

The Index Tracking Strategies of Passive and Enhanced Index Equity Funds[†]

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ABSTRACT

We document that passive funds benefit from employing less rigid rebalancing and investment strategies. During index revision periods, enhanced index funds commence portfolio rebalancing earlier than index funds, and employ more patient trading strategies. This activity translates into higher returns and lower trading costs for enhanced index funds. In cases where passive funds do not perfectly mimic the benchmark, passive funds exhibit a greater propensity to overweight stocks with higher liquidity, larger market capitalization and higher past performance. For non-index portfolio holdings, enhanced funds exhibit a higher propensity to ride 'winners' and sell 'losers'.

JEL classification: G23

Keywords: Passive funds; Enhanced index funds; Tracking Error; Index funds; Portfolio configuration; Index revisions; Trading strategies.

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We document that passive funds benefit from employing less rigid rebalancing and investment strategies. During index revision periods, enhanced index funds commence portfolio rebalancing earlier than index funds, and employ more patient trading strategies. This activity translates into higher returns and lower trading costs for enhanced index funds. In cases where passive funds do not perfectly mimic the benchmark, passive funds exhibit a greater propensity to overweight stocks with higher liquidity, larger market capitalization and higher past performance. For non-index portfolio holdings, enhanced funds exhibit a higher propensity to ride 'winners' and sell 'losers'.

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The growth in passive or index 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 exponential growth rates have been recorded across other Western countries, including the U.K., Canada and Australia. This substantial growth has in part arisen due to actively managed mutual funds (on average) underperforming the market after costs.¹

Despite the rapid growth in index funds, there has been limited research examining the actual rebalancing and portfolio configuration strategies employed by indexers. This limited research is perplexing for two reasons. First, Blume and Edelen (2002) identify that index managers would benefit from undertaking more flexible replication strategies in periods surrounding index revisions. Similarly, Keim (1999) demonstrate that by not following a pure index strategy, the small-cap '9-10' passive fund managed by Dimensional Fund Advisors achieved a 2.2 percent premium per annum in returns without incurring excessive tracking error. Second, Elton, Gruber and Busse (2004) find significant variation in fees and returns of S&P 500 index mutual funds. This finding contrasts the conventional belief that index funds are a homogenous commodity which holds identical portfolios (assuming full replication). Consequently, it is critical that investors understand the operations of index funds as they are all expected to be important determinants of how index funds meet their investment objectives.²

This study examines the rebalancing and investment strategies of passive funds by identifying and comparing the performance of index and enhanced index funds. The primary objective of index fund is to deliver performance that is in line with their risk-return objective at low cost, with enhanced tax efficiency (relative to active funds) and wide diversification benefits. An alternative investment product to index funds which exhibits very similar features is enhanced index funds. Enhanced index funds execute investment strategies that are essentially index-oriented. However, the enhanced index manager is permitted to engage in limited (risk-controlled) active strategies that offer return enhancements relative to the benchmark return.³ Comparison of the strategies and performance of index and enhanced index funds provides insights into the benefits for index funds to employ less rigid strategies.

The findings of this study demonstrate that index funds can benefit from higher returns and lower trading costs by rebalancing their portfolios during index revision well prior to the effective date of an index change. Following a rigid strategy, index funds are documented to rebalance a large portion of their portfolios on the effective date of the index revision using aggressive orders. While this strategy attempts to minimize fund tracking error, the excess demand/supply pressures associated with index revisions represents an index fund manager's trade-off decision between incurring higher trading costs and minimizing the fund's tracking error. Relative to index funds, the rebalancing activities of enhanced index funds during index revision periods are more dispersed, and their trades are executed more patiently. Subsequently, during index revision periods, relative to index funds, enhanced index funds generate higher returns and lower trading costs.

Our study provides specific attention to index revisions periods due to the nature of an indexing strategy being a buy-and-hold approach, hence index funds will only require trading when an exogenous shock arises – either due to an index reconstitution or due to fund liquidity. Our paper is specifically concerned with index changes as these events are common to passive funds that track the same benchmark. Interestingly, a direct examination of index funds' actual behavior surrounding constituent changes remains an important gap in the literature. In addition, our study of index changes is also important in that a large number of studies have documented significant abnormal returns during index revisions.⁴ These abnormal returns reflect the presence of excess demand/supply pressure during index revisions, which in turn further complicate the portfolio rebalancing tasks of index managers. Therefore, focusing on the rebalancing strategies of index funds during index revision periods enables a direct examination of the issue when it matters most to passive fund managers. Despite the cost differential between index and enhanced index portfolios, both fund types experience significantly higher transaction costs during index revision periods. The higher cost of trading persists even after these funds employ more patient trading strategies.

The study also investigates the investment strategies adopted by index and enhanced index funds as they attempt to mimic the returns and risk of the underlying benchmark. Blake, Lehmann, and

Timmerman (1999) demonstrate that asset allocation for multiple asset class portfolios is an important determinant of the total return achieve by portfolio managers. Wermers (2000) finds evidence that a mutual fund managers' stock picking talent is a significant determinant of a fund's overall performance. Portfolio configuration, which defines the composition of the fund's portfolio with reference to the stocks held, is therefore a critical element explaining fund performance and tracking error (Keim, 1999). This research analyses the portfolio configurations of index and enhanced index equity funds using the methodology of Chen, Jegadeesh and Wermers (2000) to quantify the characteristics of stocks held, and for which characteristics are over- and under- weighted.

This article demonstrates that the passive funds are more likely to overweight stocks with higher liquidity, larger market capitalization, and higher past performance (or price momentum). Consistent with Jegadeesh and Titman (2001, 2002), the findings indicate that enhanced index fund managers are reliant on momentum trading. The converse is also the case for stocks that are underweighted relative to the index.⁵ Decomposing the equity portfolio holdings of enhanced index funds, this study finds that enhanced managers indeed hold securities that are not constituents of the benchmark index. For the non-index holdings of enhanced index managers, these portfolios exhibit a strong propensity to hold stocks with higher liquidity, larger market capitalization and higher past returns. In addition, this article reports evidence that enhanced index funds adopt trading behavior which is inconsistent with Odean's (1998) disposition hypothesis. That is, enhanced index funds are found to exhibit a higher propensity to ride 'winner' stocks and to liquidate 'loser' securities.

The remainder of the paper proceeds as follows. Section I describes the sample of index and enhanced index funds employed in the study. Section II outlines the methodology while Section III reports the results documented in this study. The final section concludes the paper.

I. DATA

This study examines the daily holdings and trades of 5 index funds and 3 enhanced index funds that are offered by 5 different institutional providers contained in the *Portfolio Analytics Database*.⁶ Our sample is highly representative of the index management industry, whereby the sample of index managers account for 76.2 percent of the total size of Australian index fund assets. Mercer Investment Consulting data indicates that our sample includes 5 of the 7 index fund providers, and 3 of the 5 enhanced index fund managers in Australia.⁷ In order to ensure representativity, this paper examines the time period when all 8 funds are continuously in operation – which is the three-year period 2 January 1999 to 31 December 2001. The data consists of 34,638 daily institutional trades, where 19,645 trades are executed by index funds and 14,993 trades by enhanced index funds. Trade, quote and stock information are obtained from the ASX Stock Exchange Automated Trading System (SEATS) provided by the Securities Industry Research Centre of Asia-Pacific (SIRCA).

The sample examined in this study captures two different index regimes, and the periods for each regime are referred to as pre- and post- index reconstruction. On 3 April 2000, Australian Stock Exchange (ASX) restructured its primary index, namely the Australian All Ordinaries Index (AOI). This occurred through the sale of their index services business to Standard and Poor's (S&P). The original AOI, which had been operating as Australian's primary stock index for two decades, was originally created as a way of measuring general market movements rather than to measure portfolio performance. Subsequently, S&P reconstituted the AOI and introduced a series of new indices for the Australian equities market.⁸ In this study, the term index reconstruction denotes the change from the ASX/AOI regime to the S&P/ASX regime. All the funds examined in this study are benchmarked against the AOI index prior to the index reconstruction. Following the index reconstruction, 3 funds are benchmarked to the S&P/ASX 200 and 5 funds are benchmarked against the S&P/ASX 300.

While it is recognized that the voluntary data collection procedure employed in this study may expose the sample to the standard problem of survivorship-bias, the impact of such bias is limited for three reasons.⁹ First, the limited evaluation period employed in this study reduces the opportunity for funds to drop out of the sample. Indeed, Carhart, Carpenter, Lynch and Musto (2002) demonstrate that

the extent of survivorship bias in mutual fund studies increases with the length of the sample period. Second, the passive strategy employed by the funds in our sample also reduces the probability of failure. Elton, Gruber and Blake (1996) argue that the impact of survivorship bias is more pronounced when examining mutual funds that exhibit higher risk. Finally, examining the historical returns data of Mercer Investment Consulting, which reports the performance of all available institutionally offered index and enhanced index equity funds, shows that no funds experienced termination during the period examined.

Table 1 reports descriptive statistics of the index and enhanced index funds examined in this study. The results reported in Table 1 demonstrate that the monthly returns of enhanced index funds are, on average, 7 basis points higher than those of the index funds. Enhanced index funds are also documented to outperform the benchmark by 9 basis points on a monthly basis, whereas index funds only achieve a monthly excess return of 1 basis point. Table 1 (Panel C) reports the average tracking error of index and enhanced index funds. Two measures of tracking error are employed – Absolute Tracking Error and Standard Deviation of Tracking Error. Absolute Tracking Error measures the absolute difference in returns between the index and enhanced index portfolios and benchmark index. Standard Deviation of Tracking Error measures the variability (standard deviation) of the arithmetic difference in returns between the index portfolio and the underlying benchmark. Enhanced funds' excess returns exhibit higher tracking error variation, witnessed by the higher standard deviations for the funds' excess returns.

<INSERT TABLE 1 ABOUT HERE>

II. METHODOLOGY

A. Portfolio Rebalancing Strategy

This section outlines the methodology used to identify and assess the performance of the portfolio rebalancing strategy employed by index and enhanced index funds. Identification of the portfolio rebalancing strategy is examined according to the timing and trading strategy implemented by index managers. The performance of these funds during index revision periods is assessed based on the returns generated and the trading costs incurred by trades on stocks that are entering and leaving the benchmark during index revision periods. The differences in fund strategy and performance generated by index and enhanced index funds during index revision periods are compared in order to examine the benefits between funds that implement portfolio changes with different degrees of rigidity.

The timing ability of index and enhanced index funds are identified by examining the funds' relative daily trading, $\%Trade_{i,t}$, and accumulated relative holding, $\%Cum$, during an index revision period.

$$\%Trade_{i,t} = \frac{TradeVolume_{i,t}}{HoldingVolume_{i,t=30}} * 100\% \quad (1)$$

$$\%Cum_{i,t} = \sum_{t=30}^{30} \frac{TradeVolume_{i,t}}{HoldingVolume_{i,t=30}} * 100\% \quad (2)$$

The index revision period is defined as the 30 trading day window on each side of the index revision date, representing 60 trading day period. The choice of a 60 trading day window is determined by the insignificant excess returns experienced by Australian stocks that are involved in index revision beyond $t = -30$ and $t = 30$, given the evidence presented by Chan and Howard (2002).¹⁰ For index inclusion (exclusion), the accumulated purchases (sales) throughout the index revision periods, $HoldingVolume_{i,t=30}$, are utilized as the benchmark. This benchmark is assumed to be the quantity that the funds desire to hold (release) for the stock that is entering (leaving) the underlying index. In order to avoid potential bias caused by the index reconstruction event, any index revisions that take place within 5 trading days pre-and-post the index reconstruction date are excluded from the sample.

In order to examine the trading strategy of index and enhanced index funds during index revision periods, the funds' daily trades are packaged based on the 5-day trade packaging methodology of Chan and Lakonishok (1995). Given that institutional orders are, on average, large orders, brokers

would typically break the orders into a series of smaller trades.¹¹ Consequently, Chan and Lakonishok (1995) argue that resorting to an individual institutional trade as the basic unit for analysing the price impact of institutional trading is misleading. Unfortunately, our dataset does not identify whether a trade is part of a larger order.¹² Therefore, the trade packaging methodology of Chan and Lakonishok (1995) is employed in order to proxy for the entire sequence of trades. A buy (sell) package is constructed by including the portfolio's successive purchases (sales) of the stock via the same broker. Trade packages are constructed based on trades that are executed by the same broker, as institutional investors would be reluctant to submit their orders to multiple brokers as such a strategy could result in competition among brokers, which translates to a higher overall execution cost incurred by the institutional investor.¹³ The package ends when the portfolio stays out of the market for the stock for 5 consecutive days.¹⁴ The trading strategy of index and enhanced index managers are characterised based on three different factors, the average value of shares traded in each package, the average number of trades per trade package and the average number of days required to complete each package. All three factors measure the aggressiveness of the trading strategy implemented.

The performance of index and enhanced index funds are assessed using the returns generated and the trading costs incurred by the trades executed during index revision periods. An approach similar to Odean (1998) is employed in order to compute the returns generated by index and enhanced index funds during index revision periods.

$$RelativeRealisedGain = \frac{\sum_{t=-30}^{t=30} RealisedGains_t}{TotalHoldingValue_{t=30}} \quad (3)$$

$$RelativeUnrealisedGain = \frac{\sum_{t=-30}^{t=30} UnrealisedGains_t}{TotalHoldingValue_{t=30}} \quad (4)$$

$$RelativeTotalGain = \frac{\sum_{t=-30}^{t=30} [RealisedGains_t + UnrealisedGains_t]}{TotalHoldingValue_{t=30}} \quad (5)$$

For index inclusion (exclusion), $TotalHoldingValue_{t=30}$ represents the total amount purchased (sold) during the index revision period. For index inclusions (exclusions), *Realised Gains* denote the product between the amount sold (purchased) and the difference between the price at which the stock is sold (purchased) at day t and the average price of all purchases (sales) on the stock between the beginning of index revision period and day t . For index inclusion (exclusion), *Unrealised Gains* denote the product between the net purchases (sales) and difference between the price of the stock at day t and the average purchase (sale) price of the stock that is still held by the fund. The funds' gains and losses are not computed separately as in Odean (1998), but rather the funds' returns which take a positive value for gains and a negative value for losses are used.

The cost of trading incurred by index and enhanced index funds are computed based on three different measures, *Open to Trade*, *Trade to Close* and *Open to Close*. These measures are similar to those of Chan and Lakonishok (1993). *Open to Trade* measures the total price impact cost. *Trade to Close* measures the temporary price impact cost while *Open to Close* measures the permanent price impact cost.

$$Open\ to\ Trade = \theta \frac{(Price - Open)}{Open} \quad (6)$$

$$Trade\ to\ Close = \theta \frac{(Price - Close)}{Close} \quad (7)$$

$$Open\ to\ Close = \theta \frac{(Close - Open)}{Open} \quad (8)$$

θ denotes a dummy variable that takes the value of 1 for purchase packages and -1 for sale packages. *Price* is defined as the volume weighted average gross unit price of all the trades in the package. *Open* denote the midpoint of the opening quote at the start of the trade package whereas *Close* denote the midpoint of the closing quotes on the end of the trade package.

A regression analysis is also performed to compare the trading costs of index and enhanced index funds. The joint test analysis controls for various factors that could give rise to variations in trading costs.

$$\begin{aligned}
\text{Execution Costs} = & \alpha_0 + \alpha_1 Rm + \alpha_3 BAS + \alpha_4 \ln(\text{Complexity}) + \alpha_5 \ln(\text{MarketCap}) + \alpha_6 DEnhanced \\
& + \alpha_7 DRevision + \sum_{k=2}^{45} \text{Broker Effects}_k + \sum_{l=2}^{24} \text{Industry}_l
\end{aligned} \tag{9}$$

Execution Costs represent one of the three measures of trading costs, *Open to Trade*, *Trade to Close* and *Open to Close*. *Rm* represents market returns. The SFE SPI 200 (Sydney Futures Exchange Share Price Index), which represents the futures index of the S&P/ASX 200, is utilised as the measure of market return.¹⁵ *BAS* denotes the time-weighted relative bid-ask spread while *Complexity* measures the trade difficulty which is calculated as the ratio between the size of the trade package and the average daily trading volume of the stock 20 days prior to the start of the package. *MarketCap* denotes the market capitalisation of the traded stock. *DEnhanced* is a dummy variable that takes the value of 1 if the trade package is originated from enhanced index funds and 0 otherwise. *DRevision* is a dummy variable that takes the value of 1 if the trade is executed during index revision period and 0 otherwise. *BrokerEffects* and *Industry* is a set of dummy variables which represents broker and industry identification.

B. Investment Strategy

This section outlines the methodology employed to investigate the investment strategies of index and enhanced index funds. The investment strategy of these funds is identified by examining the variation between the composition of the portfolio and the benchmark index, *Abs Deviation from Benchmark*.

$$\text{Abs Deviation from Benchmark} = \frac{\text{HoldingValue}_{i,t} - \text{RequiredHoldingValue}_{i,t}}{\text{FundSize}_t} * 100\% \tag{10}$$

HoldingValue_{i,t} and *RequiredHoldingValue_{i,t}* denote the dollar value held by the portfolio on stock *i* at time *t* and the sumproduct between the weight of stock *i* on the constituent of the benchmark and the total market value of the fund, *FundSize_t*, at time *t*. In theory, index funds that execute a full replication strategy should exhibit zero *Abs Deviation from Benchmark* and the constituents of their portfolios

should be identical to that of the target benchmark. In addition, the constituents of the portfolio are compared against the constituents of the benchmark in order to examine whether the funds hold stocks that are outside the benchmark.

For funds that do not employ perfect replication strategy, the characteristics of the stocks that are over-or-underweighted are analyzed using the methodology of Chen, Jegadeesh, and Wermers (2000). The stocks held in both index and enhanced index funds' portfolios are examined based on their liquidity, size, book-to-market and momentum. The measure for liquidity is defined as the ratio between the average numbers of shares traded at the last quarter relative to the total number of shares outstanding for the stock in the last quarter. Stock size is measured as the market capitalization of the stock in the last quarter. A stock's book-to-market value is calculated as the book value of the company's assets relative to the stock's market capitalization as at the previous quarter. Finally, momentum is proxied as the buy-and-hold returns of the stock for the prior 12 months using the methodology of Chen, Jegadeesh and Wermers (2000).¹⁶ Consistent with Chen, Jegadeesh and Wermers (2000), each of the stocks are ranked based on the four characteristics separately. The ranking represents the stock's percentile rank relative to all stocks that are included in the benchmark index. By construction, the median rank score for all stocks in the benchmark index is 50 and rank score above (below) 50 indicates a tilt toward (away from) a particular characteristic.

For funds that hold stocks outside the benchmark, the characteristics of these *Non-Index Holding* stocks are examined using the methodology of Chen, Jegadeesh and Wermers (2000).¹⁷ *Non-Index Holding* stocks are generally smaller, less liquid and 'younger' stocks relative to those that are included in the benchmark. Consequently, ranking these stocks against the stock population of the benchmark would produce a biased result. Therefore, the *Non-Index Holding* is ranked against all stocks that are not included in the benchmark, but are listed on the ASX. In order to test the degree of fund managers' aversion when trading *Non-Index Holding* stocks, the methodology of Odean (1998) is employed.

$$PGR = \frac{RealisedGains}{RealisedGains + UnrealisedGains} \quad (11)$$

$$PLR = \frac{RealisedLosses}{RealisedLosses + UnrealisedLosses} \quad (12)$$

The Proportion of Gains Realised (PGR) is then compared to the Proportion of Losses Realised (PLR) in order to identify whether the fund managers exhibit tendency to hold losers too long and sell winners too soon.

III. RESULTS

A. Portfolio Rebalancing Strategy

This section presents the empirical evidence on index and enhanced index funds' rebalancing strategies during index revisions, using the funds' daily trading data. Table 2 demonstrates that relative to enhanced fund managers, index funds execute more rigid portfolio rebalancing strategies during index revision periods. A large portion of index funds' rebalancing are performed around the index revision date. For index inclusions, index funds commenced their trading activities at $t = -5$ and more than 50 percent of purchases are executed between $t = -1$ and $t = 0$. This is consistent with the investment mandates of index funds to mimic the returns and risk of the benchmark. On the other hand, 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 $t = -15$. In addition, significant trading activities are documented for both types of funds on $t = +22$ indicating that some funds execute their purchases well after the event date to avoid excessive trading costs that are otherwise due to the temporary price pressure associated with index inclusion.

With respect to index exclusions, index funds exhibit significant trading activities from $t = -7$, while enhanced index funds exhibit significant trading activities from $t = -15$. The trading activities during index exclusion after $t = 0$ however, are minimal. Considering that index exclusion covers corporate events such as bankruptcies and takeovers, this finding is anticipated as these stocks are de-

listed after $t = 0$, and therefore, it is no longer possible to trade these stocks. For robustness tests, the analyses are separated into two different regimes, pre- and post- index reconstruction periods. The results documented for both regimes are consistent.¹⁸ In addition, for the largest 5 percent index revisions, significant trades are documented only on the effective dates. This is anticipated as stocks from this category are those that are associated with Initial Public Offerings (IPOs), spin-offs, demutualisations, bankruptcies, mergers or takeovers. Therefore, institutional investors would be expected to have completed a large portion of their trading activities on these large stocks prior to the event date than on the effective date for index revisions.¹⁹

<INSERT TABLE 2 ABOUT HERE>

The results reported in Table 3 demonstrate that index funds employ more aggressive trading strategies compared to enhanced index funds.²⁰ The results reported in Table 3 reveal that enhanced index funds split their trade packages into smaller parcels and allow a longer time for completion of their trade packages in an attempt to minimize market impact costs. On average, enhanced index funds' trade packages consist of 1.40 trades while index funds' trade packages only consist of 1.35 trades. Our results also show that enhanced index funds' trades are also completed with a high degree of patience, with an average completion rate of 1.26 days relative to 1.14 days exhibited by index funds' trade packages. This finding is lower than that reported by Keim and Madhavan (1997), who find average completion rates of 1.80 days and 1.65 days for purchases and sales, respectively. The lower time required for completion reflects the absence of information in index and enhanced index funds trades, and therefore a lower level of trade difficulty. The higher time required by enhanced index funds to complete their trades relative to the index funds is caused by the higher tolerance for tracking error allowed by enhanced index funds. These results, however, might be biased if enhanced funds exhibit a higher likelihood of trading smaller stocks (which themselves exhibit lower liquidity and higher trade difficulty). However, the findings reported in Table 3 contradict this hypothesis.

There is no variation in the average market capitalization of stocks traded by index and enhanced index funds.

The results reported in Table 3 also indicate a greater degree of trading difficulty during index revision periods. The higher trading difficulty is primarily instigated by the higher demand for these stocks during periods surrounding an index reconstitution as passive funds purchase (sell) stocks that are entering (leaving) the benchmark. Trade packages executed by both index and enhanced index funds during index revision periods exhibit a higher number of trades per package, a smaller dollar value per trade, and longer completion time. The results are also consistent when index revision periods are partitioned according to inclusions and exclusions.

<INSERT TABLE 3 ABOUT HERE>

The results reported in Table 4 demonstrate that the more dispersed rebalancing strategy employed by enhanced index funds generate higher returns than the rigid rebalancing strategy of index funds. The total, unrealized, and realized gains of index funds during index inclusion periods are insignificantly different from zero. During index inclusion periods, enhanced index funds generated significant and positive realized gains. The realized and total gains generated by enhanced index funds are significantly higher than those of the index funds. The statistically significant and positive realized gain indicate that 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 unrealized and total losses. However, the enhanced funds' losses are significantly lower than those of index funds. In order to ensure robustness of the results, the analyses are partitioned for the pre- and post- index reconstruction periods, and the empirical results are consistent.²¹

<INSERT TABLE 4 ABOUT HERE>

Table 5 (Panel A) reports the dollar value of the trade packages. Enhanced funds' trade packages during index revision periods are smaller than for non-index revision periods. Conversely, index funds' trade packages are larger during index revision periods than during non-index revision periods. This finding further confirms that, during index revision periods, where trading is more difficult due to the higher excess demand, that enhanced index funds are more likely to engage in more patient trading in an attempt to avoid excessive trading costs.²²

Consistent with the more patient trading strategies employed by enhanced index funds, enhanced funds are found to incur lower trading costs than index funds in both index revision and non index revision periods. Table 5 (Panel B) shows the total cost associated with index fund purchases (sales), measured by *Open to Trade*, is 25.59 (20.72) basis points. These results are comparable to the magnitude reported by Keim and Madhavan (1997), who document an average implicit total cost of 23 basis points for U.S index funds. In addition, the results from Table 5 (Panel B) demonstrate that enhanced funds' trade packages induce both lower total and temporary price impacts relative to index funds' trade packages. This finding is consistent with our findings in the previous section, where enhanced index funds implement more patient trading, and incur lower market impact costs. Consistent with prior studies, index and enhanced index funds' are found to incur higher trading costs than active funds. Keim and Madhavan (1997) attribute this to the higher demand for immediacy exhibited by passive funds as they constantly aim to align their portfolios with the constituent of the index. Frino, Gallagher and Oetomo (2004) also document an average total price impact cost of Australian active funds to be 16.75 (16.31) basis points for purchases (sales).

Reflecting the higher difficulty associated with trading stocks that are involved in index revisions, the results presented in Table 5 (Panel B) demonstrate that trade packages executed during such periods incur higher transaction costs. The total and temporary costs of index fund purchases (sales) during index revision periods are 76.22 (52.09) and 43.59 (28.90) basis points, respectively,

which are significantly higher than the 30.17 (26.89) and 12.15 (9.23) basis points documented for the non-index revision periods. Enhanced index funds exhibit total and temporary transaction costs for purchases (sales) of 46.87 (35.76) and -8.71 (-27.59) basis points respectively for index revision periods and 18.62 (13.10) and 0.24 (5.06) basis points respectively for non-revision periods. The negative temporary costs measured by *Trade to Close* documented for enhanced funds' trades during index revision periods is consistent with our previous finding – that enhanced index funds are able to earn positive and significant returns during index revision periods.²³

<INSERT TABLE 5 ABOUT HERE>

Consistent results are also documented when performing a joint test analysis using regressions. Controlling for variations in bid-ask spread, trade complexity, liquidity, broker and industry effects, the results reported in Table 6 demonstrate that enhanced index funds incur lower transaction costs than index funds. Additionally, trades executed during index revision periods also incur higher total costs, reflecting the higher difficulty associated with trading these stocks. The significantly lower temporary cost associated with trades during index revision periods is induced by the excess returns on these stocks during these periods. Consistent with Chan and Lakonishok (1995), bid-ask spread is found to be positively related to trading costs, whereas trade complexity and firm size are found to be positively and negatively related to trading costs, respectively. Contradicting the findings from active funds' trades, broker and industry effects do not appear to be significant determinants of both index and enhanced index funds' total and permanent costs.²⁴ These results reconfirm the absence of information from passive funds trades. However, there is some evidence indicating that the variables affect the magnitude of temporary cost incurred by passive funds. Therefore, broker and industry effects contribute only to passive funds' temporary costs through variation in the brokers' trading ability.

<INSERT TABLE 6 ABOUT HERE>

B. Investment Strategy

Surprisingly, the results documented in Table 7 indicate that none of the funds investigated in our study follow a perfect replication strategy. This is not entirely unexpected due to index weight distribution of stocks comprising the index as well as the inclusion of a large number of small stocks in the benchmark. The results reported in Table 7 document higher *Abs Deviation from Benchmark* amongst enhanced index funds relative to index funds. The average daily *Abs Deviation from Benchmark* of the index funds is 6.63 percent, which is significantly lower than the 12.22 percent exhibited by the enhanced index funds. However, the index funds exhibit an average daily *Abs Deviation from Benchmark* variance of 0.24 percent which is significantly higher than 0.09 percent exhibited by enhanced index funds.²⁵ The index funds' average daily absolute deviation from benchmark ranges from between 2.43 to 11.46 percent, while enhanced funds' average daily absolute deviation from benchmark ranges between 12.35 to 13.13 percent.

Examining the proportion of each asset type held by the passive funds, the results in Table 7 demonstrate that both index and enhanced index funds hold more than 98 percent of their portfolios in equity securities. Enhanced index funds, however, allocate a significantly higher proportion of their portfolio assets to futures contracts. 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.

Interestingly, when examining the number of stocks held, we find that enhanced index funds hold a larger number of stocks from the benchmark constituents. On average, index funds' portfolios hold 219.77 and 225.13 stocks for both the pre- and post- index reconstruction periods, respectively. Index fund portfolios only include stocks from the constituents of their benchmark indices. The

enhanced index funds' portfolios own 231.77 and 231.69 stocks from the benchmark index for the pre- and post- index reconstruction periods, respectively. The enhanced index funds hold 23.41 and 20.40 *Non Index Holding* stocks for the pre and post index reconstruction periods respectively.

The results reported in Table 8 demonstrate that stocks that are overweighted by index funds exhibit scores that are significantly higher than 50 in liquidity, size and momentum and significantly lower than 50 for 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. With the exception of the book-to-market ratio, the converse is true for the underweighted stocks. Stocks that are overweighted by the enhanced index funds exhibit higher market capitalization, lower book-to-market and higher past returns than those that are overweighted by enhanced index funds. With the exception of the book-to-market ratio, the converse is found to be true for underweighted stocks. There is weak evidence indicating that the stocks that are underweighted by index funds exhibit higher liquidity than those that are underweighted by enhanced index funds. However, this result is not statistically significant for overweighted stocks.

<INSERT TABLE 7 ABOUT HERE>

Table 7 reveals that enhanced index fund's *Non Index Holding* represents 0.85 percent and 0.44 percent of the funds' portfolios for the pre- and post- index reconstruction periods. Table 8 (Panel C) demonstrates that these stocks generate a daily return of 0.13 percent. Hence, while the amount invested in these stocks is minimal, the decision to have exposures to *Non Index Holding* generates significant excess returns for the portfolios. Given the high returns associated with this class of stocks, this section profiles the characteristics of stocks that fall into the *Non Index Holding* of enhanced index funds. *Non Index Holding* is compared against all of the stocks that are listed on the ASX but are excluded from the benchmark index. The results documented in Table 8 (Panel A) demonstrate that

enhanced index funds' *Non Index Holding* comprises of stocks with higher liquidity, larger market capitalization, better past performance and lower book-to-market value.

<INSERT TABLE 8 ABOUT HERE>

Chen, Jegadeesh and Wermers (2000) identify that fund trades executed by investment managers represent a stronger opinion than fund holdings, as the latter might be affected by non-performance related issues such as capital gains taxes and transaction costs. Relative to stocks that are listed on the ASX, but not constituents of the benchmark index, the results reported in Table 8 (Panel B) demonstrate that, when purchasing stocks that are outside the index constituent enhanced funds exhibit a higher preference for stocks with higher liquidity, larger market capitalization, lower book-to-market value, and higher past returns. With the exception of the market capitalization value and the book-to-market value, the converse is true for sales. The higher than average market capitalization for both purchases and sales indicate enhanced index funds limit their trading activities to these types of stocks that are the largest from this category. The lower than average book-to-market values indicate that, with respect to stocks that are not benchmark constituents, enhanced funds exhibit a preference for growth rather than value-oriented stocks. Comparing the characteristics of stocks that fall outside the benchmark index that are purchased and sold by enhanced index funds, it is evident that the purchased stocks exhibit higher liquidity, lower book-to-market value and higher momentum. The results from the joint test reported in Table 9 exhibit consistent results.

<INSERT TABLE 9 ABOUT HERE>

Table 8 (Panel C) reports the gains and losses generated by enhanced funds on the stocks that are not included in the benchmark index using Odean's (1998) approach. The reported results demonstrate that for enhanced funds' *Non Index Holding*, the mean value of the PGR (2.5 percent) is significantly lower than the PLR (4.5 percent). This result is inconsistent with the disposition theory,

which states that investors are more likely to hold onto loser stocks too long and to sell out of their winning stocks too early. Our results show that enhanced index funds are more likely to ride their winners and to sell their loser stocks.

IV. CONCLUSION

This study examines the performance of index funds' rebalancing strategies during index revision periods in light of their investment strategies. The documented results are compared against enhanced index funds to investigate the benefits available to index funds that implement less rigid replication strategies. Our results demonstrate that enhanced index funds commence their rebalancing activities well prior to the effective date of an index change. This strategy yields such funds significantly higher total and realized returns during index inclusion periods. In addition, relative index funds, enhanced index funds execute more patient trading strategies by partitioning their trades into smaller parcels, and by allowing a longer interval for completion of their trade packages. Consequently, the trading costs incurred by enhanced index funds are significantly lower than those of index funds. Consistent with the literature, our study documents greater trade difficulty during index revision periods.

Stocks that are held as overweight positions relative to the benchmark by index and enhanced index funds exhibit higher liquidity, larger market capitalization and higher past returns. However, relative to index funds, stocks that are overweighted by enhanced index funds typically exhibit larger market capitalization and better past performance. The converse true for the stocks held as underweight positions relative to the benchmark. Enhanced index funds are also found to own stocks that are outside the constituents defined by the benchmark. Relative to other stocks that are not included in the benchmark but are listed on the ASX, these stocks typically exhibit larger size, lower book-to-market value, and higher past performance. Interestingly, we also identify that enhanced index

fund trading strategies for non-benchmark constituents is consistent with rational behavior, where managers sell ‘loser’ stocks early and ride ‘winner’ stocks.

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ENDNOTES

¹ Researches documenting the inability of the average active mutual funds to outperform the market include Sharpe (1966), Jensen (1968), and Gruber (1996). In recent times, there has been some controversy concerning empirical evidence that finds support for active management (i.e. ability to earn significantly positive risk-adjusted returns) – this includes Chen, Jegadeesh and Wermers (2000) and Wermers (2000).

² Despite the differences in index fund characteristics, Elton, Gruber and Busse (2004) show that a number of factors related to a fund's performance attributes can be easily forecast from past information. These authors also find that while there is a relationship between cash flows and index fund performance, new cash inflows are not invested in a rational manner – i.e. fund flows are allocated to index funds that don't necessarily exhibit the most preferable characteristics.

³ Common return enhancement strategies engaged in by enhanced index managers include participation in IPOs and placements, trading in stocks associated with Index revisions prior to the effective change date, the use of futures contracts, participating in dividend reinvestment plans, switching between similar stock attributes based on stock valuations (i.e. pairs trading), arbitrage between different security types (e.g. preference shares versus ordinary shares), and acting as an offeror of liquidity to other market participants.

⁴ Harris and Gurel (1986), Shleifer (1986), Lynch and Mendenhall (1997), Beneish and Whaley (1996, 2002), Blouin, Raedy, and Shackelford (2000), Madhavan and Ming (2002), Denis, McConnell, Ovtchinnikov and Yu (2003) and Chen, Noronha and Singal (2004).

⁵ This finding is consistent with the findings of Goetzmann and Massa (2003) which suggests that index funds investors purchases (sells) shares after an upwards (downwards) market movements.

⁶ Due to strict confidentiality and the agreements entered into with the fund managers, we are prevented from identifying the participating institutions. The funds are classified as index and enhanced index funds on the basis of each manager's self-stated classification. The classification is ultimately determined given the manager's expected (*ex-ante*) tracking error.

⁷ The funds are classified as index and enhanced index on the basis of each managers' self-citation classification based on their expected (*ex-ante*) tracking error.

⁸ For institutional details, please see Appendix A.

⁹ Studies that examine mutual fund survivorship bias include Brown, Goetzmann, Ibbotson and Ross (1992) Brown, Goetzmann, Ibbotson. (1999), Carpenter and Lynch (1999) and Elton, Gruber and Blake (1996).

¹⁰ The analysis is also performed using the conventional method of an event study based on 60 days on each side of the event date, and the empirical results are consistent. These results are not reported, but are available upon request.

¹¹ For further information regarding execution strategies, see Barclay and Warner (1993), Chan and Lakonishok (1995), Brennan and Subrahmanyam (1998) and Chakravarty (2001).

¹² It is recognised that some of these trades might be executed at once through off-market facility. However, our dataset does not distinguish between on-market and off-market trades.

¹³ The results are consistent when trade packages are constructed without restricting trades from the same package to be executed by the same broker. These results are not reported but are available upon request.

¹⁴ Robustness tests performed based on 7 day packages and end of day packages document consistent results. These results are not directly reported, but are available upon request.

¹⁵ The S&P/ASX 200 index is the most frequently used benchmark for fund managers in Australia.

¹⁶ The stocks' buy and hold returns for the last 6 months are also calculated for robustness tests. The results are also consistent.

¹⁷ Stocks subject to index revisions are excluded from this category 30 days prior to the index revision date.

¹⁸ These results are not reported, but are available upon request.

¹⁹ The results for the largest 5 percent revisions are not reported, but are available upon request. The results reported in Table 2 are consistent when the analyses are performed separately for the pre- and post- index reconstruction periods. These results are not reported but are available upon request.

²⁰ Enhanced index funds however, exhibit higher annual turnover. Annual turnover is measured as the ratio between the minimum market value of buys/sells for the fund and the average fund size over the year.

²¹ The results are not directly reported, but are available upon request.

²² This finding is not to be confused with the results reported in Table 3. Table 5 (Panel A) reports the average trade size of the trade packages while Table 3 reports the average size per trade in the trade packages.

²³ Consistent results are documented when partitioning index revision periods into index inclusion and exclusion periods. The results are not reported and are available upon request.

²⁴ See Aitken and Frino (1996) and Chan and Lakonishok (1997).

²⁵ The difference between variances is tested using the variance ratio.

APPENDIX A. INSTITUTIONAL DETAILS

This section outlines the institutional details of the benchmarks for the pre- and post- the S&P/ASX index reconstruction event. The index reconstruction event took place at 3 April 2000.

A. AOI Inclusion and Exclusion Criteria Prior to the Index Reconstruction

This section relies heavily on Chan and Howard (2002) and the ‘Review of the All Ordinaries Index’, ASX Consultation Paper, January 1999. Prior to the index reconstruction event, all funds sampled in this study were benchmarked against the ASX All Ordinaries Index (AOI). In the pre-index reconstruction period, the AOI is an open-end index that serves as a market indicator index which measures the overall performance of the Australian market. The open-end approach implemented by AOI contrasts with the S&P 500 index, which is closed-end index where at any point in time, the index comprises up to 500 stocks. In order to be included into the AOI, a company must satisfy the market capitalization and liquidity criteria imposed by the exchange. The market capitalization criterion requires the candidate to exhibit a market capitalization that is higher than 0.022 percent of the total domestic market capitalization. The liquidity criteria requires that all candidates to exhibit monthly median liquidity (relative to the ASX median market liquidity) of at least 50 percent.

The revision of the constituents of the AOI is performed on monthly basis. Stocks that have undergone mergers, takeovers or liquidation and no longer exist as publicly listed companies are excluded from the Index. Stocks that no longer satisfy the market capitalization and liquidity criteria are also excluded from the constituent of the Index. Companies with market capitalization below 0.015 percent of the total market capitalization for 6 months periods are removed from the index. Companies with market capitalisation below 0.2 percent of the total market capitalisation for a period of 3 months are also removed from the index. Additionally, companies with relative liquidity below 33%, 25%, 17% are down-weighted by the factor of 75%, 50% and 25%. Companies with relative liquidity of less than 12.5 percent after being down-weighted are subjected for removal.

B. Institutional Details of Australian Equity Indices Post AOI Restructuring

This section relies heavily on the “Understanding Indices”, Standard and Poor’s, December 2002. Following the index reconstruction, a series of S&P/ASX indices were introduced, namely, S&P/ASX 20, S&P/ASX 50, S&P/ASX 100, S&P/ASX 200, S&P/ASX 300, S&P/ASX MidCap 50, S&P/ASX Small Ordinaries Index and S&P/ASX All Ordinaries. In our sample, 3 funds are benchmarked against the S&P/ASX 200 and 5 funds are benchmarked against the S&P/ASX 300. Additionally, the AOI is transformed to a closed-end index, comprising of the 500 largest companies by market value. With the exception of the foreign domiciled companies, the liquidity requirement was dropped. The new AOI accounts for around 99 percent of the total market value of stocks listed in the ASX and the Index is reviewed on an annual basis.

The S&P/ASX 200 is recognized as the investible benchmark, which comprised of all the stocks in the S&P/ASX 100 and 100 additional stocks. The S&P/ASX 300 is introduced to provide a more in depth coverage and the index comprised of all stocks in the S&P/ASX 200 and 100 additional stocks. The S&P/ASX 200 indices cover approximately 90 percent of the total market capitalization respectively while the S&P/ASX 300 Index represents around 91 percent of the total market capitalization of stocks listed in the ASX.

The S&P/ASX indices are managed by the S&P Australian Index Committee and serves as the performance benchmark indices. Therefore, the constituents of the indices are required to exhibit sufficient liquidity, free float, and market capitalization. Stocks that are subjected to acquisition, insufficient market capitalization, insufficient liquidity, liquidation and company restructuring stand as candidates for deletion from the indices. Replacements to the deleted stocks are selected by the S&P Australian Index Committee and are made based on candidates’ market value and liquidity. Additionally, IPO (Initial Public Offerings) may also be eligible for inclusion. Constituents of the indices are reviewed on a quarterly basis at the end of February, May, August, and November and on an as-needed basis. Announcements to the index revisions are made on the 15th of March, June, September and December.

TABLE 1**Performance Comparison between Index and Enhanced Index Funds**

| | | Index | Enhanced Index | Enhanced Index - Index |
|--|--------|------------------|-----------------------|-------------------------------|
| <i>Fund Descriptive Information</i> | | | | |
| Number of Funds | | 5 | 3 | |
| Fund Size | Mean | 1.30bn | 1.11bn | |
| | Median | 1.23bn | 1.11bn | |
| | SD | 0.69bn | 0.49bn | |
| Period of Observation | | Jan 99 to Dec 01 | Jan 99 to Dec 01 | |
| <i>Fund Performance</i> | | | | |
| Monthly Fund Return | Mean | 0.90% | 0.97% | 0.07%* |
| | Median | 0.92% | 1.06% | |
| | SD | 3.47% | 3.45% | |
| Average Monthly Fund Excess Return | Mean | 0.01% | 0.09% | 0.08%** |
| | Median | 0.005% | 0.09% | |
| | SD | 0.05% | 0.15% | |
| Alpha (per month) | | 0.01 | 0.03 | |
| Beta | | 0.99 | 1.01 | |
| <i>Tracking Error Measures</i> | | | | |
| Average Monthly Abs Tracking Error | Mean | 0.05% | 0.18% | 0.13%* |
| | Median | 0.05% | 0.14% | |
| | SD | 0.03% | 0.09% | |
| Average Monthly SD Tracking Error | | 0.06% | 0.21% | 0.15%* |

This table reports descriptive statistics for the index and enhanced index fund sample utilizing monthly returns data. The sample comprises 8 portfolios, representing 5 index funds and 3 enhanced funds in the period 1 January 1999 and 31 December 2001. Fund size is reported as the market value of funds' holding as at 31 December 2001. The monthly excess return is calculated as the funds' return after controlling for market returns. Market returns are computed as the returns of the benchmark index. The average index and enhanced index funds' alphas and betas are computed using the single index model. Two measures of tracking error are used and reported. The first measure is calculated as the absolute value of the difference between the monthly returns of the fund and the benchmark index. The second measure captures the average monthly standard deviation of the variation between the monthly returns of the fund and the benchmark index. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 2
Trading Activities During Index Revisions

| Day | INDEX INCLUSION | | | | | | INDEX EXCLUSION | | | | | |
|-----|-----------------|--------|----------------|--------|----------|--------|-----------------|--------|----------------|--------|----------|--------|
| | Index | | Enhanced Index | | Total | | Index | | Enhanced Index | | Total | |
| | % Trade | Cum | % Trade | Cum | % Trade | Cum | % Trade | Cum | % Trade | Cum | % Trade | Cum |
| -30 | 0.04 | 0.04 | 0.00 | 0.00 | 0.03 | 0.03 | 0.11 | 0.11 | 0.19 | 0.19 | 0.14 | 0.14 |
| : | : | : | : | : | : | : | : | : | : | : | : | : |
| -16 | 0.72 | 2.24 | 2.82* | 14.01 | 1.14*** | 4.61 | 0.67 | 4.92 | 0.69 | 7.53 | 0.68 | 5.79 |
| -15 | 0.36 | 2.60 | 1.50 | 15.51 | 0.59* | 5.20 | 0.31 | 5.23 | 0.80** | 8.33 | 0.47 | 6.26 |
| -14 | 0.11 | 2.71 | 3.68* | 19.19 | 0.83* | 6.03 | 0.67 | 5.90 | 1.12 | 9.45 | 0.82 | 7.08 |
| -13 | 0.25 | 2.96 | 1.81* | 21.00 | 0.56** | 6.59 | 1.19 | 7.09 | 1.26** | 10.70 | 1.21** | 8.29 |
| -12 | 0.37 | 3.33 | 2.43** | 23.43 | 0.79** | 7.38 | 0.52 | 7.61 | 2.12 | 12.82 | 1.05 | 9.34 |
| -11 | 0.08 | 3.41 | 1.78** | 25.21 | 0.42** | 7.80 | 1.78 | 9.39 | 3.14** | 15.96 | 2.23** | 11.58 |
| -10 | 0.08 | 3.49 | 2.93*** | 28.14 | 0.66** | 8.46 | 1.05 | 10.44 | 1.02 | 16.98 | 1.04* | 12.62 |
| -9 | 0.22 | 3.71 | 2.87** | 31.01 | 0.75* | 9.21 | 1.72 | 12.17 | 6.49** | 23.47 | 3.31* | 15.93 |
| -8 | 0.20 | 3.91 | 2.38** | 33.39 | 0.64* | 9.86 | 0.70 | 12.87 | 0.87* | 24.34 | 0.76 | 16.68 |
| -7 | 0.88 | 4.80 | 3.12** | 36.51 | 1.33*** | 11.19 | 3.98*** | 16.84 | 3.14** | 27.47 | 3.70*** | 20.38 |
| -6 | 0.20 | 5.00 | 3.21** | 39.72 | 0.80* | 12.00 | 6.34 | 23.18 | 16.37* | 43.85 | 9.68* | 30.06 |
| -5 | 1.64** | 6.63 | 8.80*** | 48.52 | 3.08*** | 15.08 | 4.05*** | 27.23 | 1.35 | 45.20 | 3.15*** | 33.21 |
| -4 | 6.25** | 12.88 | 3.38** | 51.91 | 5.67*** | 20.75 | 7.98*** | 35.21 | 23.94* | 69.14 | 13.29*** | 46.50 |
| -3 | 2.18*** | 15.06 | 2.83* | 54.74 | 2.31*** | 23.06 | 5.89*** | 41.10 | 3.82*** | 72.96 | 5.20*** | 51.70 |
| -2 | 11.36*** | 26.42 | 4.37* | 59.11 | 9.95*** | 33.01 | 9.55*** | 50.65 | 2.44 | 75.40 | 7.18*** | 58.88 |
| -1 | 26.02*** | 52.44 | 5.73*** | 64.84 | 21.93*** | 54.94 | 22.40*** | 73.05 | 9.92*** | 85.32 | 18.25*** | 77.13 |
| 0 | 37.98*** | 90.41 | 8.49*** | 73.33 | 32.03*** | 86.97 | 12.56*** | 85.61 | 1.67*** | 87.00 | 8.94*** | 86.07 |
| 1 | 2.94*** | 93.35 | 1.77* | 75.10 | 2.71*** | 89.67 | 9.06*** | 94.68 | 7.10*** | 94.10 | 8.41*** | 94.49 |
| 2 | 0.68 | 94.04 | 0.55 | 75.65 | 0.66 | 90.33 | 1.32* | 96.00 | 0.36 | 94.46 | 1.00** | 95.49 |
| 3 | 0.25 | 94.29 | 0.61 | 76.26 | 0.32 | 90.65 | 0.68* | 96.68 | 1.02* | 95.47 | 0.79*** | 96.28 |
| 4 | 0.36 | 94.65 | 1.63 | 77.90 | 0.62 | 91.27 | 0.08 | 96.75 | 0.32 | 95.80 | 0.16* | 96.44 |
| 5 | 0.21 | 94.86 | 1.59 | 79.49 | 0.49 | 91.76 | 0.08 | 96.84 | 0.18 | 95.98 | 0.11 | 96.55 |
| : | : | : | : | : | : | : | : | : | : | : | : | : |
| 22 | 1.41* | 99.03 | 2.28* | 92.61 | 2.19* | 97.94 | 0.14 | 99.58 | 0.52 | 99.01 | 0.27 | 99.39 |
| : | : | : | : | : | : | : | : | : | : | : | : | : |
| 30 | 0.07 | 100.00 | 0.09 | 100.00 | 0.07 | 100.00 | 0.00 | 100.00 | 0.00 | 100.00 | 0.00 | 100.00 |

Table 2 reports the trading activities of the index and enhanced index funds during the index revision periods. The Index revision period is defined as 30 days either side of the revision date (-30 to +30). Funds' holding at the end (beginning) of the period is defined as the desired level of holdings in the stock, and therefore represents 100% for index inclusion (exclusion) periods. For each day in the revision period, the accumulated (Cum) and the daily trade value (% Trade) relative to the funds' holding of the stock as at $t = 30$ is computed. The t -test is used to examine whether the observation for each metric is greater than zero. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 3

Trading and Rebalancing Strategies of Index and Enhanced Index Funds

| | Total | Index | Enhanced Index | Enhanced Index – Index |
|---------------------------------|----------|----------|----------------|------------------------|
| All Observations | | | | |
| Average Market Capitalization | 4.21bn | 4.21bn | 4.21bn | -0.00025bn |
| Annual Turnover | 8.26% | 6.47% | 12.28% | 5.81%** |
| Average Value of Shares Traded | 3.31 | 3.44 | 3.12 | -0.32*** |
| Trades per package | 1.36 | 1.35 | 1.40 | 0.05*** |
| No of Trading Days per Package | 1.19 | 1.14 | 1.26 | 0.12*** |
| Revision | | | | |
| Average Value of Shares Traded | 2.23 | 2.68 | 1.64 | -1.04*** |
| Trades per package | 2.05 | 1.82 | 2.12 | 0.3* |
| No of Trading Days per Package | 1.31 | 1.23 | 1.39 | 0.16*** |
| Inclusion | | | | |
| Average Value of Shares Traded | 2.49 | 2.96 | 1.93 | -1.03*** |
| Trades per package | 2.06 | 1.86 | 2.12 | 0.26*** |
| No of Trading Days per Package | 1.28 | 1.19 | 1.38 | 0.19** |
| Exclusion | | | | |
| Average Value of Shares Traded | 1.98 | 2.42 | 1.29 | -1.13*** |
| Trades per package | 2.03 | 1.97 | 2.11 | 0.14 |
| No of Trading Days per Package | 1.33 | 1.27 | 1.41 | 0.14*** |
| Non Revision | | | | |
| Average Value of Shares Traded | 3.43 | 3.52 | 3.3 | -0.22** |
| Trades per package | 1.33 | 1.31 | 1.35 | 0.04*** |
| No of Trading Days per Package | 1.18 | 1.14 | 1.24 | 0.1*** |
| Revision - Non Revision | | | | |
| Average Value of Shares Traded | -0.12*** | -0.84*** | -1.66*** | |
| Trades per package | 0.72*** | 0.51*** | 0.77*** | |
| No of Trading Days per Package | 0.13*** | 0.09*** | 0.15*** | |
| Inclusion – Non Revision | | | | |
| Average Value of Shares Traded | -1*** | -0.56*** | -1.19*** | |
| Trades per package | 0.73*** | 0.55*** | 0.77*** | |
| No of Trading Days per Package | 0.1*** | 0.05 | 0.14** | |
| Exclusion – Non Revision | | | | |
| Average Value of Shares Traded | -1.5*** | -1.1*** | -2.01*** | |
| Trades per package | 0.7*** | 0.66*** | 0.76*** | |
| No of Trading Days per Package | 0.15*** | 0.13*** | 0.17*** | |
| Inclusion – Exclusion | | | | |
| Average Value of Shares Traded | 0.51** | 0.54*** | 0.64*** | |
| Trades per package | 0.03 | -0.11 | 0.01 | |
| No of Trading Days per Package | -0.05 | -0.08 | -0.03 | |

Average Market Capitalization reports the average market capitalization of stocks that are traded. Annual turnover is calculated as the ratio between the minimum market value of buys/sells for the fund and the average fund size over the year. The average value of shares traded represents the dollar value of the trades relative to the fund size at the time of trade. The average value of shares traded is reported in basis points. The trades per package capture the number of trades that comprise a trading package where trading packages are constructed based on the 5-day packaging methodology of Chan and Lakonishok (1995). The number of trading days per package captures the completion rate of the trade package. Revision represents trades executed during both index inclusion and exclusion periods. Non revision captures trades executed outside index inclusion and exclusion periods. Inclusion and Exclusion captures trades that are executed during index inclusion and exclusion periods respectively. Index inclusion and exclusion periods are defined as the 30 days on each side of the index inclusion and exclusion events. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 4**Returns of Portfolio Rebalancing Trades during Index Revisions**

| | Total | Index | Enhanced Index | Enhanced Index – Index |
|--------------------------------|--------------|--------------|-----------------------|-------------------------------|
| <i>All Observations</i> | | | | |
| Relative Realised Gain | 0.26%* | -0.04% | 0.70%** | 0.74%** |
| Relative Unrealised Gain | -1.32%** | -1.68%*** | -0.79%* | 0.89% |
| Relative Total Gain | -1.07% | -1.72%*** | -0.09% | 1.63%** |
| <i>Inclusion</i> | | | | |
| Relative Realised Gain | 0.87%* | 0.17% | 1.91%** | 1.75%* |
| Relative Unrealised Gain | 0.73% | 0.42% | 1.20% | 0.78% |
| Relative Total Gain | 1.60%* | 0.59% | 3.11%** | 2.53%* |
| <i>Exclusion</i> | | | | |
| Relative Realised Gain | -0.11% | -0.17% | -0.01% | 0.16% |
| Relative Unrealised Gain | -2.61%*** | -3.03%*** | -1.97%*** | 1.06%* |
| Relative Total Gain | -2.71%*** | -3.20%*** | -1.98%*** | 1.22%* |

This table reports the realized, unrealized and total gains generated by both index and enhanced index funds during Index revision periods. All three measures of gains are calculated using an approach that is similar to that of Odean (1998). However, unlike Odean's (1998) approach, the measures do not separate between gains and losses. The measures take a positive value for gains and negative value for losses. The *t*-test is used to examine whether the funds' gains are significantly different from zero. The final column tests whether the gains generated by index funds are significantly higher than those of enhanced index funds. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 5
Trading Costs

| <i>PANEL A: VALUE OF TRADE PACKAGES</i> | | PURCHASES | | SALES | |
|---|--------|--------------|----------------|--------------|----------------|
| | | Index Funds | Enhanced Index | Index Funds | Enhanced Index |
| Value of Trade Packages (Non-Revision) | Mean | \$122,350.26 | \$307,366.71 | \$123,333.46 | \$205,788.90 |
| | Median | \$14,395.17 | \$63,894.62 | \$19,853.37 | \$60,825.74 |
| | SD | \$702,334.13 | \$1,454,151.30 | \$387,254.44 | \$1,103,209.00 |
| Value of Trade Packages (Revision) | Mean | \$197,582.14 | \$177,062.52 | \$172,084.57 | \$160,222.12 |
| | Median | \$65,691.21 | \$55,211.15 | \$23,943.26 | \$14,770.50 |
| | SD | \$376,226.06 | \$886,576.26 | \$838,003.47 | \$793,458.52 |

| <i>PANEL B: TRANSACTION COSTS</i> | | PURCHASES | | | SALES | | |
|-----------------------------------|--------------------------|---------------|----------------|---------------|---------------|----------------|---------------|
| | | Open to Trade | Trade to Close | Open to Close | Open to Trade | Trade to Close | Open to Close |
| <i>All Observations</i> | | | | | | | |
| | Index and Enhanced Index | 25.59*** | 4.91** | 20.67*** | 20.72*** | 5.93*** | 14.80*** |
| | Index | 33.60*** | 14.49*** | 19.12** | 27.85*** | 9.98*** | 17.87*** |
| | Enhanced Index | 21.03*** | -0.52 | 21.56*** | 14.83*** | 2.57 | 12.26*** |
| | Enhanced Index – Index | -12.57*** | -15.01*** | 2.44 | -13.02*** | -7.41** | -5.61 |
| <i>Revision</i> | | | | | | | |
| | Index | 76.22*** | 43.59*** | 32.63** | 52.09*** | 28.90** | 23.19** |
| | Enhanced Index | 46.87* | -8.71 | 55.58*** | 35.76*** | -27.59* | 63.35*** |
| | Enhanced Index – Index | -29.35* | -52.30** | 22.95* | -16.33* | -56.49** | 40.16* |
| <i>Non Revision</i> | | | | | | | |
| | Index | 30.17*** | 12.15*** | 18.03*** | 26.89*** | 9.23*** | 17.66*** |
| | Enhanced Index | 18.62*** | 0.24 | 18.38*** | 13.10*** | 5.06* | 8.05*** |
| | Enhanced Index – Index | -11.55*** | -11.91*** | 0.35 | -13.79*** | -4.18 | -9.61** |
| <i>Revision – Non Revision</i> | | | | | | | |
| | Index | 46.05*** | 31.45*** | 14.60 | 25.20** | 19.67*** | 5.53 |
| | Enhanced | 28.25** | -8.95 | 37.20*** | 22.66* | -32.65* | 55.30*** |

Table 7 Panel A reports the mean dollar value of trade packages (in A\$). Table 7 Panel B reports the trading costs associated with index and enhanced index funds' trades. All results are reported in costs and basis points. Trades are packaged based on Chan and Lakonishok's (1995) 5-day trading package methodology. The *Open to Trade* measures is defined as the difference between the trade price and the opening price of the first day of the trade package. *Trade to Close* is defined as the difference between the trade price and the close price on the last day of the package. *Open to Close* is measured as the difference between the closing price of the last day of the package and the opening price of the first day of the package. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 6
Determinants of Transaction Costs

| - | PURCHASES | | | SALES | | |
|----------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|--------------------|
| | Open to Trade | Trade to Close | Open to Close | Open to Trade | Trade to Close | Sales |
| Full Model | 6.26 | 1.64 | 2.38 | 6.78 | 1.68 | 5.57 |
| Excluding Market Return | 5.58 *** | 1.15 ** | 1.01 *** | 5.15 *** | 1.66 | 4.09 *** |
| Excluding Bid-Ask Spread | 6.21 | 1.64 | 2.37 | 6.77 | 1.6 | 5.55 |
| Excluding Log(Complexity) | 5.91 | 1.5 | 2.35 | 6.76 | 1.46 | 5.55 |
| Excluding Log(Market Cap) | 5.99 | 1.63 | 2.36 | 4.53 *** | 1.62 | 3.87 *** |
| Excluding D Enhanced | 3.59 *** | 0.83 *** | 2.37 | 5.84 *** | 1.47 | 5.57 |
| Excluding D Revision | 6.04 | 1.62 | 2.11 | 6.34 * | 1.52 | 5.12 * |
| Excluding Broker Effects | 6.19 | 1.43 * | 2.18 | 6.62 | 1.38 *** | 5.5 |
| Excluding Industry Effects | 6.02 | 1.53 | 2.32 | 6.56 | 1.33 ** | 5.4 |
| Intercept | 0.03 *** | 4*10 ⁻³ * | 0.01 *** | 0.06 *** | 0.01 *** | 0.04 *** |
| Market Return | 0.19 *** | -0.12 *** | 0.25 *** | -0.31 *** | 0.02 * | -0.24 *** |
| Bid-Ask Spread | 0.01 *** | 8*10 ⁻⁴ | 4*10 ⁻³ | 4*10 ⁻³ * | 5*10 ⁻³ *** | -43 * |
| Log(Complexity) | 1*10 ⁻³ *** | 4*10 ⁻⁴ *** | 2*10 ⁻⁴ * | 2*10 ⁻⁴ * | 4*10 ⁻⁴ *** | 2*10 ⁻⁴ |
| Log(Market Cap) | -132 *** | -14 | -34 * | -33 *** | -34 *** | -23 *** |
| D Enhanced | -0.01 *** | -33 *** | -54 | -53 *** | -13 *** | 3*10 ⁻⁴ |
| D Revision | 4*10 ⁻³ *** | 1*10 ⁻³ * | 4*10 ⁻³ *** | 7*10 ⁻³ *** | -23 *** | 0.01 *** |
| Broker Effects | | | | | | |
| 10th Percentile | -12 | -93 | -23 | -22 | -43 | -12 |
| 25th Percentile | -33 | -43 | -13 | -33 | -23 | -43 |
| 50th Percentile | 5*10 ⁻⁴ | 6*10 ⁻⁵ | 3*10 ⁻³ | -13 | -14 | 1*10 ⁻³ |
| 75th Percentile | 3*10 ⁻³ | 2*10 ⁻³ | 1*10 ⁻² | 1*10 ⁻³ | 1*10 ⁻³ | 4*10 ⁻³ |
| 90th Percentile | 8*10 ⁻³ | 4*10 ⁻³ | 2*10 ⁻² | 1*10 ⁻² | 1*10 ⁻² | 9*10 ⁻³ |
| Industry Effects | | | | | | |
| 10th Percentile | -13 | 2*10 ⁻⁴ | -33 | -13 | -13 | -23 |
| 25th Percentile | -84 | 8*10 ⁻⁴ | -23 | -64 | -84 | -23 |
| 50th Percentile | -14 | 2*10 ⁻³ | -84 | 5*10 ⁻⁴ | 1*10 ⁻⁴ | -94 |
| 75th Percentile | 8*10 ⁻⁴ | 2*10 ⁻³ | -65 | 1*10 ⁻³ | 3*10 ⁻⁴ | 4*10 ⁻⁴ |
| 90th Percentile | 2*10 ⁻³ | 3*10 ⁻³ | 5*10 ⁻⁴ | 2*10 ⁻³ | 5*10 ⁻⁴ | 1*10 ⁻³ |

This table reports the joint test analysis on the determinants of trading costs associated with passive funds' trades. The *open to trade* captures the pre-execution benchmark. This measure is defined as the difference between the trade price and the opening price of the first day of the trade package. *Trade to Close*, a measure of post execution cost, is defined as the difference between the trade price and the close price on the last day of the package. *Open to Close* is measured as the difference between the closing price of the last day of the package and the opening price of the first day of the package. The adjusted R-Squared of each model is compared to the adjusted R-Squared of the full model using F-tests. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 7
Portfolio Configuration

| | Index | Enhanced Index | Enhanced Index – Index |
|--|-----------|----------------|------------------------|
| <i>Deviation from Benchmark</i> | | | |
| Mean Abs Deviation from Benchmark | 6.63 % | 12.22 % | -5.59 %*** |
| Variance Abs Deviation from Benchmark | 0.24 % | 0.09 % | -0.15 %*** |
| Min Mean Fund's Abs Deviation from Benchmark | 2.43 % | 12.35 % | |
| Max Mean Fund's Abs Deviation from Benchmark | 11.46 % | 13.13 % | |
| <i>Asset Allocation</i> | | | |
| Equity | 98.87 % | 98.53 % | -0.34 %*** |
| Futures | 1.12 % | 1.43 % | 0.31 %*** |
| Others | 0.01 % | 0.04 % | 0.03 %*** |
| <i>Average No of Stocks</i> | | | |
| Index Holding – Prior to Index Reconstruction | 219.77 | 231.77 | 12.00 *** |
| Index Holding – Post Index Reconstruction | 225.13 | 231.69 | 6.56 *** |
| Non-Index Holding – Prior to Index Reconstruction | 0 | 23.41 | 23.41 *** |
| Non-Index Holding – Post Index Reconstruction | 0 | 20.14 | 20.14 *** |
| <i>Average Value Held Relative to Fund Size</i> | | | |
| Index Holding – Prior to Index Reconstruction | 100 % | 99.15 % | -0.85 %*** |
| Index Holding – Post Index Reconstruction | 100 % | 99.56 % | -0.44 %*** |
| Non-Index Holding – Prior to Index Reconstruction | 0 % | 0.85 % | 0.85 %*** |
| Non-Index Holding – Post Index Reconstruction | 0 % | 0.44 % | 0.44 %*** |
| <i>Overweighting</i> | | | |
| Liquidity | 57.62 *** | 57.58 *** | -0.04 |
| Size | 70.89 *** | 71.54 *** | 0.65 *** |
| Book to Market | 45.86 *** | 45.33 *** | -0.53 *** |
| Momentum | 51.83 *** | 52.19 *** | 0.36 *** |
| <i>Underweighting</i> | | | |
| Liquidity | 49.89 * | 50.08 | 0.19 * |
| Size | 48.55 *** | 47.47 *** | -1.08 *** |
| Book to Market | 46.45 *** | 47.24 *** | 0.79 *** |
| Momentum | 47.87 *** | 47.31 *** | -0.52 *** |
| <i>Over - Underweighting</i> | | | |
| Liquidity | 7.73 *** | 7.5 *** | |
| Size | 22.34 *** | 24.07 *** | |
| Book to Market | -0.59 *** | -1.91 *** | |
| Momentum | 3.96 *** | 4.88 *** | |

Absolute deviation from benchmark denotes the absolute value of the difference between the weight of a stock in the portfolio and the weight of the stock in the benchmark index. The difference between the Variance of absolute deviation from benchmark of index funds and that of the enhanced index funds are tested using variance ratio. All other comparisons are performed based on the *t*-test. Asset Allocation reports the proportion of the portfolios invested in equity securities, futures contracts and other assets. Index Holding represents stocks that are held by index and enhanced index funds that are included in the constituent of the benchmark index. Non-Index Holding represents stocks that are not included in the constituent of the benchmark index. Average No of Stock reports the average number of index holding and non-index holding that comprise of the portfolios of index and enhanced index funds. Overweighting (Underweighting) reports the characteristics of stocks that are overweighted (underweighted) by index and enhanced index fund managers based on the approach of Chen, Jegadeesh and Wermers (2000). Over – Underweighting reports the differences in characteristics between stocks that are over and underweighted by index and enhanced index fund managers. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 8**Non-Index Holdings of Enhanced Index Funds*****PANEL A: NON-INDEX HOLDING OWNED***

| | |
|----------------|----------|
| Liquidity | 55.49*** |
| Size | 56.73*** |
| Book to Market | 43.13*** |
| Momentum | 55.34*** |

PANEL B: TRADES ON NON-INDEX HOLDING***Purchases***

| | |
|----------------|----------|
| Liquidity | 71.06*** |
| Size | 73.94*** |
| Book to Market | 23.67*** |
| Momentum | 67.42*** |

Sales

| | |
|----------------|----------|
| Liquidity | 52.86 |
| Size | 72.82*** |
| Book to Market | 37.04*** |
| Momentum | 33.12*** |

Purchase – Sales

| | |
|----------------|-----------|
| Liquidity | 18.20*** |
| Size | 1.12 |
| Book to Market | -13.37*** |
| Momentum | 33.11*** |

PANEL C: RETURNS OF NON-INDEX HOLDING

| | |
|--|---------|
| Average Daily Return of Non-Index Holdings | 0.13%** |
| Proportion of Gains Realised | 2.5*** |
| Proportion of Losses Realised | 4.5*** |
| PGR - PRL | 2.0** |

Table 10 Panel A compares the characteristics of non-index holding held by enhanced index fund managers against other stocks that are not included in the constituent of the index but are traded on the ASX. Non-Index holding represents stocks that are not included in the constituent of the benchmark that are held by enhanced fund managers. Panel B compares the characteristics of stocks that are not included in the constituent of the benchmark index that are traded by fund managers against stocks that are not included in the constituent of the benchmark index that are listed on the ASX. Purchase – Sales compares the characteristics of Non-Index Holding that are purchased and sold by enhanced fund managers. All comparisons are performed using the methodology of Chen, Jegadeesh and Wermers (2000). Panel C reports average daily return of the Non-Index Holding held by enhanced fund managers. Additionally, Panel C reports the proportion of realized and unrealized gains/losses earned by enhanced index fund managers when trading stocks that are not constituents of the benchmark index. Realised Gain and Unrealised Loss are computed using the methodology of Odean (1998). PGR – PRL tests the difference between the Realised Gain and Unrealised Loss generated by enhanced fund managers when trading Non-Index Holding stocks. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 0.1% level of significance.

TABLE 9
Joint Tests on Portfolio Configuration

| | Index | Enhanced Index | Non-Index Holdings of Enhanced Index |
|--------------------------|-----------------|-----------------|---|
| Full Model | 0.38 | 1.59 | 6.87 |
| Excluding Liquidity | 0.35 | 1.51* | 5.46 |
| Excluding Size | 0.25*** | 0.60*** | 6.81 |
| Excluding Book to Market | 0.32* | 1.57 | 6.16 |
| Excluding Momentum | 0.36 | 1.55 | 4.01* |
| Intercept | $-5*10^{-5}$ | $-3*10^{-4}***$ | $-4*10^{-5}$ |
| Liquidity | $6*10^{-7}*$ | $1*10^{-6}***$ | $8*10^{-7}**$ |
| Size | $1*10^{-6}***$ | $5*10^{-6}***$ | $4*10^{-7}$ |
| Book to Market | $-8*10^{-7}***$ | $-7*10^{-7}$ | $-6*10^{-7}*$ |
| Momentum | $5*10^{-7}*$ | $9*10^{-7}**$ | $7*10^{-7}**$ |

This table reports the results from the joint test analyses. The difference between a stock's weight in the portfolio and the benchmark index is regressed against the ranking computed for each stock across each of the characteristics as outlined in Chen, Jegadeesh and Wermers (2000). The analyses are performed separately for the index and the enhanced index funds. In addition, for enhanced index funds, the analysis is also performed on the funds' holdings of stocks that are not included in the benchmark index. * denotes significant at 5% level of significance. ** denotes significant at 1% level of significance. *** denotes significant at 1% level of significance.