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Risk, return, and beyond: A conceptual
analysis of some factors influencing New
Zealanders' investment decisions

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Elizabeth Watson

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Reserve Bank of New Zealand
PO Box 2498
Wellington
NEW ZEALAND

www.rbnz.govt.nz

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NON-TECHNICAL SUMMARY

This note is intended to complement the recent Reserve Bank *Bulletin* article ‘Asset returns and the investment choices of New Zealanders’ (Watson, 2012). This note provides the annual data underpinning the results illustrated there. The *Bulletin* article presents estimates of gross nominal asset returns since 1989 for a range of assets relevant to New Zealand investors and considers some of the many factors – in addition to trends in high-level asset returns – that are relevant to the investment choices of individuals. Possible factors include portfolio replicability, tax treatment, the impact of leverage, uncertainty about future returns, and other considerations, such as personal circumstances.

Future returns are uncertain. This is likely to be an important influence on individuals’ investment decisions and supports portfolio diversification. Analysis presented here uses the estimates of gross nominal asset returns to illustrate this idea. It also looks at how asset returns might be distributed differently in future and discusses how a wide range of possible portfolios might be desirable, reflecting the inherent uncertainty associated with future asset returns.

Overall, the analysis presented here is designed to illustrate conceptually the construction of a diversified portfolio and the practical advantage in doing so in a world of considerable uncertainty. For an individual investor, how they actually allocate their portfolio will depend crucially on their expectations of future returns, risk tolerance, and a range of other relevant factors, varying considerably between individuals.

INTRODUCTION¹

This note is intended to complement analysis found in Reserve Bank *Bulletin* article ‘Asset returns and the investment choices of New Zealanders’ (Watson, 2012) by providing additional analysis and technical detail. The *Bulletin* article presents gross nominal asset returns since 1989 for a range of assets relevant to New Zealand investors using a new set of estimates compiled by the Reserve Bank. The estimates have an economy-wide lens, reflecting the Reserve Bank’s interest in understanding trends from a macroeconomic perspective. This is in contrast to the perspective of an individual investor who would probably be interested in the realised risk and return they could achieve, as determined by a range of additional factors like taxes.

¹ No aspect of this article should be construed as financial advice. The author would like to thank her team, Phil Briggs, Hamish Pepper, Ian Nield, Jason Wong and Michael Reddell for their assistance. The author would also like to thank Goldman Sachs for allowing their data to be used in this analysis, and Enrique Gonzalez-Macuer from Beef and Lamb NZ for his help in providing farm rental yield calculations.

Future returns are always uncertain. Thus, cautious investors will probably want to diversify and hold more than one type of asset. Holding assets with different risk and return profiles can increase the likelihood that an investor will do well, even if one particular asset does poorly. This note considers what a portfolio with attractive risk and return features might have looked like if, improbably, investors had expected the actual historical average returns and the variance of those returns. To do so, mean-variance optimisation techniques are used to consider what portfolio allocation would have been ex ante efficient – that is, what portfolio would have achieved maximum returns with least possible risk under uncertainty, supposing that a representative investor is concerned only with gross nominal asset returns and associated risk. It should be stressed that mean-variance optimisation is heavily stylised. All portfolios presented here should be thought of as non-replicable for individual investors, whose realised risk and returns are likely to be greatly influenced by a wide range of additional factors, some of which are discussed in more detail in Watson (2012).

THE HISTORICAL ESTIMATES

This article uses a new set of estimated gross asset returns compiled from a variety of sources (summarised in table 1) for the period from 1989 to 2011. This particular time period was chosen due to data availability and to be comparable with a similar analysis for Australia found in Goldman Sachs (2010).² This is a much shorter time period than would typically be used for investment research, which is mostly focused on equities, bonds and cash, but allows us to analyse trends across a wider range of assets. Investment research typically finds that equities generate the highest returns over long periods, but that equity returns are very volatile.

Financial and property assets are considered. However, this is not an exhaustive list of household assets. There are other forms of investment that yield returns for New Zealand investors, but for which data are unavailable or analysis is beyond the scope of this paper – for example, human capital investment is not captured and some of New Zealand's largest businesses are unlisted.

As indicated in table 1, in some places we have had to splice series together or use approximations in the early part of the period. The sources used were chosen to be as comparable as possible to those in the Australian analysis. Of course, the results are highly sensitive to the indices chosen – for example, a corporate bond index would have suggested higher returns than the government bond index used here. Indicative estimates have also been used in some cases for inputs such as rental returns and costs. We think our assumptions are reasonable, but other analysts who have attempted this sort of comparison have used different assumptions or left rental

² In some instances Australian asset returns data from Goldman Sachs (2010) has been used to construct proxies where earlier data for New Zealand are unavailable.

returns out altogether (the latter option would however clearly bias the results). We hope to periodically update this database, and in further work we may find better historical series for some of the asset classes covered here.

Table 1: Construction of estimates

Asset class	Sources	Time period
Cash/Deposits	NZ 12-month bank bill returns	1996-2011
	Proxied by NZ 12-month government bond yield	1990-1995
New Zealand Bonds	NZ generic government bond index (total returns)	1995-2011
	Proxied by Australian fixed interest returns (from Goldman Sachs), assuming the purchase of a forward contract to eliminate currency risk	1990-1994
Australian Bonds	AU generic government bond index (total returns), calculated including currency effects	2002-2011
	Australian fixed interest returns (from Goldman Sachs), calculated including currency effects	1990-2001
New Zealand	NZX all share price index including dividends	1990-2011
New Zealand Listed Property	NZX property index including dividends	1998-2011
	Proxied by Australian listed property returns (from Goldman Sachs), assuming the purchase of a forward contract to eliminate currency risk	1990-1997
Australian Shares Unhedged	ASX200 share price index including dividends, calculated including currency effects	2001-2011
	Australian share returns (from Goldman Sachs), calculated including currency effects	1990-2000
Australian Shares Hedged	ASX200 share price index including dividends, assuming the purchase of a forward contract to eliminate currency risk	2002-2011
	Australian share returns (from Goldman Sachs), assuming the purchase of a forward contract to eliminate currency risk	1990-2001
International Shares Unhedged	MSCI world equity index including dividends, calculated including currency effects	1990-2011
International Shares Hedged	MSCI world equity index including dividends, assuming the purchase of a forward contract to eliminate currency risk	1990-2011
Residential Property	Capital gains calculated using QV quarterly house price index. Rental yields are given by the median rent for a three bedroom house from the Ministry of Housing (backcast using Statistics New Zealand data prior to 1992) as a percentage of the REINZ median house price, assuming costs equal to 2 percent of the house price per annum	1990-2011
Commercial	IPD all property total returns index	1993-2011
	IPD office property total returns index	1990-1992
Farms	Capital gains calculated using REINZ farm price index, with rental yields assumed to be 2.4 percent per annum	2011
	Capital gains calculated using QV rural property price index, with rental yields assumed to be 2.4 percent per annum	1990-2010

Sources: Bloomberg, Reuters, Goldman Sachs, Quotable Value Ltd., REINZ, IPD, Statistics New Zealand, Ministry of Housing, RBNZ, author's calculations.

Asset performance is measured in terms of risk and return, with each asset assumed to be held from year end 1989. Annual returns – comprising income and capital gains – are calculated at year end and expressed in terms of compound annual growth rates (CAGR). This measure of average returns – a geometric mean – takes total nominal returns and imputes the constant yearly returns required to achieve them. This is distinct from an arithmetic mean, calculated as the average of annual returns

over the sample period, and used later to characterise distributions of asset returns for portfolio optimisation.³ The risk associated with an asset refers to the volatility of its returns from year to year, measured as the standard deviation of annual returns. The overall performance of each asset is measured in terms of its Sharpe ratio. The Sharpe ratio is a standard metric of risk-adjusted return, which measures excess return (over cash) per unit of risk in the following way:

$$\text{Sharpe ratio}_{\text{Asset } i} = \frac{\text{CAGR}_{\text{Asset } i} - \text{CAGR}_{\text{Cash}}}{\text{SD}_{\text{Asset } i}}$$

When investing in overseas assets such as international shares, currency movements can be an important determinant of overall returns. To capture these effects, returns have been calculated with and without hedging of currency risk. If an investor does not hedge currency risk, it is assumed that they purchase the asset at the year-end spot exchange rate – NZD/USD for international assets and NZD/AUD for Australian assets – and then revalue the asset at the prevailing spot rate 12 months later. On the other hand, if an investor hedges currency risk, it is assumed that they purchase the asset at the spot exchange rate and, at the same time, also purchase a 12-month forward exchange rate contract. When they revalue the asset 12 months later, the gain or loss on the forward contract can offset any gain or loss associated with movement in the spot exchange rate.

When calculating property returns, estimates of rental returns and associated costs have been used. Residential property returns are calculated as the returns from investing in rental property, rather than the purchase of owner-occupier housing. This is because purchasing property can have the purpose of both consumption and investment. Purchasing one's own home can essentially be thought of as the purchase of a stream of future housing consumption. We assume these "imputed rents" earned by owner occupiers are comparable to rental property yields.

For residential property, costs are assumed to be 2 percent of the property price per annum. This includes direct costs such as insurance and rates, along with depreciation and landlords' time. Landlords' time is assumed to have a monetary value equivalent to the cost of property management fees, which are typically about 8 percent of gross rental payments. This equates to approximately 0.5 percent of the rental property's value on average per annum.

³ A geometric mean is useful for characterising data that grows in a compound fashion over time because it retains consistency between growth rate metrics of the series and overall dollar returns. An arithmetic mean, on the other hand, would tend to overstate total returns in this instance. An arithmetic mean is useful for comparing the yield of different assets for an average year and is used to characterise asset return distributions for portfolio optimisation later in the paper.

Returns from owning a farm can be overstated by measures of farm profits if the owner also works on the farm (without taking a market-based salary). For the purposes of this analysis we focus on the return from simply owning the land. To account for this, it is assumed that farm investors purchase farmland and then let it out to others. The rental return of letting out farmland is then incorporated into total returns. For farmland, rental returns net of costs are assumed to have been 2.4 percent per annum over the entire sample period on average.⁴

The estimates of gross nominal asset returns are summarised in table 2. The gross asset returns presented here have an economy-wide lens – in contrast to the perspective of an individual investor who would probably be interested in the realised risk and return they could actually achieve, which would be determined by a range of additional factors. Such impacts, like tax treatment and leverage, are not incorporated into the estimates because quantifying these effects is beyond the scope of the analysis. However, these are important influences that are likely to be incorporated into individuals' investment choices and are discussed more extensively in Watson (2012).

Table 2: Summary of estimates⁵

Returns (%)	Cash (Deposits)	NZ Bonds	AUS Bonds	NZ Shares	NZ Listed Property	AUS Shares Unhedged	AUS Shares Hedged	Int'l Shares Unhedged	Int'l Shares Hedged	Residential Property	Farmland
1990	13.09	15.70	18.04	-35.93	5.60	-18.24	-19.85	-15.40	-12.09	9.95	21.84
1991	7.76	25.69	33.99	30.67	21.05	44.20	35.26	29.38	25.11	2.86	1.82
1992	6.84	10.31	4.70	13.41	6.91	-7.35	-2.38	-0.03	-1.54	8.56	17.66
1993	5.42	17.34	5.63	51.71	31.26	32.06	46.70	13.50	26.69	11.14	27.94
1994	9.58	-4.15	-4.82	-6.89	-5.06	-8.81	-8.18	-7.62	6.74	19.16	25.09
1995	8.19	13.55	11.11	19.61	14.42	12.51	22.03	18.55	24.05	13.74	13.44
1996	7.78	8.99	11.07	18.66	15.31	13.75	15.41	5.39	17.27	14.68	4.21
1997	8.66	6.43	11.78	2.91	21.11	11.78	12.91	40.94	18.18	9.96	-0.42
1998	5.33	13.16	13.45	-3.30	4.80	15.63	14.54	38.23	27.79	0.57	0.26
1999	6.47	0.43	6.47	16.98	-6.39	23.82	14.87	27.00	25.58	6.36	3.80
2000	6.63	10.74	12.13	-9.09	7.34	6.52	7.61	2.63	-12.79	2.97	7.63
2001	5.11	5.25	2.20	16.71	12.12	7.75	11.52	-11.33	-15.98	7.10	14.10
2002	5.99	8.60	-4.99	4.20	10.45	-20.35	-8.26	-36.55	-17.43	15.87	9.62
2003	5.90	6.38	9.03	26.50	13.40	22.22	15.79	7.32	39.72	28.79	22.63
2004	6.80	5.15	1.20	28.04	20.05	21.21	28.11	5.12	20.30	15.62	25.75
2005	7.66	7.06	4.58	8.96	19.69	21.63	24.23	15.77	13.92	18.27	29.42
2006	7.97	3.97	7.19	18.71	24.86	29.81	25.87	17.12	23.81	12.23	0.42
2007	9.03	4.16	5.10	-0.29	-4.28	17.58	16.43	-0.22	12.36	10.44	21.44
2008	4.33	17.60	25.16	-33.74	-20.77	-35.03	-37.93	-20.13	-37.49	-6.66	14.48
2009	3.64	1.05	1.57	19.35	11.82	41.35	39.15	3.82	34.91	7.70	-12.16
2010	3.39	7.03	11.33	3.07	3.42	7.72	0.58	4.79	15.99	0.84	-1.68
2011	2.70	13.77	13.82	1.42	11.19	-10.41	-11.85	-4.65	-2.10	5.34	5.62
Asset returns summary 1989-2011											
Returns (CAGR)	6.71	8.82	8.74	6.78	9.28	8.49	9.10	4.42	8.68	9.54	10.93
Risk (SD)	2.34	6.69	8.90	19.91	11.82	20.21	20.09	18.68	19.78	7.60	11.44
Sharpe ratio	-	0.31	0.23	0.00	0.22	0.09	0.12	-0.12	0.10	0.37	0.37

According to these estimates, farming and residential property investment provided the highest returns between 1989 and 2011, performing particularly strongly from the early 2000s onwards (figure 1). On the other hand, erratic sharemarket performance in the early nineties, along with the impact of the dotcom bubble and the financial crisis, saw equities perform less well. Bond holdings were a low-risk investment that generated increasingly favourable returns following the crisis, as falling interest rates

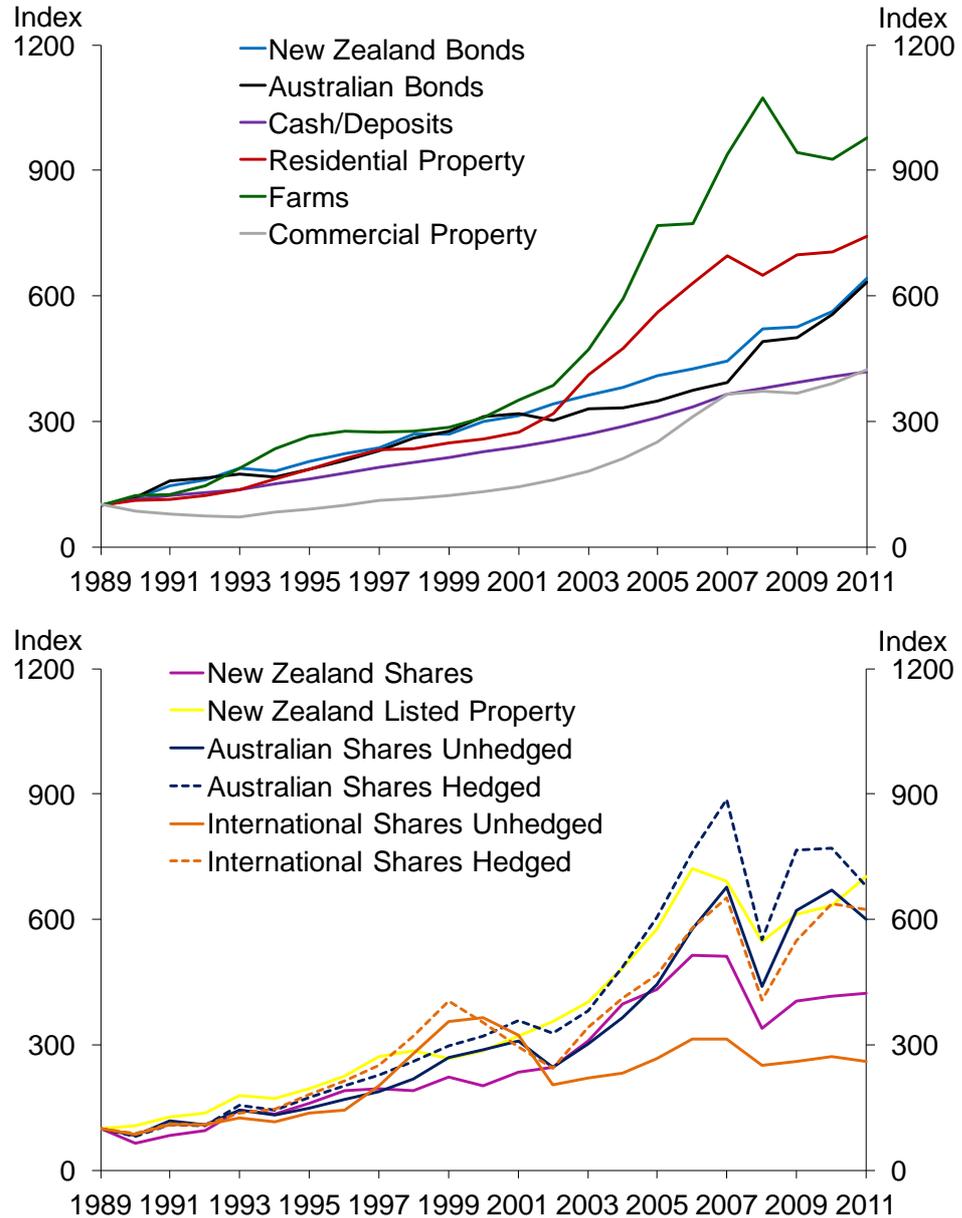
⁴ This should be treated as approximate only. Calculations are based on data helpfully provided by Beef and Lamb NZ and Dairy NZ. In constructing this estimate, rental returns for all non-dairy farms are assumed to be equivalent to the rental returns calculated for sheep and beef farms.

⁵ Commercial property returns series cannot be distributed.

raised the value of existing bond portfolios. These results are largely a function of the eventful historical period: following a share market crash and housing market downturn, and including two share market cycles, an unprecedented property boom, and a financial crisis.

Figure 1: Relative asset class returns

Dec 1989 = 100



MEAN-VARIANCE OPTIMISATION⁶

Uncertainty is likely to be an important influence on individuals' investment decisions and provides grounds for portfolio diversification. A mean-variance efficient portfolio of

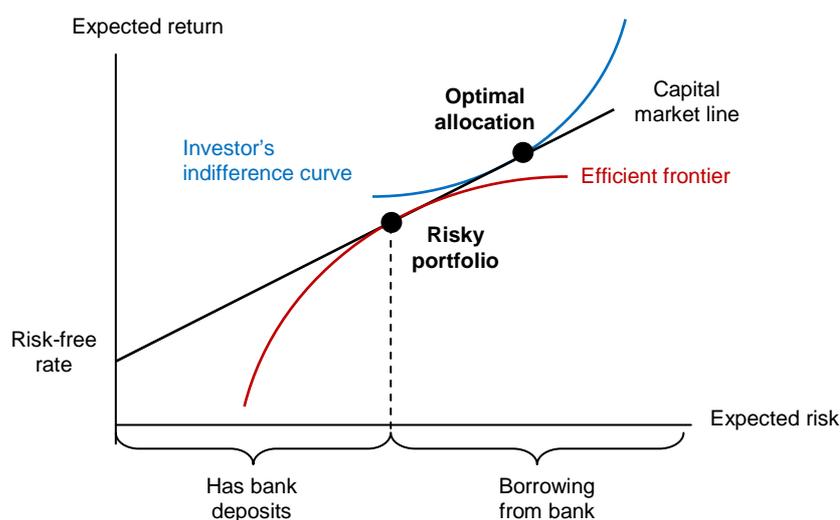
⁶ See, for example, Markowitz (1952), Tobin (1958), and Sharpe (1964) for background literature on mean-variance optimisation techniques.

assets is a portfolio that achieves maximum possible returns to the investor for any given degree of risk. Here we assume that a representative investor wishes to satisfy mean-variance efficiency and that they are concerned only with gross nominal returns and associated risk. We assume that investors are confident about how asset returns are distributed at the beginning of the sample period.

To calculate which portfolio would have been ex ante mean-variance efficient requires portfolio optimisation. This assumes that returns are normally distributed, with a matrix of expected returns (calculated using an arithmetic mean), variances, and covariances. These are often calculated from historical outcomes, and that is what we have done in this illustrative exercise. Given the investor's expected returns, they wish to buy an achievable mean-variance efficient portfolio to buy and hold for the duration of the sample period. Their exact choice of portfolio will be determined by their level of risk aversion. Effectively we assume that investment in farmland, for example, had the best prospects (highest expected return) but was not guaranteed to perform well (significant variance).

For a portfolio to be mean-variance efficient implies that no other portfolio can yield the same returns, without increasing overall risk to the investor. The efficient frontier – the red line shown in figure 2 – represents all the possible combinations of risk and return that are mean-variance efficient and can be achieved through some combination of available assets. For simplicity we abstract from the possibility of short-selling assets and assume that asset allocations cannot be negative.

Figure 2: Mean-variance optimisation



By lending or borrowing at the risk-free rate, an investor could achieve any point along the capital market line (the black line in figure 2). The 'risky portfolio' (marked above) represents the mean-variance efficient portfolio that is the best portfolio of

assets to mix with bank borrowing and deposits, and lies at the point of tangency of the efficient frontier with the capital market line.

An investor's risk aversion determines how much exposure to the risky portfolio they are willing to take on, and hence how much of their capital to invest in it. Their willingness to trade off risk against return is expressed by the slope of their 'indifference curve' (the blue line), and the 'optimal allocation' between the risk-free asset and risky portfolio is where the capital markets line touches the highest possible indifference curve. An investor is lending at the risk-free rate – i.e. holding some of their wealth as deposits – if their optimal allocation is to the left of the risky portfolio. If the investor's appetite for risk is sufficiently high, and their optimal allocation is to the right of the risky market portfolio (as in the graphed example presented here), this implies that the investor must borrow additional money to invest in the risky portfolio and achieve their optimal allocation.

Because the historical analysis presented here abstracts from leverage, we initially focus on the composition of the efficient frontier and of the risky portfolio that is achievable at the risk-free rate. The share of cash held (or borrowed) is mainly a function of the risk aversion parameter, which is subjective and dependent on investor preferences.

It is important to note that the mean-variance optimisation model used here is simplistic and may not truly represent individual investors' behaviour. Investors may not actively choose their portfolio allocation with the objective of mean-variance efficiency in mind. Instead, they might follow simple rules of thumb or a passive investment allocation. Mean-variance optimisation is also highly sensitive to assumed returns (as demonstrated by Black and Litterman (1990)).⁷ High weights on a small number of assets with the highest assumed returns are likely. For this reason, results should be treated with caution.

THE EFFICIENT FRONTIER

Given the assumptions and framework described above, how should a representative investor (assumed to be only interested in gross nominal returns and associated risk) have allocated their portfolio between available assets over this time?

Even if an investor is confident about the expected average returns and distributions associated with various assets, they will typically want to hold more than one type of asset. Holding assets with different risk and return profiles can increase the likelihood

⁷ Black and Litterman (1990) attempt to address the extreme corner solutions that are produced using mean variance optimisation by employing Bayesian techniques. Essentially, they take expected returns according to the CAPM and then construct posterior expectations by adding additional assumptions to represent investors' views subject to their degree of uncertainty.

that an investor will do well, even if one particular asset does poorly. For example, if an investor was confident that investing in farmland would be profitable on average but they wished to achieve reliable returns, then they might also choose to invest in an asset that tends to do well when farmland does poorly. This is consistent with the notion of mean-variance efficiency. To illustrate, figure 3 plots a range of portfolios that lie on the efficient frontier. In each case, no other portfolio could have yielded the same returns without increasing overall risk to the investor.

Figure 3: Efficient (risk-minimising) portfolios for given target returns

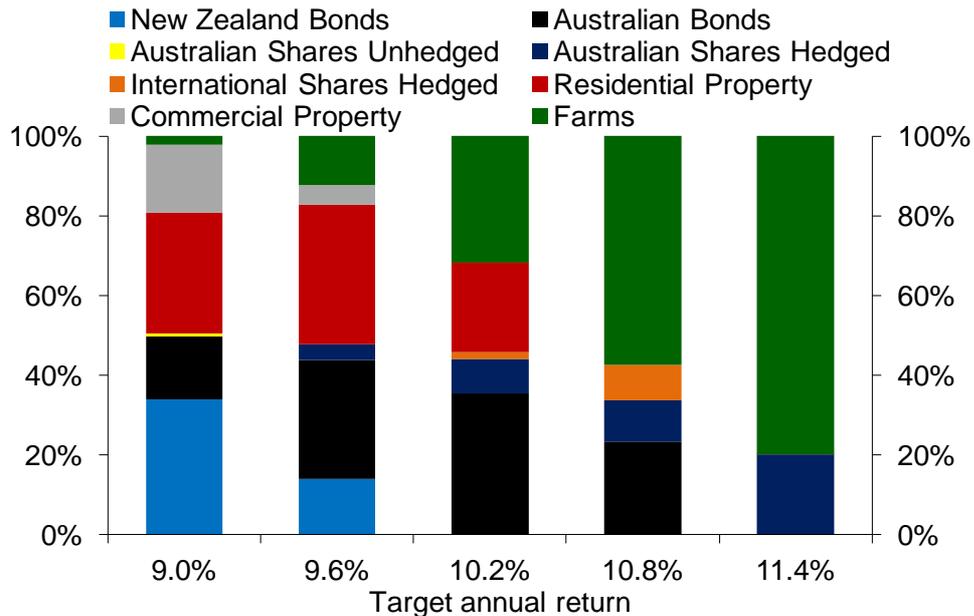


Table 3 shows that, as returns increase, so does the volatility of the associated efficient portfolio. Ultimately, for a given set of expected returns across different asset classes, generating higher total returns requires greater risk. Even if an investor feels confident about assets' future risk and return characteristics, how they allocate their portfolio depends crucially on their tolerance for risk. If an investor had sufficient risk tolerance, they could have earned the greatest possible overall returns by holding a portfolio consisting entirely of farmland, yielding returns of 11.5 percent on average per annum.⁸

⁸ This is an arithmetic mean to be comparable with the mean-variance calculations given in figure 3. This differs from the geometric mean given in table 2.

Table 3: Risk associated with efficient portfolios yielding target returns

Target returns (%)	Standard deviation of returns (%)
9.0	3.1
9.6	3.7
10.2	4.8
10.8	6.7
11.4	9.6

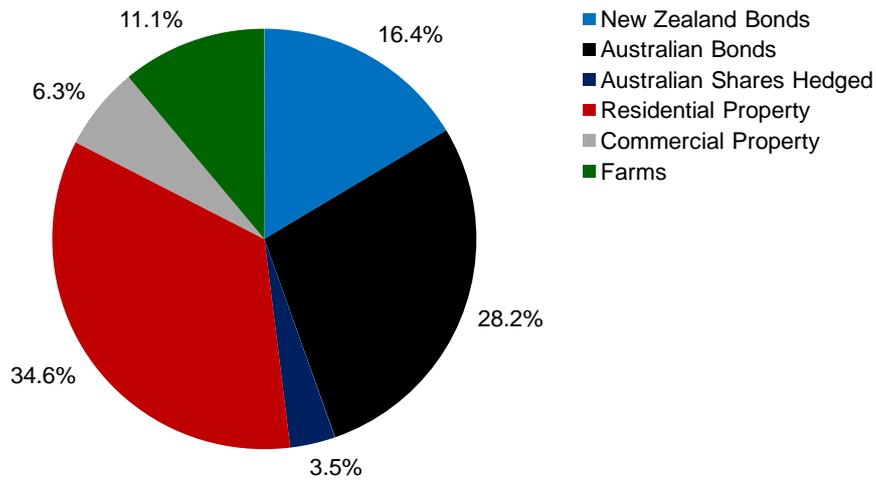
THE RISKY PORTFOLIO

As shown in figure 2, an investor can achieve an even better risk-return trade-off by combining the most efficient risky portfolio with bank gearing or bank deposits. The risky portfolio is the portfolio on the efficient frontier that allows the best combination of risk and return when combined with the risk-free asset – in this case, by borrowing from or lending to the bank. Using the average 90-day bank bill rate to proxy for the risk-free rate of interest, the efficient achievable risky portfolio is given in figure 4. A mean-variance optimising investor would invest in this portfolio and (depending on their level of risk aversion) would also borrow from or lend to the bank.

Consistent with the relative performance of assets described in previous sections, the largest portion of the mean-variance efficient portfolio is allocated to residential property investment. Equities, on the other hand, receive little weighting, with only a small holding of assets allocated to hedged Australian shares.

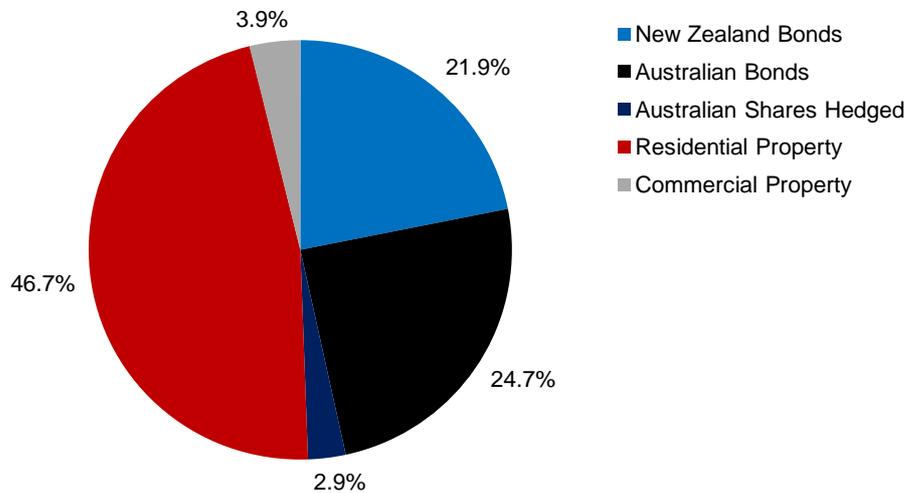
The achievable mean-variance efficient risky portfolio depicted in figure 4 would have achieved average annual returns of 9.5 percent over the sample period with a standard deviation of only 3.6 percent. Overall risk could then have been reduced by allocating some of the investors' wealth to deposits. Alternatively, investors willing to accept more risk could have used gearing to gain more exposure to the mean-variance efficient portfolio above. Suppose an investor was able to leverage up to five times their wealth and was happy to take on the additional risk. If (for simplicity) we assume they could borrow at the risk-free rate and invest in the risky portfolio, they would earn gross annual returns of just over 20 percent per annum. However, with a standard deviation of 18 percent, these returns would be extremely volatile, with the possibility of substantial net losses.

Figure 4: Achievable mean-variance efficient risky portfolio for New Zealand investors 1989-2011



For an investor to have held this mean-variance efficient portfolio would have required an investment of 11.1 percent of their risky portfolio in farmland. But it is difficult for households to gain exposure to agricultural property given the high price of a typical farm, so the achievable mean-variance efficient portfolio has been recalculated to exclude farms as shown in figure 5.

Figure 5: Achievable mean-variance efficient risky portfolio for New Zealand investors 1989-2011 (excluding farms)



In figure 5, a much greater portfolio weight is applied to residential property, along with a slight increase in bond holdings. Only a very small holding of hedged Australian shares is included. Interestingly, in this case less exposure to Australian bonds would have been desirable, in favour of New Zealand bonds which have tended to perform well in periods when equity and property markets have performed poorly. This risky portfolio would have achieved slightly lower average annual returns of 9.4 percent and, with a standard deviation of 3.5 percent, would have been slightly less risky than the optimal portfolio with farm exposure.

ADDITIONAL CONSIDERATIONS

This presentation of the issue is highly stylised. As stated previously, mean-variance optimisation is very sensitive to asset distribution assumptions. Using past returns as a proxy for future returns will lead to large weights being allocated to assets with high historical returns, but historical returns are not a good predictor for future returns.

Additionally, while gross nominal returns on aggregate asset classes are relevant for considering macroeconomic trends, they are less helpful from the perspective of an individual investor deciding how to invest. Many of the assets discussed here would be difficult for individual investors to replicate in their own portfolios – particularly in the case of property.

Risk metrics derived from property price indices do not take into account the idiosyncratic risk associated with owning one individual property, or the risk of owning properties within one specific region. This is because the price index is aggregated and inherently diversified amongst properties. Consequently, returns are likely to be more volatile for an individual property than for the price index as a whole, and the optimal portfolio allocation for individual investors – even if aggregate historical returns were to be repeated – is likely to be less heavily weighted towards property than these calculations suggest.

It may also be difficult to achieve the ‘correct’ portfolio weight on lumpy assets like property. For example, an investor looking to hold 15 percent of a \$500,000 portfolio in property would have trouble finding an appropriate house to purchase. Rebalancing of the portfolio, by selling the house and buying another one, would involve significant transactions costs, including agency fees, search costs and time. It is particularly difficult for the average New Zealander to gain direct exposure to farmland, given the high value of the average farm and the limited number of investment vehicles.

To assess the true economic risk to the investor, modern finance also acknowledges that investors should consider other factors – in addition to the realised risk and return characteristics of assets – when choosing their portfolios. Conceptually, investors should seek investments that pay off in states of the world where they will most appreciate the money, and this will depend crucially on their personal circumstances. For example, a worker employed by the largest company in a town will likely face financial hardship (via unemployment) if that company fails. At the same time, they might find it difficult to sell residential property they owned in the town, and stock they held in the company would be worthless. While some of this concentration of risk may be unavoidable (and possibly compensated for by a wage premium), it should be a relevant consideration in such an investor’s portfolio allocation decision. They might, for example, avoid owning investment properties in the town, or company stock, since

other investments provide much better ‘insurance’ against the loss of the worker’s labour income.

In general, Cochrane (1999, 2011) suggests that, when financial planners help investors choose appropriate portfolios, they should do more to help them consider additional sources of risk applying to their personal situations. In addition to risks associated with a person’s employment, these additional factors could include regional- or country-specific risks. For example, an investor may wish to hold foreign currency assets as a hedge against an economic shock affecting their own country.

An investor is also likely to want the option to liquidate their investment in times of stress. Property tends to have asymmetric liquidity: it is easy to sell in boom times, but can be very difficult to move during downturns. As such, investors are wise to give some consideration to the market liquidity of assets, particularly if they are risk-averse or highly leveraged. Such additional considerations might dissuade individuals from investing in markets or regions in which they are already heavily exposed, or in markets that tend to become illiquid in times of stress.

Investors are likely to at least partly base their expectations of asset returns on historical experience. However, making forward-looking assumptions based on past returns can be dangerous. Once asset booms in individual markets get underway they sometimes appear to develop their own momentum for a time. But rather than suggesting that an asset’s returns are reliably strong, high historical returns can sometimes indicate excessive valuation, with low or negative returns following as a consequence. It is, therefore, not safe to assume that assets’ risk and return characteristics will be replicated in the future.

THINKING ABOUT THE FUTURE

Given that historical returns are not a predictor of future returns, this section goes on to consider how asset returns might be distributed differently in future and what this might imply for mean-variance efficiency. We have experimented with calculating the implied expected returns that would be consistent with mean-variance efficiency based on New Zealand’s wealth allocation in December 2011. Implied expected returns are calculated by rearranging the first order conditions of the mean-variance optimisation problem, assuming that each asset class’s variance and covariance remains unchanged and that households allocate their wealth to satisfy mean-variance efficiency.⁹ Results are largely contingent on the assumption for the risk-free

⁹ For technical detail on reverse optimisation see Sharpe (1974). Methods used here are similar to the derivation of CAPM equilibrium return prior in the Black Litterman model – a Bayesian mean-variance optimisation model – but we assume that households’ allocation of wealth is equivalent to market capitalisation (Idzorek (2002) and Black & Litterman (1990)). A higher degree of risk aversion is assumed in this section to ensure a tangency solution point can be achieved under all assumptions.

rate, which has fallen significantly in recent years. This implies that, over coming years, returns for all asset classes are expected to be much lower than has been seen over recent history. This is consistent with current market pricing of financial assets and reflects expectations that low interest rates and subdued economic conditions will prevail for some time to come.

If asset returns are expected to be systematically lower across all asset classes, this is likely to have little impact on portfolio choice. However, if relative returns are expected to change, investors might rebalance their portfolios towards assets they expect will perform comparatively well. Some investors will have expectations of asset returns that differ from market pricing and will allocate their portfolios to be consistent with their assumptions. If they think the returns of a certain asset class will be higher than the market or consensus view, then from their perspective the asset is 'undervalued' and this represents a buying opportunity in markets.

We have experimented with a variety of methods investors might use to forecast future returns. For example, investors might look at projected house price growth from the Reserve Bank or other forecasters, or they might try to forecast stock prices on the assumption that the historical relationship between share prices and earnings is gradually restored. These sorts of methods can yield a wide range of possible expectations for each asset class, depending on the various assumptions. The corresponding mean-variance efficient portfolios are similarly varied, although under most assumptions a diversified portfolio continues to be desirable, reflecting the inherent uncertainty associated with future asset returns and the ability of diversification to lower that risk somewhat.

CONCLUSION

The key contribution of this note is to document the construction of a New Zealand aggregate returns database that can be maintained (and potentially refined) in future and compared with similar Australian statistics. From the perspective of an individual investor, a number of factors – in addition to headline risk and return metrics – influence the realised risk and returns they can achieve, and this will be reflected in their portfolio allocation decisions. Analysis presented here confirms that, under uncertainty, a diversified portfolio of assets would have been desirable over the past two decades for a representative mean-variance optimising investor concerned only with gross nominal returns. Asset returns could be much different in future and a wide range of representative portfolios could be desirable going forward. This reflects the inherent uncertainty associated with future asset returns and is consistent with the notion that past returns are not a reliable predictor of future returns. For an individual investor, portfolio allocation will depend crucially on their expectations of future returns, risk tolerance, and a range of other relevant factors, varying considerably between individuals.

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