during such periods incur higher transaction costs.

PERFORMANCE COMPARISON DURING INDEX REVISION PERIODS

The performance of index and enhanced index funds during index revision periods are assessed based on the realised, unrealised and total gains generated during index revision periods. All three measures are deflated by the total amount purchased (sold) on the revised stock during the index inclusion (exclusion) period.

Figure 5 demonstrates that, during index revision periods, enhanced index funds generate higher returns than index funds. The total, unrealised, and realised gains of index funds during index inclusion periods are insignificantly different from zero. During index inclusion periods, enhanced index funds generated significant and positive realised gains. The realised and total gains generated by enhanced index funds are significantly higher than those of the index funds.

The early rebalancing activities of the enhanced index funds are formulated not only to avoid excess trading costs but also to ride the temporary returns associated with this type of stock adjustment during index inclusion periods. During index exclusion periods, however, both types of funds generate significant unrealised and total losses. However, the enhanced funds' losses are significantly lower than those of index funds.

PORTFOLIO CONSTRUCTION

Figure 6 depicts the composition of the portfolios held by index and enhanced index funds. More than 98 percent of index and enhanced index funds are

invested in equity markets. Index funds allocate 1.12 percent of their portfolio to futures contracts, while enhanced index funds hold more than 1.43 percent of their portfolios in SPI futures. Only 0.01 percent of the index funds' portfolio is

comprised of warrants, stock options, convertible notes and other security types, while enhanced index funds allocate only 0.04 percent of their portfolios to non-equity and non-futures instruments. While index funds' equity

holdings comprise of only stocks that are included in the constituents of the benchmark, 0.6 percent of enhanced index funds' equity holding is invested in stocks that are included in the constituents of the benchmark.

In order to further analyse and compare the portfolio construction strategy of index and enhanced index funds, the methodology of Chen, Jegadeesh and Wermers (2000) is used. Stocks are ranked based on their liquidity, size, book-to-market and momentum. Liquidity and size are defined as the ratio between the average numbers of shares traded relative to the total number of shares outstanding and market capitalisation at the last quarter. Book-to-market and momentum represent the ratio between assets and market capitalisation as at the previous quarter and the buy-and-hold returns for the prior 12 months. Each stock is ranked on the four characteristics separately relative to all stocks in the benchmark with a rank score above (below) 50 indicating a tilt toward (away from) a particular characteristic. Stocks outside the constituents of the benchmark are ranked against the population of stocks on the ASX that are not part of the benchmark. Figure 7 demonstrates that both index and enhanced index funds overweight stocks with higher liquidity, market capitalisation and past performance and significantly underweight stocks with lower book-to-market ratio.

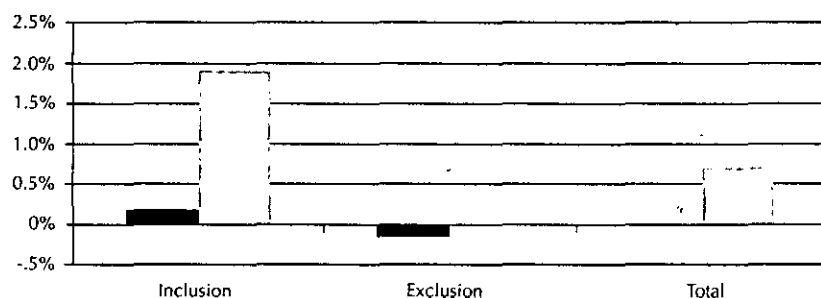
These findings highlight a higher preference towards more liquid, larger and growth-oriented stocks and with higher past returns by index funds. Consistent characteristics are also documented for enhanced index funds holding of stocks that are outside the benchmark.

While the amount invested in stocks outside index constituent is minimal, Table 2 demonstrates that the decision to have such exposures generates significant excess returns for enhanced index funds.

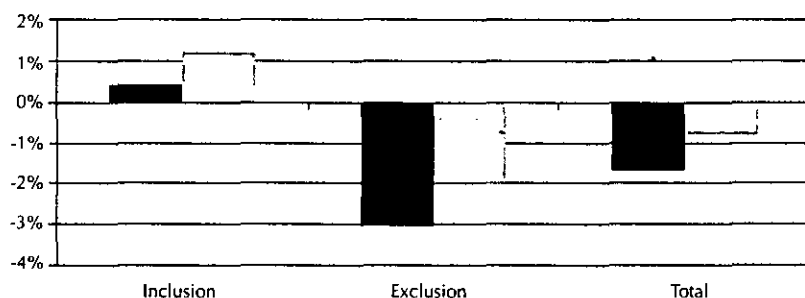
The average daily return of enhanced funds holding of stocks outside the benchmark is 0.13 percent. Fund managers' aversion when trading stocks outside the benchmark's constituents is analysed based on their PGR and PLR

FIGURE 5 RETURNS GENERATED

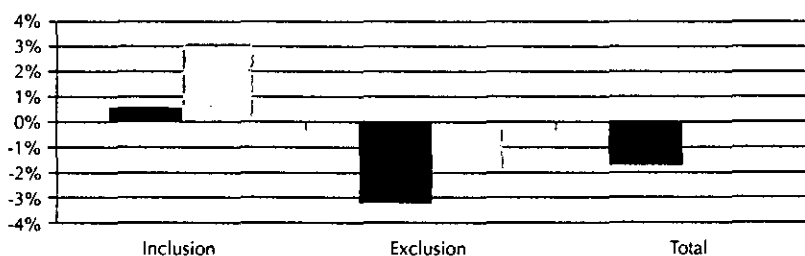
Panel A: Relative Realised Gain



Panel B: Relative Unrealised Gain



Panel C: Relative Total Gain



■ Index □ Enhanced Index

TABLE 2 RETURNS OF NON-INDEX HOLDINGS

Average Daily Return of Non-Index Holdings	0.13
Proportion of Gains Realised	2.5
Proportion of Losses Realised	4.5
PGR - PRL	2

metrics.⁵ PGR denotes the ratio between the funds' realised gains and the sum of the realised and unrealised gains generated from the stock.

PLR represents the ratio between the realised losses and the sum of realised losses and unrealised losses generated

by the funds from the stock. The reported results document that the mean value of PGR (2.5 percent) is significantly lower than the PLR (4.5 percent). This result shows that, with regard to stocks outside the benchmark constituents, enhanced index funds are

more likely to ride their winners and to sell their losers.

CONCLUSION

The findings of this study demonstrate that enhanced index equity funds undertake trading in stocks associated with index revisions by purchasing (selling) stocks that are subjected to index inclusion (exclusion) earlier than index funds. In addition, enhanced index funds tend to employ a less aggressive execution strategy, which translates into lower execution costs for these funds vis-à-vis index funds. Consequently, enhanced index equity funds are found to generate both higher unrealised and realised gains during index revision periods than index funds.

With respect to portfolio configuration, both index and enhanced index equity funds overweight stocks that exhibit higher liquidity, larger market capitalisation and higher past returns.

While index funds hold only stocks that are included in the benchmark, enhanced index funds also invest a small proportion of their portfolio in non-index holdings. Where this arises, these stocks typically exhibit larger size, lower book-to-market value, and higher past performance than the population of stocks outside the benchmark, and accordingly generate significant returns. Enhanced index fund trading strategies for non-benchmark constituents are also consistent with rational behaviour theory, where managers sell "loser" stocks early and ride "winner" stocks.

Notes

1 Researchers documenting the inability of active funds to outperform the market include Sharpe (1966), Jensen (1968), and Gruber (1996).

2 Rigid indexing strategy has previously been criticised by Keim (1999) and Blume and Edelen (2002).

3 Due to a strict confidentiality agreement, the identity of the funds is kept anonymous. The funds are classified based on managers' self-stated classification.

4 All results are robust for both regimes.

5 Odean (1998).

FIGURE 6 PORTFOLIO COMPOSITION

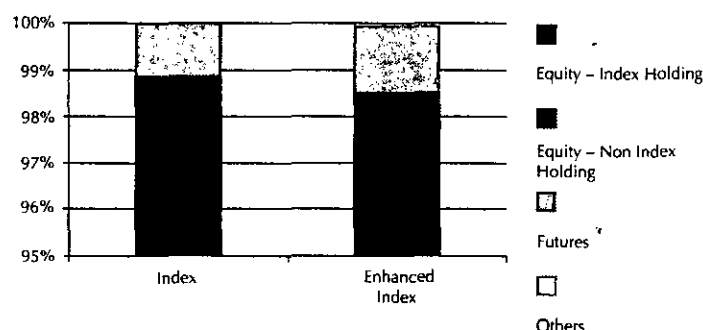
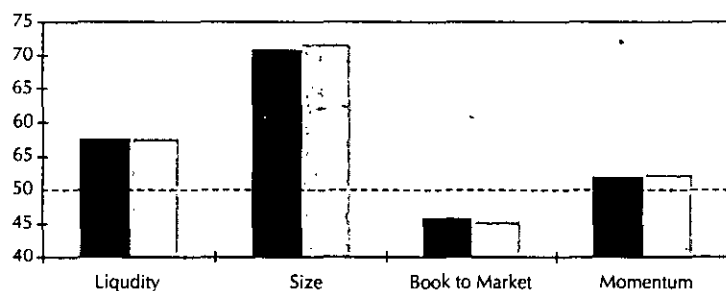
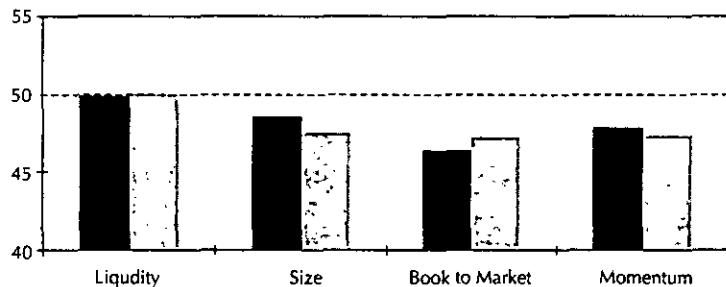


FIGURE 7 PORTFOLIO CONFIGURATION

Panel A: Overweight Stocks



Panel B: Underweighted Stocks



Panel C: Non-Index Holding

