

INVESTING IN NEW ZEALAND

Compelling evidence that a substantial home bias in asset allocation is strongly economically rational, and a prescription for a road forward

June 2003



Contents

| | Page |
|--|-------------|
| I. CONTEXT AND REASON FOR THE PAPER | 3 |
| II. SUMMARY OF MAIN ARGUMENTS | 4 |
| A. MEAN-VARIANCE MODELS AND THE DIVERSIFICATION APPROACH TO DETERMINING GLOBAL ASSET ALLOCATION HAVE SERIOUS THEORETICAL FAILINGS THAT LEAD TO UNDERSEIGHTING OF THE HOME MARKET | 4 |
| B. POSITIVE THEORETICAL RATIONALE FOR A SUBSTANTIAL HOME COUNTRY BIAS | 5 |
| C. EMPIRICAL SUPPORT FOR HOME BIAS – SOPHISTICATED INVESTORS ARE NOT IRRATIONAL IN THE LONG-RUN | 6 |
| III. DETAILED ANALYSIS | 7 |
| A. MEAN-VARIANCE MODELS AND THE DIVERSIFICATION APPROACH TO DETERMINING GLOBAL ASSET ALLOCATION HAVE SERIOUS THEORETICAL FAILINGS THAT LEAD TO UNDERSEIGHTING OF THE HOME MARKET | 7 |
| (i) Failings of mean-variance based portfolio theory in the international context | 7 |
| (ii) Diversification benefit overstated | 7 |
| (iii) Unfavourable bear/bull asymmetry means risk diversification achieved less than return dilution | 8 |
| (iv) Co-variance and estimation risk lead mean-variance to sub-optimal positions | 9 |
| (v) Power law and the inapplicability of normal distribution | 10 |
| B. POSITIVE THEORETICAL RATIONALE FOR A SUBSTANTIAL HOME COUNTRY BIAS | 10 |
| (i) Peer basing and home benchmarking | 10 |
| (ii) Matching assets to liabilities – asset allocation, space and time | 11 |
| (iii) Matching Assets to liabilities - currency | 12 |
| (iv) Sub-optimal information leads to out-performance in the home market | 12 |
| C. EMPIRICAL SUPPORT FOR HOME BIAS – SOPHISTICATED INVESTORS ARE NOT IRRATIONAL IN THE LONG-RUN | 13 |
| IV. RECOMMENDATIONS | 14 |
| A. CONSTRUCTING A THEORETICALLY SOUND FRAMEWORK | 14 |
| B. CONCLUSION | 14 |
| V. REFERENCES | 15 |

I. CONTEXT AND REASON FOR THE PAPER

The New Zealand Superannuation Fund (NZSF) faces an enormously important asset allocation decision with respect to investment in the New Zealand market versus investment in foreign markets. NZX strongly believes, and has previously provided compelling arguments, that the New Zealand market is capable of absorbing very significant proportions of the NZSF over time (e.g., 20-30%). In addition there are sound reasons based on achieving favorable national outcomes, without compromising returns, for the NZSF to make such asset allocation decisions.

This paper takes a point of departure from the standard advice given to New Zealand market participants (including, presumably the NZSF) by the global fund consultants (e.g. Frank Russell). That advice typically suggests that investing anything other than minimum amounts in the New Zealand market is irrational. This paper debunks and refutes that idea by providing a wide range of very decisive rationale for substantial home bias.

Moreover, following this rationale would be consistent with the overwhelming bulk of observed international practice. Modern Portfolio Theory suggests that investors should diversify across international markets and diversify efficiently. However, a significant number of studies have shown that sophisticated investors do not diversify their portfolios internationally, but rather exhibit a very significant bias towards domestic equities.

This paper investigates both the theoretical and practical rationale behind observed home bias in domestic portfolios. It provides a strong case for why domestic portfolio managers (and in particular the NZSF) should invest a substantial proportion of funds in domestic markets, despite the apparently contrary opinion of strict Modern Portfolio Theory enthusiasts. Moreover, this paper also shows that these arguments hold even more strongly in small countries (such as New Zealand) whose equities comprise a small percentage of the global market.

Specifically, by incorporating each of these factors into portfolio modeling, a substantial home bias emerges as theoretically rational. For the NZSF, this means constructing a theoretically sound portfolio, then modifying it to achieve optimality and reasonableness. This will indicate that a minimum of 20% of the NZSF portfolio needs to be invested in New Zealand equities.

II. SUMMARY OF MAIN ARGUMENTS

A. MEAN-VARIANCE MODELS AND THE DIVERSIFICATION APPROACH TO DETERMINING GLOBAL ASSET ALLOCATION HAVE SERIOUS THEORETICAL FAILINGS THAT LEAD TO UNDERSEIGHTING OF THE HOME MARKET

(i) Failings of mean-variance based portfolio theory in the international context

Mean-variance analysis has some serious shortcomings as standard models seriously overestimate the gains in average returns obtained from international diversification. The key theoretical flaws are (i) lack of certainty; (ii) time period mismatching; (iii) poor out of sample performance; (iv) instability of the optimal portfolio; (v) optimality does not require full diversification; (vi) full diversification may preclude optimality; and (vii) estimation risk has considerable impact on optimal selection. The combination of these factors make standard mean-variance models unreliable as an asset allocation tool. Moreover, and very interestingly, often an optimal solution appears that where most investments are zero under the model, large proportions are assigned to countries with relatively small capital markets.

(ii) Diversification benefit overstated

Over the past three decades the correlation of global markets has increased to the point where the actual obtainable benefits of diversification have been minimized. While diversification has traditionally been heralded as the key to portfolio selection, market evolution has seen the benefits of diversification largely evaporate. Consequently, the need to hold assets abroad is fast disappearing. Current thinking suggests these benefits will continue to erode and that investors should not expect to receive much diversification benefit from international stocks over the next ten years. Since the benefit of diversification relies solely on holding assets which do not exhibit the same characteristics, a high correlation of global markets significantly reduces the benefit of holding international assets. Moreover, small countries like New Zealand are explicitly seen as most to benefit from overweighting their home market.

(iii) Unfavorable bear/bull asymmetry means risk diversification achieved less than return dilution

Global markets are significantly more correlated in bear markets than bull markets. This unfavourable asymmetry means that diversification fails international investors when they need it most. At a practical level this implies that over a full business cycle, a globally diversified portfolio suffers more in a bear market (where correlations are higher) than it gains in a bull market. Accordingly, downside is achieved with more certainty than upside – the last 4 years have been evidence of this. Risk diversification is therefore achieved less through diversification, than through return dilution.

(iv) Covariance and estimation risk lead mean-variance to sub-optimal positions

There are very strong theoretical arguments that suggest co-variance across the mean vector and co-variance matrix of asset returns, imply that strict implementation of mean variance frontier analysis will result in sub-optimal asset allocation. Classical mean variance analysis requires a set of expected rates of return for asset allocation. However expected rates of returns are

traditionally proxied by historical sample means, and these means are poor predictors of future returns. In fact, many believe that stock prices follow a ‘random walk’ and future steps on directions cannot be predicted on the basis of past performance. Therefore portfolio construction under Portfolio Theory framework introduces significant estimation risk.¹

More plainly, estimation risk is inevitable because estimations (more plainly a guess) about assets future returns, will have to be made based on historical performance. This will produce a sub-optimal portfolio. A better solution for asset allocation is to reduce estimation risk by incorporating known economic variables into the model. These variables, due to geographic informational asymmetries, can reduce estimation risk more in domestic than foreign assets. Since asset allocation has as a goal to reduce risk, more weight must be placed on domestic assets, since their returns can be more accurately predicted.

(v) Power law and the inapplicability of normal distribution

The latest emerging science on networks and systems (including the global financial system) is that the mathematics of risk and return are dominated by Power Law Mathematics. Evidence of this can be seen in the tail performance of certain hedge funds that have invested on a macro basis across asset classes and countries. In a power law world, risks are not only highly correlated, but compound, resulting in tail event scenarios deeper and more frequent than suggested by mean-variance (ie, mean-variance’s basic assumption). If the underlying set of probabilistic outcomes is modeled according to Power law assumptions rather than normal distribution assumptions the optimal solution set looks significantly different, and more skewed toward domestic assets.

B. POSITIVE THEORETICAL RATIONALE FOR A SUBSTANTIAL HOME COUNTRY BIAS

(i) Peer basing and home benchmarking

If the recipients of a fund create their expectation, and hence measure their utility, relative to a benchmark that depends on aggregate consumption, they will mimic aggregate consumption to hedge changes in this benchmark. If a subset of agents in the economy is constrained to hold domestic assets, unconstrained agents must take account of this and create a first order maximization condition that has a home benchmark, not for just the home part of the portfolio, but for the entire portfolio. Empirically this first order effect (e.g., Harvard including Yale’s returns as well as the S&P 500 in its benchmark) leads to very different asset allocations. When a fund based in a national economy uses a domestic criteria as a key benchmark for all performance asset allocations, that fund should be substantially more weighted toward the home market, even under a mean variance type framework. For the NZSF, this would suggest that the NZSX 50 Index or other New Zealand – based benchmark, should be used as the yardstick for a majority of the fund, not just the proportion invested in the New Zealand market. Were the NZSF to use the NZSX 50 Index (or other domestic index) as its benchmark for the majority/all of its equities portfolio, the result would be a frontier curve with a very different shape and significant re-allocation occurring toward the home market (to track the benchmark). Unconstrained agents also mimic one another, leading to a multiplier effect and generating a large equity home bias. This particular form of preference, difference-type external habit formation preference, leads to a large and rational equity home bias.

¹ Levels of volatility, however are more stable over time. NZ shows up well in this regard.

(ii) Matching assets to liabilities – asset allocation, space and time

Funds that have a known liability profile need to be quite stable. This means limitations and assumptions (e.g., liability stream and asset matching) need to be incorporated in a mean-variance model. For example, due to their very high concentration of domestic bonds and equities from a standard mean-variance approach, the typical portfolio allocations of pension and insurance funds appear quite suboptimal. Yet if the risk of the asset allocation is measured relative to its liabilities, as it should be, the high domestic security concentration that occurs (and is mandated in many instances) is warranted the weight of this result depends on the length of liabilities, with longer liabilities leading to a higher domestic concentration than shorter liabilities. For the NZSF these results obtain strongly because of its long-term liability horizon.

(iii) Matching assets to liabilities - currency

For a fund that in 20 years will have significantly more than \$150bn in assets, it will be prohibitively difficult for the NZSF to hedge its currency position weight of this effectively. This is true because at that point in time the liquidity risk of the currency position will be such that the NZSF will become the market (i.e., the Long Term Capital Management problem). There will be a dearth of natural counterparties consistently on the other side, and the NZSF will thus be able to be gamed. There is also likely to be an increased chance of liquidity-based asset price spirals given net currency positions. Avoidance of these high risk areas (unstable solutions) implies avoiding as much currency risk as possible.

(iv) Sub-optimal information leads to out-performance in the home market

Despite globalization integrating the world's capital markets, investing locally gives investors a large advantage in terms of the information they have access to. A number of studies have documented this advantage, with the results suggesting strongly that investors should overweight their portfolios with domestic assets.

C. EMPIRICAL SUPPORT FOR HOME BIAS – SOPHISTICATED INVESTORS ARE NOT IRRATIONAL IN THE LONG-RUN

Modern Portfolio Theory advocates that investors diversify their portfolio's, in particular across international markets. Indeed, the whole of Modern Portfolio Theory, (and one would expect practice) is based upon the idea that investors diversify efficiently. However, investors have a strong home domestic bias which has persisted for decades.

A number of studies, as well as empirical observations have shown that investors do not diversify their portfolios internationally but rather exhibit a very significant bias towards domestic equities. Basic Modern Portfolio Theory, and its adherents, would suggest that these investors are either non-maximising or not rational. It would appear to be drawing a long bow to suggest that for the past three decades sophisticated investors have been irrational and not looked to maximise their investments.

III. DETAILED ANALYSIS

A. MEAN-VARIANCE MODELS AND THE DIVERSIFICATION APPROACH TO DETERMINING GLOBAL ASSET ALLOCATION HAVE SERIOUS THEORETICAL FAILINGS THAT LEAD TO UNDERSEIGHTING OF THE HOME MARKET

(i) Failings of mean-variance based portfolio theory in the international context

Portfolio theory aims to find the optimal portfolio. Mean variance is the traditional method to determine the opportunity set. However, the mean variance model used to calculate the efficient frontier is flawed due to a number of shortcomings. Moreover, many believe that the idea that there is an efficient frontier is a bit of an illusion (Liesching in Chernoff 1998).

The mean-variance analysis has four serious shortcomings. Firstly, there is the poor out of sample performance of the optimal portfolios. Performance measures always deteriorate substantially outside the sample period and the supposedly optimal choice is sometimes dominated by a naïve method. Jorion (1985) found that 1-year historical averages are poor if not useless predictors in univariate models. The 5-year averages were better but entail large standard errors.

Secondly, optimal portfolios are unstable. The proportions allocated to each asset are extremely sensitive to variations in expected returns and adding a few observations may change the portfolio distributions completely (Jorion 1985). The extent of the benefit of diversification depends on how the efficient frontier is computed. Bailey and Stulz (1990) found that when monthly returns were used instead of daily returns the standard deviation fell from 13% to 9% and depending on the measurement interval, the standard deviation reduced by as much as 50%. These results showed that the benefits for international diversification are substantially larger for a holding period of one day than they are for a holding period of one month or longer (Bailey and Stulz 1990).

Thirdly, optimal portfolios are not necessarily well diversified. For example in the Levy and Sarnat (1970) study, only seven out of the initial group of 28 enter the optimal portfolio. Often a corner solution appears where most of the investments are zero, large proportions are assigned to countries with relatively small capital markets and high average returns (Jorion 1985). This has clear relevance in the current case.

In addition, expected returns, variances and co-variances are simply replaced by their ex post sample values and the optimal portfolio is derived without mentioning the uncertainty inherent in these parameter values. The rational investor should take this uncertainty into account when forming expectations and probably will consider estimators that are less subject to estimation error than the classical sample mean.

(ii) Diversification benefit overstated

As is well known, portfolio theory explores how risk averse investors can construct portfolios to optimize expected returns for a given level of market risk (Markowitz 1952). The theory quantifies the benefits of diversification by taking a universe of risky assets and building an efficient frontier of optimal portfolios. Each portfolio on the efficient frontier offers the

maximum possible expected return for a given level of risk. Ever since Solnik (1974) extended this theory to demonstrate the benefits of international diversification, the academic community and some fund consultants have endorsed portfolios that are very biased towards greater proportions of international securities than most funds and investors hold. Nevertheless past academic research has failed to accommodate the changes in global markets and consequently the benefits of this theory and the outputs of its practitioners have been brought into question.

Diversification has traditionally been heralded as the key to portfolio selection and the benefits of international diversification have been widely documented (Solnik 1974, Bailey and Stulz 1990). However, since many of these studies were conducted, global markets have become increasingly correlated; so much so that the benefits from diversification have reduced substantially. Current thinking suggests (Malkiel 2002) these benefits will continue to erode and investors should not expect much diversification benefit from international stocks over the next ten years. Consequently, investors should instead hold a greater proportion of funds in domestic assets.

Global markets are much more correlated now than they have been in the past. For example, investigations have shown significant co-movement of the Australian, Chinese, Hong Kong, Malaysian, New Zealand and Singaporean stock markets (Johnson and Soenen 2002). These results are consistent with the investigations of co-movement of other equity markets (Bracker, Docking and Koch 1999, Karolyi and Stulz 1996). In addition, as comovements become more highly correlated, the measurement interval increases (Bailey and Stulz 1990). For funds investing for the long term this is very important. Since the benefit of diversification relies solely on holding assets which do not exhibit the same characteristic, a correlation of global markets significantly reduces the benefit of holding international assets.

The implications are clear for the NZSF. If, as seems likely given its structural elements, the optimal answer for New Zealand would be a corner solution, two direct results are clear. Firstly, a fully diversified portfolio is sub-optimal. Secondly, that a corner solution will assign a large proportion to the country with a small capital market and high average returns (NZ).

(iii) Unfavourable bear/bull asymmetry means risk diversification achieved less than return dilution

The main benefits from international diversification are expected to occur in a local bear market. This is not the case. While correlation of global markets is high, investigations have shown that the correlation between international equity markets actually increases during highly volatile bear markets (Ang and Bekaert 2002, Butler and Joaquin 2002). Many are now questioning the benefits of diversification since it fails precisely when investors need it most (i.e. when local markets experience a downturn) (Ang and Bekaert 2002, Malkiel 2002).

In addition, since there is little evidence that international diversified portfolios actually perform better than domestic ones (Elton and Gruber 1995) the case for international diversification needs to be re-considered.

One of the basic tenets of portfolio selection theory is that whilst market or systematic risk cannot be eliminated from a portfolio, company-specific or idiosyncratic risk can be diversified away. However, due to the correlation of global markets, a greater number of stocks must now be held in a portfolio to eliminate idiosyncratic risk. A 5 stock portfolio in the 1960's had about the same volatility as a 50 stock portfolio from the 1990's (Malkiel 2002). Malkiel (2002)

believes that portfolio theory as it pertains to diversification and idiosyncratic risk is no longer accurate.

The increasing availability of assets that represent claims on foreign traded assets makes it possible to receive diversification benefits by holding domestically traded assets and the need to hold offshore assets to obtain international diversification benefits is fast disappearing (Malkiel 2002, Errunza *et al.* 1999). In addition, global market correlation means investors should not expect much diversification benefit from international stocks over the next 10 years (Malkiel 2002). Since benefits from international diversification have largely evaporated, domestic funds should accommodate this change by allocating a higher proportion of their portfolio to domestic assets.

(iv) Co-variance and estimation risk lead mean-variance to sub-optimal positions

There are very strong theoretical arguments that suggest co-variance (or non-linear risk) across the mean vector and co-variance matrix of asset returns mean that strict implementation of mean variance frontier analysis will result in sub-optimal asset allocation. Classical mean variance analysis requires a set of expected rates of return for assets to be determined (Jorion 1985), expected rates of returns are traditionally proxied by sample means. These sample means are poor predictors of future returns (Jorion 1985). In fact, many believe (Malkiel 1999) that stock prices follow a 'random walk' and future steps on directions cannot be predicted on the basis of past actions. Therefore, portfolio construction under the portfolio theory framework, introduces a high degree of estimation risk.

The cost of estimation risk increases as the portfolio's diversification increases. Diversifying from a single stock to two or three stocks increases estimation risk cost (Hasan and Simaan 2000) and consequently, the marginal advantage of additional diversification can be outweighed by this estimation risk cost. Therefore the attractiveness of diversifying into international markets can be dominated by this cost. As a result the estimation errors in the mean vector and co-variance matrix of asset returns induces bias into portfolio allocations and results in inefficient portfolio choices (Hasan and Simaan 2000). The best an investor can do therefore is base his optimal portfolio on sample estimators contaminated by estimation errors that render all feasible portfolios sub-optimal (Hasan and Simaan 2000).

An investor might be able to reduce the estimation error in the mean vector by conditioning his estimation on economic variables known to him at the time he makes his allocation decision. The most commonly used variables are: the exchange rate forward premium, market dividend yields, and long- and short-term interest rates (Hasan and Simaan 2000).

The fact that each market by itself constitutes a diversified portfolio and difficulty in estimating international markets' mean returns, make home dedication the preferred alternative. The strong conclusion from these arguments is that the benefits from international diversification are obtained at relatively low levels of international diversification (Hasan and Simaan 2000).

The implication for investment is that under the umbrella of portfolio theory estimation risk will be introduced because estimations (more plainly, a guess) about assets future returns will have to be made based on their historical performance. This will produce a sub optimal portfolio. A better solution for asset allocation is to reduce estimation risk by incorporating known economic variables into the model. These variables, due to geographic information asymmetry, can reduce estimation risk more in domestic assets than foreign assets. Since asset allocations decisions

stem from an ability to reduce risk, more weight must be placed on the inclusion of domestic assets in a portfolio, since their returns can be more accurately predicted.

(v) Power law and the inapplicability of normal distribution

The latest emerging science on networks and systems (including the global financial system) is that the mathematics of risk and return are dominated by Power Law Mathematics. Evidence of this can be seen in the tail performance of certain hedge funds that have invested on a macro basis across asset classes and countries (Lowenstein 2001). If the underlying set of probabilistic outcomes is modeled according to Power Laws rather than normal distribution assumptions, the optimal solution set looks significantly different than the one based on an unlikely to hold normal distribution (ie, mean-variance's basic assumption). In this world risks are highly correlated, and compound, while returns do not have the same tendency. More particularly, a power law of granularity results in mappings between a systems variables that are assumed independent in role-based models.

B. POSITIVE THEORETICAL RATIONALE FOR A SUBSTANTIAL HOME COUNTRY BIAS

(i) Peer basing and home benchmarking

Utility theory, the core underpinning of all microeconomic theory, as it pertains to portfolio selection, states quite simply that investors prefer more to less. Investors would rather have a greater level of return, than a lower level of return, for the same degree of risk. While this may seem obvious, it does help to explain why investors have a bias toward domestic investments.

The beneficiaries of the NZSF are New Zealanders whose level of benefit will crucially depend on the difference between consumption and a standard of living. The 'standard of living' is a backward-looking moving average of national aggregate consumption. Under this situation, people are sensitive to their peers' investment behaviour and peer returns. Since these investors future 'standard of living' depends on the investment performance of other like minded investors, it is optimal for them to partially mimic the groups' aggregate portfolio choice (Shore and White 2002).

These investors act as small business owners who are forced to hold domestic assets because it is in their best interests and costly to do otherwise. If the remaining investors want to maintain their 'standard of living', then they will mimic the domestic bias of this group (Shore and White 2002).

Similarly, if investors measure utility relative to a benchmark that depends on aggregate consumption, they will mimic aggregate consumption to hedge changes in this benchmark. For example, if an investor's 'standard of living' is measured against GDP growth or the level of inflation, then that investor's natural investment strategy is to hedge against this benchmark by holding a portfolio of assets which are correlated with that benchmark.

The result of this mimicking strategy is that if a group of investors in the economy is constrained to hold domestic equities, unconstrained investors will mimic this portfolio. This particular form of investor preference leads to a rational large equity home bias in small countries (Shore and White 2002).

These arguments provide solid theoretical reasons for domestic investment. A bias toward domestic investments results when investors compete for scarce resources in fixed supply, such as real estate. Demand for local resources depends on the performance of the local aggregate portfolio. The locally held portfolio consequently serves as a hedge for the price of local resources (DeMarzo *et al.* 2002). For a portfolio whose purpose is to return funds back to the underlying unit holders who are bound by their country of residency it is more prudent to have an asset allocation that is biased toward domestic investment that thereby hedges fixed supply resources than to invest in foreign assets which provide little correlation with domestic individuals 'standard of living'.

(ii) Matching assets to liabilities – asset allocation, space and time

Funds that have a liability profile need to be more stable and this means limitations and assumptions (such as time horizon, liability stream, & asset matching) need to be incorporated into the mean variance model. Instead of funds blindly using mean variance to determine an efficient frontier and build a portfolio which is considered optimal (although it cannot be measured under the mean variance framework to determine whether it is), funds should allocate their assets based on the liability stream they have inherited.

From the perspective of Modern Portfolio Theory, the typical insurance company portfolio and pension fund appears quite suboptimal, due to a very high concentration of domestic bonds and equities. Yet if the risk of asset allocation is measured relative to liabilities, this high concentration of domestic securities is warranted (Griffin 1997). The length of the liability stream plays an important role in this respect. This is because the liability stream is not always built into the efficient frontier. Results show that a portfolio with a longer liability stream requires a higher concentration of domestic assets than a portfolio with shorter liabilities (Griffin 1997). The effect of this on asset allocation is that funds must match their assets to their liability stream and for funds like NZSF this requires having a higher concentration of domestic assets.

Insurance and pension funds who have a liability stream must build this stream into the efficient frontier of their portfolio. Pension and insurance portfolios constructed using the traditional efficient frontier with the liability stream excluded, show a considerable degree of diversification in both equities and bonds (Griffin 1997). However, risk relative to liabilities is the economic situation of insurance and pension funds. When a proxy is used for the liability stream (such as a domestic 10 year bond) and incorporated into the efficient frontier, there are substantially different results. The bond allocation is almost exclusively domestic and equities have a much higher domestic concentration than they had under the traditional efficient frontier (Griffin 1997).

Typically, insurance and pension funds have a long time horizon. Therefore these funds should have a domestic bias. This is because comovement of global markets are more correlated in the longer term thereby reducing diversification benefits. Consequently, home biased portfolios can be optimal (Ang and Bekaert 2002). Quantifying the value of portfolio decisions on the performance of a typically internationally diversified portfolio over a one year time horizon, Ang and Bekaert (2002) found that the cost of not diversifying is between 0.94 and 3.39 cents per dollar depending on the investor's level of risk aversion. Furthermore, when currency hedging is allowed, hedging accounts for half the total return of international diversification.

(iii) Matching Assets to liabilities - currency

Typically, currency fluctuations affect the potential benefit of international diversification (Malkiel 2002). However, this risk can be hedged against to maintain the performance of the fund. This is likely to be true for most portfolios but is unlikely to hold for the NZSF.

NZSF is expected to be investing a proportion of assets over the next 20 years which is likely to more than \$150bn in total. It will be impossible to hedge this level of funds in the currency market efficiently. The liquidity of the market will evaporate and the NZSF will become a price taker. This will result in their positions being gamed reducing the performance of the fund.

The impact of this is that the greater the allocation to international investment, the higher the risk that the NZSF takes on due to currency and liquidity.

(iv) Sub-optimal information leads to out-performance in the home market

Investing in international assets can place domestic investors at a large disadvantage due to information asymmetry. Conversely, local investors have an advantage in terms of the information they receive and their ability to interpret it compared to foreign investors. As a consequence, a number of investigations (Hasan and Simaan 2000, Gehrig 1993, Coval and Moskowitz 2001) suggest that not only is there a strong rationale for local investors to invest domestically but they earn greater returns compared to their foreign investments in doing so.

In international equity investment, domestic investors are on average better informed about the risk return characteristics of domestic stocks (Gehrig 1993). This information advantage stems from a number of areas. Firstly, domestic investors can immediately judge the consumer interest in a company. Secondly, they are better at estimating firms' earnings prospects by the fact that they have a better understanding of the nature of domestic businesses.

Thirdly, they can interpret domestic companies' balance sheet information more correctly than foreigners and finally, they can immediately assess the impact of country specific factors such as exchange rates, monetary/fiscal policy, inflation and weather, on the prospects of domestic firms.

All investors can infer information from prices. However, the prices are not likely to reveal the relevant payoff information. On average domestic investors observe the payoffs of domestic firms with higher precision than foreigners. The proof of this information advantage is in the actions of portfolio managers and returns on their funds. Gehrig (1993) investigated aggregate bank portfolios in bonds and equities for Germany and Switzerland and found a strong bias to local equity. German equity funds would invest only 24 per cent of their equity portfolio in foreign stocks compared to one third in Swiss portfolios. Towards the end of the 1980's, however, Swiss banks increased their domestic equity component from 64 per cent in 1985 to 74 per cent in 1989. Gehrig (1993) concluded that since there was no evidence of domestic bias towards bonds holdings and that the informational requirements for stocks are larger than for bonds, the informational advantage of domestic investors is higher for equity holders than bond holders (Gehrig 1993). Consequently, German and Swiss portfolios exhibit a high domestic bias to take advantage of this anomaly.

Domestic investment earns fund managers a higher level of return than equivalent international assets held in a portfolio. Coval and Moskowitz (1999) found a strong geographic link between mutual fund investment and performance. They then investigated the equity holdings of over

1000 actively managed mutual funds and found that fund managers earned substantial abnormal returns in their geographically proximate investments (Coval and Moskowitz 2001). The average fund manager generated an additional return of 2.67% per year from his local investments, relative to his non-local holdings. Adjusted for risk, fund managers' local investments earn 1.84% per year above passive benchmark portfolios and 1.18% per annum more than their distant holdings. Furthermore, local stocks avoided by managers' underperformed local stocks actually held, by a risk adjusted 3% per year (Coval and Moskowitz 2001). In addition, funds that had a strong local bias generated the largest gains from local investments, outperforming their distant holdings by as much as 3 percent per year and outpacing stocks not held by 4 – 5 percent per year on a risk adjusted basis. Funds that did not exhibit a local bias generate no abnormal performance in their local holdings. These results clearly show that local fund managers are able to exploit the informational advantage of local investments.

Domestic investors have an informational advantage compared to their foreign counterparts. This advantage can result in higher returns than investing internationally (Coval and Moskowitz 2001). Consequently, investors should allocate a greater portfolio weight toward domestic securities and a market they understand than to international markets where the information impediments are higher and abnormal returns lower.

C. EMPIRICAL SUPPORT FOR HOME BIAS – SOPHISTICATED INVESTORS ARE NOT IRRATIONAL IN THE LONG-RUN

Typically, corporate equity is held by domestic investors. The domestic bias to equity investment has persisted (French and Poterba 1991, Cooper and Kaplanis 1994a) although diminished somewhat in the 1990's (Tesar and Werner 1998).

French and Poterba (1991) found that domestic ownership shares of the world's five largest stock markets are: United States, 92.2 percent; Japan, 95.7 percent; United Kingdom 92 percent; Germany, 79 percent and France 89.4 percent. In contrast, Japanese investors had only 1.9 percent of their equity in foreign stocks, U.S. investors only 6.2 percent and the British only 18 percent of their portfolio abroad.

Modern Portfolio Theory assumes that investors dislike risk, will act rationally and will always try to maximise returns. This suggests that investors will invest overseas since the benefits of diversification, in particular international diversification, have been shown to improve returns (Solnik 1974).

Empirically investors have a home domestic bias which has persisted for decades. Modern Portfolio Theory suggests these investors are either non-maximising or not rational. It would appear to be drawing a long bow to suggest that for the past three decades investors have been irrational and not looked to maximise their investments.

IV. RECOMMENDATIONS

To be consistent with the most credible authorities and leading theoretical research and practice in asset allocation, the NZSF should adopt the following approach in determining its home v. foreign market asset allocation parameters.

A. CONSTRUCTING A THEORETICALLY SOUND FRAMEWORK

1. Eliminate most correlated of couplings within global investment opportunities (reduce covariance power law risk).
2. Invest, therefore, in only 8-10 main markets.
3. Use NZSX 50 Index or equivalent New Zealand measure as key benchmark for all equities portfolio (including offshore).
4. Build liability streams into the efficient frontier.
5. Adjust for bear/bull asymmetry.
6. Reduce estimation bias and risk by reducing weight of foreign assets
7. Overweight investment in home market to capture positive local information asymmetry (strong home returns).
8. Assess position v major global counterparts for reasonableness (e.g. Australia – only 2% of MSCI but over 40% invested in domestic equities)

B. CONCLUSION

Using these criterias we believe that a portfolio which is theoretically sound and as close to optimal as possible, would see the NZSF investing 25-35% in the New Zealand equities market. This is consistent with the key theme that optimality does not require full diversification.

Previous analysis has shown that up to 25-30% can be invested in New Zealand equities without the NZSF approaching prudential ownership limit guidelines.

To conclude, given the parameters of New Zealand market, we believe an investment range of 25-30% is the preferred area for the NZSF.

V. REFERENCES

- Ang, A. and Bekaert, G. (2002). International asset allocation with regime shifts. *Review of Financial Studies* 15(4): 1137 – 1187.
- Bailey, W. and R. Stulz. (1990). Benefits of International Diversification: The Case of Pacific Basin Stock Markets. *Journal of Portfolio Management*, Summer Issue: 57 – 61.
- Bracker, K., Docking, D., and Koch, P. (1999). Economic determinants of evolution in international stock market integration. *Journal of Empirical Finance* 6: 1 – 27.
- Butler, K., and Joaquin, D. (2002). Are the gains from international portfolio diversification exaggerated? The influence of downside risk in bear markets. *Journal of International Money & Finance* 21(7): 981 – 1110.
- Chernoff, J. (1998). Wild ride. *Pensions & investments* 26(21): 12.
- Cooper, I., and Kaplanis, E. (1994a). Home bias in equity portfolio, inflation hedging, and international capital market equilibrium. *The Review of Financial Studies* 7: 45 – 60.
- Cooper, I., and Kaplanis, E. (1994b). The implications of the home bias in equity portfolios. *Business Strategy Review* 5(2): 41 – 53.
- Coval, J., Moskowitz, T., and Tobias, J. (2001). The geography of investment: Informed trading and asset prices. *Journal of Political Economy* 109(4): 811 - 841.
- Coval, J., Moskowitz, T. (1999). Home bias at home: Local equity preferences in domestic portfolios. *Journal of Finance* 54(6): 2045 – 2073.
- DeMarzo, P., Kaniel, R. and Kremer, I. (2002). Community effects and externalities in portfolio choice. Working Paper.
- De Bondt and Forbes, W. (1999). Herding in analyst earnings forecasts: evidence from the United Kingdom. *European Financial Management*. 5(2):143 – 163.
- Elton, E. and Gruber M. 1995. *Modern Portfolios Theory and Investment Analysis*. 5th ed. pp 280.
- Errunza, Hogan, K., and Hung, M. (1999). Can the gains from international diversification be achieved without trading abroad. *Journal of Finance* 54(6): 2075 – 2107.
- French, K. and Poterba, J. (1991). Investor diversification and international equity markets. *American Economic Review* 81:222 – 226.
- Gehrig, T. (1993). An information based explanation of domestic bias in international equity investment. *Scandinavian Journal of Economics* 95(1): 97 – 109.

-
- Griffin, M. (1997). Why do pension and insurance portfolios hold so few international assets?. *Journal of Portfolio Management* 23(4): 45.
- Hasan, I., and Simaan, Y. (2000). A rational explanation for home country bias. *Journal of International Money and Finance* 19:331 – 361.
- Johnson, R. and Soenen, L. (2002). Asian economic integration and stock market comovement. *Journal of Financial Research* 25(1): 141 – 157.
- Jorion, P. (1985). International portfolio diversification with estimation risk. *Journal of Business* 58: 259 – 278.
- Karolyi, A. and Stulz, R. (1996). Why do markets move together? An investigation of U.S.-Japan stock return comovement. *Journal of Finance* 11(3): 951 – 986.
- Kim, C., and Pantzalis, C. (2003). Global/Industrial diversification and analyst herding. *Financial Analysts Journal* March/April: 69 – 79.
- Levy, H., and Sarnat, M. (1970). International diversification of investment portfolios. *American Economic Review* 60 (September): 668 – 75.
- Lowenstein, Roger (2001). When Genius Failed; the rise and fall of long-term capital management.
- Malkiel, B (1999). A random walk down Wall Street. Rev ed. New York. Norton.
- Malkiel, B. (2002). How much diversification is enough?. AIMR Conference Proceedings. *Equity Portfolio Construction* :18 – 28.
- Markowitz, H. (1952). Portfolio Selection. *Journal of Finance* 7: 77 – 91.
- Shore, S., and White, J. (2002). External habit formation and the home bias puzzle. Unpublished.
- Solnik, B. H. (1974). Why not diversify internationally?. *Financial Analyst Journal* 30(4): 48 – 54.
- Tesar, L. and Werner, I. (1995). Home bias and high turnover. *Journal of International Money and Finance*. 14(4): 467 – 492.
- Uppal, R. 1992. The economic determinants of the home country bias in investors' portfolios: a survey. *Journal of International Financial Management and Accounting* 4:3.