KiwiSaver and Retirement Adequacy

Kirsten MacDonald[1], Robert J. Bianchi & Michael E. Drew

Abstract

Investors face a long and uncertain journey to retirement and beyond, particularly when investing in new defined contribution schemes such as New Zealand's KiwiSaver. This paper seeks to provide positive insights into the design of KiwiSaver by assessing the recently announced move from 4 to 6% minimum contribution rates using stochastic simulation. We consider retirement adequacy from two perspectives: (i) multiples of gross final earnings achieved during the accumulation phase; and (ii) replacement rates of salaries during the decumulation phase. The findings reveal that an increase in the contribution rate from 4 to 6% dramatically increases the probability of investors reaching a retirement target of eight (8) times final earnings, from 6% to 40%. However, despite the shift in lifetime contributions in the right direction, the simulation analysis suggests that, in the majority of scenarios, KiwiSaver investors will not achieve an adequate retirement target.

Keywords: KiwiSaver; retirement outcomes; contribution rates.
JEL classification: D14; G11; G23

[1] Griffith University
Email: k.macdonald@griffith.edu.au

Introduction

Patterns identified in national savings levels have raised concerns worldwide over the adequacy of retirement savings and the sustainability of public pensions. These concerns are heightened by the trend away from defined benefit to defined contribution plans, transferring risk from governments and employers to individuals, which has coincided with a wave of pension reforms. On 1 July 2007, KiwiSaver, a system involving defined contribution investment schemes, was introduced in New Zealand (NZ) to encourage long-term savings and to provide an opportunity for investors who would not otherwise be able to provide for themselves in retirement.[2] Both prior to and post implementation, KiwiSaver was criticised for its design, particularly incentives that were argued to be inequitable or unlikely to be sustainable (Gibson, Hector & Le 2008; Le, Scobie & Gibson 2009; St John 2007, 2008; St John & Littlewood 2006). Individuals do not always make decisions consistent with their needs (Benartzi 2001), their investment behaviour is affected by plan design (Choi et al. 2002) and, unlike consumer purchases, they are unable to evaluate the effectiveness of their investment until they reach retirement (Blake, Cairns & Dowd 2001). These elements in the literature provide the motivation for a program of evaluation and improvement of the KiwiSaver system design.

Despite concerns from leading economists (in the aforementioned studies) and parliamentary critique in respect of continuing proposed and actual changes to the scheme over a short period of time (Hansard 2011), there is limited research on KiwiSaver. In fact, much of the current debate is focussed on the issue of national savings rather than being concerned with individuals' retirement outcomes. Faced with the challenge of assessing the savings required to retire comfortably and how to achieve the required pre-retirement savings, investors require accurate and adequate information to plan appropriately and make optimal savings decisions (Lusardi 1999; Lusardi & Mitchell 2006), thus insights from other institutional settings are important.

An interesting contrast that emerges between two similar open and neighbouring economies is the case of Australia and NZ. For nearly 20 years, NZ was 'uniquely simple' offering a flat universal government pension and voluntary unsubsidised private saving (St John 2007) while over much of the same period Australians have experienced compulsory savings via the Superannuation Guarantee.[3] More recently, while Australia debated the move from 9 to 12% minimum contribution rates, NZ reduced the minimum and default joint employee-employer contributions from 6 to 4%. Motivated by concerns over retirement adequacy (Savings Working Group 2011), the NZ government has now introduced legislation to revert to 6% contributions from 1 April 2013.

---

[2] KiwiSaver is a voluntary scheme and, although primarily work-based and administered through the PAYE tax platform via Inland Revenue, can also be accessed by those outside paid employment including children. NZ has no capital gains tax, thus a strong bias exists towards investment in property (Savings Working Group 2011).
At the aggregate level, financial assets held by New Zealanders represent only 36% of the value of housing. Furthermore, superannuation represents only 16% of total household financial assets compared with 51% on deposit in financial institutions, 13% in managed funds, and 10% in direct investment in a combination of domestic and foreign equities (Reserve Bank of New Zealand 2012). At the individual level, the 2006 Survey of Family, Income and Employment shows that the median value for an owner-occupied home is 17 times more than the median value of holdings in financial assets, with investment property close behind with a median value of 16 times more than financial assets (Scobie & Henderson 2009).

[3] In 2006, prior to the introduction of KiwiSaver, the levels of NZ and Australian household investment in residential property and financial assets held outside of superannuation were almost equal. However, when compared to Australia, NZ household assets were invested significantly more in farms and businesses than in superannuation funds (Savings Working Group 2011).

The pensions' literature shows a positive relationship exists between wealth accumulation and contribution rates. The average contribution rate for defined contribution plans in Organisation for Economic Co-operation and Development (OECD) countries is 8%, with rates ranging from 2 to 15% (OECD 2011). From 1 April 2013, KiwiSaver requires a minimum employee contribution of 3% of gross earnings plus a 3% employer contribution totalling 6%. Although 6% is only just below the OECD average, the NZ superannuation system is most similar to Australia.[4] In Australia, it is argued that 9% is not enough (Bateman, Piggott & Kingston 2001), even when combined with additional voluntary contributions (Gallery & Gallery 2005). The question arises whether a 6% contribution rate is enough to provide New Zealanders with standards of living in retirement similar to those in pre-retirement. On the one hand, KiwiSaver is said to be the answer to a savings problem, while on the other, it is argued to be a high cost solution to a savings problem that may not even exist (Gibson & Le 2008; Le et al. 2009; Yong & Cox 2008).[5] If investors in other countries are contributing a higher percentage of, in many cases, higher income, and many investors still face a retirement shortfall, this suggests there is a gap in our understanding of the NZ superannuation system.[6]

To address the conflicting views and research-based evidence in the NZ context to date, this paper sets an outcome oriented research agenda to provide positive insights (as opposed to a normative approach) into the design of KiwiSaver. This study applies a stochastic simulation methodology to evaluate KiwiSaver retirement outcomes and we find the shift in minimum contribution rates from 4 to 6% is inadequate to ensure most investors are successful compared to popular benchmarks in the pensions literature and practice. Furthermore, the analysis expands our knowledge of the NZ equity risk premium, the lack of equity home bias and we report on the skewed distribution of retirement outcomes from this long-term analysis.

The remainder of this paper is organised as follows. The following section discusses the literature, including definitions of the measures of adequacy used to evaluate KiwiSaver retirement outcomes. This is followed by an explanation of the simulation methodology and discussion of the data sources and characteristics. The results are then presented from both an accumulation and decumulation phase perspective, followed by the conclusions of the study.

Literature Review

Traditional finance theory of how investors allocate funds and build portfolios to create wealth are founded on the seminal work of Markowitz (1952, 1959) and the principles of Modern Portfolio Theory (MPT). Although these theoretical models inform us about the fundamentals of risk and return, the traditional Markowitz (1952, 1959) one-period equilibrium model is problematic in its application to real world settings, with its restrictive assumptions such as quadratic investor utility and normally distributed asset returns. Furthermore, MPT is too narrow for the purpose of determining the retirement adequacy and

---

[4] Despite similarities in the underlying systems, key differences include compulsory superannuation contributions and means testing of the government pension in Australia. Although NZ pays the highest level of government pension in the OECD, with the absence of a compulsory superannuation system, many NZ investors receive low retirement income compared to OECD standards (OECD 2011).

[5] Although the Savings Working Group (2011) finds little evidence that the quantity of investment in NZ is inconsistent with international benchmarks, they question the quality and efficiency of New Zealanders' investments. Nevertheless, after adjusting for owner-occupied housing, the median saving rate is 5%, with a "strikingly wide" distribution of rates. New Zealanders aged 25 and under are saving the least and there is evidence of negative savings across many different categories of savers (Scobie & Henderson 2009 p55).

[6] Working life incomes in NZ are currently up to 35% below those in Australia with the income gap forecast to increase to 42% by the year 2025 (2025 Taskforce 2010).

the optimal portfolio choice of a NZ KiwiSaver investor over their working life. Other models by Mossin (1968), Merton (1969) and Samuelson (1969) have been developed to address the multiple period portfolio selection problem in Markowitz (1952, 1959), however, they also exhibit restrictive assumptions that are difficult to apply to real world investment applications. A multiple period geometric mean approach from Latané (1959) seems more consistent with an investigation of terminal wealth outcomes.[7] Despite being shown by Hakansson (1971a, 1971b) to be more likely to maximise capital growth than a Markowitz (1952, 1959) style portfolio with a goal of maximising the risk-adjusted return, the geometric mean approach may entail a higher risk strategy (Elton et al. 2009). Moreover, mean-variance optimisation is shown to be a convenient approximation anyway (Young & Trent 1969). Despite the evolution of various portfolio selection models, the mean variance optimisation from Markowitz (1952, 1959) remains the cornerstone of MPT.

Although the body of pensions literature is embedded in portfolio theory, the pensions literature broadens optimal portfolio choice by examining other empirical variables such as contribution rates, time-varying investment and dollar weighted returns along with the characteristics of empirical financial market returns. The pensions literature is important in providing more real-world insights into both the design and modelling of KiwiSaver. Some frequently cited pension models apply static assumptions about market variables (see, for example, Mitchell and Moore (1998) while others allow for stochastic behaviour (see, for example, Blake et al. (2001). Stochastic pension models can further be distinguished by their purpose. Theoretical pension models take a dynamic programming approach to determine what ought to be the appropriate course of action (see, for example, Haberman & Vigna; Vigna & Haberman 2001), while applied models employ an outcomes based approach via the use of stochastic simulation (see, for example, Basu, Byrne & Drew 2011; Basu & Drew 2010). Regardless of the nature and purpose of the model, it is important to determine an appropriate benchmark against which to define and evaluate successful retirement outcomes.

Determining whether a retirement outcome is 'adequate' is problematic. First, there is no single measure of retirement adequacy.[8] Second, whether a particular measure represents an adequate retirement income depends on whether it employs an appropriate measure of pre-retirement earnings (Biggs & Springstead 2008). Biggs and Springstead (2008) review four different measures of gross pre-retirement earnings. Although they show the benefits of alternate measures such as the constant income payable from the present value of lifetime earnings or a CPI adjusted average of all earnings prior to claiming a government pension, they also conclude that there are compelling arguments for the use of final earnings. While final earnings may not reflect lifetime earnings, particularly where employees transition to retirement by working fewer hours, final earnings is the most common measure, is easy to use and, as explained in the seminal work of Blake et al. (2001), it is consistent with the determination of benefits from a defined benefit plan. Finally, judgement must be applied to determine the level beyond which one can say there has been success in achieving an adequate outcome.

Importantly, this paper does not seek to prescribe an appropriate benchmark but instead evaluates retirement outcomes against the KiwiSaver legislation and popular benchmarks from the pensions literature and practice. According to section 3.1 of the

[7] The goal of this multiple period approach is to select the portfolio with the highest expected value of terminal wealth which Latané (1959) demonstrates is the portfolio that has the highest geometric mean return.

[8] The adequacy of retirement wealth has been defined in many different ways, for example, in terms of income replacement rates (Burns & Widdows 1988; Le et al. 2009; Mitchell & Moore 1998), prescribed savings rates (Bernheim 1996; Le et al. 2009; Mitchell & Moore 1998), net worth (Scholz, Seshadri & Khitatrakun 2006), confidence whether an adequate income will be achieved (Drew & Tharenou 2008) and multiples of pre-retirement salary (Basu & Drew 2010; Booth & Yakoubov 2000; Park 2011).

KiwiSaver Act, the objective of KiwiSaver is to enable a retirement nest egg to be saved by those who would otherwise not be able to provide for themselves to achieve standards of living in retirement similar to those in pre-retirement. This is consistent with the generally accepted goal of retirement planning which is to provide enough income in retirement to prevent one's standard of living from falling much below the pre-retirement level (Schulz 1992).

Turning to the literature for guidance, the measure of retirement success in terms of multiples of final earnings is generally in the range of between five to eight times final earnings.[9] With little opportunity for annuitisation of retirement wealth and a low wage economy, many New Zealanders potentially require higher earnings multiples or replacement rates, yet hospital care and non-elective surgery in NZ is provided free of charge, therefore both final earnings multiples and replacement rates may be higher than usual but not as extreme as the worst case outcomes reported for US investors. Following the Australian model of Basu and Drew (2010), the target employed in this study is defined as eight (8) times final earnings. In terms of replacement rates, both the literature and financial planning practice in NZ and abroad suggest that 70% is a reasonable benchmark for the replacement of pre-retirement earnings.[10] However:

> "there is an emerging new consensus that middle and high income people need close to 95% to 100% of income to maintain living standards because more elderly are in debt and still paying mortgages and health care costs are increasing." (Ghilarducci 2010 p4).

Recognising that the results will be conservative in the context of changing retiree demographics, the replacement rate target in this study is defined as 70% of final gross earnings. Both the final earnings and replacement rate targets are used to evaluate the adequacy of pre-retirement savings for the baseline simulation for the current 4% and the shift to the higher 6% KiwiSaver contribution rate.

Extant literature relating to managed funds and pensions in NZ is limited, not only in terms of the number of studies, but the lack of consensus on whether New Zealanders are saving enough, as well as data and methodological limitations.[11] The international empirical pensions literature shows that retirement wealth is primarily dependent on asset allocation, asset returns and contributions, yet there is almost no research dedicated to these variables in the NZ context with most research being descriptive or survey based.[12] New Zealanders'

---

[9] Wysocki (1995) reports Merrill Lynch survey results of the time recommending a multiple of 6.5 times final earnings to retire in comfort. Booth and Yakoubov (2000) refer to a benchmark of five times final earnings, while Basu and Drew (2010) argue that, despite a lack of agreement on a definition of adequacy, a multiple of eight times final earnings is more appropriate. Park (2011) demonstrates that US investors in different income categories, with differing allocations to equity and differing degrees of annuitisation of retirement wealth face varying requirements for final earnings multiples to achieve adequacy. For example, a final earnings target of 5 for a high income earner could be as high as 33 for a low income earner due to the characteristics associated with living conditions.

[10] Replacement rates in the literature vary between 65 to 90% (Myers 1993; Schieber 1998). A popular rule of thumb for US financial advisors is the requirement for a total retirement income equal to between 70 and 90% of earnings immediately prior to retirement (Biggs & Springstead 2008), which is comparable to the 70% of final gross earnings advocated by the popular www.sorted.org.nz web page developed by the Commission for Financial Literacy and Retirement Income.

[11] In general, data is limited in terms of the disclosure of asset allocations, methods for reporting of fees and returns, and problems caused by data sets available from consumption surveys. These data and methodological differences are highlighted in the works of Fowler, Grieves and Singleton (2010); Le et al. (2009); Scobie, Gibson and Le (2004); Vos, Brown and Christie (1995).

[12] None of the studies of NZ managed funds have considered investors' contributions, however, the issue of savings rates has been widely discussed in the NZ pensions literature and empirically addressed in a number of more recent studies.

retirement wealth has been modelled once by Le et al. (2009) who use a very specific economic framework with restrictive assumptions that do not capture real world investor and financial market dynamics.[13] Le et al. (2009) find that for the most part, New Zealanders do indeed save enough for their retirement, with the possibility of some individuals being less well-prepared, however, alternate viewpoints suggest that 'some' may be an understatement of the problem and that the findings are a reflection of the methodology applied.[14]

An alternative method to model retirement wealth, taking into account financial market dynamics, which is particularly important in the post-global financial crisis (GFC) environment, is the stochastic simulation approach of Blake et al. (2001) and Basu and Drew (2009). The contribution of this study is that for the first time, the potential retirement wealth outcomes from a KiwiSaver investment can be examined over the entire working life of an individual, including stochastic modelling of financial market variables and the consideration of asset allocation.[15] Unlike prior studies of KiwiSaver, no assumptions are made about a savings-consumption model or savings rates other than to apply the required contribution rates when an individual joins KiwiSaver. This is arguably a potentially improved approach to consider retirement wealth outcomes than previous models applied to evaluate KiwiSaver because it more closely follows the process used by real world investors by focusing on investor contribution rates in an investment plan.

A weakness of the simulation approach is that historical returns do not necessarily provide an accurate estimation of the future. This problem is compounded by the lack of sufficient historical data to evaluate superannuation plan design over the long time horizons of retirement savers. As the length of historical data sets increases, the more it is possible to get a sense of likely retirement wealth outcomes. Although the data sets employed in this study date back to the 1930s and earlier, without a century or more years of data, bootstrap resampling must be employed to improve the information derived from the simulation model.[16] On the other hand, the separate analysis of savings and wealth accumulation is recommended since the dynamic nature of financial markets has the potential to cause saving and wealth accumulation to move in either the same or opposite directions (Bollard et al. 2006; Toder & Khitatrakun 2006). Furthermore, the strength of the simulation approach is its ability to provide an understanding of an investor's chosen asset allocation, contributions, the market environment and their combined impact on retirement wealth outcomes. This form of analysis is yet to be explored in the NZ context.

Methodology

A simulation model is developed for a hypothetical investor, a 25 year old male with no accumulated savings who earns the 2010 average NZ male salary of $43,153 over his

---

[13] In order to measure the rate at which households are saving, Le et al. (2009) follow the methodology of Mitchell and Moore (1998) who apply Modigliani and Brumberg's (1954) lifecycle hypothesis of smoothed consumption over the investor's lifetime. Survey data is then used to simultaneously solve for the income replacement rates and estimated savings rates needed for individuals and couples to have adequate retirement income.

[14] Scobie et al. (2004) also find that households save enough to maintain their living standards in retirement. Toder and Khitatrakun (2006 p4) contend that this conclusion is 'controversial' particularly because of data issues and the methodology employed, although some methodological issues are resolved in Le et al. (2009). St John and Littlewood (2006) describe a highly skewed distribution of asset returns and conclude that New Zealanders are comparatively less prepared for retirement than investors in other countries. St John (2005) also notes that middle income New Zealanders are most at risk and require more than the government pension to maintain pre-retirement living standards.

[15] Le et al. (2009) consider household rather than individual data for a sample in the 45 to 64 age group only.

[16] Applying the law of large numbers, 10,000 iterations ought to produce an average from the sample data that approximates the true average.

working lifetime from age 25 to 65.[17] The hypothetical investor joins KiwiSaver at age 25 and both he and his employer contribute the minimum rate of 3%, equating to a joint contribution of 6%. For illustrative purposes, contributions are assumed to be credited to the investor's account at the end of every year at which time the portfolio is rebalanced to maintain their target asset allocation.[18] Furthermore, investment fees and taxes vary according to the chosen plan and individual's income, thus taxes and fees on KiwiSaver earnings and transactions are ignored.[19]

The stochastic simulation is based on bootstrap resampling of empirical annual return vectors from 1970 to 2010 for six asset classes being NZ equities, NZ bonds, NZ cash, NZ property, international equities, and international bonds. The bootstrap resampling approach of Efron (1979) is particularly important in this case where 41 years of annual return data is used to generate returns for the hypothetical investor's 40 year investment timeframe. By redrawing randomly to create 10,000 samples from the data set, it is possible to generate potential retirement wealth outcomes based on asset returns that reflect many different plausible capital market environments while retaining the cross correlation between each class of asset returns and assuming independence in individual asset class distributions over time (Blake et al. 2001; Hibbert & Mowbray 2002). The asset allocation weights in Table 1 representing typical NZ 'default', 'conservative', 'balanced' and 'growth' investment profiles are applied in turn to 10,000 iterations of the model to provide an estimate of 10,000 independent final KiwiSaver account balances for the 40 year investment horizon.

[17] Salary data was sourced from Statistics NZ (2011). Age 65 is the age of entitlement to New Zealand Super (NZS) and the working life assumption of 25-65 is consistent with previous studies by Basu and Drew (2010) and Blake et al. (2001).

[18] This study can be extended to include different profiles including, but not limited to, females, different types of employment, periods of unemployment, variation in salaries over the investor's lifetime, and employing a longer set of historical empirical returns. It is important to acknowledge the varying productivity and income over an investor's lifetime and to more closely match the real world situation where some individuals work part-time over long periods or move between part and full time employment modes, where one or both parents experience breaks in paid employment to start a family or for other reasons become unemployed. This analysis only considers outcomes compared to a retirement target, but not the risk of failing to meet the target. Future avenues of research may examine this by assessing both the chance and size of shortfall relative to a selection of savings targets.

[19] Like all savings products, contributions are paid from after-tax income, fund earnings are taxed and withdrawals are exempt. Marginal income tax rates and employer superannuation contribution tax rates range from 10.5 to 33%. Taxes payable on income, employer contributions and investment earnings are dependent on a combination of the particular circumstances of an individual investor and the tax status of the superannuation vehicle (Inland Revenue 2012). While there are issues with disclosure and inconsistencies in the way fees are reported (Ministry of Economic Development 2010), it is estimated that the average KiwiSaver scheme charges a management and expense ratio equivalent to 1.46% consisting of 0.83% of assets plus an average charge of $2.55 per member per month (Savings Working Group 2011).

Table 1
Average Benchmark Asset Allocations for Top Ten KiwiSaver Schemes

KiwiSaver investment profile	NZ cash	NZ bonds	NZ property	NZ equities	International bonds	International equities
Default	39%	14%	3%	6%	26%	12%
Conservative	22%	27%	4%	6%	29%	12%
Balanced	10%	17%	8%	15%	19%	30%
Growth	11%	5%	10%	24%	7%	43%

This table presents the average benchmark asset allocations for the largest ten KiwiSaver schemes by funds under management as at 30 June 2008.[20]
Source: Government Actuary (2008)

The terminal value of KiwiSaver assets is given by:

$$W = k\sum_{t=0}^{R-1} S_t (1 + r_t) \prod_{u=t+1}^{R-1} (1 + r_u) \qquad (1)$$

where:
W is the value of KiwiSaver assets accumulated at the point of retirement;
k is the sum of employee and employer contribution rates;
S_t is the annual salary in year t;
r_t is the nominal rate of investment return earned in year t; and,
R is the number of years in the plan before retirement.

The cash flows contributed to a KiwiSaver plan are affected by both k, the contribution rate, and S_t, the annual salary in year t, where annual salary is defined by the equation:

$$S_t = S_0 (1 + g)^{t-1} \qquad (2)$$

where:
S_0 is the initial salary of a KiwiSaver member;
g is the nominal wage growth; and,
t is the years elapsed since commencement of employment.

As Hibbert and Mowbray (2002) explain, salary inflation is an important consideration due to its relationship with superannuation contributions and the replacement ratio, but with uncertainty increasing with the investment horizon, its importance is reduced and a fixed salary inflation rate can be assumed. Although assumed rates of salary growth vary across studies and countries (for example, 2.5% in excess of inflation in the UK (Hibbert & Mowbray 2002) or 4% linear growth applied to US data (Basu, Byrne & Drew 2011), the literature indicates a preference for a simple nominal analysis over more complex assumptions about inflation and real salary growth. The nominal wage growth rate, g, is therefore fixed at 4%, a rate equivalent to the average nominal NZ labour cost index for the period 1996-2010 (Statistics NZ 2011).

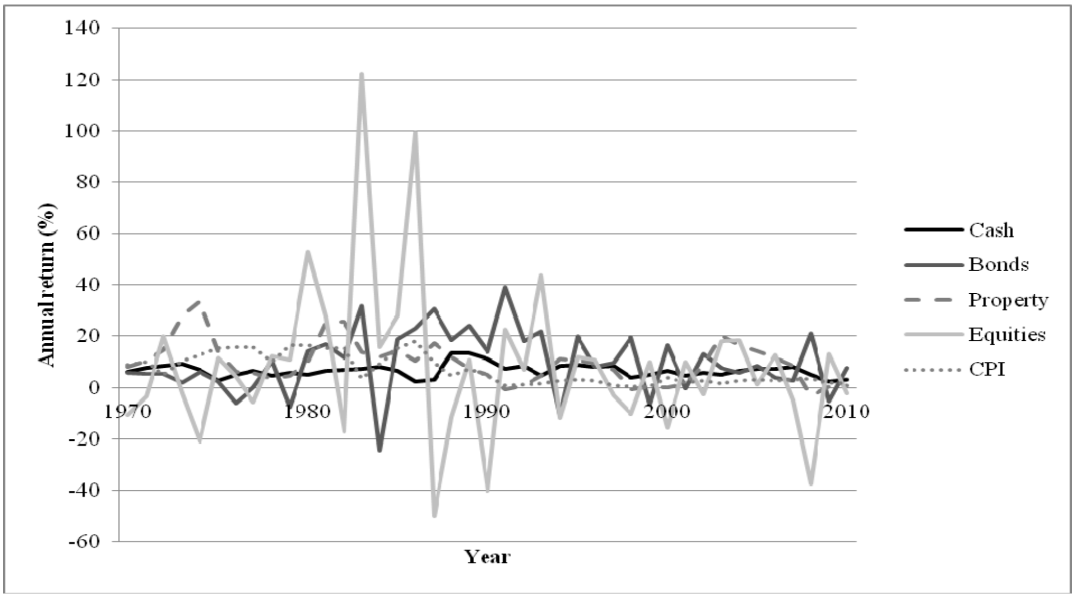
[20] Updated benchmark allocations are available as at 30 June 2011, however, NZ equities are not separately disclosed from Australian equities. Asset allocations for the other asset classes remain the same or very close to the values reported in Table 1.

Data

Asset class index return data was obtained from reliable and accepted sources.[21] International stock and bond indices were converted to NZ dollars using NZD-USD foreign exchange rates. Due to the lack of disclosure surrounding asset classes, little is known about the mix of assets known as 'other' reported by the top ten KiwiSaver schemes. With minute proportions of 'other' assets in each of the typical NZ asset allocation profiles and a low allocation to property, 'other' assets have been incorporated into the property allocation.[22] The limited availability of long reliable data sets for NZ industrial and commercial property has led to the use of the NZ residential property index.[23]

While it is acknowledged that some drivers of residential and commercial property returns differ, NZ residential property has a similar long term average to direct investment in commercial property and follows a similar trend to commercial property. According to IPD (2011), the long term average annual rate of return for direct investment in commercial property, including industrial, office and retail property, is 10%. Our data shows the average for NZ residential housing is 9.85% per annum. Using 1979-2003 data, Gunasekarage, Power and Zhou (2008) find similar correlations between industrial property, commercial property and the CPI. Our data set confirms that residential property follows a similar trend to the CPI for the 1970-2010 period, as illustrated in Figure 1.

Figure 1
Comparison of NZ Asset Class Returns and NZ CPI 1970-2010



Despite a similar long term average and trend, the volatility of residential and direct commercial property differ. For the period 1995 to 2005, Nartea and Eves (2008) report a

[21] NZ cash, bond, and equity series along with NZ CPI and USD-NZD currency rates were sourced from Global Financial Data. International stocks are sourced from MSCI world index, while an international bond series is spliced together from Shiller (2005) and the Barclays Capital US government long bond index. NZ residential housing data is sourced from the Reserve Bank of New Zealand in the form of the Quotable Value (QV) quarterly index.

[22] The addition of 'other' assets to the property asset allocation is not unreasonable given that asset allocation to real estate is found to be much lower in practice than implied by theory (Ennis & Burik 1991).

[23] Since long data sets are required, the NZ residential property index excluding flats and apartments was selected.

coefficient of variation for retail, industrial and office property of 0.24, 0.31 and 0.49, respectively. Selecting the same ten year period for residential property data in this study produces a coefficient of variation of 0.89. Nonetheless, the higher volatility of residential property does not preclude its use as a proxy for commercial property since KiwiSaver schemes are primarily invested in listed property trusts, including global listed property, where higher volatility with equity market price movements is expected. To avoid any impact on the volatility associated with appraisal-based data, the raw residential property data was unsmoothed by applying Geltner's (1989) de-smoothing approach.[24]

Table 2 presents the descriptive statistics of the nominal asset class returns for the period 1970 to 2010. It can be seen that NZ equities exhibit a fat-tailed distribution in comparison to other asset classes.[25] As expected, the lowest risk is associated with cash and the highest risk occurs in equities. The NZ sharemarket exhibits significantly more risk than US equities with a coefficient of variation twice that of the US sharemarket. The higher risk of the NZ sharemarket is not commensurate with a higher return. With the exception of cash, NZ equities earn lower returns than all other NZ and US asset classes. NZ property stands out as a very attractive domestic investment with a similar long term average return to bonds, but with much less risk.

Table 2
Descriptive Statistics of Nominal Annual Asset Class Returns 1970-2010

	NZ cash	**NZ bonds**	**NZ property**	**NZ equities**	**International bonds**	**International equities**
Mean	6.64%	9.82%	9.85%	8.39%	10.37%	12.69%
Median	6.50%	8.59%	9.44%	9.93%	8.53%	13.00%
Maximum	13.50%	39.17%	33.65%	122.17%	59.22%	69.72%
Minimum	2.50%	-24.62%	-3.32%	-50.34%	-15.25%	-36.05%
Standard deviation	2.54%	12.41%	8.31%	31.00%	18.10%	21.62%
Coefficient of variation	0.38	1.26	0.84	3.69	1.75	1.70
Skew	0.69	-0.16	0.86	1.58	0.72	0.01
Kurtosis	3.84	3.47	3.59	7.37	3.16	3.09

This table presents the summary statistics of annual nominal returns for NZ cash, bonds, property and equities and international bonds and equities for the sample period 1970-2010.

Although NZ bonds report a large negative annual loss of -24.62% in 1984 (the year of the infamous snap election and removal of interest rate controls), NZ bonds uncharacteristically outperform NZ equities in the sample. Similarly, and in contrast to theory, in an examination of 39 equity markets, Jorion and Goetzmann (1999) demonstrate that 16 countries have a very low or negative equity risk premia including NZ with a negative real return on the NZ sharemarket for the period 1931-1996. This study extends the data set beyond 1996 to 2010. The NZ market is therefore not unique in this respect. Indeed, even a

[24] QV housing data is produced quarterly and is based on the sale price appraisal ratio (SPAR) method. Quarterly SPAR indices are shown to smooth volatility in prices more than indices that measure price on a more frequent basis (Shi 2008). The QV quarterly index is used to derive annual returns in this study, therefore Geltner's (1989) de-smoothing procedure has been applied. For a discussion of the factors leading to actual serially correlated real estate prices or serially correlation even when the underlying transaction process generating prices is serially uncorrelated, see Quan and Titman (1999). The findings here are consistent with Lai and Wang (1998) who find appraisal based data may exhibit higher rather than lower variances than the true returns.

[25] Non-normality of the data reinforces the choice of a nonparametric simulation methodology such as the Efron (1979) bootstrap.

cursory examination of popular financial media reveals, for example, discussion of a negative equity risk premium for the US about 25% of the time and its persistence in the past 40 year period (Voss 2011).

The interesting empirical characteristics of NZ equities explain the asset allocation weightings of the KiwiSaver fund profiles. The asset allocations previously reported in Table 1 show that the KiwiSaver fund profiles are more heavily weighted towards defensive assets than asset allocations reported in Australia. The equity risk premium puzzle and analysis of Jorion and Goetzmann (1999) suggests that the high weightings to defensive assets is sensible in the NZ context with NZ bonds outperforming NZ stocks in some periods. Further examination of the NZ returns along with consideration of the asset allocation to global investments is necessary to explore how KiwiSaver schemes can exploit the opportunities available with the potential to inform investors, fund managers and policymakers not only in NZ, but also in other countries that experience a negative equity risk premium.

Results

Accumulation Phase

The current 4% and forthcoming 6% contribution rates are applied in the stochastic simulation model in conjunction with the average asset allocations for four different investment profiles from the top ten KiwiSaver schemes. The findings in Table 3 are broadly consistent with Basu and Drew (2010) but exhibit some differences that can be attributed to NZ market idiosyncrasies. Table 3 reveals that no one investment profile consistently outperforms the others. In contrast to other nations that exhibit a strong home equity bias, NZ institutional investors have a greater affinity for global diversification than elsewhere, which is explained by the small size and narrow breadth of the NZ market (Warren 2009). Thus, despite the negative equity risk premium in NZ, the ‘growth’ investment profile generates the highest possible outcomes because of the high portfolio weighting towards global equities.

Table 3
Distribution Parameters of Final Year Earnings Multiples

KiwiSaver investment profile	**5th percentile**	**Median**	**Mean**	**95th percentile**
Panel A: Simulation results based on 4% contributions				
Default	3.05	4.95	5.21	8.27
Conservative	3.22	5.58	5.99	10.16
Balanced	2.94	6.25	7.14	14.15
Growth	2.94	6.03	7.49	17.15
Panel B: Simulation results based on 6% contributions				
Default	4.57	7.42	7.82	12.40
Conservative	4.82	8.33	8.96	15.14
Balanced	4.41	9.37	10.72	21.22
Growth	3.45	9.04	11.23	25.72

Table 3 reports the distribution parameters of the final year earnings multiples derived from simulated terminal account balances and simulated final year gross salary. Potential return paths are created via 10,000 iterations of the simulation model for each investment profile over 40 years.

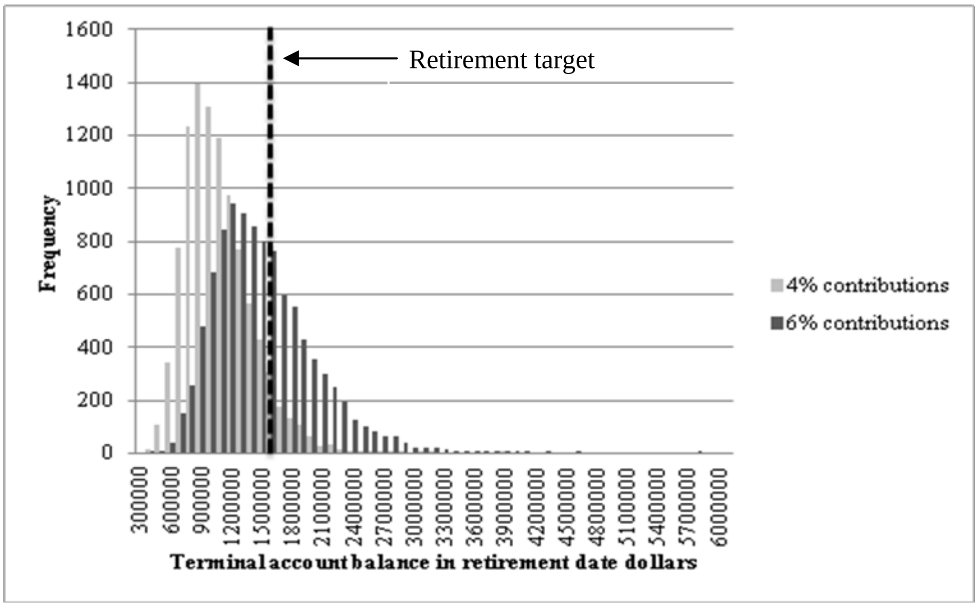
Table 3 also reports that, at the 5th percentile, the ‘conservative’ profile produces the highest result. This result reflects the strong performance of NZ cash and NZ bonds relative to the performance of NZ equities. At both contribution rates, the median outcome is highest for the ‘balanced’ investment portfolio suggesting that an investor in ‘default’ or ‘conservative’ could move to ‘balanced’ to improve returns without being exposed to the highest level of risk in the ‘growth’ profile. Nevertheless, for both contribution rates, ‘growth’ not only has a higher outcome at the mean and 95th percentiles, but there is a growing gap between the outcomes for ‘growth’ and other investment profiles, particularly the ‘default’ profile, as the contribution rate increases. Importantly, the difference between outcomes is much larger on the upside of the distribution than the downside of the distribution, represented by the 95th and 5th percentiles in Table 3.

A closer inspection of Table 3 reveals that, at a 4% contribution rate, the hypothetical investor achieves an 8 times or greater multiple of final earnings in only the best 5% of trials across all investment profiles. In comparison, at a 6% contribution rate, on average, the hypothetical investor achieves an 8 times or greater multiple of final earnings in all investment profiles with the exception of the ‘default’ profile. Whilst these simulations with a 6% contribution rate look promising, we need to examine the distribution of these retirement outcomes.

The distributions of simulated retirement outcomes are presented in Figure 2 and they reveal the skewed nature of the terminal account balances. Figure 2 shows that investors with a 4% contribution rate have a 6% probability of achieving their retirement target of eight times final earnings. When the contribution rate increases to 6%, Figure 2 reports that investors have a 40% probability in attaining their retirement target. The distribution of outcomes in Figure 2 reveals that a majority of investors will not attain the long-term savings required under a KiwiSaver scheme with a 6% contribution rate. These results can be considered conservative since the wage profile and characteristics of the hypothetical investor have been simplified to produce baseline data.

Figure 2

Comparative Histogram of ‘Default’ Terminal KiwiSaver Account Balances



Decumulation Phase

Up to this point, the analysis ignores the fact that, like all New Zealanders, the hypothetical investor is entitled to the government pension, NZS, once aged 65 and over. Replacement rates are commonly used in practice and in the pensions’ literature to express the ratio of retirement income to pre-retirement income. To broaden the interpretation of the simulation results, this section considers the combination of personal wealth that must be accumulated in conjunction with the receipt of NZS to replace different proportions of final gross salary over different durations of retirement. Given the desired percentage replacement of final gross earnings the hypothetical investor wishes to consume per year in retirement and their entitlement to NZS, the self-funded amount to be accumulated in KiwiSaver can be determined and expressed as a multiple of final earnings. To estimate this, the present value of the self-funded portion, the difference between desired consumption and NZS in retirement date dollars that is required for different retirement lengths, is calculated.[26] The distribution of the simulated multiples of final year earnings is then mapped to (i) post retirement age and (ii) percentage of final year earnings replacement. This analysis provides some perspective on the adequacy and expected duration of these retirement savings during the decumulation (post retirement) phase.

Given the large proportion of NZ investors in the ‘default’ profile, Table 4 reports the ‘default’ profile simulation results for an investor’s decumulation phase. At a 4% contribution rate, on average, the hypothetical investor is able to replace 60% of their final gross earnings per year from a combination of KiwiSaver and NZS until age 85 (i.e. 20 years of retirement income) or they can consume less per year for a longer period, by replacing say 50% of their income until age 95 (i.e. 30 years of retirement income from age 65). Increasing the contribution rate to 6% allows the hypothetical investor, on average, to replace 60% of their final gross earnings per year from a combination of KiwiSaver and NZS until age 95, or consume less, say 55% until the age of 100 years. The findings in Table 4 demonstrate that the current and future contribution rates legislated in KiwiSaver are inadequate to deliver sufficient income (i.e. a 70% replacement rate) to retirees during their retirement years. To add further colour to these sobering statistics, the worst recorded simulation of the terminal account balance based on a 6% contribution rate represents a final earnings multiple of 2.37, whereby the hypothetical investor may not achieve the replacement ratio of 45% of his/her final gross salary from a combination of KiwiSaver and NZS per year beyond the age of 85.

Overall, the analysis of a hypothetical investor’s decumulation phase demonstrates that the policy decision to increase the KiwiSaver contribution rate from 4 to 6% certainly improves the multiples of final earnings, however, the higher accumulated retirement savings are not sufficient enough to replace an investor’s earnings based on their final year of working life. Furthermore, the analysis of an investor’s savings in their decumulation phase demonstrates that in many cases they are not expected to finance their post retirement years beyond the age of 85.

[26] The present value of the self-funded portion is calculated using the same 4% discount rate used to inflate salary data. This is consistent with the approach of Queisser and Whitehouse (2006) who link discount rates to earnings growth rates.

Table 4
Retirement Needs Versus Simulated 'Default' Profile Income

Panel A: Simulation results based on 4% contributions

Final salary replacement	Years in retirement 20	25	30	35
40%	1.39	1.74	2.09	2.43
45%	2.35	2.94	3.53	4.12
50%	3.31	4.14	4.97	5.80
55%	4.28	5.34	6.41	7.48
60%	5.24	6.55	7.86	9.16
65%	6.20	7.75	9.30	10.85
70%	7.16	8.95	10.74	12.53
75%	8.12	10.15	12.18	14.21
80%	9.08	11.35	13.62	15.89
85%	10.04	12.56	15.07	17.58
90%	11.01	13.76	16.51	19.26
95%	11.97	14.96	17.95	20.94
100%	12.93	16.16	19.39	22.63

Panel B: Simulation results based on 6% contributions

Final salary replacement	Years in retirement 20	25	30	35
40%	1.39	1.74	2.09	2.43
45%	2.35	2.94	3.53	4.12
50%	3.31	4.14	4.97	5.80
55%	4.28	5.34	6.41	7.48
60%	5.24	6.55	7.86	9.16
65%	6.20	7.75	9.30	10.85
70%	7.16	8.95	10.74	12.53
75%	8.12	10.15	12.18	14.21
80%	9.08	11.35	13.62	15.89
85%	10.04	12.56	15.07	17.58
90%	11.01	13.76	16.51	19.26
95%	11.97	14.96	17.95	20.94
100%	12.93	16.16	19.39	22.63

Key:
- (dark shading) Mean (or closest value to mean) from simulation results
- (light shading) Outcomes between 5th and 95th percentile
- (bold line) Outcomes below the median

Table 4 reports the 'default' profile simulation results from a decumulation phase perspective. The table reports the different proportions of final salary replacement that can be achieved over a range of 20 to 35 years in retirement when self-funding and the government pension, NZS, are combined. Recognising that the investor is entitled to NZS, the final earnings multiples represent only the top up or self-funded proportion to be contributed by the investor to reach each level of final salary replacement. The simulation results are mapped onto Panel A and Panel B to compare what is required for various replacement levels and retirement lengths with the distribution of simulated outcomes based on 4 and 6% contributions respectively.

Conclusion

The findings in this study attempt to improve our understanding of retirement adequacy and the NZ KiwiSaver superannuation system. NZ has experienced a negative equity risk premium for the sample period examined, yet it experienced a very low degree of equity home bias with the higher weightings to international equities in a typical KiwiSaver 'growth' investment profile which earned the highest returns. This study assessed the retirement adequacy of the KiwiSaver system by employing a stochastic simulation approach to an individual's superannuation investment account. Two definitions of retirement adequacy were employed, namely, (i) multiples of gross final earnings achieved in the accumulation phase; and (ii) replacement rates incorporating decumulation phase cash flows. Despite the simulations reporting high final earnings multiples across all investment profiles, the distributions of the terminal values were skewed, suggesting the current system design does not support the generation of 'adequate' outcomes for most investors.

The findings presented demonstrate that the increased contribution rate from 4 to 6% in NZ is a step in the right direction as it increases the probability of retirement success.

While this positive relationship is expected, the results inform stakeholders that despite the increased probability of adequate retirement outcomes, the skewed distribution means that a majority of ‘default’ investors will not achieve their desired long-term savings target for their retirement years. The results highlight a need to consider what additional policy improvements can be made over time to address, in particular, the issues facing young New Zealanders. We would encourage future researchers to consider exploring further questions around differing contribution rates and asset allocations strategies in the KiwiSaver context.

References

2025 Taskforce 2010, 'Focussing on growth: The second report of the 2025 taskforce', accessed 17/1/2012, http://purl.oclc.org/nzt/r-1252

Basu, A K, Byrne, A & Drew, M E 2011, 'Dynamic lifestyle strategies for target date retirement funds', *Journal of Portfolio Management*, vol.37, no.2, pp83-96.

Basu, A K & Drew, M E 2009, 'Portfolio size and lifecycle asset allocation in pension funds', *Journal of Portfolio Management*, vol.35, no.3, pp61-72.

Basu, A K & Drew, M E 2010, 'The appropriateness of default investment options in defined contribution plans: Australian evidence', *Pacific-Basin Finance Journal*, vol.18, pp290-305.

Bateman, H, Piggott, J & Kingston, G H 2001, *Forced saving: mandating private retirement income*, Cambridge University Press, Oakleigh, Victoria.

Benartzi, S 2001, 'Excessive extrapolation and the allocation of 401(k) accounts to company stock', *The Journal of Finance*, vol.56, no.5, pp1747-1764.

Bernheim, B D 1996, *The Merrill Lynch Baby Boom Retirement Index: Update '96*, Merrill Lynch, New York.

Biggs, A G & Springstead, G R 2008, 'Alternate measures of replacement rates', *Social Security Bulletin*, vol.68, no.2, pp1-19.

Blake, D, Cairns, A J G & Dowd, K 2001, 'Pensionmetrics: stochastic pension plan design and value-at-risk during the accumulation phase', *Insurance: Mathematics and Economics*, vol.29, pp187-215.

Bollard, A, Hodgetts, B, Briggs, P & Smith, M 2006, 'Household savings and wealth in New Zealand', Background paper prepared for the Reserve Bank Govenor's presentation to INFINZ 27 September 2006, Reserve Bank of New Zealand, accessed 26/7/2011, http://www.rbnz.govt.nz/speeches/2823190.pdf

Booth, P & Yakoubov, Y 2000, 'Investment policy for defined-contribution pension scheme members close to retirement: An analysis of the "lifestyle concept"', *North American Actuarial Journal*, vol.4, pp1-19.

Burns, S A & Widdows, R 1988, 'An estimation of savings needs to adequately fund baby boomers' retirement', paper presented to the 34th Annual Conference of the American Council on Consumer Interests, Columbia, MO.

Choi, J, Laibson, B, Madrian, B & Metrick, A 2002, 'Defined contribution pensions: Plan rules, participant choices, and the path of least resistance', in Poterba, J (ed.), *Tax Policy and the Economy*, MIT Press, Cambridge, MA.

Drew, M E & Tharenou, G 2008, 'Retirement wealth decisions in Australia's superannuation system: Part 1, accumulation', *Australasian Journal of Business and Social Inquiry*, vol.6, no.2, pp2-23.

Efron, B 1979, 'Bootstrap methods: Another look at the Jackknife', *The Annals of Statistics*, vol.7, no.1, pp1-26.

Elton, E J, Gruber, M J, Brown, S J & Goetzmann, W N 2009, *Modern Portfolio Theory and Investment Analysis*, Wiley, New York.

Ennis, R M & Burik, P 1991, 'Pension fund real estate investment under a simple equilibrium pricing model', *Financial Analysts Journal*, vol.47, no.3, pp20-30.

Fowler, R, Grieves, R & Singleton, J C 2010, 'New Zealand unit trusts: Asset allocation, style analysis and return attribution', *Pacific Accounting Review*, vol.22, no.1, pp4-21.

Gallery, G & Gallery, N 2005, ' Paradox of choice in a mandatory pension savings system: Challenges for Australian retirement income policy', *Policy and Politics*, vol.33, no.3, pp519-532.

Geltner, D 1989, 'Bias in appraisal-based returns', *Journal of the American Real Estate and Urban Economics Association*, vol.17, no.4, pp463-481.

Ghilarducci, T 2010, 'Testimony on the future of retirement income adequacy and employer pensions before the State of California Little Hoover Commission', accessed 4/2/2012, http://www.lhc.ca.gov/studies/activestudies/pension/GhilarducciJun10.pdf

Gibson, J, Hector, C & Le, T 2008, 'The Distributional Impact of Kiwisaver Incentives', *Working Paper in Economics*, Waikato University, accessed 5/9/2009, ftp://mngt.waikato.ac.nz/RePEc/wai/econwp/0802.pdf

Gibson, J & Le, T 2008, 'How much new saving will Kiwisaver produce?', *Working Paper in Economics*, Waikato University, accessed 5/9/2009, ftp://mngt.waikato.ac.nz/RePEc/wai/econwp/0803.pdf

Government Actuary 2008, *Report of the Government Actuary for the year ended 30 June 2008*, accessed 7/6/2011, http://www.asfonz.org.nz/assets/KiwiSaver/gaar2008.pdf

Gunasekarage, A, Power, D M & Zhou, T T 2008, 'The long-term inflation hedging effectiveness of real estate and financial assets: A New Zealand investigation', *Studies in Economics and Finance*, vol.25, no.4, pp267-278.

Hakansson, N H 1971a, 'Capital growth and the mean-variance approach to portfolio selection', *Journal of Finance and Quantitative Analysis*, vol.6, pp517-557.

Hakansson, N H 1971b, 'Multi-period mean-variance analysis: Toward a general theory of portfolio choice', *The Journal of Finance*, vol.26, pp857-884.

Hansard 2011, *New Zealand Parliamentary Debates*, vol.672, pp18771-18834.

Hibbert, J & Mowbray, P 2002, 'Understanding investment policy choices for individual pension plans', *Pensions*, vol.8, no.1, pp41-62.

Inland Revenue 2012, *KiwiSaver and tax*, accessed 20/7/2012, http://www.kiwisaver.govt.nz/already/contributions/tax/

IPD 2011, 'Quarterly index results NZ property markets March 2011', accessed 7/2/2012, http://propertynz.co.nz/files/Events/IPD_NZ_INDEX_LAUNCH_Q1_2011.pdf

Jorion, P & Goetzmann, W N 1999, 'Global stock markets in the twentieth century', *The Journal of Finance*, vol.54, no.3, pp953-980.

Lai, T-Y & Wang, K 1998, 'Appraisal smoothing: The other side of the story', *Real Estate Economics*, vol.26, no.3, pp511-535.

Latané, H A 1959, 'Criteria for choice among risky ventures', *Journal of Political Economy*, vol.67, pp144-155.

Le, T, Scobie, G & Gibson, J 2009, 'Are Kiwis saving enough for retirement? Evidence from SOFIE', *New Zealand Economic Papers*, vol.43, no.1, pp3-19.

Lusardi, A 1999, 'Information, expectations and savings for retirement', in Aaron, H (ed.), *Behavioral Dimensions of Retirement Economics*, Brookings, Washington D.C.

Lusardi, A & Mitchell, O S 2006, 'Financial literacy and planning: Implications for retirement well-being', Working paper, Pension Research Council, Wharton School, University of Pennsylvania, accessed 14/7/2011, http://www.dartmouth.edu/~alusardi/Papers/FinancialLiteracy.pdf

Markowitz, H M 1952, 'Portfolio Selection', *The Journal of Finance*, vol.7, no.1, pp77-91.

Markowitz, H M 1959, *Portfolio Selection: Efficient Diversification of Investments*, John Wiley and Sons, Inc., New York.
Merton, R C 1969, 'Lifetime portfolio selection under uncertainty: The continuous time case', *Review of Economics and Statistics*, vol.50, pp247-257.
Ministry of Economic Development 2010, 'Report on Kiwisaver supply side evaluation', accessed http://www.med.govt.nz/upload/75359/Kiwisaver%20supply%20side%20Evaluation.pdf
Mitchell, O S & Moore, J F 1998, 'Can Americans afford to retire? New evidence on retirement savings adequacy', *The Journal of Risk and Insurance*, vol.65, no.3, pp371-400.
Modigliani, F & Brumberg, R 1954, 'Utility analysis and the consumption function: An interpretation of cross-section data', in Kurihara, K K (ed.), *Post-Keynesian Economics*, Rutgers University Press, New Brunswick, NJ.
Mossin, J 1968, 'Optimal multiperiod portfolio policies', *Journal of Business*, vol.41, pp215-229.
Myers, R J 1993, *Social security*, University of Pennsylvania Press, Philadelphia.
Nartea, G & Eves, C 2008, 'Diversification benefits from New Zealand Real Estate', *Pacific Rim Property Research Journal*, vol.14, no.1, pp27-43.
OECD 2011, Pensions at a glance 2011: Retirement income systems in OECD and G20 countries. Paris: OECD.
Park, Y 2011, 'Retirement income adequacy with immediate and longevity annuities', *EBRI Issue Brief*, Employee Benefit Research Institute, accessed 5/5/2011, http://www.ebri.org/pdf/briefspdf/EBRI_IB_05-2011_No357_Annuities.pdf
Quan, D C & Titman, S 1999, 'Do real estate prices and stock prices move together? An international analysis', *Real Estate Economics*, vol.27, no.2, pp183-207.
Queisser, M & Whitehouse, E 2006, 'Neutral or fair? Actuarial concepts and pension-system design', *OECD Social, Employment and Migration Working Paper*, OECD Publishing, accessed 22/7/2012, http://www.oecd.org/insurance/pensionsystems/37811399.pdf
Reserve Bank of New Zealand 2012, *Household Financial Assets and Liabilities*, accessed 21/7/2012, http://www.rbnz.govt.nz/statistics/monfin/4786910.html
Samuelson, P A 1969, 'Lifetime portfolio selection by dynamic programming', *Review of Economics and Statistics*, vol.51, pp239-246.
Savings Working Group 2011, 'Saving New Zealand: Reducing vulnerabilities and Barriers to Growth and Prosperity, Savings Working Group final report to the Minister of Finance', accessed 8/4/2011, http://purl.oclc.org/nzt/r-1348
Schieber, S J 1998, 'Deriving pretreatment income replacement rates and the savings rates needed to meet them', *Benefits Quarterly*, vol.14, no.2, pp53-69.
Scholz, J K, Seshadri, A & Khitatrakun, S 2006, 'Are Americans saving "optimally" for retirement', *Journal of Political Economy*, vol.114, no.4, pp607-643.
Schulz, J H 1992, *The Economics of Aging*, Auburn House, New York.
Scobie, G, Gibson, J & Le, T 2004, 'Saving for retirement: New evidence for New Zealand', *New Zealand Treasury Working Paper*, The Treasury, accessed 10/9/2009, www.treasury.govt.nz/publications/research.../2004/04.../twp04-12.pdf
Scobie, G & Henderson, K 2009, 'Saving rates of New Zealanders: A net wealth approach', *New Zealand Treasury Working Paper*, The Treasury, accessed 22/08/2012, http://www.treasury.govt.nz/publications/research-policy/wp/2009/09-04/twp09-04.pdf

Shi, S 2008, 'Evaluating a house price index based on the sale price appraisal ratio (SPAR) method', accessed 8/2/2012, http://www.prres.net/papers/Song_Shi_Evaluating_A_House_Price_Index.pdf
Shiller, R J 2005, *Irrational exuberance,* Princeton University Press, Princeton, N.J. Data available from http://www.econ.yale.edu/~shiller/data.htm
St John, S 2005, 'Pensions taxation and retirement incomes in New Zealand', *Pensions Institute Discussion Paper*, accessed 4/4/2011, http://www.pensions-institute.org/workingpapers/wp0506.pdf
St John, S 2007, 'KiwiSaver and the tax treatment of retirement saving in NZ', *NZ Economic Papers*, vol.41, no.2, pp251-268.
St John, S 2008, 'Labour and National must agree to review KiwiSaver after the Election', *NZ Herald*, 14 October, accessed 22/7/2009, http://www.nzherald.co.nz/retirement/news/article.cfm?c_id=305&objectid=10537308
St John, S & Littlewood, M 2006, 'Does KiwiSaver improve the unique New Zealand mix of retirement policies?', paper presented to the 14th Australian Colloquium of Superannuation Researchers: Choice in Retirement Funding, UNSW Sydney, accessed 19 August 2009, http://docs.business.auckland.ac.nz/Doc/Paper-Does-KiwiSaver-improve-the-unique-New-Zealand-mix-of-retirement-policies.pdf
Statistics NZ 2011, *Infoshare*, accessed 7 February, http://www.stats.govt.nz/infoshare
Toder, E & Khitatrakun, S 2006, *Final Report to the Inland Revenue: KiwiSaver Evaluation Literature Review*, Tax Policy Center Urban Institute and Brookings Institution, accessed 22 July 2009, http://www.taxpolicycenter.org
Vos, E, Brown, P & Christie, S 1995, 'A test of persistence in the performance of New Zealand and Australian equity mutual funds', *Accounting Research Journal*, vol.8, no.2, pp19-34.
Voss, J 2011, 'What the equity risk premium tells us today', The Financial Times, accessed 19/2/2012, http://www.ft.com/cms/s/0/30eec02e-03d4-11e1-bbc5-00144feabdc0.html#axzz1mpsMJBud
Warren, G 2009, 'Home bias? It's a matter of perspective', Russell Research, accessed 19/2/2012, http://www.russell.com/AU/_pdfs/capital-markets-reserach/research/2009-March-Home-Bias.pdf
Wysocki, B J 1995, 'Binge buyers: Many baby boomer save little, may run into trouble later on: They don't build nest eggs nearly rapidly enough for an easy retirement', *Wall Street Journal*, June 5, pA1.
Yong, S & Cox, N 2008, 'The compliance costs of the KiwiSaver scheme', paper presented to the Accounting and Finance Association of Australia and New Zealand Conference, Sydney, accessed 19 August 2009, http://www.afaanz.org/openconf-afaanz2008/modules/request.php?module=oc_proceedings&action=view.php&a=Accept+as+Forum&id=434
Young, W E & Trent, R H 1969, 'Geometric mean approximations of individual security and portfolio performance', *Journal of Finance and Quantitative Analysis*, vol.4, no.2, pp179-199.