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The Investment Environment and Retirement Income Alternatives

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Abstract

Two key challenges for retirement incomes are longevity and inflation. The Institute's Retirement Incomes Policy recognises a role for deferred annuities, as a compliment to flexible drawdown of account based pensions in earlier stages of retirement. Plans of capital consumption are premised on investment assumptions and typically a continuation of the benign inflation outcomes of the last twenty years. Markets and economies can misbehave with unfortunate consequences. Retirees may find themselves craving deferred annuities long before they are payable. The current investment environment suggests an alternative approach to retirement incomes that addresses longevity and inflation risk, and integrates reasonably well with the age pension. This paper explores the simple alternative of living off investment income in retirement. The actuarial profession can make a valuable contribute to establishing this retirement income alternative. Superannuation funds should consider adding investment income options because of the significant marginal utility relative to existing options. This approach will not suit all retirees However it will be ideal for those with substantial retirement assets, and retirees prepared to moderate immediate retirement living standard to address longevity and preserve options in old age.

Keywords: Retirement Income

Problems with consuming capital

In it's Retirement Incomes Policy Position the Institute acknowledges the current popular retirement income framework of flexible account based pensions with longevity risk ideally hedged by a deferred annuity. The difference between this arrangement and an immediate annuity on retirement is essentially flexibility. Retirees may choose to accept more investment risk than prudential standards would effectively allow[1] and vary the drawdown of income to suit their needs. Behind this more flexible arrangement is still the reality that capital is being amortised over the life of the retiree to augment investment outcomes. This capital amortisation contribution declines with increasing longevity. As there is some interaction with the level of discount rate, a traditional life annuity calculation provides a reasonable measure of this capital amortisation contribution, even though the delivery of retirement income is not typically via an immediate annuity contract. The graph below looks at the decline of this capital amortisation contribution since the early twentieth century.

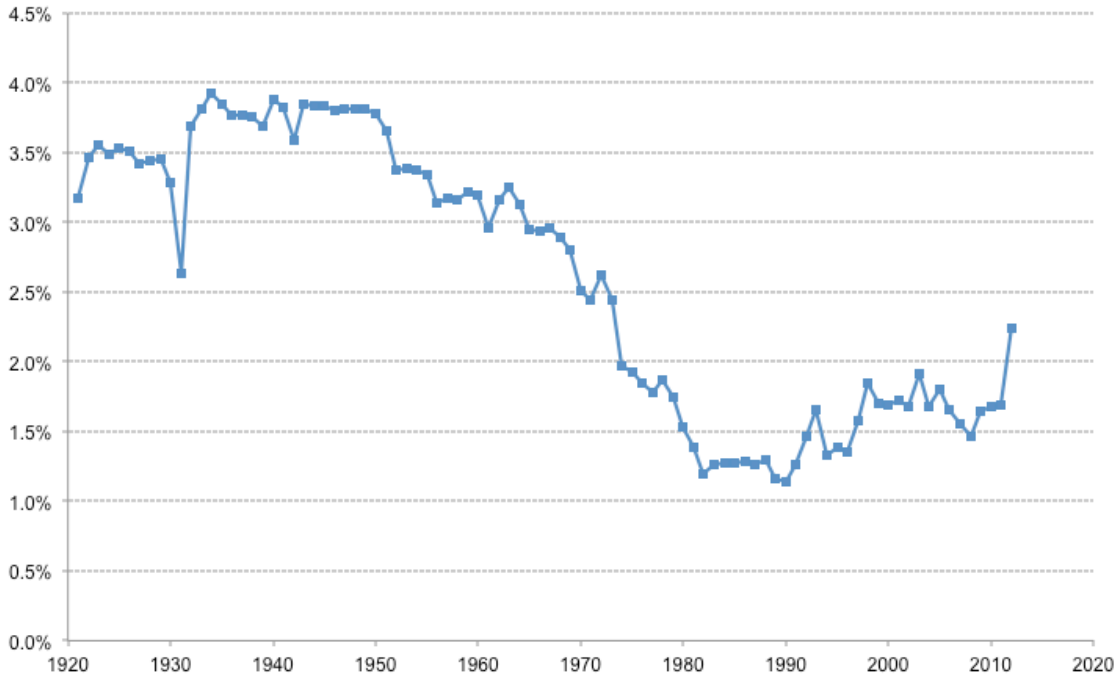

Figure 1 Capital Amortisation Contribution

The calculation shown above is for an immediate joint life annuity to a male aged 62 and a spouse aged 59, with reversion of 60% to either survivor.[2] The calculation for each year is based on the bond yield at 30 June and cohort mortality.[3] The capital amortisation contribution is the difference between the reciprocal of the annuity value and the force of interest.[4] The reciprocal of the annuity value is the income payable from the annuity if the pensioner had given their money to a life office. The force of interest corresponds to the regular interest income if they had instead bought a government bond. The difference represents the amortisation of capital over their lifespan. For example at 30 June 2012 the calculated continuous annuity value is 19.1 and the force of interest is 3.0%pa giving a capital amortisation contribution of 2.2%pa.

In the early part of the twentieth century, amortising capital over the remaining joint life span added 3.5-4.0%pa to the alternative of interest on capital. Annuities had much to offer in this era. With mortality improvement this contribution has fallen to around 1.5-2.0% since the 1970's. The recent spike above 2.0% is a consequence of current extremely low bond yields, and the nature of the calculation.

The contemporary account based pension generally trades the longevity of an annuity solution for a higher income over a shorter period, recognising the reduction in consumption with age, and the ultimate support of social security. This stepped down approach from employment income, to unsustainable elevated retirement income, to finally the age pension, is a consequence of inadequate retirement wealth. Essentially retirees are still amortising capital over the retirement lifespan, but the modern approach is haphazard and front loaded compared to a traditional annuity.

As demonstrated below, the income yield on an appropriately designed portfolio in the current environment offers a better margin over bonds than the capital amortisation margin. This is due to a coincidence of reduced contribution from capital amortisation, and distortion in capital markets which has elevated the income yield of risk assets.

The estimation of how long retirement wealth will last, when capital is consumed, involves assumptions about investment performance. As experience departs from assumptions, the duration of drawdown from an account based pension will vary. The chart below shows the results of a simulation of an account-based pension using actual investment experience since 1970.[5]

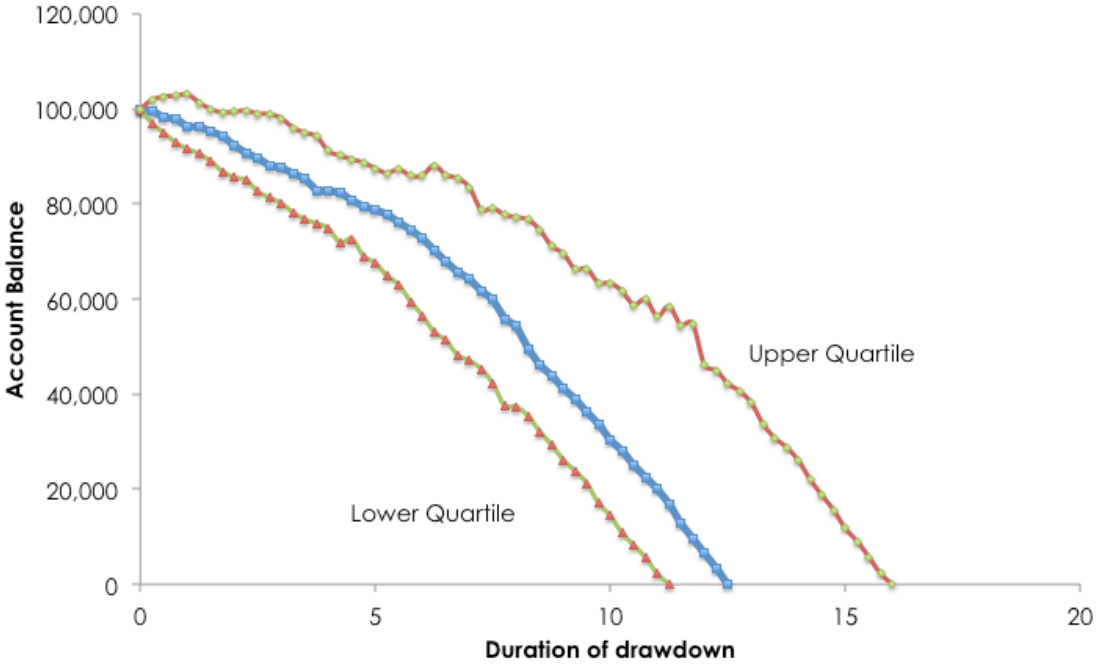

Figure 2 Simulated Drawdown of Account Based Pension

At each calendar quarter from December 1969 to December 1997, an account based pension is commenced with an estimated duration of 15 years.[6] The graph shows the median and quartile trajectories of the account balance, across the 113 simulations. The investment periods of these simulations overlap to a significant degree. Hence the dispersion observed may be somewhat understated. Over the entire period investment performance disappointed relative to the assumptions made at pension commencement, hence the median duration of 12.25 years falls short of the target 15 years. The more interesting result is the spread of outcomes. These simulations show an interquartile spread of 5 years, from 11 to 16 years, or a third of the target duration.

The uncertainty due to investment outcomes could be minimised by a fixed term annuity, but this would limit investment performance to fixed interest returns. The amount of the pension would be reduced accordingly.

The foregoing highlights two problems with consuming capital in retirement:

- Increasing life expectancy spreads capital more thinly so that the contribution from capital amortisation over the full retirement life span is now slim.
- It is difficult to accurately judge how long retirement wealth will last. A planned glide path to the age pension in old age can be caught in a sudden downdraft. There may be a craving for the deferred annuity long before it's due.

The simple alternative to capital consumption is living off the investment income generated by capital. The next section looks at how feasible this alternative is in the current investment environment.

The current investment environment

In the Australian context equities have a particular appeal because of dividend imputation, which affects the comparison in two ways. Firstly, franking credits need to be added to nominal dividend yields to correctly compare the income yields of asset classes. Secondly, Australian payout ratios are much higher than global payout ratios as a consequence of imputation. For example currently the average payout ratio for the S&P/ASX 200 index portfolio is 79% compared to 42% for the MSCI World Index. The flip side of higher payout ratios is lower growth expectations, as discussed later. The chart below summarises gross yields of the major asset classes, as at end March 2013.[7]

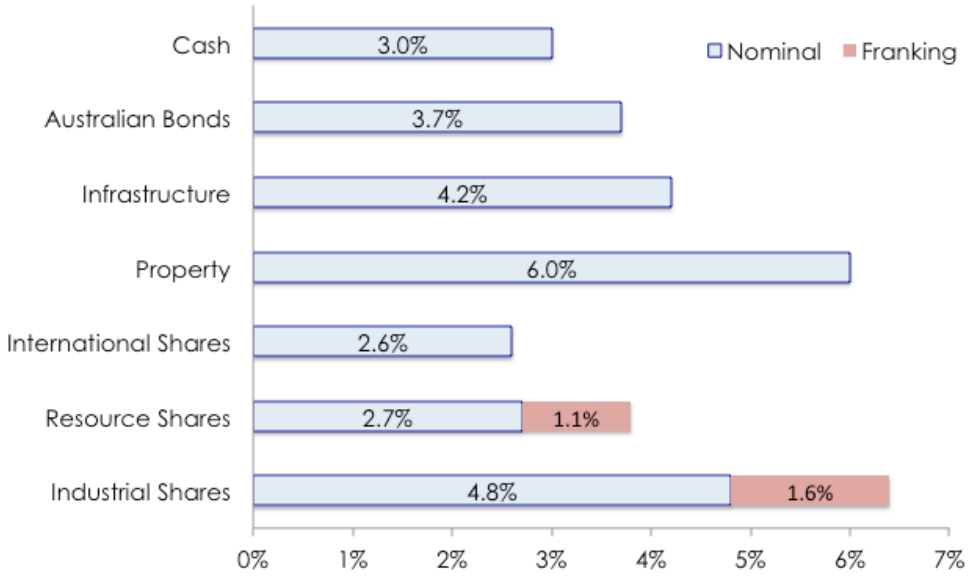

Figure 3 Asset Class Income Yields - March 2013

The current gross yield on industrial shares[8] of 6.4% (4.8% nominal plus 1.6% franking) compares to a weighted average index bond yield of 3.7%, a

differential of 2.7%. By historical standards this is exceptional. The chart below examines this yield gap since 1921. The data sources for the chart below are described in Appendix A.

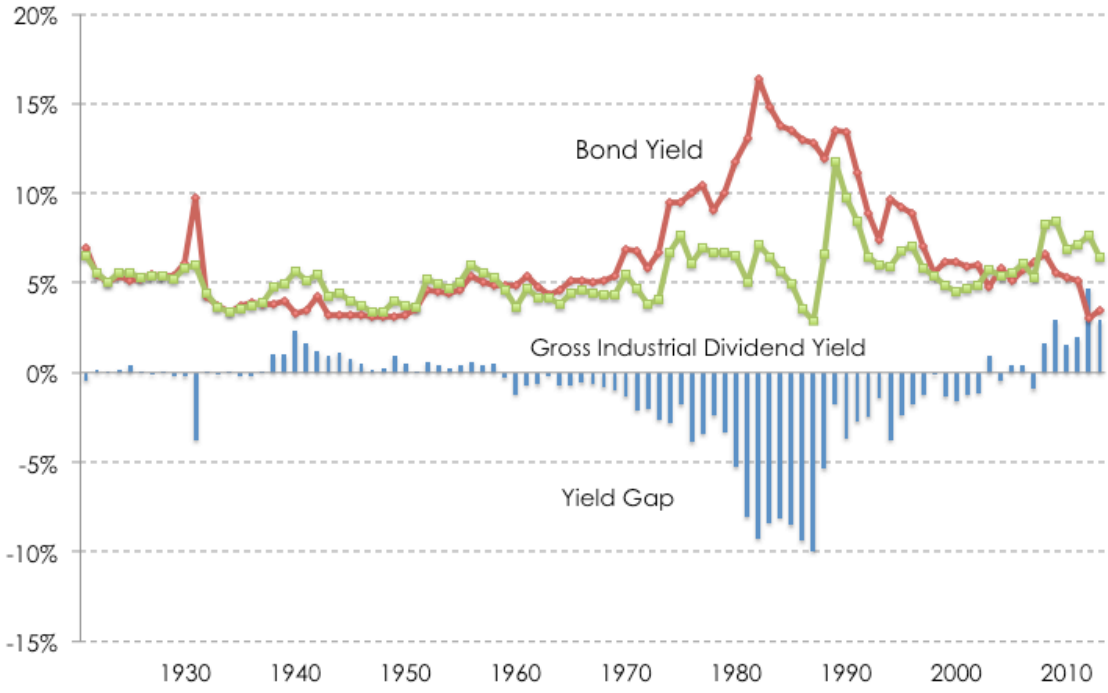

Figure 4 Gross Industrial Yield - Bond Yield Gap 1921-2013

The gross industrial dividend was significantly changed by the introduction of dividend imputation in 1987, hence the discontinuity. Callen, Morlong and Pleban (1992) show payout ratios on industrial shares lifted from around 45% to 75% over the next few years. The introduction of taxation on superannuation earnings in July 1988 further encouraged franking credit distribution.

The extremely low current bond yield contributes to the width of the yield gap, and this occurs against an exceptional global financial background. In the aftermath of the Global Financial Crisis global bond yields have been driven to historically low levels. This is a consequence of aggressive US monetary policy and persistent risk aversion. Equity markets have recovered in the US to touch all time highs, with the deliberate impact of quantitative easing on asset prices. Hence the market advance there has been disproportionate to the mild economic improvement, with the corporate profit outlook still subdued.

Notwithstanding a healthier economy, the Australian market remains well below its peak.[9] Locally the official cash rate has been reduced from 4.75% in November 2011 to 3.0% currently. In RBA (2013a) the economic outlook is described as 'mixed'. The imminent peak in mining investment does not look like it will be offset by any significant increase in non-mining business investment. Fiscal consolidation is occurring at the State and Federal level. Consumption is growing only moderately in line with incomes. Unemployment is drifting gradually higher. Major global currencies are competing for weakness, with the

Australian dollar firm as a result This has a constrictive effect on most Australian businesses.

The risks to the global environment include the unresolved European crisis, the US equity market's unhealthy dependence on quantitative easing, and the inevitable rebalancing of China's economy away from debt-fuelled investment and towards consumption, which would reduce growth and weaken commodity prices. There is some uncertainty about the output gap of the US economy (the difference between its current and potential economic output). The US productive capacity may have atrophied since the GFC, with low levels of business investment and high rates of long-term unemployed. This elevates inflation risk if monetary stimulus via quantitative easing persists too long.

In this investment environment dividend yields would be expected to be somewhat higher than historical norms to compensate for a subdued growth outlook and attendant global risks. However it is the current distortion of the global bond market that is the main reason for the positive, and unusually wide, yield gap. The RBA's target inflation band of 2-3% officially dates from 1996[10], and since that time the bond yield has averaged 5.5%, so the current level is around 2% below par.

The Australian gross industrial dividend yield, currently 6.4% is underpinned by the banking sector. The banks currently account for 38% of industrials, and have an average gross yield of 8% compared to 5.4% for non-bank industrials. Appendix B looks at banks in the context of Australia's high household indebtedness and elevated housing prices. The appropriate weighting of banks from a yield perspective is examined in light of the experience of the past thirty years. That analysis suggests a weighting of 35-40% is defensible.

While a gross industrial yield of 6.4% is a good starting point, there are various high yield indices for the Australian market offering up to around 7.0% gross yield. These are surveyed in Appendix C. The designs of these underlying indices vary considerably in the use of quality filters, sector diversification, the use of trailing or forecast dividends, and surprisingly the acknowledgement of dividend franking. The four indices listed each have associated Exchange Traded Funds (ETFs).

These high yield variants beg the question of whether emphasising yield in portfolio construction might come at some sacrifice of overall investment performance.

High yield equity variants

Many investment professionals find the concept of high yield equity unpalatable because there are often significant risks lurking behind an attractive dividend yield. The issue of investment quality is not lost on the providers of high yield equity indices and a more accurate synopsis of high yield investing, is 'yield filtered by quality', rather than 'raw yield'. That said the scope for index providers to filter by quality is limited by data availability and the sophistication of their approaches varies widely. As an example the MSCI World High Dividend Yield Index excludes stocks without a record of consistent dividend growth over five years, or with extreme payout ratios.[11] Beyond these

passive alternatives, active fund managers can improve scrutiny of yield by analysis of free cash flow backing and help avoid stocks with acute current business risks.

MSCI has a performance record for the MSCI World High Dividend Yield Index since June 1995, although the index has only been 'live' since May 2006. The chart below compares the performance of that index to the common MSCI World Index (local currency), on a gross accumulation basis (log scale) from June1995 to March 2013.

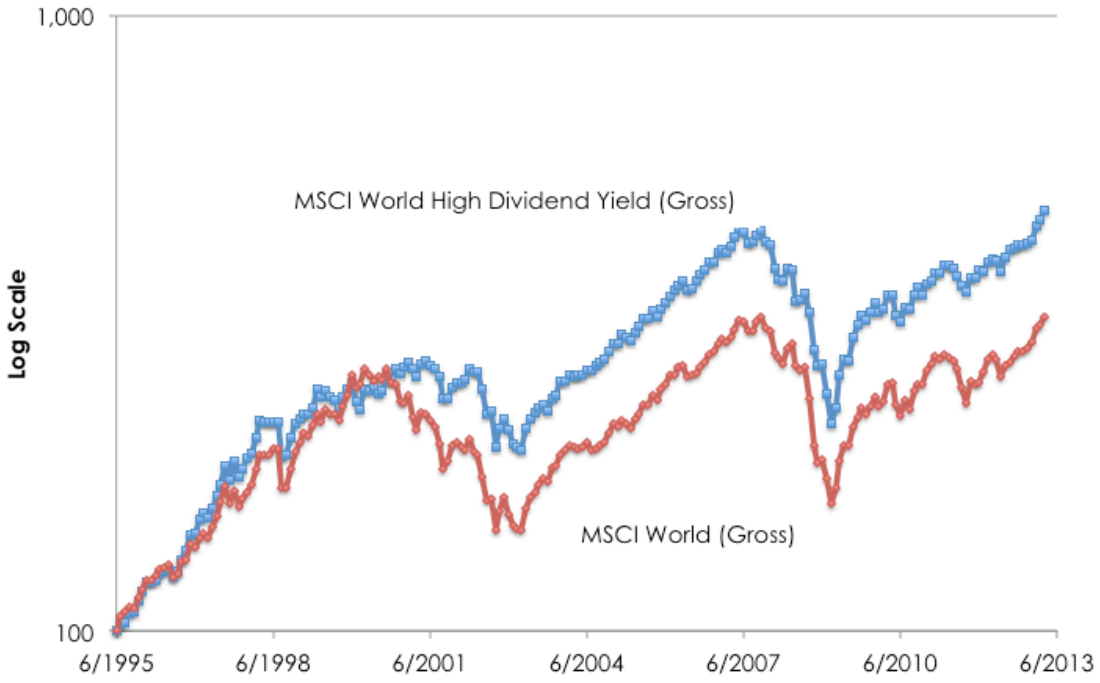

Figure 5 MSCI World High Dividend versus MSCI World Normal

Over the eighteen-year period the compound performance of the High Dividend Yield Index is 9.3%pa compared to 6.8%pa for the MSCI World. In the global recessionary period from September 2000 to February 2003 the High Yield Index returned -22% compared to -45% for the MSCI World. Through the GFC slump the results were similar, -51% compared to -49%. So on these summary numbers the high yield variant looks robust in terms of total return. Delving a little deeper, the dividend flow of each index can be disaggregated from the price and accumulation indices. The chart below compares the calendar year dividend flows from 1996 to 2012, per $1000 invested on 31 December 1995.

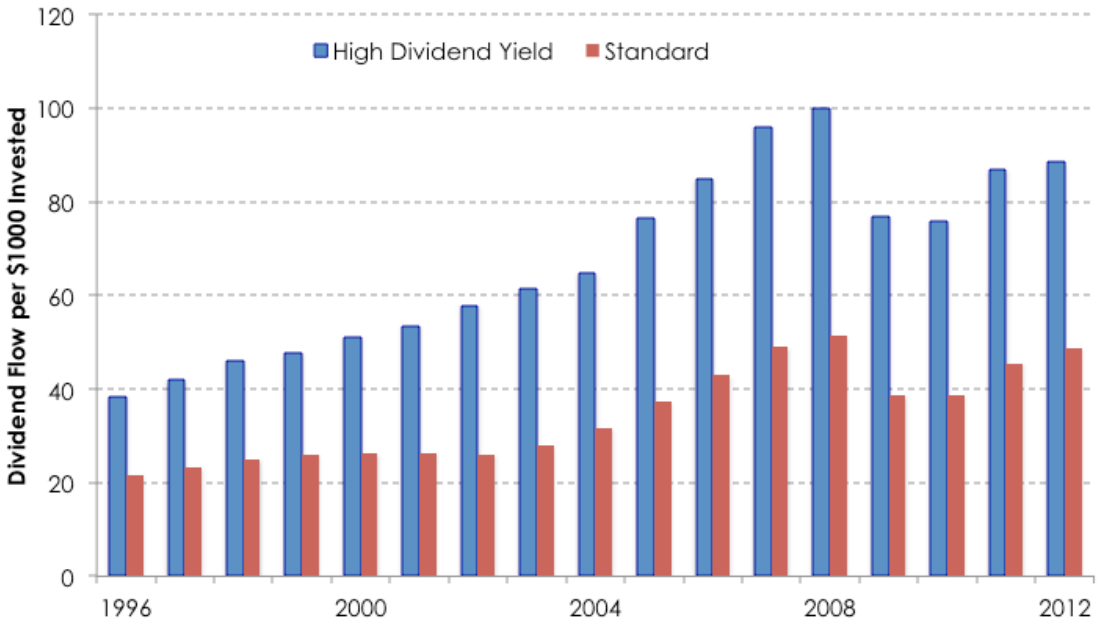

Figure 6 High Dividend Flow versus Normal Dividend Flow

The High Dividend stream grows at a similar rate to the normal dividend stream over the 17 years. The actual compound growth rates are 5.3%pa for High Yield compared to 5.2%pa for normal.

The initial income advantage of the High Yield Strategy is not diminished by any deficit in income growth. Hence the High Yield strategy outperforms over the period. This is a result averaged across the world's major developed markets. On the basis of this global data there is no evidence that opting for a high yield equity variant will disadvantage total return performance.

As of 31 March the MSCI High Yield Index had a trailing yield of 4.2%pa compared to 2.6%pa for the MSCI World. That is still somewhat short of the yield on Australian shares including franking. Currency hedging would add circa 2.5%pa to that yield, bearing in mind that increment is highly volatile over time.[12]

The comparison of yield levels across different asset classes, and comfort with high yield variants, is only the first step in resolving a diversified portfolio for retirement income. The ability of that income to grow is the next consideration.

Income Growth and Inflation

Developed economies have enjoyed a good run against inflation over the last quarter of a century. An important by product of that success is the anchoring at inflationary expectations. However it would be reckless to contemplate retirement income strategy on the presumption that inflation would forever be subdued.

A medium term inflation expectation of 2.5%pa, the middle of the RBA's target range, encourages retirement planning around flat dollar drawdowns which are expected to only gradually lose purchasing power. This is consistent with a gradual reduction in consumption until the later stages of retirement. However given the wide amplitude of inflation experience over the last half century it's informative to look at investment income across different environments.

The long run industrial dividend data described in Appendix A enables a comparison of dividend growth to inflation over rolling ten year periods commencing from 1965. The dividend imputation transition years of 1988-89 have been excluded as they positively distort dividend growth. The Chart below shows the dividend trajectory in constant dollar terms[13] of the median of these rolling periods. For comparison the constant dollar trajectory is also shown. This corresponds to a flat dollar drawdown of an account-based pension.

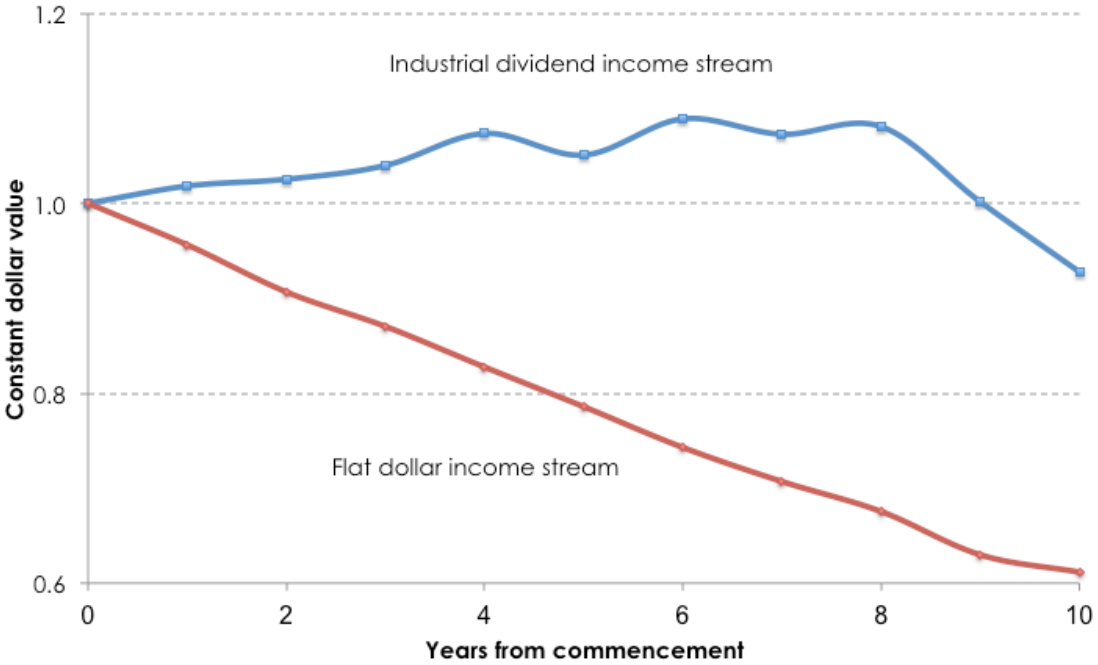

Figure 7 Industrial Dividends and Inflation 1965-2012

The constant dollar interquartile range across the 36 rolling ten-year periods for dividends was 0.77 to 1.22 (median 0.93 as illustrated). The flat dollar equivalent interquartile spread was 0.43 to 0.76 (median 0.61). The decline of the trajectory from years eight to ten is because over this period higher inflation is hard to avoid at longer horizons. An expectation of 2.5%pa inflation is consistent with a constant dollar relativity of 0.78 after ten years for a flat dollar drawdown. That would be a top quartile result based on the history examined here. The median outcome is more than 20% worse.

The performance of industrial dividends as an inflation hedge over this period is credible. The traditional arguments for equities as an inflation hedge were undermined by the stagflation of the 1970's. In total return terms the ability of equities to provide a hedge will depend in part on the origins of inflation (cost-push or demand-pull). Total return analysis is also affected by the impact

of higher discount rates on the valuation of financial assets generally. However in income terms the question is not complicated by share price changes. It simply comes back to the income generating capacity of companies. So it is reasonable to accept that dividends fare well against inflation, even though total share returns may not.

The other traditional inflation hedge is property. Unfortunately there was no access to long-run data on property income in Australia for this paper. The Property Council/ IPD Australia indices enable derivation of property income estimates from 1985. The chart below shows the results of a similar analysis over this more recent period.

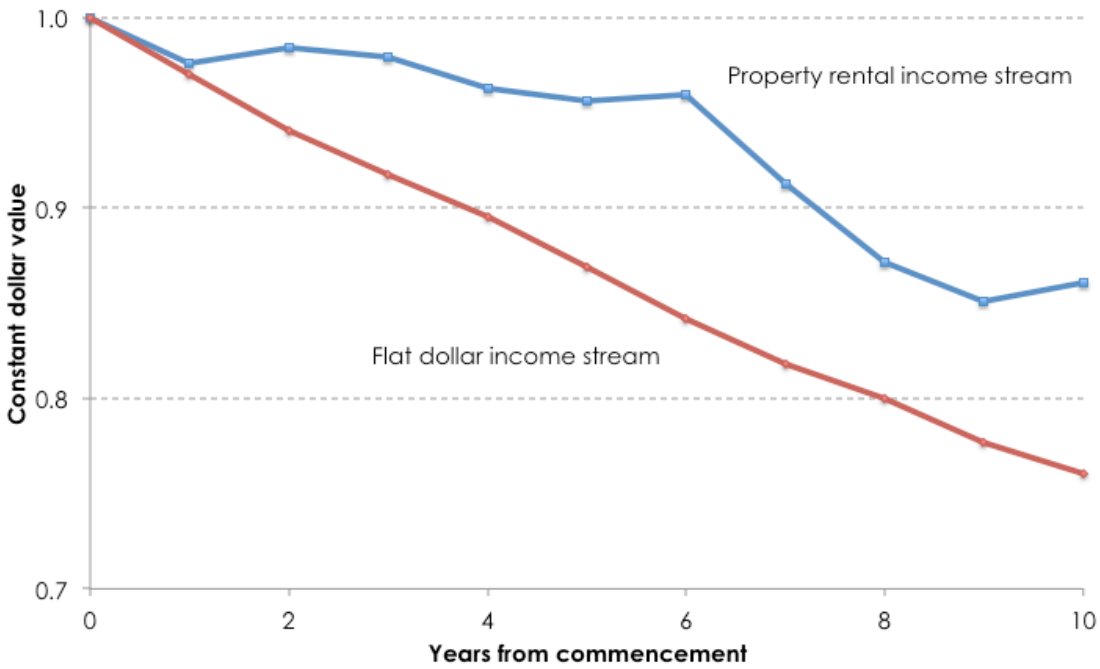

Figure 8 Property rental income and inflation 1985-2012

The inflation experience since 1985 is relatively benign with a median ten-year constant dollar ratio of 0.76 corresponding to an average rate of 2.8%pa. However even in this more benign climate property rental income has lagged with a median ratio of 0.86, suggesting property income has risen at around half of the inflation rate. That reflects the slump in property rentals in the early 1990's following the build of excess supply. After rentals plateaued in the mid-1990's they have generally kept place with inflation. The simple observation of the entire period is that credit fuelled property cycles have a long hangover, but in a slow credit environment that scenario is unlikely to emerge in the foreseeable future.

The high yield currently on offer by equities and property offers some hope of countering inflation. But it is important to understand the underlying volatility of asset income, which in some ways is a little more complicated than return volatility.

Income volatility

Equities have a bad reputation for volatility and in total return space it is well deserved. However the volatility of equity dividend income is much less than the volatility of share prices. The chart below summarises the annual changes in Australian industrial dividends since 1965. While dividend yield data is available for earlier periods it is not sufficiently accurate for the analysis of change in income.

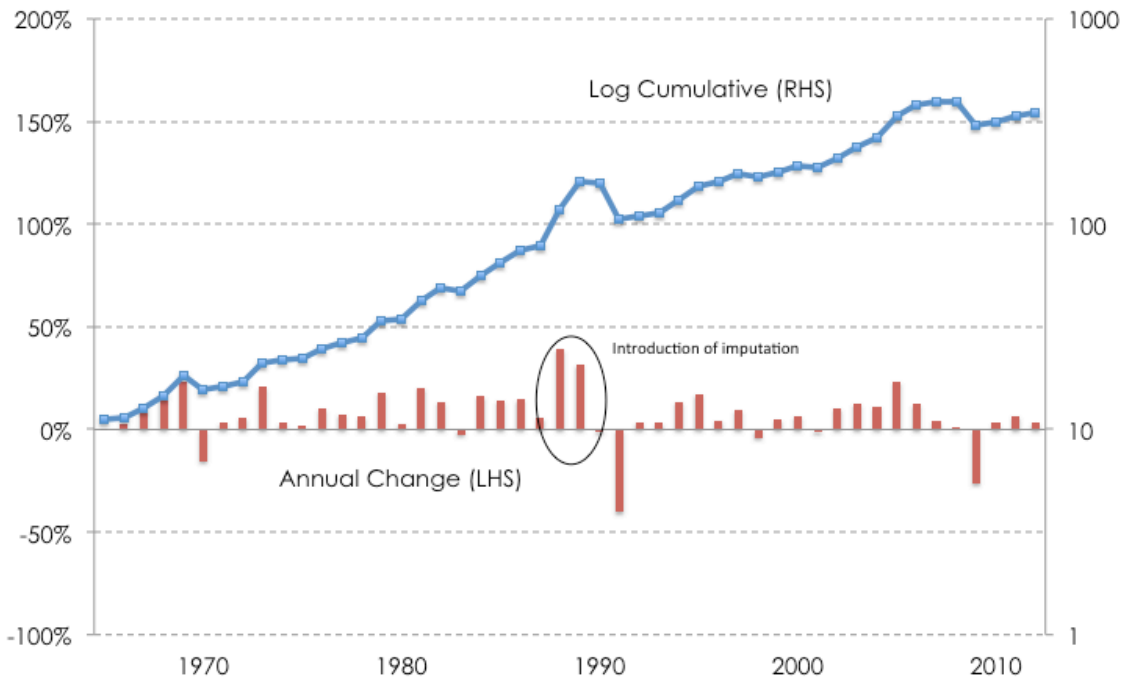

Figure 9 Australian Industrial Dividends 1965-2012

Annual change[14] is measured relative to the dividend itself, not dividend yield. For example over successive years consider the situation where trailing dividend yield moves from 5% to 4% while end of year prices move from 100 to 120. The actual dividend flow changes from 5 to 4.8, a decline of -4%. This is the number represented by the vertical bars. The chart below shows the distribution of the annual dividend changes.

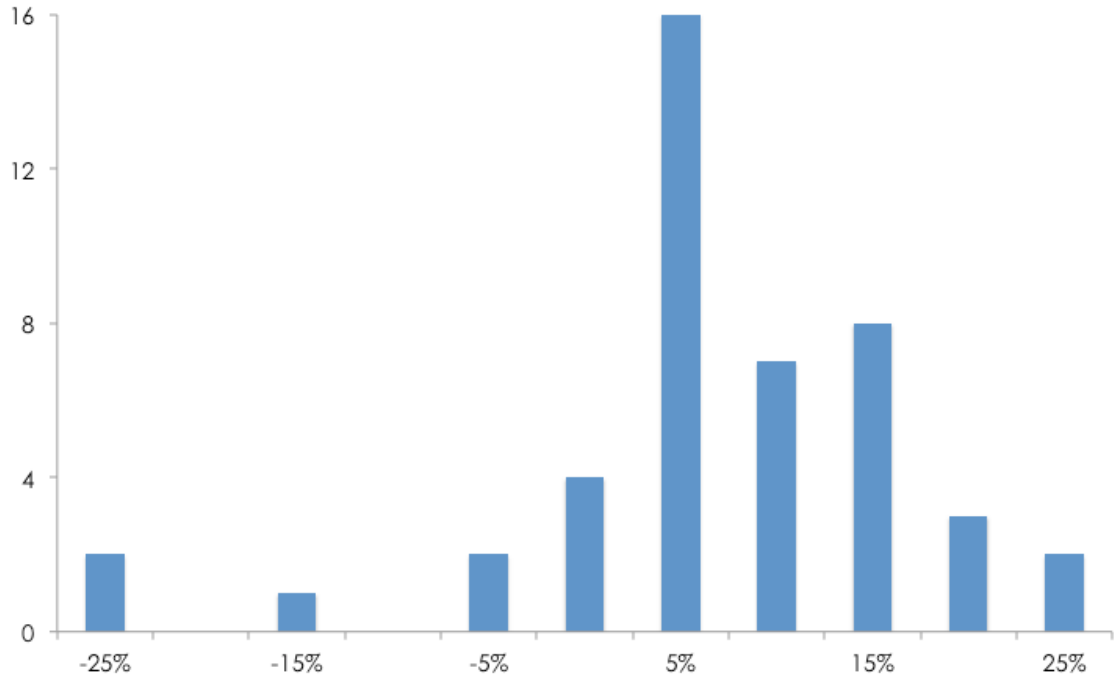

Figure 10 Distribution of annual dividend changes 1965-2012

As previously noted the introduction of dividend imputation caused a structural lift in payout ratios. Those years have been excluded from the distribution. The volatility of dividend change over the remaining 45 years is 11.6%. In the post-imputation period volatility has been higher at 13.4% due to the 1990s recession, compared to 8.9% in the earlier period. However the volatility in the two periods is reasonably consistent.[15] By comparison share price volatility, based on annual changes for the same 45 year period, is 23.5%, around double the volatility of dividends. The table below summarises the sub-period analysis.

Table 1 Industrial dividend and price volatility comparisons

	1965-1987	1990-2012	Combined	1992-2012
Dividends	8.9%	13.4%	11.6%	9.7%
Prices	27.4%	19.0%	23.5%	17.7%
Ratio	0.32	0.70	0.49	0.55

Post the 1990s recession the relativity between dividend and price volatility has been consistent with the longer term average. The observation that prices are much more volatile than the dividends they are supposedly discounting was interpreted by Shiller (1981) as a critique of efficient markets.

If retirement income is based on investment income, rather than asset sales, it is this lower level of income volatility that is relevant, not price volatility.

Appendix E includes a statistical profile of income change across the major asset classes. For industrial dividends over the 45 year period:

- The distribution of changes is significantly non-normal. There is excess kurtosis (ie fat tails) and skewness.
- There is no evidence of autocorrelation
- Dividend changes appear to be reasonably stationary overall
- Notwithstanding the above comment the median annual dividend change in the second period is 3.3% compared to 8.9% in the first period. Imputation has driven a fall in earnings retention from around 55% to around 20-25%. Other things being equal dividend growth should be proportionate to earnings retention so these numbers are consistent.

These observations about the distribution of dividend changes mean that simple assessments about income risk based on the normal distribution are invalid. Similarly comparing asset classes on the basis of standard deviations can be misleading.

In return space these issues are arguably not as severe. The Central Limit Theorem means that, subject to serial independence, the assumption of log-normality for asset returns improves as the horizon lengthens. So assuming log-normality for annual returns is more reasonable than for monthly returns. However there is no such compounding at play with annual asset income.

While cash is generally regarded as the risk free asset in total return space, in income terms it is the high risk asset. Tightening and easing cycles shift interest rates by proportionately large amounts. The standard deviation of changes to interest income since 1990 has been 25% compared to 13% for industrial dividends. With the conduct of monetary policy in the late 1980's the statistical profile goes awry. However in making assumptions about the near term future, that particular period is less relevant.

Another important observation is autocorrelation in property and bond income. This simply means that income changes in successive years tend to be related. For the period since 1990 the autocorrelation coefficient for property income change is approximately 0.5.

In the case of bonds the transition of the running yield (ratio of coupon to price) of an existing bond portfolio towards the current bond yield is readily predictable. Where bond yields have been higher over recent years, bonds issued over that period will typically trade above par. The total return of the bond portfolio consists of an elevated running yield and an amortisation of the average premium or discount of price to par. For example the hypothetical index used in the analysis above has a running yield at December 2012 of 4.6%, compared to a bond yield at that time of 3.2%. If yields remained stable, prices would adjust by around -1.4%pa over the period to maturity. In estimating a durable income level for a bond portfolio it may be preferable to use the current bond yield if lower than the running yield, as any variation from the

running yield essentially represents a capital transaction. With that approach the autocorrelation observed in bond portfolio income is not applicable.

The correlation of income change across asset classes is unrelated to the correlation of total return. Because the distributions of income changes are markedly different across asset classes it is more meaningful to look at Spearman rank correlations rather than the more common Pearson correlations. The correlation matrix of income changes across major asset classes is also included in Appendix E. Shifts in cash income tend to correlate positively with income shifts in other asset classes in particular Industrial Dividends (0.42), International Dividends (0.37) and Property Income (0.37). So aside from being a volatile income source, cash is the least effective diversifier.

Having reviewed asset class income growth and volatility it is now possible to construct a portfolio risk model.

A model of portfolio income variability

The table below shows income yield and growth calculations for a sample portfolio. The essential character of this portfolio is its high weighting to real income assets. The individual asset class weights are arbitrary and are not intended to be prescriptive. In practice funds may have access to mature infrastructure investments that may warrant inclusion. Income yields will be specific to the particular direct assets held by the fund.

Table 2 Income Portfolio Example

	Capital Weight	Income Yield	Income Weight	Growth
High Yield Industrials	35%	7.0%	38.7%	2.5%
High Yield International	30%	4.2%	20.0%	4.0%
Forward Premium		2.5%	11.9%	0.0%
Property	25%	6.0%	23.8%	2.0%
Fixed Interest	5%	4.1%	3.2%	0.0%
Cash	5%	3.0%	2.4%	0.0%
	100%	6.3%	100%	2.2%

Industrial and international shares are invested in high yield variants. International shares are fully hedged to earn the forward currency premium,

which is shown separately.[16] The portfolio bond yield is assumed to be 0.40% higher than weighted average yield of the UBS Composite Bond Index, which is the lift when AAA issues are excluded.

A gross income yield of 6.3% would reduce to around 6% after fees. Having resolved the income yield, the more intriguing question is the variability of that income. Changes in dividends for industrial and international shares need to be modelled in a way that acknowledges their skewness and excess kurtosis. A skew-t distribution has the flexibility to accommodate these variations. A regime change model is a conceptually appealing alternative but annual data is too sparse for estimation. Central estimate assumptions usually make no distinction between mean, median or mode because these are the same for symmetrical distributions. When dealing with skewed distributions there is some ambiguity. The approach taken for this model of income variability is to adjust the location parameter of the skew-t distribution so that the peak of the density function is close to the central growth assumption.

A Gaussian copula is used to correlate the randomisation of each asset class. For property income an AR(1) is applied to model the autocorrelation in income change. As discussed above, bond income is set at the level of the current bond yield so the structural autocorrelation of bond portfolio income does not apply. Cash is an unattractive asset for income purposes and has been handled simply in this model. Change in cash income is assumed to be serially uncorrelated on an annual basis and the current setting is assumed to be neutral.

When making calculations about total return volatility the weights for different asset classes are based on the capital allocated. The definition of volatility considered here is proportionate change in income. Hence the weights for calculations are income weights derived from the product of capital weight and income yield, as shown in the table above.

The chart below looks at the distribution of portfolio income change based on simulations of the integrated risk model.

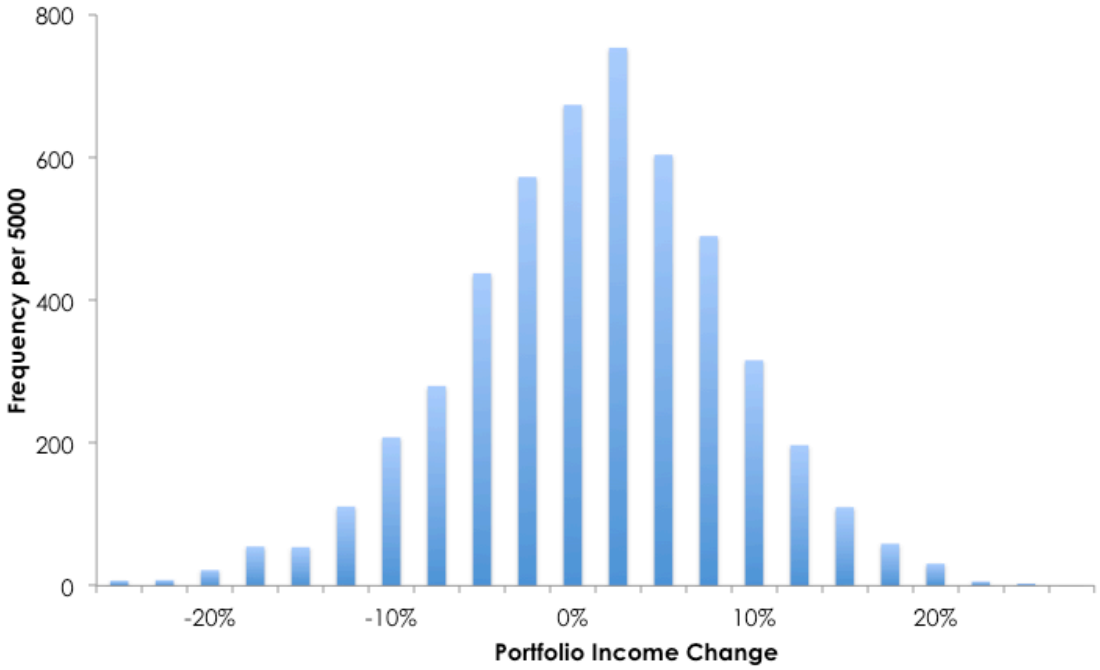

Figure 11 Distribution of Income Change

The skewness of the individual equity components has been diluted in the context of the total portfolio. The proportion of simulations worse than a 5% fall in income is around 1 in 5. The proportion worse than a 10% fall in income is around 1 in 15.

To clarify the interpretation, a couple currently earning 6% net of fees on combined assets of $250,000 would anticipate investment income of $15,000 to supplement the age pension. The risk of that falling by $750 or more in the year ahead is around 1 in 5. That income has estimated medium term growth of 2.2%pa. It will slip marginally relative to an inflation expectation of 2.5%pa. In constant dollar terms in ten tears time the income would equate to $14,600. That level of income support is enduring because capital is not being consumed.

There is an important twist with income variability that may entice sophisticated investors to be somewhat less diversified. In total return space equities have a significantly inferior Sharpe ratio to a diversified portfolio so higher equity weightings tend to increase the chance of adverse outcomes. As discussed above the volatility of dividend income is around half the volatility of share prices, but equities currently offer a substantive yield margin over bonds. Equity concentration is not so disadvantageous in the income space.

A 5% fall in portfolio income from a gross yield of 6.3% of assets to a yield of 5.99% (asset base unchanged) has an estimated probability of 1 in 5. A fall in high yield industrial dividends from a 7.0% yield to 5.99% is a change in income of 14.5%. High yield industrial dividends are more variable than the income of the portfolio overall but the estimated probability of them falling by that amount is 1:16, much less likely than for the diversified portfolio.

This is all well in theory but in practice many trustees would be uncomfortable basing a retirement income option solely on high yield industrial shares. The idea of income investment is that volatility of capital values can largely be ignored. However in practice it is very difficult to disregard volatility of capital values, especially when total returns are being reported to members. A conventionally diversified portfolio will achieve some dampening of total return volatility, which will be elevated by the substantive real asset commitment.

The table below compares the income generation of a standard moderate risk portfolio, substituting normal yields instead of the high yield variants included above. International shares are usually unhedged so there is no forward premium.

Figure 12 Normal Conservative Balanced Portfolio

	Capital Weight	Income Yield	Income Weight	Growth
Australian Equity Yield	22%	5.8%	30.3%	2.5%
International Equity Yield	18%	2.6%	11.1%	4.0%
Property	12%	6.0%	17.1%	2.0%
Infrastructure	13%	4.2%	12.9%	2.5%
Fixed Interest	22%	3.7%	19.3%	0.0%
Cash	13%	3.0%	9.3%	0.0%
	100%	4.2%	100%	1.9%

This portfolio has a very different objective of moderating total return volatility. Where capital is being consumed over a finite horizon it may well be more appropriate than the high income portfolio. However the weighted average income yield of 4.2% is very low compared to the 6.3% yield of the income portfolio above. It is ill suited to support an income investment option.

Integration with the age pension

The age pension for a couple is currently $28,840. This is reduced by either the income or the assets test, whichever has the greater impact. The assets test in isolation imposes a reduction of $39.10 ($1.50 per fortnight) for every $1000 of assets in excess of the threshold of $273,000. The income test is a little more complicated.

In general, the income test reduces the age pension by half of the amount by which income exceeds $6987pa ($268 per fortnight).

However, if the income stream is being sourced from an allocated pension, then an amount of income known as the 'deduction amount' is not counted towards the income test. The deduction amount is calculated as the account balance at the commencement of the account based pension divided by the life expectancy of the account holder (usually the longer life expectancy for a couple). In these illustrations the life expectancy applied is for a 65 year old female (21.6years).

Until the assets test cuts in at $273,000, the age pension can only be reduced by the income test. The level of income yield required to reduce the age pension is very high at low asset levels, although by the cut in level it is more moderate at 7.2%. Once the assets test comes into consideration it will be the dominant test unless income yield is very high.

Account based pensions also have a minimum drawdown that is 5% of assets in the first ten years after age 65. This increases at later ages so that eventually a retiree may have to drawdown at a higher rate than investment income.

Income yield above 5%, but below the threshold determined by the interplay of the income and the assets test has no impact on the age pension. It flows straight through to retirement income. For example a couple with combined superannuation assets of $400,000 can earn up to 8.85% income yield before the income test would have a more severe impact than the assets test. The chart below illustrates how this income yield threshold varies with assets.

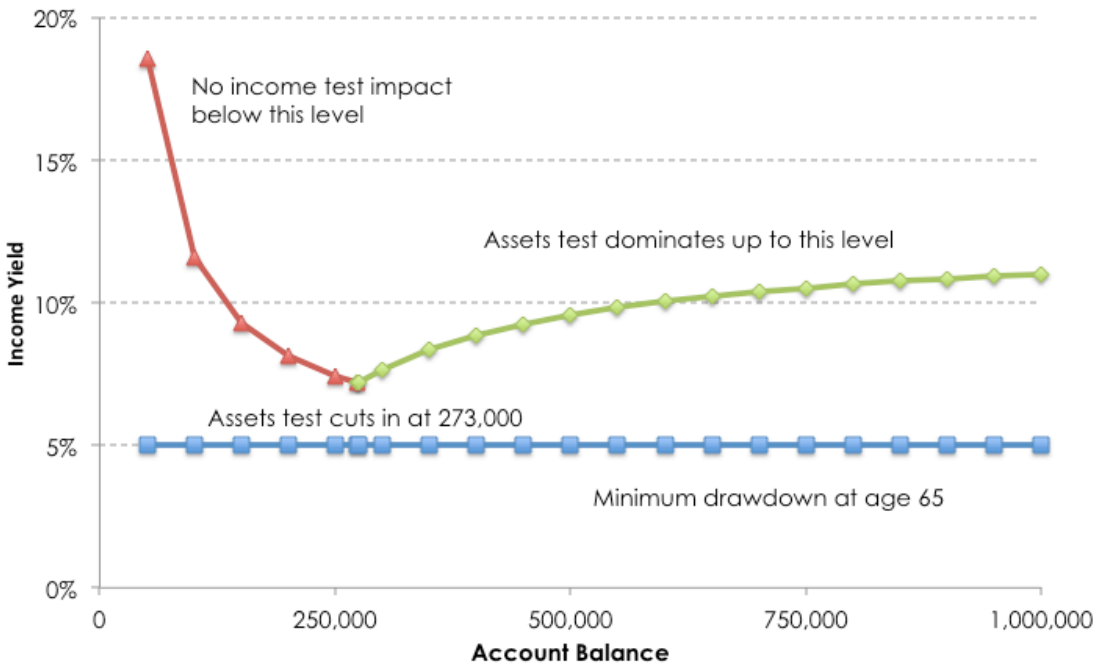

Figure 13 Income yield threshold for age pension impact

The most recently released ASFA retirement standard for a comfortable life style is $56,339 per couple for the December quarter of 2012. That retirement standard naturally increases each year with cost of living. Hence a flat dollar retirement plan that meets the standard at the outset will fall below it over time. An account based pension based on real investment income has a reasonable chance of moving in line with the standard.

The chart below shows the assets required to achieve the ASFA Moderate and Comfortable Retirement Standards where the account based pension pays investment income.

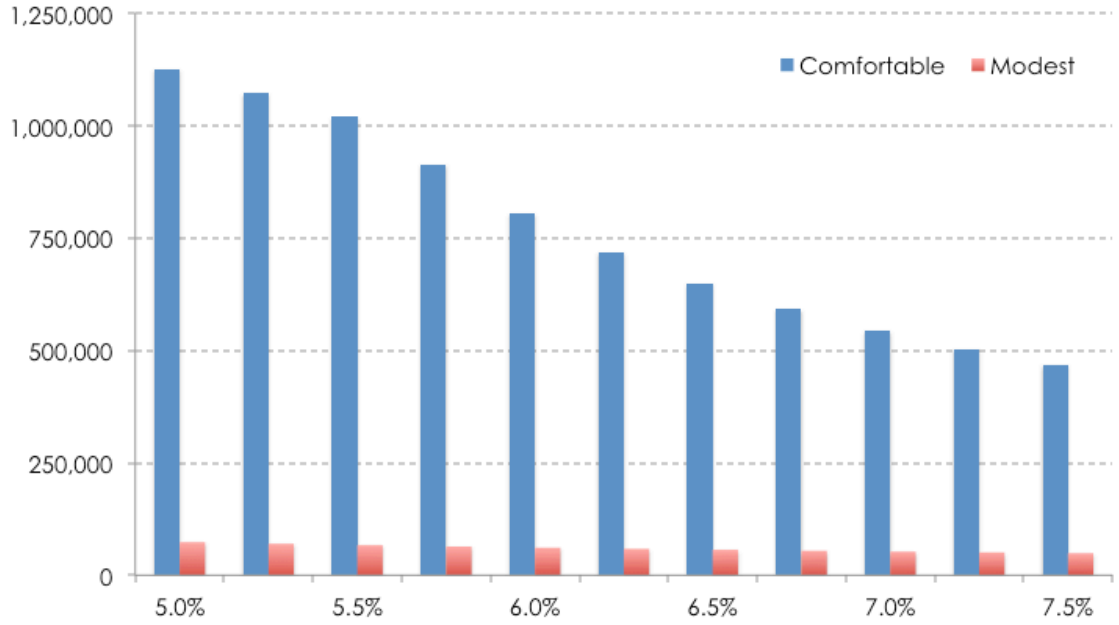

Figure 14 Required assets at various income yields

For example if the asset income yield is 6%pa, a high combined asset base of $805,000 is required to deliver the ASFA Comfortable Retirement Standard. An aggressive investment program with say with all income sourced from high yield industrial shares (circa 6.7% net income), could aim to hit that standard with around $600,000, albeit with higher income variability. The gap between the age pension for a couple and the ASFA Modest Standard is $3,673pa, not much but very material at a modest living standard. That is achievable with only $61,000 earning 6%pa. The reality of these numbers is that most retirees do not have adequate retirement wealth to sustain a durable comfortable retirement standard. They will be forced to settle with something less.

The chart below looks at the integration with the age pension for different levels of combined retirement assets earning an income yield of 6%.

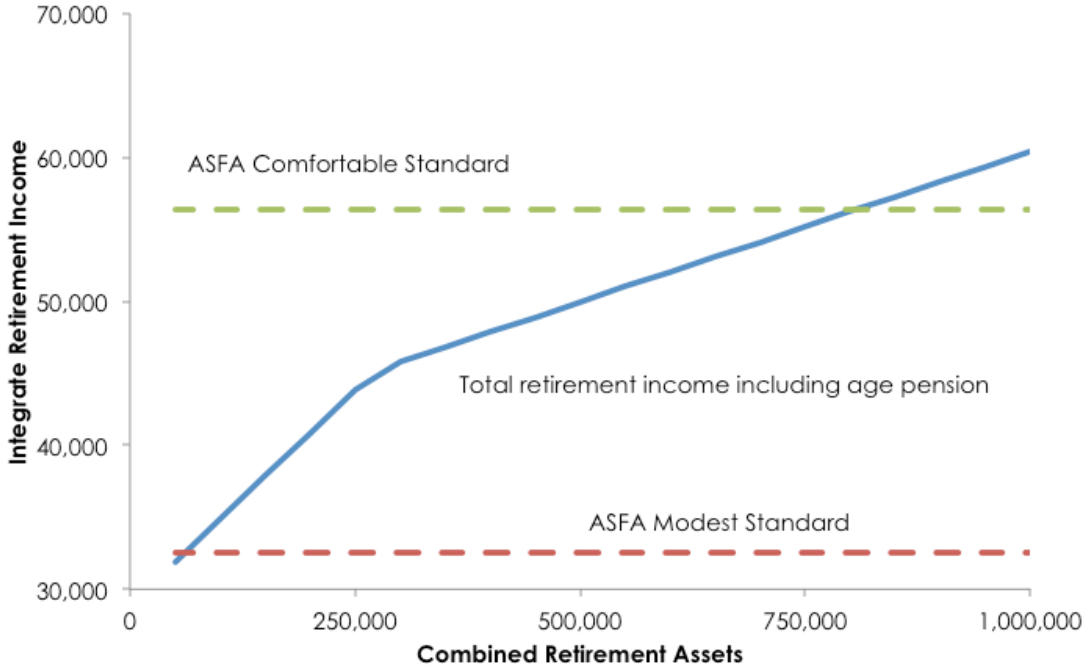

Figure 15 Integrated retirement income at yield of 6%

The progress from the ASFA Modest Standard to the ASFA Comfortable Standard is at a faster steady rate up until an asset level of $273,000, but from there is slowed by the assets test.

Retirees face difficult decisions at lower asset levels. They may choose to sacrifice longevity to ensure a comfortable standard over a finite period. Compared to a 6% real asset yield, the investment assumptions and fee levels embedded in many commercial offerings mean that this elevated retirement income would largely be delivered by capital consumption. Once capital is consumed the retirement standard of the age pension will be below the ASFA Modest Standard benchmark.

Account based pensions paying investment income provide the alternative of a more level retirement living standard, with longevity protection, subject to a moderate degree of income volatility.

Superannuation funds should consider adding investment income options because of the significant marginal utility relative to existing options. This approach will not suit all retirees, but it will be ideal for some. Those will include retirees with substantial retirement assets, and retirees prepared to moderate immediate retirement living standard to address longevity and preserve options in old age.

An investment role for actuaries

Asset consulting over the last quarter of a century has been much concerned with advice on active manager selection and strategic asset allocation. Over the last decade advice on dynamic asset allocation has also become common. Strategic asset allocation is the key determinant of the volatility of investment returns through time and is the basic characteristic that differentiates member investment choices.[17] Dynamic asset allocation and active performance within sectors can be at least as important in explaining how performance varies across superannuation funds. Performance relative to other funds is a natural distraction for trustees so success with dynamic asset allocation and manager selection, particularly in the short-term (ie one year) is highly valued. However it is hard to discern value added from these pursuits in the short term because outcomes are very noisy.

An important difference between income investment and total return investment is that the level of income is readily estimable with much greater certainty than total return. The emphasis on professional advice shifts to modelling income variability, growth profile and portfolio construction. The actuarial profession has naturally strong credentials in modelling income, which is more stable than total return because the emotion of market pricing is not a factor. Understanding income variability and growth requires a fundamental knowledge of investments, consistent with an actuarial qualification.

It is hard to argue that actuarial profession has comparative advantage in total return pursuits such as active manager selection and asset allocation, dynamic or strategic. However income investment is a better match to the knowledge and skills of an actuary.

Income investment for superannuation is in its infancy. Investment practitioners tend to be ambivalent about income investing for various reasons. The profession can make a valuable contribution by stepping into the breach.

Other issues

Once a portfolio construction for an income investment option is resolved there are still a range of other issues requiring attention.

A straightforward design for an account-based pension is to sweep asset income from the main portfolio fund to a linked cash fund from where pensions are payed. These internal income sweeps are similar in nature to income distributions from unitised trusts, but have a little more flexibility. In most instances a practical frequency would be quarterly. Income earned by investments will accrue in the main fund prior to the sweep. The handling of new entrants to the main fund should preferably ensure that accrued income is not diluted. This dilution can be avoided if an accrued income element is prorated from the new entrants assets.

Asset income occurs irregularly during a year, particularly with equities. A quarterly sweep of income will still exhibit a degree of seasonality. If new pensioners seed the linked cash fund with a small proportion of their retirement assets, say 5%, there will be a buffer to smooth both seasonality and variation of income from expected levels.

A pensioner intending to live off investment income will need regular advice as to the current income yield of the investment option. Investment performance reporting should divide results between income generation and price fluctuations. Arguably this is helpful information for pre-retirement members as well.

Consideration should be given to a separate investment governance structure for income investment. The issues addressed by an investment committee overseeing the income portfolio will differ from those of the general investment committee.

The income investment committee will focus on:

- The level of income
- The stability of income
- The growth of income relative to inflation

The income investment committee will decide a portfolio construction based on expectations of the above. In the usual way that portfolio construction will involve specification of asset allocation, and implementation within asset classes, such as high yield equity variants. As experience unfolds those expectations will be reviewed and new opportunities may arise, possibly warranting portfolio changes. This is the essence of a planning and control cycle. The difference compared to the total return situation is that the feedback from experience is more directly interpretable.

In some cases post-retirement assets of a superannuation fund may be relatively small. An implementation of this approach is still feasible, but it may involve a slightly narrower range of options in portfolio construction, and greater reliance on passive investment alternatives.

The concept of 'transition to retirement' asset allocation generally involves reducing total return risk. That is somewhat defensible where the retirement 'income' plan is for steady consumption of capital over a finite horizon.

The transition from a wealth accumulation to an income generation investment strategy will be along a different path. The default wealth accumulation investment strategy will typically not be ideal for investment income in retirement because its income yield will be too low. However its aggregate weighting to real assets may be in the right ballpark. Members opting for an income investment option in retirement may require guidance about the investment transition.

Conclusion

There is a significant gap in the investment choices offered to retirees. Longevity is a widely acknowledged challenge, compounded by the popular choice of capital consumption. A simple answer to the longevity challenge is not to consume capital but to live off the investment income it produces. The current investment environment is very accommodating to this alternative, offering high income with the prospect of growth to offset inflation. The investment

income approach integrates well with the age pension. However it is no panacea for inadequate retirement assets. Many retirees will still choose unsustainably higher income, with a step down to the age pension at an indeterminate time. The unpredictable nature of investment markets may mean that step down occurs much earlier than anticipated, long before any deferred annuity is payable.

Superannuation funds should consider adding investment income options because of the significant marginal utility relative to existing options. When reviewing post-retirement investment options, an income option should have priority. This approach will not suit all retirees. However it will be ideal for retirees with substantial retirement assets, and retirees prepared to moderate immediate retirement living standard to address longevity and preserve options in old age.

Appendix A – Australian Share Market Data

To analyse the characteristics of dividend income it is desirable to extend the time series as far back as accurate data is available. In 1980 the Australian Stock Exchange (ASX), following recommendations from the Institute of Actuaries of Australia, introduced capitalisation weighted price and accumulation indices covering a representative sample of companies. These are the standard reference from that time for determining dividend flows for the market. The point of extending data capture prior to 1980 is to expand the diversity of economic and market conditions against which dividend behaviour is assessed. While there are some matched price and accumulation indices available in the 1970s, there are also separate price and dividend yield series to be considered. The criteria for selecting data for the purpose of this study are:

- The data should ideally be capitalisation weighted as this best resembles how institutional equity portfolios are constructed.
- It is preferable to focus on the dividend flow of industrial shares rather than the broad market, as resource shares typically have much lower dividend yields and suppress the market average. This is a significant issue for example over the period of the resource boom of the late 1960s.
- When available, a broad capitalisation index is preferable to a large capitalisation index (eg Fifty Leaders) as smaller companies tend to have higher yields and would typically feature in a yield-focussed portfolio.
- When using dividend yield series together with price indices to estimate a dividend flow, the underlying share portfolios from which the series are derived should be consistent.

Pre-1980 data

The Statex-Actuaries price and accumulation indices are available from 1972 however the design of these indices is equal-weighted rather than capitalisation-weighted, and restricted to fifty companies with highest turnover. The accumulation indices reinvested income at year-end rather than continuously. The Australian component of the MSCI indices is also available since December 1969.

The Sydney and Melbourne Stock Exchanges (SSX and MSX) had independently developed price indices in the late 1950's and early 1960s and these were published prior to the introduction of the ASX indices in 1980. Each exchange also published series of dividend yields.

The Sydney Share Price Index replaced an earlier index, published from 1938, which was of very different geometric construction. The Sydney indices, published from January 1958, were designed by the economist Donald McLean Lamberton, and calculated back to 1875. Lamberton (1958) provides a thorough description of his method and includes data on industry and group indices monthly from July 1936 to December 1957. Three group indices covering the earlier period from 1875 were published in the Sydney Stock Exchange Official Gazette in January 1958: Financial Index (1875-1936), Commercial and Industrial Index (1875-1936), and Mining Index (1875-1910). The list of stocks included in the earlier indices is narrow. For example in 1900 the Commercial

and Industrial Index is based on thirteen stocks. Lamberton also calculated a history of dividend yields based on unweighted averages from 1882.

The Sydney Stock exchange commenced publication of a dividend yield series in July 1961. This series was based on an unweighted average of all stocks paying dividends, which numbered around 500 on commencement. By comparison the Sydney Share Price Index included approximately 150 stocks at that time. This dividend yield series is biased in comparison to the true yield of the Sydney Share Price Index for three basic reasons:

- The calculation excluded stocks that did not pay dividends.
- The sample is was so broad that it included more stocks outside of the index than stocks in the index, and most of these additional stocks would have been of smaller capitalisation than index constituents.
- The average yield is unweighted which amplifies the distortion of the point above.

Brailsford, Handley and Maheswaran (2008) refer to email correspondence with the ASX indicating that the ASX considered an adjustment factor of 0.75 was appropriate for the unweighted dividend yield series. A regression of the monthly ASX Statex yields against the SSX unweighted series for the period 1973-1979 gives a coefficient of 0.76 with an estimate standard error of 0.5% in yield terms.

The ASX published capitalisation-weighted yields for the period 1973-1984 based on the broad Statex data base and including stocks not paying dividends. Importantly these series are available separately for industrials and resources and are a reasonable match to the respective capitalisation weighted price indices of the SSX.

The Adjusted Melbourne Dividend Yield Series

The ASX Statex yields enable an estimate of industrial dividends back to 1973. Prior to 1973 the MSX produced a weighted fifty leaders dividend yield back to 1965. The problem with this intervening period is the resources boom of the late 1960's. Resource stocks only numbered around six of the 50 stocks on which the Melbourne series was based. However they accounted for over half of the weight of the index. Fortunately the Melbourne Share Price Index Chart Books, and the Official Record of the Melbourne Stock Exchange provide enough data for the calculation of the weighted resource dividend yield of these large mining stocks including BHP, and their weight in the Fifty Leaders. A weighted industrial dividend yield series can be constructed by subtraction of the contribution of this resource yield from the overall weighted average.

Industrial Yield = (Fifty Leaders Yield – Weight*Resource Yield)/(1-Weight)

This original industrial yield data is then applied to the Series 25 Index of the SSX. Before the term 'All Industrials' was in common use the SSX had constructed this index series by excluded both mining and steel stocks (dominated by BHP) from the All Ordinaries.

The imperfection in this calculation is the capitalisation mismatch between the industrial segment of the Melbourne Fifty Leaders, and the industrial segment of the SSX All Ordinaries. This is unavoidable but is unlikely to be a significant distortion for the purposes of this study.

Prior to 1965 resources were a much less significant part of the market. The overall market yield prior to 1965 is broadly consistent with the industrial series thereafter.

The more critical issue for the earlier period is the quality of yield approximation. The 0.75 reduction factor applied to the SSX unweighted yield series is too approximate to gauge changes in dividend flow. However it is adequate for the purpose of comparing yield levels.

Bond yields

The bond yield data used in Figures 1 and 4 has been sourced as follows:

1922-1925 Butlin(1977)

1926-1936 Yield Calculations based on selected long dated bonds with prices reported in the Sydney Stock Exchange Monthly Stock and Share List

1937-1949 Commonwealth Bank Statistical Bulletin

1949- RBA website (www.rba.gov.au)

Appendix B - A closer look at bank weighting

Currently banks account for 38% by market weight of the industrial segment of the S&P/ASX 200 index. Twenty five years ago, as the credit expansion was just beginning, the equivalent number was 11%.[18] The weighted average gross yield for banks at 31 March 2013 was 8.0% compared to 5.4% for non-bank industrial stocks. Hence investing for yield in the Australian equity market requires comfort with a substantial weighting to banks.

An underlying concern for the banking sector is the stability of home prices given home lending accounts for around half of bank assets. A significant correction in home prices would adversely affect the collateral of existing loans, tighten the rollover of bank funding and generally dampen credit. It is generally accepted that Australian house prices are inflated.[19] However there are various factors that differentiate Australia from countries where house prices have collapsed.[20] Importantly Australia's bank regulation and supervision is highly regarded.

Australia's path to higher home prices was driven by financial deregulation and a lowering of interest rates which enabled household indebtedness as a proportion of household disposable income to rise from around 40% to a little over 150% in the twenty years to 2006 (RBA chart pack). It has since hovered around that level as the savings rate has moved up towards 10%. The era of rapid credit growth that saw banks dramatically expand balance sheets appears to have ended, with both housing prices and debt levels behaving as if they've reached a ceiling relative to incomes in recent years.

Falls in interest rates have helped existing borrowers to establish prepayment buffers. estimated at 20 months on average. The non-performing share of housing loans appears to have peaked in June 2011 (RBA (2013b)), but rising unemployment may slow further improvement. Bank funding has also become more robust since the GFC with an increase in wholesale fixed term loans and domestic deposits reducing rollover risks.

On a solvency basis the Australian banks are robust to APRA stress tests.[21] The question here is the robustness of dividends, rather than solvency. In the event of significant capital impairment banks would need to raise capital, most likely at depressed share prices, diluting the dividend entitlements of existing shareholders. In the interim dividend payouts would be restricted.[22] The APRA stress tests contemplate an exceptionally severe set of circumstances that would reduce Tier 1 capital by 3.8% and lead to credit losses comparable to the early 1990's. The chart below shows the history of bank dividends since 1980.[23]

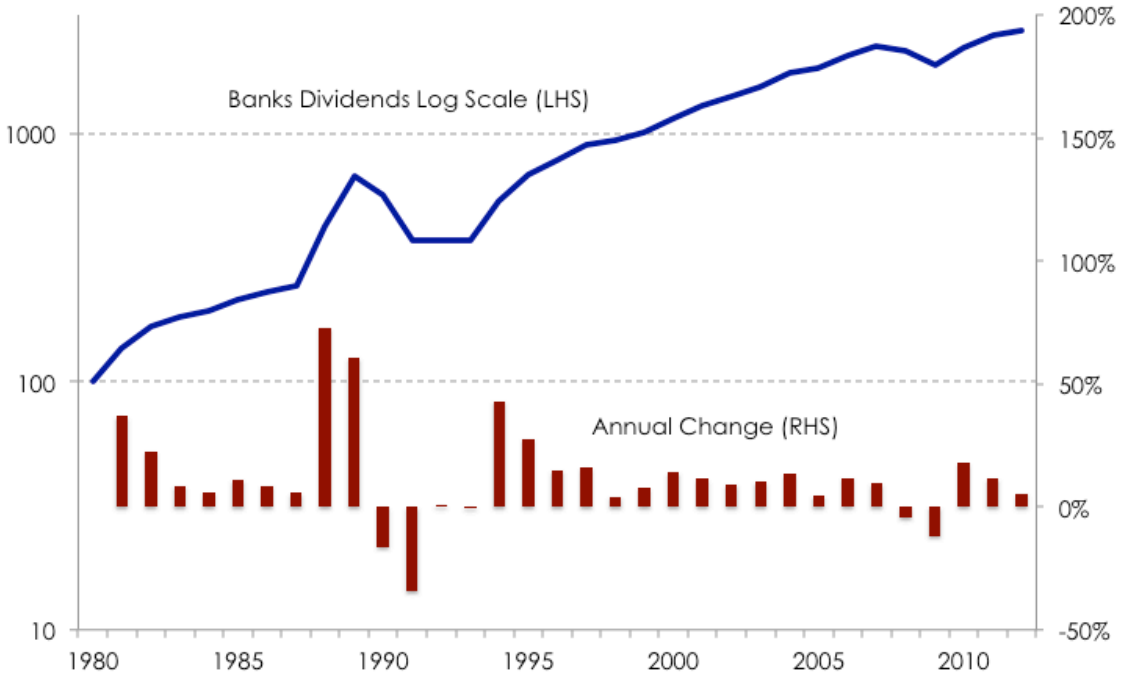

Figure 16 Bank Dividends 1980-2012

Bank dividends declined on average by a cumulative 45% in 1990 and 1991, although as the chart illustrates this was from an elevated level. The falls were not uniform across banks. For example Westpac's dividend fell by 77% whereas National Australia's dividend fell by only 17%. The bank capital regime is tighter now and might impose different adjustment in the same circumstances.

Over this entire period the volatility of bank dividend changes has been around 20%pa. The history includes one significant disruption in the banking sector over a thirty-year interval. That provides an arbitrary allowance of major event risk. Based on the weight of the banking sector in the industrial segment of the market over time, and sector yields, the approximate changes in non-bank industrial dividends can be derived over the same period. These have a volatility of 15%. The rank correlation of the two series is 0.45. With these parameters and the current observed yields of 8% for banks and 5.4% for non-bank industrials it is possible to look at composite yield and dividend volatility at different bank weights. This simple analysis is shown below.

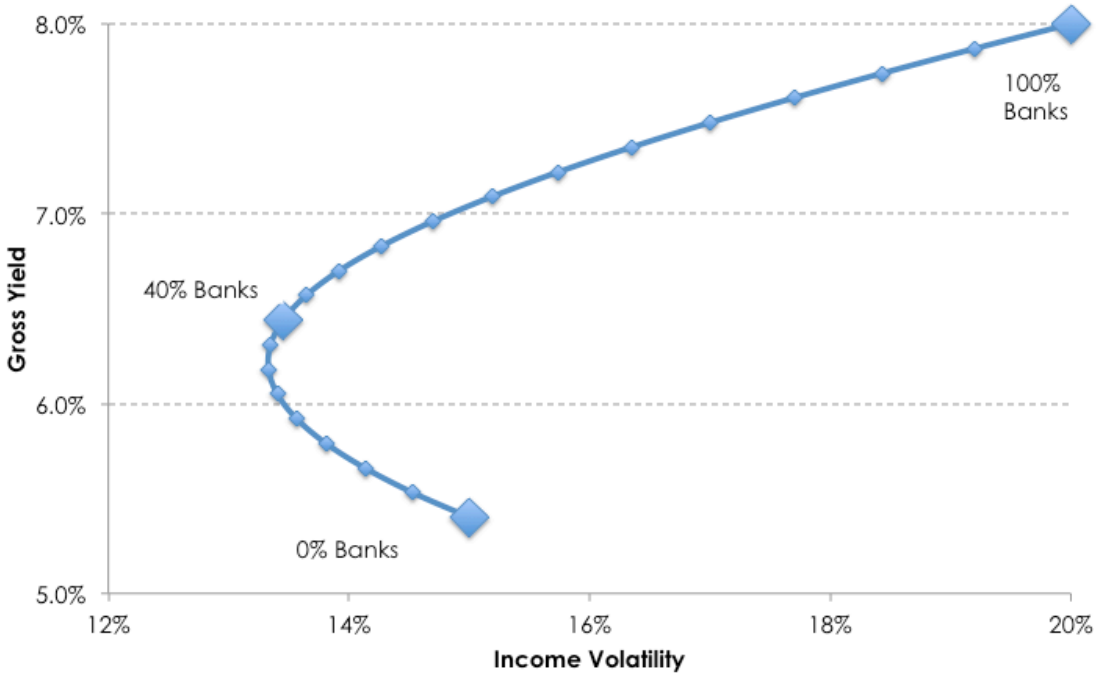

Figure 17 Yield and dividend volatility at different bank weightings

At around 35-40% the bank weighting is in a relative sweet spot in this framework. Based on the history of the last thirty years, including the bank mischief of the early 1990's, the current market weighting of banks within the industrial segment is not unreasonable.

Overall sluggish housing credit growth (4.5% over the past year compared to 13.5%pa on average during the credit boom), and changed household savings behaviour is slowly ameliorating household leverage. Slow credit growth also gives banks some room to preserve capital through earnings retention. Absent a sharp and significant rise in unemployment, the consequence of high household leverage is expected to be slow credit growth for an extended period, rather than a sudden rise in loan impairment. Slow credit growth can beget stronger competition, which in turn may compress bank interest rate margins. This would compound the impact on dividend growth.

Appendix C – Australian High Yield ETFs

In Australia there are currently four Exchange Traded Funds (ETFs) with underlying High Yield Indices as shown below.

Table 3 High Yield ETFs and Underlying Indices

ETF	Underlying Index	ASX Code
iShares S&P/ASX High Dividend	S&P/ASX Dividend Opportunities	IHD
Russell High Dividend Australian Shares	Russell Australia High Dividend Yield Index	RDV
SPDR MSCI Australia Select High Dividend Yield Fund	MSCI Australian Select High Dividend Yield Index	SYI
Vanguard Australia Shares High Yield ETF	FTSE/ASFA Australian High Dividend Yield Index	VHY

The construction of these underlying indices varies considerably in their use of quality filters, sector diversification, the use of trailing or forecast dividends, and surprisingly the acknowledgement of dividend franking. It appears of the four, only RDV takes into account dividend franking in its portfolio construction. The table below summarises portfolio characteristics based on recent portfolio listings and reported distributions.

Table 4 High Yield ETF Portfolio Characteristics

	Trailing Gross Yield	Forecast Gross Yield	MER	Total stocks/ex 100	Top Ten Weight	Financials ex Property/Banks Weight
IHD	6.0%	6.6%	0.30%	51/17	43%	21%/16%
RDV	6.8%	6.9%	0.46%	51/4	55%	44%/36%
SYI	5.5%	7.1%	0.35%	43/3	61%	44%/41%
VHY	6.1%	7.3%	0.25%	58/25	68%	40%/34%

The portfolio diversification of these indices is also mixed. IHD and VHY include meaningful exposures to high yielding smaller companies of 8% and 9.4%. The other ETFs tend to be large cap biased. IHD has significantly lower concentration in the financial sector. The chart below compares individual stock concentration.

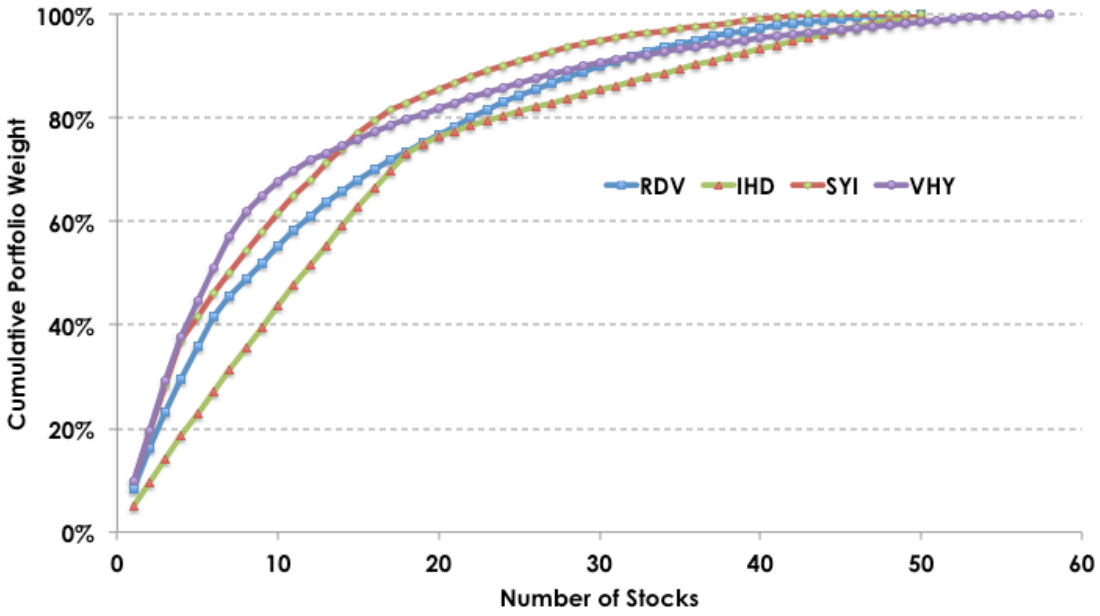

Figure 18 ETF Portfolio Diversification

IHD appears to be better diversified across its large holdings than the other three, with VHY the most concentrated.

Appendix D - Income growth assumptions

Barker(2003) describes the two classical approaches for making assumptions about future dividend growth, the GDP method and the earnings retention/return on equity method.

In applying the GDP method its necessary to allow for the dilution of capital raisings in addition to retained earnings. Over the last fifteen years secondary capital raisings on the ASX have averaged 3% of market capitalisation, excluding the exceptional capital rebuild of 2009. Hence the level of dilution appears to be quite high. However a good proportion of that capital raising has fed into the grossly expanded financial sector. With subdued credit growth this rate of capital raising will likely be at a lower rate in the future. The RBA expects nominal GDP growth of around 5%pa in the medium term. Diluting that figure by say 2% would leave profit growth of 3%.

The earnings retention/return on equity approach adjusts directly for Australia's imputation induced high rate of payout, currently around 80% for industrial shares. The return on equity in this calculation refers to the investment of newly retained capital. Accounting return on equity for non-financial companies may be a very distant relation because of the accounting nature of book value. Also the direction and opportunities of new investment may differ from the existing business. An equity risk premium approach to return on equity would give a standard assumption of 9-10%, implying growth of around 2%. Bank return on equity is currently circa 15%, implying bank profit growth in excess of 3%. But given the leverage of banking it doesn't take much compression in the net interest margin to dent profitability. Against this background for the industrial segment overall a reasonable growth band would be 2-3%. This range may seem low compared to the level of growth assumed by broking analysts for example. However the median annual growth in industrial dividends since 1990 has been 3.3%, and the outlook now is subdued relative to that period.

The earnings retention/return on equity approach would imply that other things being equal global equities should have higher income growth. Globally earnings retention is circa 60% compare to 20% in Australia. Lower base discount rates imply lower return on equity however. For example a return of equity assumption of say 7.5% would imply growth in equity income of 4.5%. The latest IMF outlook implies nominal GDP growth in developed countries of a little over 4% in 2014, hopefully improving longer term. A consequence of higher earnings retention is less need for external capital so the capital raising dilution of the alternative GDP method is less. Even so the GDP method would imply equity income growth circa 4% or less in the near term. Hence a reasonable range for global equity income growth is 3.5-4.5%, maybe a little quicker than the domestic inflation outlook.

An important adjustment to property income is the need for irregular redevelopment. For example if 10-15% of the value of a property is reinvested every 10 years the adjustment to growth is a reduction of around 0.5%pa. That might bring net rental growth a little below the inflation rate, say closer to 2%.

The table below summarises the income growth assumptions discussed above.

Table 5 Income Growth Assumptions

	Income Growth %pa
Australian Industrial Shares	2.5%
Global Shares	4.0%
Australian Direct Property	2.0%

Given the stability of inflation over the last twenty years the logical assumption for the near term would be the mid-point of the Reserve Bank's target range of 2-3%. Against that background these income growth assumptions imply that industrial dividends will keep place with inflation, global dividends may do better, and property rental income might lag slightly.

Appendix E – Statistical Profile of Income Change

Table 6 Income change statistical profile by asset class

	Test	Industrial Shares		International Shares		Property		Bonds		Cash	
Period Start		1965	1990	1970	1990	1985	1990	1982	1990	1970	1990
Normal	Shapiro-Wilk (null normal)	0.002% Reject	0.003% Reject	0.005% Reject	1.24% Reject	56.7% Accept	41.9% Accept	59.0% Accept	70.8% Accept	0.05% Reject	89.6% Accept
Stationary	Augmented Dickey Fuller (null stationary)	99% Accept	77% Accept	99% Accept	74.8% Accept	80.4% Accept	17.9% Accept	51.9% Accept	48.2% Accept	99.0% Accept	95.8% Accept
Autocorrelation	ACF,PACF inspection	No	No	No	No	AR(1)	AR(1)	AR(1)	AR(1)	AR(2)	No
Volatility		11.6%	13.4%	7.6%	9.2%	5.4%	4.0%	2.8%	2.2%	30.8%	25.0%
Skewness	D'Agostino (p value, null = 0)	-1.79* (0.6%)	-1.86* (2.2%)	-1.25* (3.8%)	-1.34* (7.0%)	0.44 (48.1%)	-0.44 (50.2%)	0.43 (47.3%)	0.13 (84.6%)	1.64* (1.1%)	0.37 (57.2%)
Kurtosis	Anscombe-Glynn (p value, null = 3)	8.00* (0.03%)	6.91* (0.03%)	7.39* (0.08%)	6.27* (0.6%)	3.08 (52.1%)	2.28 (56.7%)	2.60 (90.7%)	2.02 (22.8%)	8.22* (0.03%)	3.72 (18.8%)

Table 7 Annual income change rank correlation 1990-2012 (and significance p-value)

	Industrial Shares	International Shares	Property	Bonds	Cash
Industrial Shares	1.00				
International shares	0.35 (10.1%)	1.00			
Property	-0.03 (89%)	0.45 (0.45%)	1.00		
Bonds	-0.18 (40%)	0.30 (16.3%)	0.26 (22.8%)	1.00	
Cash	0.42 (4.8%)	0.37 (8.3%)	0.37 (8.2%)	0.23 (29.3%)	1.00

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[1] Under Prudential Standard LPD 114, APRA January 2013, the Asset Risk Charge is magnified by any mismatch between asset and liability sensitivities, encouraging a matched fixed interest investment program to back annuity liabilities.

[2] Average recent retirement age for men, ABS 6238.0. An article by Lixia Que, *Age Difference between Brides and Grooms in Australia*, Family Matters No.49, Autumn 1998, suggests an average age difference of 3 years for recently retired couples.

[3] Cohort mortality allows for mortality improvement with time. Using cohort mortality retrospectively is a better measure of actual experience. The mortality rates used here up to 2009 are sourced from the Human Mortality Database, an

international mortality data provider. The 2010 mortality is based on ALT 2009-2011 from the ABS. Mortality improvement beyond 2010 is based on mortality improvement factors included in ALT 2005-07 from the Australian Government Actuary. The relationship between population and pensioner mortality, and spouse to pensioner mortality, is assumed to be constant over the period and based on Stevenson and Wilson (2008).

[4] The force of interest simply adjusts for continuous payment to match the annuity calculation

[5] This approach is based on the framework of American advisor Jim Otar, www.retirementoptimizer.com

[6] The regular drawdown is based in an annuity certain calculation which varies by date of pension commencement. The investment return assumption is based on the bond yield at commencement and an equity risk premium of 6% for equity asset classes. The conservative balanced asset allocation across domestic equities, overseas equities, bonds and cash is 20/20/50/10 rebalanced quarterly. The Australian equity performance is based on the All Ordinaries Accumulation Index from 1980 and the MSCI Australia Gross Index prior. International equity performance is based on the MSCI Net ex Australia Index converted to Australian dollars. Bonds are based on the Commonwealth Bank Bond Index All Maturities from December 1976, with an approximation based on RBA bond yields for prior years. Cash is based on the UBS bank Bill Index with an approximation based on RBA Bank Bill yields prior to 1987.

[7] Cash is the Official Cash rate. The bond yield is the weighted average yield on the UBS Composite Bond Index, as reported by UBS. Infrastructure is as reported by IPD Australia Unlisted Infrastructure Index for domestic funds, December 2012. The property yield is the Adjusted Funds From Operations (AFFO) yield for the weighted average of seven major asset owning trusts (CFX,CPA,DXS,GPT, IOF,SGP,and WRT) sourced from J P Morgan research in February 2013, repriced at end March. The yield for International Shares is as reported by MSCI for the World Index. The yields for the resource and industrial segments of the S&P/ASX 200 are derived from 2013 forecasts supplied by Macquarie Equities. All equity yields are end March.

[8] Throughout this paper the term 'industrial' has the Australian conventional meaning of non-resource. S&P's Global Industry Classifications System (GICS) unfortunately has no equivalent. The GICS industrial sector is a minor subset of the Australian conventional wider classification.

[9] At 28 March 2013 the S&P/ASX 200 closing level of 4967 compare to a closing high of 6829 on 1 November 2007, and a recent trough of 3145 on 6 March 2009.

[10] Macfarlane (2006) points out that Governor Bernie Fraser raised the idea of the inflation band in a speech in 1993, from when it became informally acknowledged as the RBA's target. Finally it was formalized by Treasurer Peter Costello in the *Statement on the Conduct of Monetary Policy* (August 1996).

[11] There is also a quality sift based on a composite of return on equity, earnings variability and debt to equity, and a sift to preclude extreme negative one year price momentum. The quality and momentum sifts are effective from June 2013.

[12] The MSCI Hedge index is available since 1998 for a US dollar base. Combining that with the Australian/US Libor interest rate differential gives an estimate of the Australian base forward premium for the global equity basket. The volatility of year-to-year change in that forward premium since 1998 has been 28%, similar to the gross cash income.

[13] The constant dollar adjustment involves discounting each year's cash flow by the cumulative inflation since the start of the period. If cash flows keep pace with inflation the constant dollar adjustment will result in a horizontal line. A trajectory above the horizontal indicates cash flows outgrow inflation. A trajectory below the horizontal implies inflation is stronger than any growth.

[14] Difference in log dividend has not been used in this analysis. The focus ultimately is on portfolio aggregation of income change, rather than addition of change through time.

[15] Because the distribution of dividend changes is significantly non-normal, a simple F test of equality of variances is invalid. A modified robust Brown-Forsythe Levene-type test for heteroscedasticity based on the absolute deviations from the median gives a test statistic of 0.149 with a p-value of 0.70.

[16] Traditionally it may have been argued that Australia's persistent interest rate differentials were compensation for an underlying weakness in the currency. However empirical studies have highlighted a Forward Premium Puzzle whereby positive interest rate differentials tend to be associated with currency appreciation. Especially in the current environment where major currencies are trying hard to be weak, there is a strong case to hedge back to the Australian dollar. However this will require liquidity support for occasional losses on currency forwards, even though these are the flipside of currency induced valuation gains in the international equity portfolio.

[17] The seminal study on this aspect of asset allocation is Brinson G, L. Randolph Hood, and Gilbert L. Beebower, *Determinants of Portfolio Performance*, The Financial Analysts Journal, July/August 1986. The structure of this study is not relevant to the importance of asset allocation in explaining performance variation across superannuation funds for a specific time period.

[18] *ASX Monthly Index Analysis* November 1987. The current gross yield of the Industrial segment of the S&P/ASX 200 of 6.4% would reduce to 5.4% if the bank weighting were 11%, other things being equal.

[19] Housing pessimists are encouraged by the regular survey of the Economist magazine (latest Economist (2013)) that estimates Australian housing to be 45% overvalued on the basis of rents and 23% on the basis of income ratios, ranking fifth out of eighteen surveyed countries in price level. Fox and Finlay (2012) show the dwelling price-to-income ratio on a median basis to be around 6.5, a

little below its 2005 peak, compared to a ratio of around 5.0 in 2000 before the final steep ascent.

[20] Muellbauer (2012) examines the diversity of factors contributing to housing busts and dismisses general comparisons. Australia did not experience a large expansion in housing supply as did the US, Ireland and Spain. Home lending in Australia is full recourse, unlike the US, so that bank foreclosures tend to occur where there is a high loan to value ratio and a high debt servicing ratio. In RBA (2013b) this problematic share of bank lending is estimated to be currently around 2%. On the negative side Australian mortgages tend to be floating rate, which increases sensitivity to any rise in interest rates due to funding pressures.

[21] The most recent results were summarised by Laker (2012). The stress scenario involves an economic contraction of 5%, a rise in unemployment to 12%, and a fall in house prices by 35%. Under the stress test bank Tier 1 capital fell by a weighted average of 3.8%.

[22] APRA imposes a bank specific Prudential Capital Requirement and an additional capital preservation buffer. If loan loss provisioning dents the capital preservation buffer, the dividend payout of the bank is restricted. The first restriction is a reduction in payout to 60% (the major banks currently average 74%). Payout then falls progressively to zero depending on the depletion of the buffer. Beyond the direct hit on capital, changes in provisions will also lift capital requirements via changes in risk weighting of assets.

[23] Based on the differential performance of S&P/ASX bank industry accumulation and price indices. Prior to March 2000 the S&P/ASX series is spliced with the earlier ASX industry series. Adjustments are made for the shift in dividend payment from December/January to December.