The performance and trading characteristics of exchange-traded funds

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ABSTRACT

This study examines the performance and trading characteristics of exchange-traded funds (ETFs) in Australia. We investigate the ability of the population of index oriented (classical) ETFs on the Australian Stock Exchange (ASX) to track underlying equity benchmarks, and provide a comparison of the tracking error volatility between these types of market-traded instruments and equity index funds operated off-market. Our study finds that while index-oriented ETFs closely track their respective benchmarks, these instruments have not been embraced to the same extent as in overseas markets and relative to off-market index managed funds. Our research provides an important comparison of classical ETFs between Australia and the United States.

1. INTRODUCTION

This study examines the performance and trading characteristics of "classical" exchange-traded funds listed on the Australian Stock Exchange (ASX). Classical exchange-traded funds, or ETFs as they are commonly known, are tradeable securities which derive their value from a pre-defined basket of securities which are constituents of an index. These types of ETFs derive their value (and volatility) from the market movements of the underlying stocks, which comprise the portfolio, and these funds are similar to index funds managed by institutional portfolio managers. Index-linked products, such as ETFs, have been increasingly successful because they provide investors with benefits of diversification through one investment product, improved tax efficiency relative to active portfolio management and lower expenses. In addition, ETFs have advantages over futures contracts as they can be transacted in smaller quantities.

Perhaps the most significant benefit available to ETF investors is that when redemptions arise, the sale does not create a potential capital gains tax liability for other investors, which is otherwise the case for investors who remain in an open-end managed fund operated by a fund manager. Other features which have helped make ETFs attractive is their high degree of transparency in identifying the constituents underlying the fund, intra-day valuation, the speed of trading which is possible when the market is open, as well as the ability for ETFs to be sold short. On the other side of the coin, potential disadvantages associated with ETFs is that they incur the same transaction cost elements common to other securities (ie bid/ask spread, brokerage) as well as the potential that an investor trades at a price where the ETF is at either a premium (buyer) or discount (seller) to the net asset value (NAV).

ETFs represent a significant innovation across global financial markets since the first exchange-traded fund was launched in 1989 on the Toronto Stock Exchange.[1] Today, ETFs have proliferated in terms of both their number and the market value of total assets. In the world's largest market, more than 130 different ETFs are listed on the American Stock Exchange, NYSE or Nasdaq, and their current market value is estimated at around US$178 billion. However, while the total value of ETF assets is significant, ETFs still only account for a very small fraction of the traditional off-market mutual funds at around three per cent of total assets. On the ASX there are four classical and six hybrid ETFs currently available on the market, with a combined value in excess of A$0.75 billion.

1 An excellent discussion of the operation of ETFs is also presented by Gastineau (2001) and Fuhr (2001).

Research examining ETFs can be motivated in a number of ways. First, given the limited evidence on the performance of ETFs internationally, and the absence of empirical research in Australia, our study contributes to the literature by providing analysis of the performance and index tracking capabilities of a relatively new financial product available to Australian investors. This gap in the literature is surprising given the significant growth and size of assets invested in exchange-traded funds. Second, while much research has provided attention to the relative merits of alternative open-end mutual funds (ie the active and passive fund debate), research which compares the performance of more closely defined substitutes is extremely limited.[2] While classical ETFs and open-end index funds benchmarked to common indices will have the same investment objective, the implementation of their respective strategies is structurally different. Accordingly, this research provides a direct comparison between the magnitude of tracking error between two similar passive instruments, as well as an analysis of the variation in performance between the fund and index due to well documented market frictions incurred by index replicators.

Recent research by Elton *et al* (2004) identifies that while S&P 500 Index funds hold virtually the same stocks in approximately the same weights, significant variation exists in the performance and management fees associated with commoditised investment vehicles. Elton *et al* (2002) identify that for S&P's Depository Receipts, the treatment of dividends is an important factor explaining their underperformance relative to the S&P 500 benchmark and open-end index funds tracking the same index. Other studies, including Blume and Edelen (2004), evaluate the difficulties faced by index managers around index reconstitution dates, finding that index fund managers would benefit from executing less rigid replication strategies surrounding index revisions. Recent work by Frino, Gallagher and Oetomo (2005) also shows that index-oriented funds exercising greater flexibility in index replication is more optimal. Therefore, examining the source of potential performance variation between highly standardised investment vehicles in Australia represents an interesting and important area for research, as the outcome can significantly impact upon investor choice. Third, an interesting debate has recently been opened by proponents of traditional indexation and classical ETFs, including a comparative analysis of the relative tracking efficiency between these investment structures (eg see Gastineau (2002, 2004), Kostovetsky (2003)).

The remainder of this study is structured as follows. Section 2 provides a literature review on the performance behaviour of both ETFs and index funds. Section 3 follows with the institutional background of the Australian exchange-traded fund market. Section 4 describes the data and the research design implemented, and section 5 presents the empirical results. The final section concludes the study and makes suggestions for future research.

2. LITERATURE REVIEW

Index-linked products, whether open-end managed funds or ETFs, attempt to replicate the returns and risk of the underlying market index. Index management, at face value, appears to be a very simple investment strategy, however in reality its implementation is not necessarily straightforward. Frino and Gallagher (2001, 2002) argue that the index represents a paper portfolio, which assumes that a passive benchmark strategy can be instantaneously and costlessly implemented. Given the existence of market frictions, the inevitable fact is that index funds and ETFs will be unable to deliver investors with identical returns to that of the benchmark. Accordingly, a passive portfolio manager's objective must then be to implement an investment strategy which seeks to constrain the tracking error (ie a quantitative measure of differences in the performance between the fund and benchmark over time) such that investors achieve returns which closely approximate the target benchmark at minimal cost.

The techniques for replication of the benchmark include full-replication, stratified sampling or optimisation techniques. Full replication is implemented through the acquisition of all index constituent securities and holding each in the same weight as the index. Stratified sampling and optimisation are both non-replication techniques which involve holding a subset of stocks defined by the market index, but where the portfolio is constructed such that the fund closely mimics the performance and risk attributes of the underlying benchmark. As identified by Keim (1999) and Frino *et al* (2004), the liquidity of the stock universe and the size of the fund have an important impact on the replication technique adopted by the fund, as well as explaining the magnitude of tracking error (ie the difference in performance between the portfolio and index).

Due to the existence of an inverse relation between tracking error accuracy and cost, an investor utilising a passive investment vehicle must recognise that perfect replication is not achievable and will ultimately depend on the design of an index, the underlying liquidity of stocks comprising the benchmark, the size of the investment portfolio being managed and the replication technique adopted.

Frino and Gallagher (2002) examine the determinants of tracking error in passive equity fund performance in Australia and find that while open-end index funds approximate the returns and risk of the All Ordinaries Accumulation Index before costs, tracking error is explained by exogenous liquidity shocks experienced by the fund, market bid/ask spreads, index volatility and the index replication technique adopted. In a study of S&P 500 index mutual funds, Frino *et al* (2004) identify that tracking error is also determined on the basis exogenous factors associated with the index management procedures executed by Index Committees.

Research concerning ETF performance is limited, however studies have examined the pricing mechanism of ETFs and the relative performance of on-market investment vehicles relative to the underlying benchmark and index fund alternatives. Elton *et al* (2002) examine Spiders which track the S&P 500 index, and show that while the ETF's NAV is close to fair market value, these investment products underperform the market by 28 basis points per year, as well as underperforming competing index funds by

2 See Dellva (2001) and Kostovetsky (2003) for a brief discussion.

18 basis points per annum. Their research shows that a large determinant of the underperformance arises from management fees and the costs associated with non-accruing earnings on dividends. The work also highlights that the relative performance difference may be tolerated by investors given the value that is provided for immediacy, together with the product's usefulness in risk control.

Jares and Lavin (2004) examine the pricing efficiency of ETFs compared to the value of the underlying stocks and find that for foreign ETFs, the asynchronous nature of trading and the information flow across markets leads to frequent premiums and discounts in ETF valuation. Their work documents the importance of information sourced from the US, which leads to predictability in the daily return of Japanese and Hong Kong iShares ETFs.

Dellva (2001) and Kostovetsky (2003) provide a comparison between index mutual funds and ETFs. Dellva (2001) finds that ETFs are relatively unattractive to retail investors dealing in small assets due to the transaction costs associated with trading. Dellva (2001) also argues that there are either little or no benefits associated with tax-deferred, long-term retirement-class investors utilising such products. Kostovetsky (2003) scrutinises the source of cost differences between open-end funds and ETFs and highlights that key differences arises due to "management fees, shareholder transaction fees, tax efficiency and other qualitative differences" (p. 91).

3. INSTITUTIONAL BACKGROUND IN AUSTRALIA

3.1 Features of ETFs

ETFs are designed to track the performance of a pre-defined market index.[3] The innovation associated with traded stock baskets was first advanced by Hakansson (1978) and further developed by Rubinstein (1989). Marketable ETFs have been structured to replicate either aggregate market benchmarks in equities or bonds, as well as investors also having available to them sector-specific ETFs or ETFs which mimic international baskets of stocks. ETFs enable retail and institutional investors to either buy or sell a portfolio of securities in a single transaction and on a real-time intra-day basis (during normal trading hours on the stock exchange). ETFs have often been described as "hybrid securities" due to them having some characteristics of both exchange-listed stocks and open-ended managed funds.

ETFs do not receive cash and then purchase the required securities on-market to acquire ETF units. Rather, investors deliver in-kind, to the sponsor, securities which match the benchmark and therefore avoid any liquidity costs that are otherwise associated with implementation.

ETFs need to be relatively cost effective against competing open-end managed funds, hence investors accessing ETFs will be concerned about the management fees (ie management expense ratio) charged by the institution operating the ETF product.[4] All ETFs have two quoted indicators measuring their value, namely the fund's Net Asset Value (NAV) and the unit's traded price. The NAV of the units is calculated with reference to the value of the underlying portfolio of securities and/or other assets that are in the fund. For ETFs that invest in shares or other liquid securities the NAV is usually calculated on a daily basis and reported at the close of the trading day. The unit traded price of the ETF is determined by active trading on the secondary market and is reported as the last traded price.

ETFs have three common features. First, ETFs are open-ended rather than closed-end funds. This means that the number of units on issue, and therefore the number of units available to be traded on the stock exchange, is driven by market forces of supply and demand. Second, as open-ended funds, all ETFs feature a continuous primary market for ongoing unit creation and redemption that operates simultaneously within a secondary market (ie tradeable on the stock exchange). The ongoing primary market (operated by the ETF issuer) provides a means to either increase or decrease the number of units on issue, thereby facilitating a balance between supply and demand for units. The role of the secondary market is to provide investors with an active and liquid market when trading ETFs, where participants can buy and sell at a minimum of one ETF unit on-market.[5] Third, ETFs are price efficient, where one of the principal objectives of an ETF is to maintain close price parity between the traded unit price and the NAV of the fund's units NAV. The reliance on arbitrage between the primary and secondary market is used to achieve this outcome. By changing quantities of units on issue in the primary market, the ability of investors to capitalise on arbitrage opportunities is therefore minimised. For example, if we assume that an ETF unit is trading at a premium to NAV, then by applying for the creation of units in the primary market and then selling the ETF units into the secondary market, an arbitrageur can capture the premium between the unit traded price and NAV. The additional supply of ETF units on the secondary market will move to close any mispricing opportunity, and therefore keep the unit NAV and traded price very close to fair value.

ETFs can be described as either 'classical' or 'hybrid' instruments. Classical ETFs are passively managed and are designed to remove the information-motivated elements of active asset management by seeking to replicate the performance of the underlying index on a before costs basis. One feature of a classical ETF is that it typically exhibits a lower management expense ratio (MER). This is due to the rules-based approach adopted by the underlying investment portfolio which is designed to replicate the returns and risk of the basket index. Another feature of the classical ETF is the high transparency in its portfolio of securities held within the fund. As the fund only accepts applications for new units in-kind, the fund issuer will regularly publish information regarding the portfolio of securities that it will accept (ie in-specie) for issuing new units (or will deliver in return for redeeming ETF units). The second type of ETF, known as a hybrid, can be either passively or actively managed, and these fund types typically levy higher expense ratios. The fund manager selects a range of preferred securities or other assets to be included in the fund, and they provide investors with access to a much broader range of investment management styles, strategies, asset classes and operational practices. Additionally, hybrid funds accept cash applications, where investors can buy units directly from the

3 An excellent discussion of the operation of ETFs is also presented by Gastineau (2001) and Fuhr (2001).
4 The expense ratio is a fund's total annual operating expenses expressed as a percentage of the fund's assets. The operating expenses include such things as money management, record keeping, legal and communication fees.
5 It should be noted that traditional index managed funds generally can be purchased or redeemed only at the end of the trading day.

fund manager through lodging an application form contained in the fund product disclosure statement, as well as being able to buy units already issued on the exchange. For the purposes of this study, we provide an examination of classical ETFs that track S&P/ASX Australian equity benchmarks.

3.2 History of ETFs

Prior to the introduction of ETFs to the market, the only way to access a fund which tracked an underlying basket of securities was through a managed investment vehicle, such as a unit trust or mutual fund. The launch of ETFs on the Toronto Stock Exchange in 1989 signalled the issuance of a new financial product that combined the benefits of collective investment with the tradeability and flexibility of an ordinary share. In 1993, State Street Global Advisors (SSgA) and AMEX introduced the first ETF in the US – the Standard and Poor's Depository Receipt (SPDR) (also known as the "Spider"). Each Spider represents an investment in the underlying stocks forming the S&P 500. Today, the SPDR is the most widely held ETF, with an open interest of US$42.3 billion (as at January 2004). Other well known ETFs to have operated since the launch of the Spider include Diamonds (tracking the Dow Jones Industrial Average), QQQs (benchmarked to NASDAQ 100), and iShares (mimicking MSCI indices).

Based on the success of ETFs in the US, similar products have been launched on stock exchanges in Europe, Asia, Africa and Australia. ETFs arrived in Australia in March 2001, when Salomon Smith Barney launched the Index Shares 100 product on the ASX. The Index Shares 100 ETF tracks the S&P/ASX 100 Accumulation Index. In September 2000, SSgA entered into an agreement with the ASX to develop ETF products over the new S&P/ASX indices.[6] In August 2001, SSgA subsequently launched the StreetTRACKS 200 and StreetTRACKS 50 funds, benchmarked against the S&P/ASX 200 and S&P/ASX 50 Accumulation Indices, respectively.

Table 1 provides a profile of all ETFs that have been listed on the ASX. There are seven ETFs on the ASX which track equity baskets, fixed interest or overseas markets, and account for more than A$791 million. The majority of ETF assets in Australia are

TABLE 1.
EXCHANGE-TRADED FUNDS (ETFS) IN AUSTRALIA

ETF name	ETF managers	ASX code	ETF type	Underlying investment	Investment objective	Listing date	Fund size ($m)	MER (% pa.)
StreetTRACKS S&P/ASX 50 Fund	State Street Global Advisers (SSgA)	SFY	Classical	Australian equities	Track the S&P/ASX 50 Index	27/08/2001	37	0.286
StreetTRACKS S&P/ASX 200 Fund	State Street Global Advisers (SSgA)	STW	Classical	Australian equities	Track the S&P/ASX 200 Index	27/08/2001	436	0.286
StreetTRACKS S&P/ASX 200 Listed Property Fund	State Street Global Advisers (SSgA)	SLF	Classical	Australian listed property	Track the S&P/ASX 200 Property Index	15/02/2002	118	0.400
The Index Shares Fund*	Citigroup	IDX	Classical	Australian equities	Track the ASX 100 Index	02/03/2001	13	0.90
Commonwealth Diversified Share Fund	Commonwealth Bank	CDF	Classical	Australian equities and derivative contracts	Track the 190 constituents of the S&P/ASX 200 Accumulation Index	04/01/1999	61.5	0.95
Wilson HTM Australian Equities Fund	Wilson HTM Ltd	WHTMAE	Hybrid	Australian equities	Outperform the S&P/ASX 300 Accumulation Index	01/09/1999	31	1.12
Wilson HTM Fixed Interest Fund*	Wilson HTM Ltd	WHTMFI	Hybrid	Australian fixed interest	Outperform the UBS Warburg Bond Index	01/12/2000	19	0.55
Wilson HTM Overseas Share Fund	Wilson HTM Ltd	WHTMOS	Hybrid	International equities	Outperform the MSCI World Index	01/10/1998	20	0.99
Wilson HTM Smaller Companies Fund	Wilson HTM Ltd and previously managed by BNP Paribas	AXSBSC	Hybrid	Australian equities	Outperform the S&P/ASX Smaller Companies Index	01/04/2001	6	1.12
Access WHTM Australian Equities Fund	Wilson HTM Ltd and previously managed by BNP Paribas	AXSBAE	Hybrid	Australian equities	Outperform the S&P/ASX 300 Accumulation Index	01/07/2001	11	0.99
Access WHTM Balanced Portfolio Fund	Wilson HTM Ltd and previously managed by BNP Paribas	AXSBMD	Hybrid	Mix of growth and income assets	Maintain real growth/ minimise risk	01/07/2001	33	0.99
Access WHTM Global Equity Fund	Wilson HTM Ltd and previously managed by BNP Paribas	AXSMGE	Hybrid	International equities	Capital appreciation through investment in global stocks	01/07/2001	6	0.99

* These funds have been delisted from the Australian Stock Exchange. The Index Shares Fund was removed from trading on 17 February 2003, while the Wilson HTM Fixed Interest Fund was removed from ASX on 3 December 2003.

6 The agreement between the ASX and SSgA allowed for the exclusive development of ETFs over the S&P/ASX20, the S&P/ASX 50, the S&P/ASX 100, the S&P/ASX 200, the S&P/ASX 300 and the S&P/All Ordinaries Index.

operated within the three streetTRACKS products. The most popular (by size) is the S&P/ASX 200 Fund with assets of approximately A$436 million under management.

3.3 Benefits of ETFs available to investors

Exchange-traded funds have provided investors with an inexpensive and efficient method to achieve a broad-exposure to a selected market segment through purchasing a single security type. ETFs provide several other applications to both individual and institutional investors. Principal traders and arbitrageurs seeking trading opportunities and an efficient way of riding short-term trends in the market can arbitrage between the primary and secondary market. Retail and institutional investors wishing to form a "building block" to establish their portfolio core can benefit from purchasing ETFs. Investment managers, looking to equitise their cash flows, can decide to use ETFs to manage their short-term liquidity demands. Before the availability of ETFs the only choice for an investor of a super fund to equitise their additional cash flows was to buy futures. Fhur (2001) suggests that ETFs provide investors with a better alternative than futures contracts, where ETFs can be purchased closer to their fair value. Furthermore, ETFs also provide investors with improved tax efficiency as the fund is structured to limit events that trigger realised capital gains distributions to unit holders. Overall, ETFs represent a useful tool to investors wishing to diversify in a single investment, hedge their existing investments, and/or gain exposure to additional asset classes that may be sector or country specific.

4. DATA AND RESEARCH DESIGN

Our study obtains data from the Securities Industry Research Centre of Asia-Pacific (SIRCA). ETF data for the entire Australian market is extracted from the Stock Exchange Automated Trading System (SEATS) database, which provides complete records of all orders and trades placed on the ASX.[7] The data provides details concerning price, volume, date, time and broker for every order and trade. We capture daily transaction data for four classical ETFs, which are benchmarked against various

TABLE 2.
EXCHANGE-TRADED FUNDS (ETFS) AND INSTITUTIONAL INDEX FUNDS ANALYSED IN THIS STUDY

The table reports a summary of ETFs that have been listed on the ASX and wholesale index funds that are benchmarked against various S&P/ASX stock indices. The fund value and MERs of these products are reported as at 31 December 2003, with the exception of the Index Shares Fund (IDX) that was removed from trading on 17 February 2003.

PANEL A: CLASSICAL EXCHANGE-TRADED FUNDS (ETFS)

ETF issuer	ASX code	Fund name	Investment objective	Listing date	Fund size	MER (%)
State Street Global Advisers (SSgA)	STW	streetTRACKS S&P/ASX 200 Fund	Track the S&P/ASX 200 Index	27/08/2001	436.1	0.29
State Street Global Advisers (SSgA)	SFY	streetTRACKS S&P/ASX 50 Fund	Track the S&P/ASX 50 Index	27/08/2001	36.8	0.29
Citigroup	IDX	The Index Shares Fund	Track the ASX 100 Index	02/03/2001	13.1	0.90
Commonwealth Bank	CDF	Commonwealth Diversified Share Fund	Track the performance of the S&P/ASX 200 Index	04/01/1999	65.1	0.95

PANEL B: WHOLESALE INDEX FUNDS

Index fund provider	APIR code	Fund name	Investment objective	Listing date	Fund size ($m)	MER (%)
AMP Capital Investors	AMP0281AU	AMP Australian Share Index Fund	To closely track the S&P/ASX 200 Accumulation Index on a rolling 12 month basis	31/01/1999	150.9	0.2045
State Street Global Advisers (SSgA)	SST0014AU	SSgA Australian Equities Index Trust	Closely matching the performance, before fees, of the S&P/ASX 200 Accumulation Index	01/02/1998	565.7	0.18
MLC	MLC0014AU	MLC Australian Share Index Fund	To provide long-term growth that approximates the S&P/ASX200 Accumulation Index	01/02/1998	323.13	1.28

6 The agreement between the ASX and SSgA allowed for the exclusive development of ETFs over the S&P/ASX20, the S&P/ASX 50, the S&P/ASX 100, the S&P/ASX 200, the S&P/ASX 300 and the S&P/All Ordinaries Index.

7 SEATS is a competitive and open electronic order book which trades continuously (from 10:00 to 16:00) from Monday to Friday. It allows brokers to clearly see bids and offers, place buy or sell orders, execute transactions, communicate with other brokers, and report any off-market transactions.

8 For one of the ETF products named the Index Shares Fund (IDX), data is taken across a different sample period because of its removal from trading on the exchange. For IDX, transactions data is obtained between 2 March, 2001 and 31 December, 2002.

S&P/ASX equity indices between 2 January 2002 and 31 December 2003.[8] While the number of ETF products examined in this study is small, these instruments represent the full population of classical equity ETFs benchmarked against Australian equity indices. The price series for all Australian equity indices that these products track across the sample period are also incorporated into our database. Index fund data is sourced from in-house databases held by various institutional portfolio managers. We acquire the daily NAV, MERs and monthly fund values for all four index funds that are benchmarked against the more marketable S&P/ASX 200 Accumulation Index. Index fund data is obtained for the same two year sample period used for the analysis of ETFs. Table 2 provides a profile of all classical ETFs and institutional index funds that are analysed in this study.

4.1 Performance measures (tracking error)

If an index manager is unable to perfectly replicate the returns on a benchmark index (ie it experiences tracking error), then this is prima facie evidence that these funds will not entirely meet their investment objective. Frino and Gallagher (2001) find that factors such as transaction costs, fund cash flows, dividends, benchmark volatility, corporate activity and index composition changes prevent index funds from perfectly replicating the performance of the benchmark index. The extent to which fund performance differs from the underlying benchmark index is assessed by quantifying the level of tracking error. In order to estimate tracking error before expenses, index fund returns are adjusted by reported historical fund expense ratios, in order to approximate gross returns. Roll (1992), Pope and Yadav (1994) and Larsen and Resnick (1998) identify a number of different ways tracking error can be quantified. This study measures tracking error using two methods. First, tracking error in day t is calculated as the absolute difference in returns of the index portfolio and the benchmark index, where the daily average absolute tracking error of n days ($TE_{1,p}$) is defined as follows:

$$TE_{1,p} = \frac{\sum_{t=1}^{n} \left| e_p \right|}{n} \tag{1}$$

where:
$e_{pt} = R_{pt} - R_{bt}$
R_{pt} = the return of index portfolio p in period t;
R_{bt} = the return of the benchmark index b in period t; and
n = the number of observations in the period.

An alternative measure of tracking error measures the standard deviation of the difference in returns between the index portfolio and the underlying benchmark index return ($TE_{2,p}$). This measure is expressed as follows:

$$TE_{2,p} = \sqrt{\frac{1}{n-1} \sum_{t=1}^{n} \left(e_{pt} - \bar{e}_p \right)^2} \tag{2}$$

It is important to note, however, if an index fund consistently underperforms the index by x per cent per day, then the use of this method will result in zero tracking error over the period (Roll, 1992). The converse is also the case for fund outperformance.

We next evaluate the performance of ETFs and wholesale index equity funds by comparing the individual tracking errors of three wholesale index funds with a control ETF with similar investment objectives. The wholesale index funds are benchmarked against the S&P/ASX 200 Accumulation Index. The streetTRACKS S&P/ASX 200 Fund, which is the largest ETF, is chosen as the control ETF. Standard two-tailed t-tests are then employed to test for differences in the tracking error between each of the wholesale index funds and the control ETF.

4.2 Evaluating the trading characteristics of ETFs

The purpose of this section is to provide alternative tests to describe the trading characteristics of ETFs. First, we examine the extent of deviations of ETF traded prices from net asset value (NAV), which represents both a cost and an arbitrage opportunity to investors. To undertake this analysis, we report the frequency distribution using closing prices of both dollar difference between price and NAV, and differences in percentage returns expressed as the dollar difference divided by NAV. Second, we examine the number of ETF units that are created and deleted across our sample period. Creations/redemption in-kind are a unique feature of ETFs and play an important role in preventing ETF prices diverging substantially from the NAV of a fund's constituent stocks. Third, we provide descriptive statistics of the trading activity of ETFs to assess the extent of growth and use of these instruments in the Australian market.

5. EMPIRICAL RESULTS

5.1 Performance

When employing an indexing strategy, the performance of the fund can be assessed by the magnitude of its tracking error, which quantifies the degree to which the strategy differed from the underlying benchmark. Table 3 documents the daily performance of each of the four classical ETFs in our sample, measured by their tracking error.[9] For this analysis, our sample period is partitioned into half-yearly intervals for each calendar-

9 While Pope and Yadav (1994) highlight the potential bias induced by high frequency data when examining tracking error, our analysis does not find that this is a significant problem for our analysis.

10 It is noteworthy to mention that CDF is unique in the way it is managed and should be considered on its own and not with the other three ETFs when examining the performance of truly classical ETFs. From our earlier discussion, CDF is designed so that its performance (before fees and expenses and assuming reinvestment of income) tracks the performance of the S&P/ASX 200 Accumulation Index. However, it is unique in that under the Corporations Law, the fund is not permitted to invest directly in Commonwealth Bank (CBA) ordinary shares that comprises the index. Subsequently, the fund achieves its investment objective by using financial derivatives such as equity swap transactions.
For open-ended index funds, liquidity costs are borne by the fund itself. An index manager's role is to invest cash deposits received from outside investors in either acquiring stocks within the index or selling stocks to pay back those investors who are redeeming shares. In turn, the fund manager bears liquidity costs in the form of bid-ask spreads and market impact costs. Unlike index funds, the investor of ETFs in the primary market pays the liquidity costs to obtain a minimum parcel of shares constituting the target index. Because ETFs operate through the process known as creation-redemption in-kind, there are virtually no liquidity costs borne by the fund.

year. On examination of $TE_{1,p,}$ the magnitude of daily tracking error ranges between ETFs from an average of 0.0167 per cent to 0.8280 per cent across all ETFs within those partitioned intervals. This indicates that market frictions prevent classical index-linked ETFs from perfectly matching the performance of the benchmark. While the range of tracking error across all ETFs is considerable, it should be noted that the higher tracking error is specific to the Commonwealth Diversified Share Fund (CDF).[10] For the remaining ETFs in the sample, the cross-sectional average ranges from 0.0167 per cent for the Index Shares Fund (IDX) to 0.0290 per cent for the streetTRACKS S&P/ASX 200 Fund (STW). The results also show that there is considerable variability in tracking error for each ETF through time. For example, the daily tracking error for the entire sample of STW ranges from 0.0001 per cent to 2.7356 per cent. However, the magnitude of mean tracking error across half-yearly intervals is generally consistent across funds. Tracking error estimates using $TE_{2,p}$,as expected, provide similar results. $TE_{2,p}$ across all ETFs (excluding CDF) ranges from 0.0347 per cent for IDX and 0.2459 per cent for STW.

While there is evidence of significant tracking error in table 3, there is no significant bias in performance in the majority of half-yearly intervals examined. For example, in the majority of cases, the mean arithmetic differences in returns documented in table 3 are negligible and not statistically significant based on standard *t*-tests. With the exception of IDX, this finding confirms that ETFs neither systematically outperformed or underperformed their relevant S&P/ASX equity benchmark index over the half-yearly windows examined. This result suggests that investors with a long-term horizon will be able to still achieve investment returns that are similar to index returns. The significant underperformance of IDX, whose investment objective was to track the performance of the S&P/ASX 100 Accumulation Index, may have been one of the principal reasons behind why the ETF issuer (ie Citigroup) delisted the fund from the ASX in February 2003.

Table 4 documents the tracking error of three wholesale index equity funds that are benchmarked against the S&P/ASX 200 Accumulation Index. These funds are managed off-market by fund managers. Comparative analysis of the mean absolute differences in returns between these funds and the comparable streetTRACKS S&P/ASX 200 ETF is also provided. The cross-sectional mean of $TE_{1,p}$ for all wholesale index equity funds ranges from 0.0228 per cent for the MLC Australian Share Index Fund to 0.1739 per cent for SSgA Australian Equities Index Trust. Tracking error exists for all three wholesale index equity funds, but only significant underperformance is detected for the MLC Australian Share Index Fund using standard *t*-tests. We find evidence of considerable variability in the tracking error across the sample period for all wholesale index funds examined. For example, the daily tracking error of SSgA Australian Equities Index Trust ranges from 0 per cent to 7.7017 per cent. Tracking

TABLE 3. THE PERFORMANCE OF ETFs – TRACKING ERROR

This table reports the performance, as measured by the tracking error of four exchange-traded funds benchmarked against various S&P/ASX equity market indices. Tracking error and risk-adjusted returns are expressed in daily percentage terms, where expenses have been added back to index returns to approximate gross returns.

			Absolute difference in returns						Arithmetic differences in returns			
Fund	**Period**	**N**	**Mean ($TE_{1,p}$)**	**SD**	**Min**	**Q1**	**Q2**	**Q3**	**Max**	**Mean**	***t*-stat**	**SD ($TE_{2,p}$)**
STW	1st half, 2002	123	0.0326	0.2458	0.0002	0.0046	0.0092	0.0150	2.7356	-0.0228	-1.03	0.2459
	2nd half, 2002	130	0.0243	0.0965	0.0005	0.0053	0.0110	0.0175	1.0334	-0.0099	-1.14	0.0986
	1st half, 2003	123	0.0281	0.1729	0.0001	0.0059	0.0118	0.0186	1.9273	-0.0173	-1.10	0.1736
	2nd half, 2003	130	0.0313	0.1809	0.0002	0.0050	0.0092	0.0150	2.0222	-0.0168	-1.05	0.1821
	All	**506**	**0.0290**	**0.1805**	**0.0001**	**0.0051**	**0.0100**	**0.0166**	**2.7356**	**-0.0166**	** **-2.05**	**0.1818**
SFY	1st half, 2002	123	0.0186	0.0995	0.0001	0.0038	0.0079	0.0137	1.1097	-0.0102	-1.12	0.1003
	2nd half, 2002	130	0.0275	0.1957	0.0002	0.0040	0.0080	0.0157	2.2392	-0.0185	-1.08	0.1959
	1st half, 2003	123	0.0217	0.0700	0.0005	0.0053	0.0093	0.0180	0.6453	-0.0061	-0.92	0.0728
	2nd half, 2003	130	0.0334	0.1962	0.0001	0.0029	0.0077	0.0151	2.1527	-0.0174	-1.00	0.1975
	All	**506**	**0.0254**	**0.1524**	**0.0001**	**0.0041**	**0.0083**	**0.0155**	**2.2392**	**-0.0132**	**-1.92***	**0.1537**
IDX	1st half, 2001	81	0.0188	0.0338	0.0000	0.0012	0.0028	0.0162	0.1902	-0.0155	*** -3.94	0.0352
	2nd half, 2001	129	0.0155	0.0344	0.0000	0.0008	0.0019	0.0122	0.1795	-0.0130	*** -4.17	0.0353
	1st half 2002	123	0.0158	0.0338	0.0000	0.0010	0.0026	0.0138	0.1847	-0.0136	*** -4.34	0.0347
	2nd half, 2002	130	0.0172	0.0385	0.0000	0.0009	0.0025	0.0135	0.2247	-0.0157	*** -4.59	0.0390
	All	**463**	**0.0167**	**0.0353**	**0.0000**	**0.0010**	**0.0023**	**0.0142**	**0.2247**	**-0.0144**	*** **-8.53**	**0.0362**
CDF	1st half 2002	123	0.7297	0.5799	0.0095	0.3417	0.6222	0.9700	3.4851	-0.0111	-0.13	0.9305
	2nd half, 2002	130	0.8280	0.6567	0.0039	0.3013	0.7000	1.2153	2.9399	-0.0416	-0.45	1.0545
	1st half 2003	123	0.7761	0.5962	0.0087	0.2794	0.7235	1.0840	2.6062	-0.0006	-0.01	0.9772
	2nd half, 2003	130	0.4859	0.5139	0.0027	0.1544	0.3534	0.6170	3.5040	-0.0270	-0.44	0.7053
	All	**506**	**0.7036**	**0.6020**	**0.0027**	**0.2545**	**0.5585**	**0.9593**	**3.5040**	**-0.0205**	**-0.50**	**0.9252**

* Significant at the 0.10 level ** Significant at the 0.05 level *** Significant at the 0.01 level, n/a – not available

error estimates using $TE_{2,p}$ also provide similar results. Our study then compares the mean absolute difference in returns for each of the three wholesale index funds against STW using standard *t*-tests. Two of the three wholesale index funds for the full sample period are found to have tracking error significantly higher in magnitude than the streetTRACKS S&P/ASX 200 Fund. Only the MLC Australian Share Index Fund is found to have a similar tracking error to STW.

In summary, these results demonstrate that tracking error is inherent in performance, although for the majority of index fund products their overall investment objective is not compromised. We also find that the tracking error of wholesale index equity funds is significantly higher relative to ETFs that are benchmarked against appropriate underlying indices. This may be due to problems associated with liquidity costs, dividend policies in the timing of receiving dividends for re-investment purposes and/or higher expenses. For example, liquidity costs (ie in the form of bid-ask spreads and/or market impact costs) is the principal source of tracking error for index fund managers, whilst this is nearly non-existent for ETFs.[11] This is most likely to be an important factor that explains the higher tracking error of index funds relative to their ETF counterparts.

5.2 The extent of price deviations for ETFs

An ETF has two quoted indictors measuring their value. These are the NAV and the unit's traded price. The NAV of the fund is calculated with reference to the market value of the securities held. However, the trading price of an ETF on the ASX is determined by the supply and demand from market participants. Consequently, the trading price of an ETF may not be identical to the NAV, which represents both a cost and an arbitrage opportunity to the investor. Table 5 reports the frequency distribution of both the dollar difference between price and NAV (see panel A) and differences in percentage returns as measured by the dollar difference divided by the NAV (see panel B). On average, price lies below NAV for both SFY and IDX, and the reverse is observed for

TABLE 4. THE PERFORMANCE OF INDEX FUNDS TRACKING THE S&P/ASX200 ACCUMULATION INDEX – TRACKING ERROR

This table reports the performance of three index funds, which are benchmarked against the S&P/ASX 200 Accumulation Index. Index fund tracking error is reported together with comparisons of their tracking error against the streetTRACKS S&P/ASX 200 Fund. Tracking error and risk-adjusted returns are expressed in daily percentage terms, where expenses have been added back to index returns to approximate gross returns.

			Absolute difference in returns						Arithmetic differences in returns			
Index fund	Period	N	Mean ($TE_{1,p}$)	SD	Min	Q1	Q2	Q3	Max	Mean	*t*-stat	SD ($TE_{2,p}$)
AMP	1st Half, 2002	123	0.0449	0.1575	0.0000	0.0025	0.0053	0.0095	0.8829	0.0012	0.08	0.1632
	2nd Half, 2002	130	0.1227	0.3690	0.0001	0.0034	0.0074	0.0159	1.7660	-0.0147	-0.43	0.3873
	1st Half, 2003	123	0.1239	0.3846	0.0001	0.0039	0.0087	0.0211	2.5457	-0.0340	-0.94	0.4012
	2nd Half, 2003	130	0.0917	0.3370	0.0000	0.0017	0.0046	0.0116	2.9383	-0.0226	-0.74	0.3473
	All	**505**	**0.0962**	**0.3267**	**0.0000**	**0.0027**	**0.0059**	**0.0142**	**2.9383**	**-0.0176**	**-1.16**	**0.3395**
MLC	1st Half, 2002	123	0.0302	0.1690	0.0004	0.0046	0.0093	0.0161	1.7997	-0.0227	-1.47	0.1695
	2nd Half, 2002	130	0.0236	0.0433	0.0003	0.0071	0.0145	0.0240	0.4134	-0.0077	*-1.81	0.0486
	1st Half, 2003	123	0.0270	0.1029	0.0002	0.0044	0.0103	0.0218	1.0061	-0.0195	**-2.07	0.1042
	2nd Half, 2003	130	0.0228	0.0929	0.0002	0.0046	0.0080	0.0145	0.9241	-0.0162	*-1.96	0.0939
	All	**505**	**0.0258**	**0.1101**	**0.0002**	**0.0053**	**0.0098**	**0.0190**	**1.7997**	**-0.0164**	***-3.29	**0.1116**
SSgA	2nd Half, 2002	129	0.1739	0.4544	0.0001	0.0025	0.0071	0.0155	2.9311	-0.0007	-0.02	0.4849
	1st Half, 2003	123	0.0269	0.2124	0.0000	0.0034	0.0054	0.0081	2.3586	-0.0191	-0.99	0.2123
	2nd Half, 2003	130	0.0774	0.6774	0.0000	0.0022	0.0045	0.0092	7.7017	-0.0593	-1.00	0.6766
	All	**382**	**0.0937**	**0.4928**	**0.0000**	**0.0026**	**0.0054**	**0.0098**	**7.7017**	**-0.0266**	**-1.04**	**0.4997**

Comparisons of mean absolute difference returns between three index funds and the streetTRACKS S&P/ASX 200 Fund.

	Wholesale index funds					
	AMP		MLC		SSgA	
Period	Mean difference	*t*-stat	Mean difference	*t*-stat	Mean difference	*t*-stat
1st Half, 2002	0.0124	0.43	-0.0023	-0.10	n/a	n/a
2nd Half, 2002	0.0985	***2.74	-0.0007	-0.08	0.1496	***3.62
1st Half, 2003	0.0959	**2.51	-0.0011	-0.06	-0.0011	-0.05
2nd Half, 2003	0.0604	**2.06	-0.0085	-0.47	0.0461	0.75
All	**0.0672**	***4.01	**-0.0032**	**-0.34**	**0.0647**	**2.48

* Significant at the 0.10 level ** Significant at the 0.05 level *** Significant at the 0.01 level, n/a – not available

STW and CDF. In all cases, the mean difference in price is very small, where the mean percentage differences range from -0.0349 per cent for IDX to 0.0635 per cent for CDF. While the mean difference is small between price and NAV for all ETFs examined, there exists considerable variability in the dollar and percentage differences within each ETF. For example, although STW has a small dollar (percentage) difference of 0.08¢ (0.0024 per cent), it ranges from -20¢ (-0.61 per cent) to 29¢ (0.90 per cent). For both STW and SFY, around 88 per cent of the time the dollar difference is within 10¢. However, it is noteworthy to mention that the NAV equals the unit traded closing price for 12 per cent and 67 per cent of the time for STW and SFY, respectively. For IDX and CDF the dollar differences do not extend beyond +/- 5¢.

In general, these results suggest that dollar and percentage differences in price are small and do not substantially deviate from one another for the majority of cases. However, the question of whether there is persistence or lack thereof in those deviations needs to be examined further. To investigate this issue, a regression model is employed. The difference between price and NAV as expressed in dollars at the close of day t (D_t), is regressed in a model with a constant (_) and its one day lagged variable (D_{t-1}). Table 6 provides the results of this regression model.

An examination of table 6 indicates that the intercept term (_) is significant for three of the four ETFs where they are all shown to be close to the mean difference in dollar price (see panel A of table 5). While the fit of the regression models (R^2) are close to zero, we find more importantly that the slope of the regression coefficient is not significantly different from zero. This finding provides support that deviations between unit traded price and NAV disappear within a day and are consistent with the US.findings of Elton *et al* (2002) for Spiders. Overall, it would appear that the market is efficient, where deviations that do occur between price and NAV do not persist over time, but rather disappear within a day.

5.3 Trading profile of ETFs

An overview of the average trading profile of each ETF in our sample is provided in table 7. Trading metrics examined include average daily trading frequency, average daily trading volume and average daily trading volume as a percentage of the issues outstanding. The amount of issues outstanding and the fund value for each ETF at the end of each half-yearly interval is also reported. As of December 2003, it can be observed that by fund value alone, STW was 12 times larger than SFY and seven times larger than CDF. Even though IDX was the first listed ETF in Australia, it was 30 times smaller relative to STW as at December 2002. Clearly, it is evident that STW is the most actively traded ETF in Australia, where it has the highest fund value out of all the ETFs examined. However, while average trading frequency for STW has continually risen from the first half of 2002, the average trading volume has continuously declined as a percentage of total number of issues outstanding. For the entire sample period for STW, only 0.50 per cent of the outstanding shares were traded each day. The lack of trading activity in this fund is also comparable with the trading activity of other ETFs in our sample, although on average these experience lower trading activity (ranging from 0.03 per cent for CDF to 0.32 per cent for IDX). The small level of trading activity in the ETFs in Australia clearly shows that these instruments have not yet grown in popularity amongst investors, relative to other countries such as the US. For example, Elton *et al* (2002) report that as of 1998, the most widely held and traded ETF in the US – the Spider – experienced more than 10 per cent of its outstanding shares being traded each day.

The question that arises is why ETFs in Australia have not grown as favourably relative to those that were introduced into the US. Based on private consultation with a number of market practitioners, we offer two explanations. First, fund managers have been reluctant to issue more ETFs into the marketplace and promote their growth, as ETF vehicles could erode their market share if the distribution function is controlled by an independent party (eg ASX). Considering that significant capital has been spent by fund managers to establish networks and infrastructures to distribute their products, it may not be in their best interests for them to issue ETFs. Second, a significant portion of funds in the US are no load funds (ie no up-front fee is required to enter the fund). In Australia, this is not the case, and provides a significant disincentive for fund managers to issue or even promote ETFs in Australia. Despite the lack of relative growth in the ETF market, the existence of this market provides investors (eg transitional managers or a fund that implements a large asset allocation shift) with a useful alternative investment tool to gain broad exposure to an equity index.

6. CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This study examines the performance and trading characteristics of classical exchange-traded equity funds on the ASX and provides a comparison relative to open-end index equity funds. Classical ETFs are tradeable securities, which derive their value from a pre-defined basket of securities, which are constituents of an index. ETFs represent a very recent financial market innovation and are instruments that can provide investors with diversification benefits through one investment arrangement, improved tax efficiency relative to active portfolio management, lower expenses and the ability to transact such instruments on the stock exchange. Our research is motivated by the need to better understand the features and performance of index-linked investment products and to provide a comparative analysis between ETFs, traditional off-market index funds, and differences between the US and Australian ETF markets.

Our study reports a number of important results. As expected, classical ETFs in Australia provide investors with returns commensurate with the underlying benchmark before costs. Interestingly, the one ETF to have been delisted from ASX (IDX) did experience significant track error volatility, which is likely to have been the catalyst for its closure. According to the theory and structural operation of ETFs, these instruments incur lower tracking error relative to index managed funds. The variation between net asset value (NAV) and traded price for ETFs is small and does not occur with high frequency. These findings are consistent with Spiders operating in the US market. One of the perplexing issues arising from our research is the limited growth experience and investor participation in ETF instruments in Australia, particularly in light of the proliferation of ETFs in the international market. This represents an important area for future research, as a means of better understanding why this has been the case.

TABLE 5. FREQUENCY DISTRIBUTION OF ETF NET ASSET VALUE (NAV) VERSUS MARKET CLOSING PRICES

Panel A: NAV less MARKET VALUE OF ETF

ASX CODE	STW		SFY		IDX		CDF	
Difference in price ($)	Freq	Prop observ	Freq	Prop observ	Freq	Prop observ	Freq	Prop observ
-0.30 or less			7	1.383				
-0.30 to -0.20		7	1.383					
-0.20 to -0.15	8	1.581	11	2.174				
-0.15 to -0.10	20	3.953	16	3.162				
-0.10 to -0.05	71	14.032	32	6.324				
-0.05 to 0.00	131	25.889	32	6.324	253	54.526	98	19.368
0	62	12.253	341	67.391	36	7.759	277	54.743
0.00 to 0.05	122	24.111	25	4.941	175	37.716	131	25.889
0.05 to 0.10	58	11.462	14	2.767				
0.10 to 0.15	24	4.743	12	2.372				
0.15 to 0.20	7	1.383	4	0.791				
0.20 to 0.30	2	0.593	5	0.988				
Mean	0.0008		-0.0112		-0.0009		0.0007	
Median	0.0000		0.0000		-0.0007		0.0000	
Standard deviation	0.0647		0.0696		0.0082		0.0077	
Skewness	0.3472		-1.3101		0.3360		0.1416	
Kurtosis	1.5766		7.6480		2.9227		3.4839	
Minimum	-0.2000		-0.3900		-0.0336		-0.0400	
Maximum	0.2900		0.2400		0.0381		0.0400	

Panel B: [(NAV less MARKET VALUE OF ETF) / NAV]*100

ASX CODE	STW		SFY		IDX		CDF	
Difference in price ($)	Freq	Prop. observ	Freq	Prop. observ	Freq	Prop observ	Freq	Prop observ
< -2.05					1	0.198		
-2.05 to -1.05			3	0.593	2	0.431	10	1.976
-1.05 to -0.55	3	0.593	15	2.964	16	3.448	69	13.636
-0.55 to -0.45	7	1.383	7	1.383	9	1.940		
-0.45 to -0.35	13	2.569	8	1.581	27	5.819	5	0.988
-0.35 to -0.25	20	3.953	16	3.162	35	7.543	8	1.581
-0.25 to -0.20	16	3.162	12	2.372	27	5.819		
-0.20 to -0.15	39	7.708	13	2.569	36	7.759	4	0.791
-0.15 to -0.10	34	6.719	14	2.767	31	6.681		
-0.10 to -0.05	68	13.439	10	1.976	30	6.466	1	0.198
-0.05 to 0.00	30	5.929	7	1.383	40	8.621		
0	62	12.253	341	67.391	36	7.759	277	54.743
0.00 to 0.05	31	6.126	5	0.988	18	3.879		
0.05 to 0.10	60	11.858	12	2.372	35	7.543	5	0.988
0.10 to 0.15	28	5.534	8	1.581	22	4.741		
0.15 to 0.20	23	4.545	4	0.791	17	3.664	3	0.593
0.20 to 0.25	16	3.162	5	0.988	14	3.017	1	0.198
0.25 to 0.35	31	6.126	9	1.779	28	6.034	8	1.581
0.35 to 0.45	12	2.372	6	1.186	19	4.095	4	0.791
0.45 to 0.55	8	1.581	5	0.988	7	1.509		
0.55 to 1.05	5	0.988	6	1.186	11	2.371	94	18.577
1.05 to 2.05					4	0.862	13	2.569
> 2.05							3	0.593
Mean	0.0024		-0.0359		-0.0349		0.0635	
Median	0.0000		0.0000		-0.0257		0.0000	
Standard deviation	0.2040		0.2201		0.3091		0.6974	
Skewness	0.3471		-1.4282		0.2490		0.1238	
Kurtosis	1.6314		8.1866		2.9018		3.5911	
Minimum	-0.6111		-1.2577		-1.2891		-3.7383	
Maximum	0.9029		0.7950		1.3331		3.3613	

TABLE 6. DETERMINING THE PERSISTENCE OF DOLLAR PRICE DIFFERENCE DEVIATIONS IN ETFS

ASX code	Variable	Intercept (_)	D_{t-1}	R^2
STW	Coefficient	0.0008	0.0934	0.0087
	t-statistic	0.26	1.6	
SFY	Coefficient	-0.0117	-0.0360	0.0013
	t-statistic	-3.59***	-0.9	
IDX	Coefficient	-0.0010	-0.0512	0.0026
	t-statistic	-2.44**	-1.21	
CDF	Coefficient	0.0007	-0.0259	0.0007
	t-statistic	2.04**	-0.61	

** Significant at the 0.05 level *** Significant at the 0.01 level

TABLE 7. A TRADING PROFILE OF EXCHANGE-TRADED FUNDS (ETFS)

ASX code	Period	N	Avg trading frequency	Avg trading volume	Avg trading volume as a % of issues outstanding	Issues outstanding	Fund value
STW	1st half, 2002	123	6.95	68,481.58	0.9820	4,301,086	138,236,904
	2nd half, 2002	130	5.95	43,977.80	0.5719	14,003,691	424,171,800
	1st half, 2003	123	8.76	50,795.75	0.3564	12,205,308	372,628,053
	2nd half, 2003	130	8.85	19,754.30	0.1312	13,116,082	436,109,727
	All	**506**	**7.62**	**45,368.15**	**0.5060**	–	–
SFY	1st half, 2002	123	0.84	1,346.89	0.1682	802,880	26,551,242
	2nd half, 2002	130	0.30	234.28	0.0292	802,908	24,568,985
	1st half, 2003	123	0.85	2,589.72	0.3199	1,803,018	55,803,407
	2nd half, 2003	130	1.01	2,903.38	0.2011	1,103,106	36,843,740
	All	**506**	**0.75**	**1,763.04**	**0.1778**	–	–
IDX	1st half, 2001	82	7.32	29,647.98	0.5301	5,618,355	16,057,820
	2nd half, 2001	129	5.78	24,789.12	0.4406	5,633,412	15,769,047
	1st half 2002	123	3.14	13,386.67	0.2376	5,633,412	14,832,210
	2nd half, 2002	130	2.13	9,674.67	0.1717	5,633,412	13,881,854
	All	**464**	**4.33**	**18,390.51**	**0.3273**	–	–
CDF	1st half 2002	123	4.35	19,267.25	0.0318	61,883,718	71,166,276
	2nd half, 2002	130	3.06	15,209.61	0.0253	59,829,035	62,222,196
	1st half 2003	123	2.73	18,175.30	0.0302	60,384,487	64,611,401
	2nd half, 2003	130	3.24	20,709.25	0.0357	56,639,802	65,135,772
	All	**506**	**3.34**	**18,329.81**	**0.0307**	–	–

REFERENCES

Australian Stock Exchange (2001), Exchange Traded Funds (ETFs).

Australian Stock Exchange (2002), Listed Managed Investments, http://www.asx.com.au

Blume, M Edelen, R 2004, S&P 500 Indexers, Tracking Error, and Liquidity, *Journal of Portfolio Management*, vol. 30(3), pp. 37-46.

Dellva, W 2001, Exchange-Traded Funds Not for Everyone, *Journal of Financial Planning*, vol. 14(4), pp. 110-124.

Elton, E, Gruber, M, Comer, G & Li, K 2002, Spiders: Where are the Bugs?, *Journal of Business*, vol. 75(3), pp. 453-472.

Elton, E, Gruber, M & Busse, J 2004, Are Investors Rational? Choices Among Index Funds, *Journal of Finance*, vol. 59(1), pp. 261-288.

Frino, A, Gallagher, D 2001, Tracking S&P 500 Index Funds, *Journal of Portfolio Management*, vol. 28(1), pp. 44-55.

Frino, A, Gallagher, D 2002, Is Index Performance Achievable? An Analysis of Australian Equity Index Funds, *Abacus*, vol. 38(2), pp. 200-214.

Frino, A, Gallagher, D, Neubert, A & Oetomo, T 2004, Index Design and Implications for Index Tracking: Evidence from S&P 500 Index Funds, *Journal of Portfolio Management*, vol. 30(2), pp. 89-95.

Frino, A, Gallagher, D & Oetomo, T 2005, The Index Tracking Strategies of Passive and Enhanced Index Equity Funds, *Australian Journal of Management*, Forthcoming.

Fuhr, D 2001, Exchange-Traded Funds: A Primer, *Journal of Asset Management*, vol. 2(3), pp. 260-273.

Gastineau, G 2001, Exchange-Traded Funds: An Introduction, *Journal of Portfolio Management*, vol. 27(3), pp. 88-96.

Gastineau, G 2002, Equity Index Funds Have Lost Their Way, *Journal of Portfolio Management*, vol. 28(2), pp. 55-64.

Gastineau, G 2004, The Benchmark Index ETF Performance Problem, *Journal of Portfolio Management*, vol. 30(2), pp. 96-104.

Hakansson, N. (1978), Welfare Aspects of Options and Supershares, *Journal of Finance*, vol. 33, pp. 759-776.

Jares, T & Lavin, A 2004, Japan and Hong Kong Exchange-Traded Funds (ETFs): Discounts, Returns, and Trading Strategies, *Journal of Financial Services Research*, vol. 25(1), pp. 57-69.

Keim, D 1999, An Analysis of Mutual Fund Design: The Case of Investing in Small-Cap Stocks, *Journal of Financial Economics*, vol. 51(2), pp. 173-194.

Kostovetsky, L 2003, Index Mutual Funds and Exchange-Traded Funds, *Journal of Portfolio Management*, vol. 29(4), pp. 80-92.

Larsen, G & Resnick, B 1998, Empirical Insights on Indexing, *Journal of Portfolio Management*, vol. 25(1), pp. 51-60.

Pope, P, Yadav, P 1994, Discovering Errors in Tracking Error, *Journal of Portfolio Management*, vol. 20(2), pp. 27-32.

Roll, R 1992, A Mean/Variance Analysis of Tracking Error, *Journal of Portfolio Management*, vol. 18(4), pp. 13-22.

Rubinstein, M 1989, Market Basket Alternatives, *Financial Analysts Journal*, vol. 45(5), pp. 20-29.