

4. The role of index funds in retirement asset allocation

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INTRODUCTION

Pension fund trustees have exercised significant management and fiduciary responsibilities in activities on behalf of pension fund members. Some important tasks undertaken by trustees are the implementation and monitoring of the plan's portfolio strategy and performance. Therefore, once the pension fund has decided on the strategic asset allocation to be adopted, manager and/or investment selection is critical. In this respect, trustees are required to make choices about whether the plan will exercise either active, enhanced index, or passive fund management (or some combination of the three). Active management is built on the premise that capital markets are not perfectly efficient, and that information gathering and synthesis can lead to superior investment returns relative to the market. At the other end of the spectrum, passive fund management seeks to replicate the returns of the underlying benchmark, which means that outperforming the market is not the goal of the strategy. Enhanced index management is largely passive management, although quantitative techniques are permitted such that the strategy attempts to generate small alpha (that is, outperformance of the market) in a risk-controlled setting.

Investment markets to date have been most commonly associated with active investment management. Indeed, a significant majority of assets managed by pension funds, institutions and retail investors are founded on active management principles. However, indexing has been growing in significance as an alternative and lower-cost investment strategy designed to capture the returns of a particular asset class. This trend has arisen for a number of reasons, perhaps the most significant being the empirical research that has highlighted the overall underperformance of active managers (on average) after expenses. In the context of retirement provision in scary markets, pension funds will be significantly sensitive to active managers being unable to generate at least the returns of the underlying indexes across asset classes. Underperformance will result in the fund having difficulties in achieving the plan's investment objective over the long term.

The size of assets benchmarked to well-known broad market benchmarks is significant. Indeed, more than US\$1 trillion of index mutual fund assets are benchmarked to the S&P 500 Index in the USA. In addition, indexing has become an ever-increasing component of investment management, particularly for pension fund investors. Exchange-traded funds, or ETFs as they are more commonly known, represent an alternative and increasingly popular indexing product. The difference between open-end index mutual funds and ETFs is that the latter are closed-end funds which trade as listed securities on an exchange, and whose performance and volatility move in alignment with the underlying basket of stocks in which the security is tied.

Indexes represent a statistical methodology which summarizes the behaviour, that is, risk and return, of a pre-defined group of securities. More specifically, indexes permit quantitative analysis that measures the change in value of a basket of securities over time. Asset classes such as equities, bonds, property and cash markets are generally easily identified through the availability of well-known benchmark proxies. These benchmarks enable investors to better understand the risk-and-return dimensions of the underlying securities comprising the market index. However, indexes vary according to the depth and breadth of stocks included in the list of constituents, as well as variation in the preferences of investors as to which stock universe most appropriately relates to their investment objectives.

Some of the best-known index providers include Standard and Poor (S&P), Dow Jones, Morgan Stanley Capital International (MSCI), Russell, and the FTSE Group. While indexes help to define the overall performance of national markets, benchmark indexes are also commonly available which explain the performance of industry sectors, such as energy, industrials, health care and financials, and securities based on stock size (where market capitalization is decomposed into large-cap, mid-cap and small-cap). In addition, indexes have varying histories, where the oldest benchmark of common US stocks (the Dow Jones Industrial Average) date back to the late 1800s.

Indexes are constructed and maintained almost exclusively as market capitalization weighted benchmarks, where the weight attributable to each constituent security is on the basis of the size of securities within the investible universe. Therefore, under this index methodology, the increase in value of one security, *ceteris paribus*, leads that stock to become increasingly significant in explaining changes to the overall index. The other important feature of a closed-end benchmark index which adopts a market-cap-weighted index is that rebalancing is significantly more critical (and cumbersome) where other index methodologies are adopted, such as equal or price-weighted constituents. Perhaps the three most significant operating requirements for any successful index is that the stocks included in the benchmark are 'investible' (that is, liquid and available to investors to legally own), they are representa-

tive of the market that the index is seeking to reflect, and the benchmark maintenance procedures cause minimal disruption to the smooth operation of the index. In other words, the benchmark composition needs to reflect securities that can be easily replicated by investors; the securities should be liquid, the index methodology should be transparent, and the index provider should consistently maintain the stock universe in a manner that minimizes turnover. Recent times have witnessed changes to index weight determination using a 'free-float methodology'. Here the proportionate share of a security comprising the benchmark is not only considered in terms of market capitalization and liquidity, but also in terms of the available quantity of stock freely available to be traded. The free-float approach therefore avoids giving a greater benchmark allocation to stocks that have a larger quantity of investors holding stocks for strategic ownership purposes (such as Murdoch family's ownership in News Corporation).

The remainder of this chapter discusses indexing in the context of pension fund investors. The asset class spectrum is discussed next, followed by the types of investment vehicles through which investors attempt to capture the returns available from security markets. The relative merits of active versus passive investment management are considered. A review of the approaches used by index fund managers to replicate the benchmark is then presented, together with a discussion of the various challenges faced by index portfolio managers in their pursuit of the returns and risks of the underlying benchmark. The final section concludes.

THE ASSET CLASS SPECTRUM

An asset class represents a group of financial assets. In theory numerous asset classes may exist. However, in investment markets, asset classes are typically defined in broad terms on the basis that the securities comprising the asset class have some degree of commonality in their characteristics. In the Australian investment markets, the six largest and easily identifiable asset classes are Australian equities, international equities, Australian bonds, international bonds, property and cash. Table 4.1 documents the size of the major asset classes which comprise the Australian investment industry.

Australian investors have the highest exposure to domestic and international equities asset classes, with domestic bonds representing the third largest asset class in the market. The category 'other investments' identified in Table 4.1 includes private equity or venture capital, tactical asset allocation investments and infrastructure-type investments.

Asset classes may be divided into two broad categories – growth assets and defensive assets. Growth assets include equity and property investments,

Table 4.1 Size of Australian asset class sectors managed by investment managers (at 30 June 2001)

Asset class	A\$ billion	(%)
<i>Panel A: Growth asset classes</i>		
Australian equities	211.16	29.43
International equities	140.22	19.55
Property	77.51	10.80
<i>Panel B: Defensive asset classes</i>		
Australian bonds	123.81	17.26
International bonds	28.54	3.98
Cash	85.37	11.90
<i>Panel C: Other assets</i>		
Other investments*	50.78	7.08
Total	717.41	100.0

Note: *Other assets include capital guaranteed assets, tactical asset allocation assets, life insurance policies and infrastructure investments.

Source: Rainmaker Information.

where returns derived from such investments comprise income and changes in capital value. Defensive assets on the other hand are defined as income returns from investments in bonds and liquid securities. Defensive asset classes exhibit a degree of stability in the underlying value of an investor's initial investment. That is, highly liquid money market securities and bonds derive interest income from the underlying capital value, where the capital value remains fixed. In the case of bonds held to maturity, the principal component or initial investment is redeemable at maturity. Debt instruments provide the investor with a legal claim to repayment of the principal value at a future date.

In addition, growth and defensive asset classes may be distinguished in terms of their historical returns, *ex-post* volatility, and the level of asset class correlation existing between sectors. Table 4.2 presents the returns, volatilities and correlations between asset classes. Standard industry benchmarks are used as asset class proxies. Table 4.3 identifies and defines these indexes. Benchmark indexes are defined as a statistical measure that enables changes in the value of a group of securities comprising a particular asset class to be calculated. They therefore allow market participants to measure the returns and risks of a portfolio of securities to serve as a yardstick or reference point when comparing alternative portfolios.

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Table 4.2 Historical annual returns, volatility and correlations (13-year period January 1988–December 2000)

Asset class	Return (% p.a.)	SD (% p.a.)	Correlation (%)						
			AEQ	IEQ	DP	LP	AFI	OFIH	Cash
AEQ	11.6	13.8	100.0	33.8	0.2	52.2	34.8	17.1	0.1
IEQ	12.8	15.1	–	100.0	–3.9	27.8	17.6	31.1	–3.1
DP	5.8	4.6	–	–	100.0	–1.1	–12.6	–10.0	15.5
LP	11.6	10.1	–	–	–	100.0	41.8	28.0	–0.7
AFI	11.5	4.9	–	–	–	–	100.0	58.6	26.0
OFIH	11.3	3.3	–	–	–	–	–	100.0	27.2
Cash	8.4	1.1	–	–	–	–	–	–	100.0
CPI	3.3	2.2	–	–	–	–	–	–	–
AWE	3.9	2.5	–	–	–	–	–	–	–

Source: Mercer Investment Consulting.

Table 4.3 Benchmark indexes employed as asset class proxies

Asset class	Code	Benchmark index
Australian equities	AEQ	S&P/ASX 200 Accumulation Index*
International equities	IEQ	MSCI World (ex-Australia) Index in (net dividends AU\$ reinvested)
Direct property	DP	Mercer Direct Property Index
Listed property	LP	S&P/ASX Listed Property Trusts Index
Australian bonds	AFI	UBS Warburg Composite All Maturities Bond Index
Overseas bonds	OFIH	Salomon Smith Barney World Government Bond Index Hedged in AU\$
Cash	Cash	UBS Warburg Bank Bill Index
Inflation	CPI	ABS Consumer Price Index
Average weekly earnings	AWE	ABS Average Weekly Earnings (All Males)

Note: *ASX All Ordinaries Accumulation Index was used before March 2000. The difference in market capitalization coverage between the S&P/ASX 300 and the S&P/ASX 200 is less than 3 per cent.

While future returns and the volatility of asset classes are unknown, historical data provide investors with some degree of insight into the level of returns derived and the risks associated with each of the asset classes.¹ Consideration of historical data assists investors to forecast likely future scenarios.

Table 4.2 reveals that international equities recorded both the highest return and standard deviation in the 13-year period than any other asset class sector. As expected, growth asset classes exhibit higher standard deviations (or risk) than is the case for defensive asset classes. However, the problem of evaluating returns and risk over static periods is two-fold. First, such an approach does not allow analysis of returns and risks over different periods of time. The second disadvantage is that all observations are treated equally and therefore there is no scaling to apply greater weights to the most recent data. To better understand the relative returns and risks over varying time periods within the 13-year period evaluated, Figures 4.1 and 4.2 show the five-year rolling returns and standard deviations for each of the major asset classes.

INVESTMENT VEHICLES AVAILABLE TO INVESTORS

Pension fund trustees are required to decide on the implementation strategy to

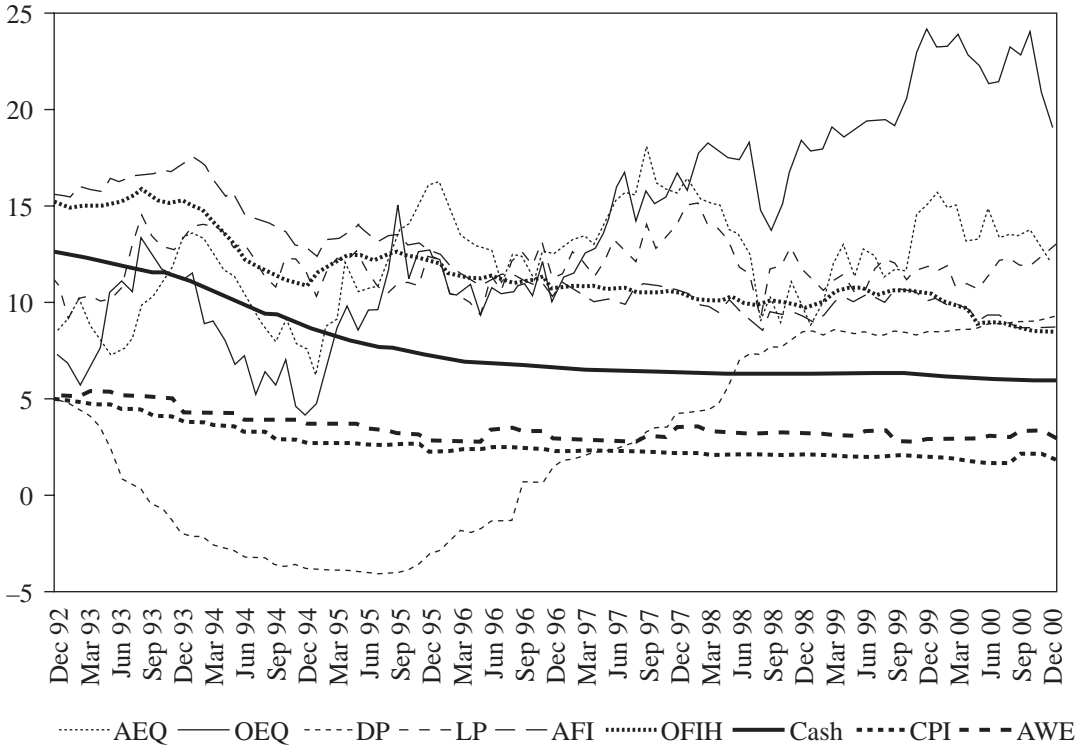


Figure 4.1 Five-year rolling annual returns (% per annum)

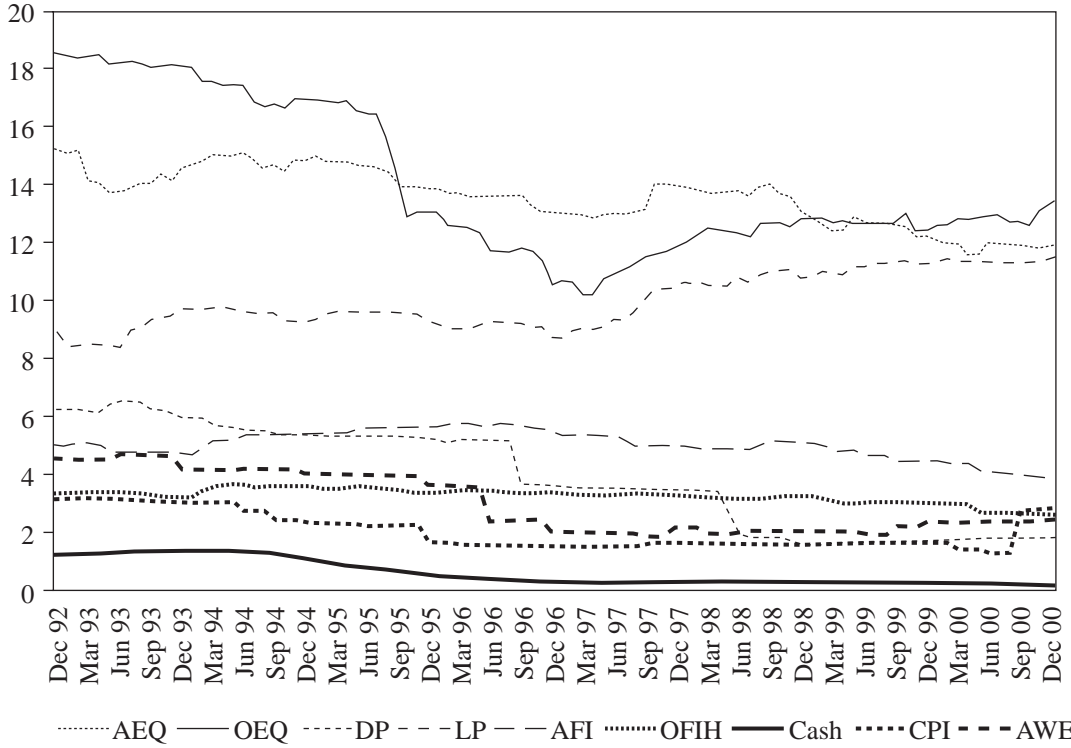


Figure 4.2 Five-year rolling annual standard deviations (% per annum)

be adopted in executing the investment strategy on behalf of fund members. Accordingly, the trustee must make decisions as to what type of investment vehicle is appropriate for the pension fund, and, if necessary, whether the fund's assets are to be delegated to professional external managers.

Fund Structures

Public and private portfolios

A managed fund is an investment product made available to investors by professional investment managers. It is through managed funds that investors are able to access the investment services offered by fund managers. Managed funds are typically collective or pooled investment vehicles offered to investors as unit trusts (public portfolios); however, investment managers may also provide investment services to large institutional clients through an individually managed or discrete (private) portfolio.

A managed fund represents the combined assets of investors who have subscribed to the fund. With this pool of liquid assets, investment managers allocate funds across different securities and asset classes in accordance with the investment objective of the fund. Managed funds offered as unit trusts are established under a trust deed that governs the operation of the fund. The trust deed also dictates the means by which the unit trust can receive and redeem investments made by investors.

Features of managed portfolios

Managed funds are attractive to investors for a variety of reasons. These include:

- **Diversification benefits:** investments made in pooled investment vehicles make it easier to spread small monetary investments across a large number of asset classes and individual financial securities than would be possible without such a vehicle.
- **Economies of scale:** transaction costs incurred by managed funds in physical transaction securities are likely to be much lower through collective investments than would be the case through smaller, private transactions. In addition, dividend imputation may allow managed funds to more efficiently utilize franking credits on domestic shares.²
- **Access to investment skill:** investors may not have the necessary time or expertise (either locally or globally) to invest their capital in both a prudent and profitable manner.
- **Portfolio administration services:** investors may find the administration services provided, including record-keeping, accounting and taxation services to be a valuable additional service.

Types of Managed Funds

Investment managers provide investors with access to a multitude of different types of managed investment products. These products can be differentiated on the basis of three main criteria: the investment objective; the spectrum of asset classes and securities comprising the managed fund; and the type of investor to whom the product is tailored.

The investment objective or strategy to be implemented by a portfolio manager is the most significant differentiating feature of a managed fund. The investment strategy documents how the funds invested will be managed, including the investment style that will be followed. Managed fund assets are invested using (1) an active investment philosophy, (2) a passive or index approach or (3) an investment objective that is largely passive in structure, but incorporates some active strategies, such as enhanced index or quantitative strategies.

Essentially the active and passive investment philosophies are diametrically opposite to one another and their use will depend on investors' preferences and beliefs as to whether capital markets are efficient.

Actively managed funds

Active investment managers believe that returns in excess of the underlying benchmark index are achievable through the use of security-specific and macroeconomic information. The identification of mis-priced securities (security selection) and altering the portfolio's asset allocation in anticipation of market movements (market timing) are the two most common methods active managers use in their attempts to outperform benchmark indexes.

Index managed funds

Index fund managers subscribe to the view that markets are broadly efficient and that, over time, index-mimicking portfolios will outperform the average active fund. Index managers also cite potential advantages in that their funds are offered at a lower cost to investors compared to active funds, and that a passive strategy minimizes the crystallization of capital gains tax liabilities.

Enhanced index funds

Enhanced index funds attempt to earn returns above the benchmark index. However, the achievement of active returns requires minimizing the fund's tracking error – standard deviation of the difference between the fund's return and the target benchmark's return. Enhanced index funds represent a blended strategy between an active and index approach. The enhanced-passive approach is predominantly structured as an index strategy with small tilts relative to the underlying index. The objective generally involves the following enhancement strategies:

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- Investing in companies through initial public offerings (IPOs) ahead of an IPO's inclusion in an index.
- Internal 'crossings' with other funds actively managed by the same investment manager. Securities may be acquired at more favourable prices than may exist in the market.
- Receiving dividends in the form of shares by participating in dividend reinvestment plans (DRPs). The attractive feature of DRPs is the issue of shares at a discount to the current market price. DRPs can also provide cost benefits to the manager by minimizing the required trading in index securities. The costs of order execution are minimized.
- Very small sector bets within industries and stocks relative to the index.
- Employing derivatives, such as futures and options contracts, to take advantage of short-term market movements.

Exchange-traded funds

Exchange-traded funds (or ETFs) are relatively new investment vehicles that trade as listed securities on a securities exchange. ETFs are listed unit trusts or 'shares' representing investment in a basket of other listed securities. An ETF's market value is determined with respect to the market values of the individual securities comprising the basket. Because ETFs are equivalent to the purchase or sale of a security linked directly to an underlying index, these products represent an alternative to investing in index funds managed by professional investment managers. ETFs provide investors with an efficient and diversified security that tracks market indexes. Indeed, ETFs in the USA levy lower expenses than open-end mutual funds. ETFs are also beginning to be used by investment managers as substitutes for futures contracts or in addition to derivatives.

The first ETF was launched in Canada and was listed on the Toronto Stock Exchange (TSE) in 1989. This Canadian ETF tracked the largest 35 TSE listed stocks. ETFs then became available in the USA in 1993 with the introduction of the Standard & Poor's Depository Receipts (SPDRs), or Spider, traded on the American Stock Exchange (AMEX). Spiders represent an investment in a value-weighted portfolio of common shares comprising the S&P 500 Index, with the objective of providing investors with identical returns to the S&P 500. Spiders pay dividends equal to the proportional weight of stocks that actually declare dividends. The launch of the Spider was quickly followed by other ETF issues, Diamonds based on the Dow Jones Industrial Average, World Equity Benchmark Shares (WEBS) and iShares issued by Barclays Global Investors, and the NASDAQ listed Cubes (derived from their ticker symbol QQQ) tracking technology stocks. ETF assets offered in the USA have approximately doubled in the year to December 2000 to US\$70 billion, which are invested across 80 ETF securities. In Australia, ETFs have only recently

been issued and are traded on the Australian Stock Exchange. Salomon Smith Barney was the first to introduce an ETF in 2001.

THE ACTIVE VERSUS PASSIVE DEBATE

The debate about active versus passive management has continued to evolve for more than four decades. Literature around the world confirms the inability of active mutual funds to outperform passive benchmarks or indexes such as the S&P 500 on a risk-adjusted basis after expenses (Jensen 1968; Elton et al. 1993; Malkiel 1995; Gruber 1996; and Edelen 1999). The findings of Australian studies are generally consistent with the international evidence (Bird et al. 1983; Robson 1986; Hallahan and Faff 1999; Sawicki and Ong 2000). An interesting paradox is that the significant majority of assets professionally managed on behalf of investors are actively managed, which means that the average investor is underperforming the benchmark after expenses are deducted! In addition, research also shows that these findings have largely been time independent, including the high proportion of fund managers' products underperforming the benchmark on a relatively persistent basis (see Malkiel 1995).

While capital markets efficiency theory says that these findings of underperformance (after expenses) should not be unexpected, a number of papers have attempted to explore capital market anomalies (such as momentum, seasonality, size, post-earnings announcement drift and turn-of-the-year effects) which might provide sufficient evidence that market efficiency does not hold in absolute terms. Behavioural finance has also sought to explain some of these issues, given that investors are not rational 100 per cent of the time.

Indeed, a number of mutual fund studies have attempted to explore why active mutual funds have not outperformed risk-adjusted benchmarks. The first reason, noted by Sharpe (1991), is concerned with the definition of the benchmark, and why the average investor must earn a return equal to the benchmark. The reasoning is that the performance of the index equals the weighted-average return of both active and passive investors before investment expenses. Sharpe's (1991) law concerning the aggregate return to investors equating to the market return must hold. Therefore, by definition, active management must be a zero-sum game.

Other factors that have been postulated as reasons for underperformance by active managers include the size of their management fees (relative to index funds), their inability to identify mis-priced stocks and to successfully time the market, and their higher relative trading costs and market impact costs relative to index funds. Also relevant is the large size of the funds under management,

which makes it difficult for an active manager to quickly and efficiently alter the portfolio's composition.

This is not to say that active management is all bad. However, the empirical evidence suggests that a significant proportion of active fund managers have been unable to provide investors with superior returns to the market index. In many ways, the higher degree of scrutiny now applied to underperforming active managers, who levy higher expense ratios compared to index-linked products, has ensured that pension fund investors in particular have considered alternative strategies that can minimize their expenses incurred, while also helping their funds to achieve the investment objectives mandated by their pension plan.

STRATEGIES FOR INDEX TRACKING AND TRACKING ERROR MANAGEMENT

Index management, at face value, appears to be a very simple investment strategy that requires an investor to simply hold all index constituents in the exact same weights as the underlying benchmark. In reality, however, the implementation of an indexing strategy is not necessary straightforward. As discussed below, index management leads to the portfolio manager incurring frictions in index replication against an index which is a paper portfolio that can be altered instantaneously and without cost. Therefore, given the frictions that are experienced by index portfolio management, the inevitable fact is that index funds will be unable to deliver investors with identical returns to the benchmark. Accordingly, a passive portfolio manager's objective must then be to implement an investment strategy which seeks to constrain the tracking error (that is, a quantitative measure of differences in the performance between the fund and benchmark over time) of the fund such that investors achieve returns which closely approximate the target benchmark at minimal cost.

The choice of index replication technique adopted by a passive portfolio manager depends on a number of criteria. However, the overriding objective for a passive fund manager is to achieve an optimally configured portfolio that minimizes the costs incurred, but also minimizes the tracking error volatility. There is an inverse relationship between tracking error accuracy and cost. An investor utilizing passive funds must recognize 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. Liu et al. (1998) highlight three methods commonly adopted in indexing by professional money managers – full replication, stratified sampling and optimization. Each is discussed in turn below.

Full Replication

Full replication involves a passive portfolio manager holding each stock in the index in the same weight as the target benchmark index. Depending on the liquidity of stocks comprising the index, and the extent to which index changes and corporate actions require a benchmark adjustment, full replication techniques should lead to investors incurring minimal tracking error relative to other non-replication techniques. However, they can be more costly to implement.

Stratified Sampling

Stratified sampling relies on a passive portfolio manager holding a subset of stocks to the benchmark. However, the subset of stocks held are required to have factor risk exposures which together will mimic the index. Two important risk factors considered important in the process are the size of the stock in the benchmark (that is, stocks with bigger weights in the benchmark have a higher degree of dominance) and the sectors comprising the index. Stratified sampling relies on estimates of the variances, covariances and correlations of returns for index-securities, such that the subset of securities selected in the index-mimicking portfolio will exhibit similar risk/return properties to the benchmark. However, given that the factor inputs cannot perfectly predict the future relationship between stocks, tracking error in performance will be unavoidable when non-replication techniques are employed.

Optimization

Similar to stratified sampling, quantitative risk modelling is the more rigorous of non-replication techniques for building index-tracking portfolios. The key objective in portfolio optimization is to select a subset of securities that are expected to approximate the underlying benchmark's performance and risk, using a highly quantitative technique which attempts to find the minimum tracking error volatility portfolio that can be achieved at minimal cost.

ISSUES IN INDEX TRACKING AND MANAGEMENT

Market Frictions

Since the aim of index funds is to replicate the performance of an index, then the difference between the return on a benchmark index and the return on an index funds' portfolio (or tracking error) can be used to evaluate their perfor-

mance. Tracking error in the performance of index funds is likely to arise from the difficulties inherent in management of passive portfolios. Theoretically, the management of an index portfolio is straightforward, requiring passive fund managers to hold each constituent index security in the same proportion to the benchmark (known as a ‘full replication’ strategy). In reality, index funds will experience considerable difficulty in replicating the target index, because the index represents a mathematical calculation that does not take into account market frictions. The calculation of an index ignores market frictions in the sense that when the security weights within the index change, the index implicitly assumes that rebalancing of securities to reflect the new market weights can occur costlessly, instantaneously, and at prevailing market prices. However, index funds face a number of market frictions in attempting to mimic the index portfolio, or more specifically, returns on the index. These frictions can ultimately result in tracking error in performance.

Transaction Costs

Explicit costs associated with trading in securities markets, including brokerage fees and stamp duty, can influence the ability of passive funds to replicate index performance. The index itself is calculated as a ‘paper’ portfolio, which assumes transactions can occur costlessly (see Perold 1988). In reality, passive funds incur explicit costs associated with transactions relating to client capital flows. For example, cash-flow movements cause flow-induced trading for passive funds, requiring new cash to be invested across index securities or part of the portfolio to be liquidated. Apart from cash-flow-induced trading, index funds also trade regularly for a variety of other reasons associated with strategy implementation. Because index funds are required to trade, explicit transaction costs are incurred. These costs erode the value of the index fund by the amount of the explicit costs and lead to tracking error in performance measured after management expenses.³

Funds also incur implicit transaction costs in trading, including bid–ask spreads and the price impact of trading. These costs will also cause tracking error in performance measured before management expenses. Transactions by passive funds can cause temporary demand-and-supply imbalances, which imply that they are not able to trade instantaneously at prevailing market prices. Overall, this implies that client-related cash-flow movements and the implicit costs of trading, such as bid–ask spreads, are likely to be related to the magnitude of tracking error.

Index Volatility

Another factor likely to be related to tracking error is the volatility of the

underlying benchmark index. If the composition and weighting of stocks held by an index fund perfectly match those of the index, changes in the value of the index fund portfolio should match changes in the benchmark index. However, at any point in time, the composition of the portfolio of a passive fund is unlikely to be perfectly aligned with the index portfolio for a number of reasons. For example, most index fund managers are likely to use some form of proxy portfolio because the smaller, less liquid, stocks in the underlying index are more difficult to acquire. Other funds explicitly aim to hold an imperfect proxy portfolio with the objective of minimizing the costs of assembling a portfolio to track the underlying index. New client cash inflows may also take time to be invested in the funds' desired portfolio, especially those involving less liquid stocks. As a result, unsystematic movements in the stocks underlying an index that are not in a passive fund manager's portfolio will result in tracking error. Similarly, unsystematic movements in the overweight stocks in a fund manager's portfolio relative to the index portfolio will also cause tracking error. Consequently, higher benchmark index volatility is likely to be associated with higher tracking error.

Dividends

Tracking error can also arise from dividends paid by stocks in the index. When a listed company in an index goes ex dividend, the index effectively assumes that the dividend is reinvested in the stock from which it is derived on the ex-dividend date. However, investors (including passive funds) experience a significant time delay, which normally extends into weeks, in receiving cash in relation to a dividend. As a consequence, tracking error can occur for two reasons. First, transaction costs are associated with reinvesting the dividends once received, and these erode the value of the passive funds portfolio. In contrast, the index assumes that the proceeds from the dividend payment are reinvested costlessly at the prevailing market price.

Second, the fund manager must wait for receipt of cash in relation to dividends before being able to reinvest it. Hence there is likely to be a positive relationship between the level of dividends paid by stocks in an index and passive fund tracking error.

Index Constituent Changes and Corporate Actions

Tracking error may also be related to changes in the composition of the benchmark index. These include periodical index adjustments related to company additions and deletions, capitalization changes and corporate restructuring. Fund managers may need to trade in order to adjust their portfolios to properly track the index following such changes. Transaction costs are also incurred in

this trading, further increasing tracking error. Depending on the relative size of the stocks entering and exiting the index (in terms of market capitalization), these changes may also require a number of costly odd-lot transactions in order to match the rebalanced index. The index manager also faces the additional challenge of executing orders at the best possible prices and in a manner that minimizes the crystallization of capital gains tax liabilities to avoid significant erosion of returns. In the case of corporate restructuring, tracking error can also arise when index securities are involved in a merger or takeover by another company outside the index. For example, a timing delay may exist between the date on which the index fund receives the cash settlement and the date when the target firm is removed from the index.

Price Pressure in Stock Prices Due to the Demand for Immediacy in Trading

Periodical changes to the index can also make it difficult (and costly) for a passive fund to replicate the benchmark index.⁴ Beneish and Whaley (1996) identify that ‘front-running’ by market participants, who acquire index securities ahead of their inclusion in a benchmark, can have an undesirable impact on index funds.⁵ Ultimately, changes in the composition of the index require passive funds to trade, which can result in transaction costs and tracking error. Overall, changes in the composition of the index are also expected to cause tracking error.

Index Replication Strategy

The magnitude of tracking error may differ across index managers depending on the portfolio management approach used to replicate returns on the index. The index replication policy adopted by a passive portfolio manager will in large part be determined by the number of stocks in the benchmark, a stock’s relative size (that is, the market capitalization weight) and the underlying liquidity of the stocks in the index. The liquidity of stocks in the basket will have a significant impact on the implicit transaction costs incurred by passive funds, as well as the ease with which accurate pricing of stocks can be achieved (that is, the avoidance of stale prices from infrequent trading). Essentially, the availability of a futures contract underlying the cash market benchmark will help to minimize tracking error.

Full replication strategies require that index funds hold *all* securities in the basket index in the same proportion as represented in the index. Stratified sampling and optimized portfolios on the other hand are non-replication strategies designed to mimic the index through investment in a *subset* of index securities, while at the same time ensuring the portfolio has similar risk and return

characteristics as the index.⁶ Non-replication strategies aim to minimize transaction costs compared with full replication strategies. However, the trade-off is potentially higher tracking error arising from the performance of excluded securities which comprise the underlying index. Optimized portfolios are constructed using highly quantitative, multi-factor risk models aimed at minimizing tracking error through an understanding of the covariance between factors driving asset returns (Liu et al. 1998 and Olma 1998). The expectation, *ceteris paribus*, is that tracking error will be systematically lower for full replication index funds compared with non-replication index funds.

Index Design and Maintenance Rules

Frino et al. (2004) highlight the important role that index providers and committees have in ensuring that passive portfolio managers are able to efficiently replicate benchmark indexes. Indeed, in the case of any action which will affect the index divisor, such as changes in the constituents of the benchmark, share issuances, share repurchases and spin-offs, the manner in which the index treats such activity, as well as the timing of these amendments, has been shown to explain exogenous tracking error in the performance of index-linked mutual funds. Great care needs to be exercised by an index committee when maintaining the benchmarks under their control. This includes maintaining an index that is organized in a fair, consistent and transparent fashion.

Index Exclusivity Effects

A recent paper by Haberle and Rinaldo (2004) presents interesting empirical evidence about the constituents of indexes often forming an 'exclusive' benchmark, and they argue that the selection rules for inclusion/exclusion constituting these indexes is essentially another form of active management. Their evidence, for a wide sample of well-known and cited equity benchmarks globally, shows that the exclusive-type indexes outperform all-inclusive indexes on a risk-adjusted basis. Therefore, exclusive benchmarks are argued to have attributes consistent with momentum-based strategies, where 'winners' have a higher probability of becoming members in exclusive-based benchmarks, and for market-cap-weighted indexes, these better-performing stocks constitute an even greater weighting in the benchmark.

Scale

Index fund management, in contrast to active management, benefits from economies of scale. Evidence in the finance literature (Frino et al. 2004)

shows that large funds tracking a benchmark experience lower tracking error in their performance than smaller funds. Larger funds are also more easily able to adopt full replication strategies compared to smaller funds, conditional on a number of factors (including the liquidity of the benchmark).

EXTERNALITIES IN INDEX FUND MANAGEMENT

Index strategies represent a low-cost, buy-and-hold, rules-based method of portfolio management. Stocks held by passive funds are determined on the basis of the security's membership of a benchmark, and then weighted in the portfolio according to their representation in the underlying index (that is, a full replication strategy). There is no need for fundamental analysis to be undertaken in determining whether the stock represents 'fair value', and the decision to buy or sell is dictated entirely by an index committee. Indeed, it is this very aspect of investing that has generated significant debate and propaganda about the viability and appropriateness of index funds. John C. Bogle, founder of Vanguard Investments in the USA, one of the indexing pioneers of the 1970s, faced significant criticism about whether index funds were a legitimate strategy in promoting efficient, well-functioning and highly liquid capital markets.

The buy-and-hold indexing approach means that there are a number of issues that investors need to consider in determining whether the benefits of indexing (lower cost, lower turnover, lower taxation and so on) outweigh the controversial aspects of passive portfolio management. Each of these externalities is briefly discussed below.

Corporate Governance

Indexing (using full replication) does not involve selecting stocks based on any other criteria than whether the security is a constituent of the benchmark. Therefore, contrary to an investor allocating scarce resources (that is capital) to those areas in the economy that are most productive, indexing requires that assets are allocated using a mathematical and rules-based approach. To this end, passive fund managers are limited in the ways they might otherwise discipline poor company management (other than by voting as shareholders, if indeed they decide to participate at all in the voting process). Given that the full replication indexation approach allocates assets to all constituents depending on their relative benchmark weighting, a passive manager is unable to sell their ownership in the company if corporate performance has been adverse for shareholders.

Winners versus Losers

Based on the work of Haberle and Ranaldo (2004), indexing might be perceived to be a momentum-based strategy. In market-capitalization-weighted benchmarks, the larger stocks are given greater weights in the benchmark. It follows that as stocks perform strongly, their relative weight in the benchmark becomes greater, *ceteris paribus*. This means that if markets do not behave in a rational manner, and if stock prices move to levels that appear ‘stretched’ (or overpriced) in terms of their valuation, an indexing strategy will require a new investor to allocate a disproportionate level of total wealth to stocks that might well experience price reversals in the short term. Another example in the case of poorly performing stocks is that if a stock is expected by the market to file for bankruptcy, but remains a constituent of the benchmark, then an index approach will still require new money to be allocated to the stock irrespective of any rational or subjective view about whether the company will continue to operate into the future.

Investor Choice and Socially Responsible Investing

While there is a variety of benchmarks available to investors, including sub-indexes based on stock size and value/growth dimensions, *broad* market indexes do not cater for investors who hold social and/or moral beliefs. This is because an indexing strategy requires that pension fund trustees invest assets in a manner that is not consistent with their preferences. In other words, investors wishing to follow a passive approach and who also have strong religious, environmental, or other socially determined priorities will still be required to own stocks that are otherwise inconsistent with their wishes. Depending on the index and the preferences of the investor, an example of stocks that may not be consistent with socially responsible investing include those with poor workplace practices, poor environmental policies, or who manufacture or provide services that are not deemed to be either safe or desirable in the community. Examples of the latter relate to tobacco, alcohol, gambling, armaments/weapons manufacture, animal testing and the mining of uranium.

CONCLUSION

This chapter highlights the important role of index-oriented investments for pension funds. While index funds have been available for more than 30 years, their rapid growth has only been relatively recent, particularly since the 1990s. The primary driver of index fund growth among investors is the relative

underperformance of actively managed funds documented in the literature. This should not be surprising when a benchmark, by definition, represents the weighted average sum of all investment opportunities of index constituents; hence, on average, for every winner there must be a loser (relative to the benchmark). In addition, investors have been attracted to passive investment strategies given their lower-cost structures, increased tax efficiency and wide diversification.

While index investment strategies appear simple in theory to implement, there are a number of complexities which makes perfect replication of the underlying benchmark unachievable. Therefore it is the role of an index fund manager to adopt an index replication technique that attempts to minimize tracking error in performance, while also ensuring that the fund does not engage in excessive trading and portfolio turnover. In essence, there is an inverse relation between tracking error volatility and fund trading costs. The choice of index replication technique adopted, and the tracking error tolerance permitted by the fund manager, will depend on both endogenous factors (manager's portfolio process) and exogenous factors (the nature of the indexes' liquidity as well as the rules governing amendments to the benchmark constituents). The role of an index manager is therefore to achieve returns (and risk) commensurate with the market index, conscious of the fact that market frictions, and the nature of the index representing a paper portfolio, will make exact replication of the index return impossible. Overall, evidence suggests that, on average, index funds achieve their risk-and-return objectives over the long run.

Indexing also results in investors acting in a manner that may lead to negative externalities being present in their investment arrangements. Largely these arise because an indexing approach is a rigid and rules-based methodology, and does not require an investor to act in a rational manner. Accordingly, indexing raises concerns relating to the strategy of allocating assets without regard to the investment prospects of the index constituents and the capability of exercising effective corporate governance responsibilities.

The future of indexing should witness continued growth in both the size of assets and the number of accounts delegated to passive portfolio managers. In addition, increasing economies of scale, and advances in portfolio management configuration practices, which attempts to more optimally blend active and passive portfolio management, should ensure an increasingly important role for index-linked products among pension plans globally.

NOTES

1. For this reason the evaluation period does not include data from 1987, as the October equity market crash would potentially distort the analysis.
2. Dividend imputation entitles investors in Australian companies, paying profits out as franked

- dividends, to a reduction in the amount of their personal income tax. This is achieved by accounting for the corporate tax that has already been paid on profits. In other words, an investor who is taxed at their top marginal tax rate is only assessed for tax on the difference between the corporate tax rate and their top marginal tax rate if the dividends are fully franked.
3. Management expenses cover costs incurred by the fund manager associated with custodian services, trading and administration. They also include the profit earned by the fund manager.
 4. The ASX rules governing the inclusion and exclusion of securities from the All-Ordinaries Index are made with regard to a stock's liquidity and market capitalization. Full replication funds may experience increased difficulties as a result of index changes, given that smaller capitalized securities have a higher probability of not meeting the All-Ordinaries Index liquidity rules.
 5. For example in the USA from October 1989, Standard and Poor's pre-announced changes to the S&P 500 Index, where the index change became effective five days after the announcement. This amendment was designed to make it easier for index funds to acquire the new securities ahead of their inclusion in the index. However, because index funds rebalance portfolios on the day the change becomes effective, this allows risk arbitrageurs the opportunity to sell the stock to index funds at a premium. The Australian Stock Exchange (ASX), in a similar manner to Standard and Poor's, pre-announces changes to the All-Ordinaries Index, however the length of time between the announcement of the change and the actual index amendment depends on the size of the stock.
 6. These characteristics include size, industry and dividend yield and other risk attributes such as those identified by BARRA.

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