

## **ATTACHMENT 5 – WATSON WYATT PENSION PHASE STRATEGY**



## Retirement Income Modelling

**Challenger Group Services Pty. Ltd.**

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# Section 1: Introduction

- 1.1 Watson Wyatt has been commissioned by Challenger Group Services Pty. Ltd. ("Challenger") to carry out a detailed investigation to assist in further understanding the impact of different asset allocations in the post-retirement phase of an individual's life. This investigation focuses on the use of lifetime annuities as a replacement for bonds and cash as the defensive element of an individual's asset allocation.
- 1.2 The scope of Watson Wyatt's investigation is set out in this section.

## Previous work

- 1.3 In April 2009 Watson Wyatt issued a report entitled "Investment and Spending in Retirement – the Longevity Risk Impact"<sup>1</sup>. This report considered the risks associated with various investment and spending strategies in retirement. The investment strategies considered were portfolios of "growth" and "defensive" assets in varying proportions.

## Project objectives

- 1.4 Challenger has asked us to extend our existing research and modelling of retirement incomes in the following ways:
- to consider the use of lifetime annuities in place of the current defensive component of the retiree's investment portfolio;
  - to allow for the impact of different levels of platform and administration fees in the model; and
  - to investigate the effects of a market downturn early in the retirement period.
- 1.5 This report sets out the results of certain scenarios obtained using our projection model. In the process of producing the figures for this report, we have modelled a number of other scenarios to help understand the driving factors behind the presented outcomes. We would be happy to discuss further aspects of this work with you in due course and provide any further results you may require.

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<sup>1</sup> Available at [www.watsonwyatt.com](http://www.watsonwyatt.com)



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# Section 2: Methods and Assumptions

## Methods

- 2.1 We have created a retirement income model which allows us to perform stochastic projections of a new retiree's income and wealth for a set of given starting assumptions. For each projected scenario, the initial starting conditions required to perform the projection modelling are:
- an initial amount of retirement savings (the "initial account balance");
  - a target income level to be drawn in aggregate from all sources; and
  - an asset allocation decision for the account (i.e. a growth and defensive percentage allocation).
- 2.2 Each scenario is then run through the projection model twice. Once with the defensive allocation invested in a diversified bonds and cash portfolio and then repeated with the defensive allocation used to purchase a lifetime annuity at retirement. These are referred to as the "non-annuity" strategy and "annuity" strategy respectively.
- 2.3 Underlying the retirement income model is the Watson Wyatt Global Asset Model. This is a projection tool which generates stochastic rates of investment returns and other market indicators such as the level of Consumer Price Indexation (CPI) and Average Weekly Ordinary Time Earnings (AWE). The model includes most of the major global asset classes and a correlation matrix has been developed as part of this model to ensure results are as consistent as possible with real world outcomes.
- 2.4 As agreed with Challenger, Watson Wyatt's standard asset model has been modified to remove some short term effects which have been recently incorporated to reflect the current state of financial markets. These adjustments were deemed appropriate as this research is intended to reflect a long-term view on the performance of annuities in providing for retirement and therefore should avoid any bias in outcomes as a result of the current financial crisis.
- 2.5 Under the annuity strategy, the retirement income model begins by calculating the annuity income which would be generated by purchasing an annuity with the assumed defensive allocation. The annuity purchase price is a function of the market swap rates which are determined from interest rates generated by the stochastic investment model. The result is that annuity price is allowed to vary for each stochastic outcome in a manner consistent with the other projected variables. Once the annuity income has been determined, it increases annually in line with projected CPI from the stochastic investment model.
- 2.6 After allowing for the annuity income (if any), the balance of the target income, under both annuity and non-annuity strategies, is drawn from a combination of the Age Pension and drawings from the account based pension. This is an iterative process due to the social security means tests. The model then calculates the remaining account based pension balance at the end of the projection year, allowing for investment returns, fees and any income drawn, and begins the calculations for the next projection year.
- 2.7 The stochastic nature of the underlying investment model means that our retirement income model results in a probabilistic range of retirement income results which we are then able to use to draw conclusions.





## Assumptions

- 2.8 All investment returns and other market indicators used in the modelling in this report are generated using the Watson Wyatt Global Asset Model. Further details of that model and the underlying assumptions are contained in Appendix 2.
- 2.9 A summary of the non-investment related assumptions which drive the core results is set out below.

### *Core Results*

- All modelled scenarios consider a single female who retires at age 65;
- The initial account balance (before annuity purchase) is \$500,000;
- The target retirement income drawn by the retiree from all sources (Age Pension, annuity income and account based pension) is assumed to be the December 2008 ASFA-Westpac Comfortable income of \$37,621 pa. We assume that the target income increases annually in line with Average Weekly Ordinary Time Earnings (AWE);
- The adequate retirement income used for calculating the probability of inadequacy metric (defined in 3.3) is assumed to be the December 2008 ASFA-Westpac Modest income of \$19,450. We assume that the adequate income increases annually in line with AWE;
- The Age Pension commences at age 65 and is assessed annually each year. The maximum Age Pension is assumed to increase annually in line with AWE;
- Account based pension platform and administration fees are in line with the Superannuation Fees Report 2008 published by Rice Warner Actuaries. These have been labelled as "High Fees" for the purpose of this report;
- The asset allocation assumption is 70% growth asset classes and 30% defensive asset classes. Under the non-annuity strategy the account based pension assets are annually rebalanced to maintain the asset allocation;
- The defensive allocation is assumed to be invested entirely in a lifetime annuity under the annuity strategy or in a diversified bonds and cash portfolio under the non-annuity strategy;
- Lifetime annuity rates have been provided by Challenger and are determined by reference to interest rates generated by the investment model. A summary of the annuity rates provided and a more detailed description of this process is set out in Appendix 1. The income from the annuities in our model increases annually in line with the Consumer Price index (CPI), with a minimum of 0%; and
- All dollar amounts have been discounted at AWE in order to present results in today's dollars.



### *Other Scenarios*

Apart from the core scenario outlined above, we have also considered other scenarios to determine the sensitivity of the core result to variations in certain assumptions. The assumptions varied are:

- Initial account balance;
- Target and adequate income levels;
- Asset allocation;
- Account based pension fee levels; and

Further details of assumptions used are contained in Appendix 1.



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## Section 3: Key Concepts and Metrics

### Ruin vs Inadequacy

- 3.1 The fundamental metric which we examined in our April 2009 research paper was based on the concept of "Ruin". Ruin is defined as the risk of running out of money before death (i.e. becoming reliant on the Age Pension as the only source of income). The "probability of ruin" metric allows for uncertain investment returns (via the stochastic investment model) and the uncertainty of the retiree's lifespan (via a random lifespan based on the underlying retiree mortality assumptions).
- 3.2 When considering a strategy in which the retiree purchases a lifetime annuity at retirement, the concept of ruin falls away since under that strategy, while the retiree may still run out of money in their account based pension balance, the underlying annuity income means that they will never become reliant on the Age Pension as their only source of income.
- 3.3 We have therefore amended the concept of Ruin to become "Inadequacy". This is defined as the event of the retirement income falling to (or below) a predetermined "adequate" income level at any time over the modelled lifetime. Using this concept, we can now use the "probability of inadequacy" metric to compare results under annuity and non-annuity strategies.
- 3.4 The metric is still not perfect since ultimately the income under the annuity strategy will stabilise at a level (Age Pension + annuity income), which is greater than a strategy with no annuity (Age Pension only). That is to say, while this metric captures the probability of income falling below an adequate level, it does not allow for the differing extent of that inadequacy under the annuity and non-annuity strategies.

### Remaining account balance

- 3.5 In order to provide a comparable measure of the downside (and upside) risks associated with each scenario, we have also determined the remaining account based pension balance at each future age. This amount represents the bequest that the retiree would leave to their estate if they were to die at that age. Thus a larger dollar value could be viewed as leaving a larger bequest. Alternatively, it could be viewed as reflecting that a larger income (i.e. in excess of target) could have been drawn by the retiree up to that age.
- 3.6 If the account based pension balance is exhausted, this metric then shows a negative amount which reflects the cumulative amount of income shortfall relative to the target income level. In principle, this reflects the amount of money the retiree would need to borrow in order to continue receiving their target income level.
- 3.7 The concept of a cumulative shortfall could be viewed in the context of reverse mortgage products available in the market to homeowner retirees. In principle our retiree could access additional capital from their home to maintain the target retirement income when other sources are exhausted. One could therefore argue that interest should be added to these shortfall amounts at a rate similar to that charged in the reverse mortgage market. As an approximation to this, where a negative account balance arises we have allowed for interest to be added at cash rates.





### *Allowance for income in excess of target*

- 3.8 The remaining account balance in a year (as described above) does not reflect the fact that income in any preceding year may have exceeded target. This "excess income" may occur due to the inflexibility of the annuity income (where applicable) in any year and/or the minimum drawdown rules applying to the account based pension.
- 3.9 Without making an appropriate allowance for these years of excess income, the remaining account balance measure is not directly comparable under annuity and non-annuity strategies as a different total income has been received in the past.
- 3.10 An adjusted remaining account balance has therefore been created which makes allowance for income in excess of target, as follows.
- Income in excess of target income in any year is identified and allocated to a new account ("savings account"), we assume the excess income is saved rather than spent. Interest at cash rates is added to this account.
  - The savings account is not used to supplement shortfalls in the income below target income where the account based pension balance has been depleted. Hence, the savings account would continue to roll up with interest even where the retiree's account based pension assets are exhausted.
  - The savings account is added to the remaining account balance metric (described in 3.5 to 3.7 above), at each age.
  - The balance of the savings account is added to the individual's assets for the Age Pension means test calculation in each projection year.
- 3.11 The interpretation of the savings account is money set aside (outside the superannuation system) which adds to the individual's resources but is not used to supplement annual spending (and hence does not augment retirement income). While not a perfect representation of reality, within modelling constraints it is a reasonable means of allowing for years where income is in excess of the target level when calculating the remaining account balance metric. We have used this adjusted metric in the rest of this report.
- 3.12 We note also that the remaining account balance metric does not capture the fact that, under an annuity strategy, the retiree has the ongoing annuity income entitlement (as well as any positive remaining account balance) as support during any remaining years of life. Hence if the remaining account balance metric at a given retiree age has the same value under the annuity and non-annuity strategies, we would regard a retiree using an annuity strategy as being in a more secure financial position than one using a non-annuity strategy.



## Section 4: Analysis of Results

### Impact of purchasing an annuity (Core scenario results)

- 4.1 Our initial (core) results look at the impact of purchasing a lifetime annuity with the defensive allocation of the retiree's account balance. The results analysed here are based on the initial starting conditions and assumptions set out in 2.9.
- 4.2 The results for the core scenario are shown in Table 1 below and Figures 1.1 to 1.3 in Appendix 4.
- 4.3 Table 1 below shows the probability of inadequacy, and the "best" (95<sup>th</sup> percentile), median (50<sup>th</sup> percentile) and "worst" (5<sup>th</sup> percentile) outcomes of the remaining account balance (as discussed in sections 3.5 to 3.11) for our core scenario at age 90 (which is the assumed life expectancy for a 65 year old female).

Table 1: Core scenario results – impact of purchasing an annuity

| Initial Balance (\$) | Target Income (\$) | Adequate Income (\$) | Strategy    | Pr (Inadequacy) | Remaining account balance at age 90 (\$) |        |         |
|----------------------|--------------------|----------------------|-------------|-----------------|--|--------|---------|
|                      |                    |                      |             |                 | Worst                                    | Median | Best    |
| 500,000              | 37,621             | 19,450               | Non-annuity | 42%             | -167,867                                 | 18,682 | 348,781 |
| 500,000              | 37,621             | 19,450               | Annuity     | 4%              | -121,776                                 | 98,179 | 563,188 |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; High Fees.

- 4.4 These core results indicate that incorporating a lifetime annuity on the terms modelled into the retirement portfolio to replace a diversified bonds and cash allocation results in:
- a smaller risk of inadequacy; and
  - a larger remaining account balance (or a smaller shortfall) at age 90.
- 4.5 The charts in Appendix 4 show the progression of incomes and remaining account balances for various scenarios over time. Figure 1.3 shows the progression of the remaining account balance for each strategy under the core scenario presented in Table 1. The bars represent the 90% confidence interval with the "worst"/"best" outcomes in Table 1 being the bottom/top of the bar at age 90. The average modelled outcome is identified by the solid line.
- 4.6 From Figure 1.3, we can see that, at earlier ages, a larger remaining account balance is expected under the non-annuity strategy. This is due to the purchase of the annuity costing the member 30% of their initial account balance at retirement which would be non-refundable on early death. However, as time progresses the average modelled outcomes cross over as a result of the smaller income being drawn from the account based pension balance under the annuity strategy. On death anytime prior to age 81, the average remaining account balance is larger if an annuity is not purchased.





- 4.7 When these observations are considered along side Figures 1.1 and 1.2, we see that under both the annuity and non-annuity strategies the target income is still being received at age 81. If a retiree does not expect to live beyond age 81 we can therefore deduce that the non-annuity strategy would provide a better outcome for the retiree.
- 4.8 However, beyond age 82, Figure 1.3 shows that the average remaining account balance is larger under the annuity strategy. Furthermore, Figures 1.1 and 1.2 show that, on average, purchasing an annuity results in:
- target income being received for 6 years longer, with a larger income than target in some years due to the application of minimum drawdown rules for account based pensions;
  - income not falling below the adequate level, whereas under the non-annuity strategy the income becomes inadequate from age 99 onwards;
  - a reduction in the amount of income sourced by the Age Pension (visible by inspection); and
  - the sum of the average annuity income and the age pension providing an income which is greater than the adequate level until after age 100.
- 4.9 Table 1 also shows the probability of inadequacy over the retiree's lifetime. Adding an annuity on the terms modelled reduces the probability materially for the core scenario. The probability of inadequacy under the annuity strategy remains slightly greater than zero due to the stochastic annuity rates (which allows a possibility for the retiree purchasing annuities at unfavourable rates), and also the assumption that adequate income level is indexed with AWE, whereas annuity income is indexed with (lower) CPI.
- 4.10 Extending our analysis to look at more extreme outcomes, we can observe from Figure 1.3 that under the "best" outcome (95<sup>th</sup> percentile) the cross over of the annuity and non-annuity strategy occurs at age 77 - 4 years earlier than under the average result. Conversely, under the "worst" outcome (5<sup>th</sup> percentile) the cross over of the two strategies occur at age 83 - 2 years later than under the average result.
- 4.11 The reason that the "best" outcomes favour the annuity strategy (when the converse might have been expected) is the effective increase in growth exposure over time under the annuity strategy, as explained in 4.45 – 4.49 below.

### **Sensitivity to the initial account balance**

- 4.12 We have considered the effect of varying the amount of the initial account balance at retirement. We have looked at scenarios with initial account balances of \$1 million, \$250,000 and \$100,000 in place of the "core" \$500,000. In each case we have retained the same target and adequate incomes as the core scenario.
- 4.13 We have also modelled two further scenarios for the \$1 million and \$100,000 initial account balances where the target and adequate income levels have been adjusted to reflect a more appropriate income given the size of the initial account balance.



- 4.14 Table 2 shows the same metrics as Table 1 but under these initial account balance sensitivity scenarios. The results for our Core assumptions are also included below for easy comparison.

Table 2: Sensitivities to variation in initial account balance

| Initial Balance (\$) | Target Income (\$) | Adequate Income (\$) | Strategy    | Pr (Inadequacy) | Remaining account balance at age 90 (\$) |          |           |
|----------------------|--------------------|----------------------|-------------|-----------------|--|----------|-----------|
|                      |                    |                      |             |                 | Worst                                    | Median   | Best      |
| 1,000,000            | 37,621             | 19,450               | Non-Annuity | 6%              | 179,815                                  | 721,061  | 1,982,340 |
|                      |                    |                      | Annuity     | 1%              | 266,579                                  | 851,057  | 2,407,016 |
| 500,000              | 37,621             | 19,450               | Non-Annuity | 42%             | -167,867                                 | 18,682   | 348,781   |
|                      |                    |                      | Annuity     | 4%              | -121,776                                 | 98,179   | 563,188   |
| 250,000              | 37,621             | 19,450               | Non-Annuity | 90%             | -447,941                                 | -344,376 | -221,845  |
|                      |                    |                      | Annuity     | 75%             | -409,464                                 | -314,140 | -194,829  |
| 100,000              | 37,621             | 19,450               | Non-Annuity | 98%             | -688,130                                 | -546,661 | -443,139  |
|                      |                    |                      | Annuity     | 98%             | -658,802                                 | -525,762 | -427,193  |
| 1,000,000            | 75,242             | 38,900               | Non-Annuity | 70%             | -788,096                                 | -422,117 | 417,291   |
|                      |                    |                      | Annuity     | 66%             | -712,485                                 | -351,164 | 825,758   |
| 100,000              | 19,450             | 14,971               | Non-Annuity | 24%             | -20,729                                  | 40,507   | 158,197   |
|                      |                    |                      | Annuity     | 0%              | -10,422                                  | 56,099   | 189,047   |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; High Fees.

- 4.15 In all cases considered, adding an annuity on the terms modelled to the portfolio continues to result in improved "best" outcomes and less poor "worst" outcomes at age 90 than the corresponding non-annuity strategy. Figures 2.3, 3.3, 4.3, 5.3 and 6.3 show similar results to Figure 1.3 in that, in the years following retirement, the remaining account balance on death is larger under the non-annuity strategy. However, there is a cross over age in each chart beyond which a larger remaining account balance at each future age is provided under the annuity strategy.
- 4.16 Figures 1.1 to 6.3 in Appendix 4 contain all the corresponding charts to the scenarios set out in Table 2.





## Sensitivity to asset allocation

4.17 We have considered the effect of varying the underlying asset allocation in our core scenario. The alternative allocations we have investigated are:

- 100% Defensive;
- 30% Growth / 70% Defensive;
- 50% Growth / 50% Defensive; and
- 90% Growth / 10% Defensive.

4.18 In each scenario the defensive allocation is either entirely used to purchase an annuity or entirely invested in a diversified bonds and cash portfolio. All other assumptions in the core scenario as set out in 2.9 have been retained.

4.19 The results to these sensitivities are set out in Table 3 which shows the usual metrics but under these asset allocation sensitivity scenarios. The results for our core assumptions are also included for easy comparison. Corresponding charts demonstrating these results are in Figures 7.1 to 10.3 of Appendix 4.

Table 3: Sensitivities to variation in asset allocation

| Asset Allocation |           |             | Remaining account balance at age 90 (\$) |          |          |         |
|------------------|-----------|-------------|--|----------|----------|---------|
| Growth           | Defensive | Strategy    | Pr (Inadequacy)                          | Worst    | Median   | Best    |
| 0%               | 100%      | Non-Annuity | 67%                                      | -180,359 | -103,035 | -2,698  |
|                  |           | Annuity     | 0%                                       | -115,676 | 28,296   | 254,911 |
| 30%              | 70%       | Non-Annuity | 57%                                      | -157,853 | -51,762  | 96,277  |
|                  |           | Annuity     | 0%                                       | -98,456  | 78,148   | 362,986 |
| 50%              | 50%       | Non-Annuity | 50%                                      | -160,139 | -18,006  | 204,226 |
|                  |           | Annuity     | 0%                                       | -102,315 | 96,905   | 462,624 |
| 70%              | 30%       | Non-Annuity | 42%                                      | -167,867 | 18,682   | 348,781 |
|                  |           | Annuity     | 4%                                       | -121,776 | 98,179   | 563,188 |
| 90%              | 10%       | Non-Annuity | 36%                                      | -183,093 | 55,496   | 594,990 |
|                  |           | Annuity     | 32%                                      | -163,898 | 84,891   | 691,012 |

Assumptions: Initial Balance \$500,000; Target income \$37,621 pa; Adequate income \$19,450 pa; High Fees.

- 4.20 The figures set out in Table 3 show that purchasing an annuity at retirement on the terms modelled provides a larger remaining account balance at age 90 over all asset allocation scenarios considered. This is consistent with our core scenario results and indicates that on the modelling assumptions used, purchasing an annuity improves this metric regardless of the asset allocation adopted. The improvement in this metric from purchasing an annuity is greater for high defensive asset allocations.
- 4.21 It is instructive also to examine the impact on this metric of varying asset allocation under an exclusively non-annuity (and alternatively, annuity) strategy. Under a non-annuity strategy, increasing the growth allocation in all cases improves the "best" and median outcomes. The "worst" outcome, conversely, deteriorates as the growth proportion is increased (with the exception of a shift from 0% to 30% growth assets), consistent with the greater downside risk of higher growth allocations. The results under an annuity strategy are broadly consistent, although the improvement in median outcomes is more marginal (and the metric actually worsens as the growth allocation is increased from 70% to 90%).
- 4.22 Figures 7.1 and 7.2 demonstrate an extreme scenario where the asset allocation is 100% defensive, and so the entire initial account balance is either invested in a bonds and cash portfolio or used to purchase an annuity. Under the annuity strategy, the income purchased, when combined with the Age Pension income, is sufficient to provide the target income until age 83. At that age, the impact of the annuity income being indexed with CPI rather than AWE means the income falls below the target level. However, the income never falls below the adequate level. Under the non-annuity strategy the target income is received until age 80 and then falls below the adequate level at around age 88.
- 4.23 Looking at the probability of inadequacy metric in Table 3, we see that an annuity strategy improves this metric relative to a non-annuity strategy under all asset allocations modelled. We note that the probabilities under the annuity strategy are zero when a proportion of greater than 30% of the initial account balance is used to purchase the annuity. This result is observed because the purchased level of annuity income proves to be larger than the benchmark adequate income used.
- 4.24 The probability of inadequacy metric demonstrates that, under a non-annuity strategy, the risk of achieving an inadequate income prior to death falls as the growth proportion in the account based pension is increased. This result is consistent with our previous results in our April 2009 report referred to in paragraph 1.3.
- 4.25 We have also modelled two further scenarios where we have assumed that the annuity allocation is capped at 30% of the initial account balance. In these scenarios the balance of the defensive portfolio remains in a diversified bonds and cash strategy. These scenarios are as follows:
- 30% Growth, 40% Bonds and Cash, 30% Annuities (Figure 11.1)
  - 50% Growth, 20% Bonds and Cash, 30% Annuities (Figure 12.1)

The corresponding tables for these scenarios are contained in Table 3.1 in Appendix 3.





## Sensitivity to level of account based pension fees

- 4.26 We have considered the effect of varying the level of fees associated with the account based pension. The core scenario allowed for administration and platform fees on invested assets in line with the Rice Warner Superannuation Fee Report 2008. We have also looked at the impact of using fees which are lower than those set out in the Rice Warner Report, and a no fee environment. Further details of the fees assumed are set out in Appendix 1. In each case we have retained all other assumptions as the core scenario as set out in 2.9.
- 4.27 The scenarios modelled to demonstrate the fee sensitivity are a repeat of our core scenario and the variations in initial account balance. This sensitivity has been modelled in order to capture the dependency of fees on the size of the account balance.
- 4.28 Table 4 shows the usual metrics for the fee sensitivity under our core scenario for easy comparison. The remaining fee sensitivity scenarios under the various initial account balances are contained in tables 4.1 to 4.3 in Appendix 3. We have only produced corresponding charts for the low fee scenario and these are contained in Figures 13.1 to 18.3.

Table 4: Sensitivities to variation in account based pension fees

| Fee Level | Strategy    | Pr<br>(Inadequacy) | Remaining account balance<br>at age 90 (\$) |         |         |
|-----------|-------------|--------------------|---|---------|---------|
|           |             |                    | Worst                                       | Median  | Best    |
| High      | Non-Annuity | 42%                | -167,867                                    | 18,682  | 348,781 |
|           | Annuity     | 4%                 | -121,776                                    | 98,179  | 563,188 |
| Low       | Non-Annuity | 38%                | -155,860                                    | 44,091  | 397,819 |
|           | Annuity     | 4%                 | -114,612                                    | 118,879 | 614,206 |
| None      | Non-Annuity | 35%                | -145,790                                    | 64,068  | 437,111 |
|           | Annuity     | 4%                 | -105,871                                    | 138,170 | 662,611 |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; Initial Balance \$500,000; Target income \$37,621 pa; Adequate income \$19,450 pa

- 4.29 The above figures demonstrate the obvious result that lowering the account based pension fees results in an increase in the remaining account balance at age 90. The improvement in remaining account balance at age 90 due to the purchase of an annuity is reasonably consistent across all fee scenarios.
- 4.30 Under the non-annuity strategy, Table 4 shows that the probability of inadequacy reduces as the fees on the account based pension are lowered. A similar result arises under the annuity strategy due to lower fees on the account based pension element. However, the probability of inadequacy is already small so the effect is not easily observed.

## Adverse Event Outcomes

- 4.31 A key driver of outcomes for retirees who hold an account based pension is the return on growth assets during the retirement period. In particular, early in the retirement period (where the dollar amount of the retiree's account balance is at its largest), the retiree is vulnerable to poor growth asset returns significantly eroding the size of their account balance and potentially reducing the likelihood of the retiree being able to draw enough to maintain target income throughout retirement.
- 4.32 The results presented in this report to this point capture the likelihood and impact of poor returns early in retirement in the stochastic scenarios modelled. That is, all of the outcomes generated include such poor return events, with the frequency and extent of such events in line with the underlying model assumptions.
- 4.33 Nonetheless it is instructive to explicitly identify the impact on retiree outcomes if poor returns occur early in the retirement period. This is equivalent to "stress testing" the chosen retirement strategy to see the effect of an adverse investment environment occurring shortly after a retiree's retirement date.
- 4.34 We have investigated this by defining the following as an "adverse event":

*"an average real (i.e. in excess of CPI) return on growth assets of -5% pa or less over any five year period during the first ten years following retirement".*

It should be noted that in any adverse event scenario, a recovery in growth asset returns after the first ten years is not precluded.

- 4.35 Using this definition, we have then isolated those stochastic outcomes where an adverse event occurs, generated the same metrics as previously (based on these outcomes), and compared results.
- 4.36 Table 5 below compares the core scenario results based on all outcomes, and alternatively adverse outcomes only.

Table 5: Core scenario results – Adverse event outcomes

| Outcomes | Strategy    | Pr<br>(Inadequacy) | Remaining account balance<br>at age 90 (\$) |          |         |
|----------|-------------|--------------------|---|----------|---------|
|          |             |                    | Worst                                       | Median   | Best    |
| All      | Non-Annuity | 42%                | -167,867                                    | 18,682   | 348,781 |
|          | Annuity     | 4%                 | -121,776                                    | 98,179   | 563,188 |
| Adverse  | Non-Annuity | 71%                | -252,260                                    | -150,650 | 738     |
|          | Annuity     | 5%                 | -205,358                                    | -98,312  | 91,900  |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; Initial Balance \$500,000; Target income \$37,621 pa; Adequate income \$19,450 pa





- 4.37 The results show that an adverse event is expected to lead to significantly worse outcomes for retirees (as measured by remaining account balance at age 90) under both non-annuity and annuity strategies. In particular, under each strategy the median outcome moves from a positive to a significant negative position.
- 4.38 When the probability of inadequacy metric is considered, however, the impact of an adverse event is minimal under an annuity strategy but material under a non-annuity strategy. The minimal impact under an annuity strategy reflects that the (less onerous) "adequate" income level can generally be met over time by the annuity income plus age pension even where growth returns early in the retirement period are adverse.

## Drivers of Results

- 4.39 On the metrics used, the results indicate a reduction in risk arising from a re-allocation of the defensive portion of the retiree's assets to an annuity at the date of retirement. The risk reduction is not uniform; however the reduction is robust to a range of different initial balances, target incomes and portfolio asset allocations.
- 4.40 We have undertaken some analyses to understand the key underlying drivers of these results. In our view the results are dependent on the following two important drivers

### *Annuity Pricing Basis vs Bond Portfolio Return*

- 4.41 The defensive portfolio used in the non-annuity strategies assumes a mix of government and corporate bonds and cash, with an overall expected return similar to that of Australian government bonds. The annuity pricing basis we have used as provided by Challenger is based on swap rates, and we have used an expected margin of swap rates over government bonds of approximately 100 bps (1%) pa. Further details of the annuity rates can be found in Appendix 1.
- 4.42 Hence by substituting a lifetime annuity for defensive assets, in return terms the retiree is effectively generating an additional 1% pa on those assets. However, there is no accompanying increase in risk – indeed, as the annuity payments are certain (no probability of life office default is modelled), on the risk metrics used a reduction in risk occurs. Effectively the retiree is relying on the life office and/or the surrounding regulatory environment to "absorb" the additional credit risk inherent in the assets underlying the annuity.

### *Effective Increase in Growth Exposure over time under Annuity Strategy*

- 4.43 Under the non-annuity strategies, assets are assumed to be rebalanced annually to the starting growth and defensive allocations (e.g. 70% / 30% under the core scenario). The retiree's proportional allocation to growth and defensive assets is therefore constant over time.
- 4.44 Given the higher assumed median return on growth assets compared to defensive assets, maintaining this constant growth/defensive proportion in fact requires (more often than not) a reallocation of assets from growth to defensive at the start of each year. (After a year where defensive assets outperformed growth, the reverse would be true). This process would be hidden from a retiree who invests via a managed portfolio which would maintain the proportion on the retiree's behalf.
- 4.45 Under the annuity strategy, the defensive assets are used to purchase an annuity at the start date, the remaining account balance (after the annuity purchase) is held in growth assets, and thereafter no reallocation between asset classes occurs.



- 4.46 By analogy with the non-annuity strategy, it can be seen that the higher median return on growth assets results in the overall growth exposure of the retiree's portfolio under the annuity strategy increasing over time. To maintain a constant growth allocation, it would be necessary to rebalance growth assets portfolios annually (e.g. by "selling" growth assets in good return years, and allocate assets to a defensive portfolio – either by purchasing further annuities or allocation the assets to a cash/bonds portfolio). This approach would cause the investment returns underlying the annuity and non-annuity strategies to be comparable, meaning the results would be driven instead by the "repackaging" effect of the retiree selecting annuities instead of bonds.
- 4.47 This possible alternative approach is outside the scope of this report.



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# Section 5: Reliances and Limitations

## Reliances

- 5.1 In carrying out our analysis and producing this Report we have relied without independent verification upon the accuracy and completeness of the data and information provided to us, both in written and oral form, by Challenger which produced the sources of information discussed in the Report.
- 5.2 Reliance has been placed upon, but not limited to, the lifetime annuity rates provided by Challenger found in Table 6 in Appendix 1.

## Limitations

- 5.3 The Report has been prepared by Watson Wyatt Limited on an agreed basis to meet the specific purposes of the Challenger Group Services Pty. Ltd. and must not be relied upon for any other purpose. The Report has been prepared for use by persons technically competent in the areas covered. Except with the written consent of Watson Wyatt Limited, the Report and any written or oral information or advice provided by Watson Wyatt Limited must not be reproduced, distributed or communicated in whole or in part to any other person, or be relied upon by any other person. Any reference to Watson Wyatt Limited in any report, accounts or other published documents is not authorised without our prior written consent.
- 5.4 The Report must be considered in its entirety since individual sections, if considered in isolation, may be misleading. Draft versions of the Report must not be relied upon by any person for any purpose. No reliance should be placed on any advice not given in writing. If reliance is placed contrary to the guidelines set out above, Watson Wyatt Limited disclaim any and all liability which may arise.
- 5.5 Assumptions are made about future experience, including mortality and morbidity. These assumptions have been made on the basis of reasonable estimates. However, actual future experience is likely to differ from these assumptions, due to random fluctuations, changes in the operating environment, and other factors. Such variations in experience could have a significant effect on the results and conclusions of this Report. No warranty is given by Watson Wyatt that the assumptions made in this Report will be reflected in actual future experience.
- 5.6 This Report was based on data available to Watson Wyatt Limited at, or prior to, 2 September 2009, and takes no account of developments after that date.
- 5.7 This Report is subject to the terms and limitations, including limitation of liability, set out in our engagement letter of 21 July 2009.



Nick Callil  
Consulting Actuary



Review: John Burnett  
Consulting Actuary

**Date: 2 September 2009**

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# Appendix 1: Modelling Assumptions

## 1.1 Investment Model

All results and analysis contained in this report are based on stochastic projections of a wide range of future market conditions, including investment returns for major asset classes and future levels of CPI and interest rates. Details of the methods and assumptions for the underlying Investment Model are set out separately in Appendix 2.

## 1.2 Model Retiree

Our investigations have been based on the assumption that the model retiree is a single female who retires at age 65. The retiree is assumed to be a homeowner (for Age Pension means test purposes).

Previous research was based on a retired couple. However, incorporating a spouse into the research adds a significant degree of complexity into the modelling parameters and adds to the challenge of presenting and analysing results. We believe that the key insights into the project objectives can be obtained without incorporating a spouse.

## 1.3 Mortality

In order to make a direct comparison of the impact of incorporating an annuity into a retiree's asset allocation in isolation, much of the analysis has been performed without regard to underlying mortality rates. This is necessary since incorporating mortality would dilute the average outcomes through members dying before running out of account based pension either with or without an annuity.

Where a mortality assumption has been adopted, the base table adopted is the Australian Life Tables 2005-07.

We have adjusted these tables to reflect the general principle that socio-economic status is a key driver behind differences in health and therefore mortality. On this basis we have assumed that retirees with larger superannuation savings exhibit lighter mortality than the general population due to access to better healthcare and a better general standard of living.

In addition, we have also made a further adjustment to the mortality tables to make a specific allowance for mortality improvements in the future.

The actual adjustments made are:

- Socio-economic status (SES) allowance: 75% of base rates at age 60 rising to 95% of table at age 100 and over; and
- Mortality Improvement: 25-year improvement factors in Australian Life Tables 2000-02 (Australian Government Actuary).

Based on the adjusted mortality, the expected future lifetime of a female aged 65 is 25 years. An equivalent male future lifetime is 22 years.

The mortality tables which underpin the lifetime annuity rates used in the research may differ to those referenced here. The annuity rates used have been provided by Challenger.





## 1.4 Initial Retirement Account Balance

In order to examine the impact of the magnitude of a retiree's amount of savings at retirement, we have modelled four initial account balances:

- \$1,000,000;
- \$500,000;
- \$250,000; and
- \$100,000.

The retiree is assumed to have no assets other than the initial account balance.

## 1.5 Target Retirement Income

In each modelled scenario, we have made an assumption about the level of target retirement income which the individual will receive. This target income is the combination of income from three sources: Age Pension income, lifetime annuity income (if any) and account based pension income. The annual amount of income drawn from the account based pension is calculated as the balancing item required in order to achieve the target income in each year. This is an iterative process due to the social security means tests.

For the purpose of modelling, our core assumption is to assume that the initial target income is the December 2008 ASFA-Westpac Comfortable income level of \$37,621 pa ("Comfortable"). We have then extended our investigation to two additional scenarios set out below:

- \$1,000,000 with a target income of \$75,242 pa ( $2 \times$  Comfortable)
- \$100,000 with a target income of \$19,450 pa (Modest)

These additional scenarios have been modelled to reflect a target income which is more sustainable given the level of initial account balance.

## 1.6 Adequate Retirement Income

In each modelled scenario, we have made an assumption about the level of "adequate" retirement income. We assume that falling below this income level is an unacceptable outcome for the retiree.

For the purpose of modelling, our core assumption is to assume that the initial adequate income is the December 2008 ASFA-Westpac Modest income level of \$19,450 pa ("Modest"). The assumed adequate income level for the two additional scenarios is set out below:

- \$1,000,000 with an adequate income of \$38,900 pa ( $2 \times$  Modest)
- \$100,000 with an adequate income of \$14,971 pa (Maximum Age Pension)

As with the target income for these additional scenarios, the adequate income level adopted is designed to reflect an income which may be more appropriate to the level of initial account balance.

## 1.7 Indexation of Retirement Income

We have assumed that both the target income and the adequate income are indexed in line with Average Weekly Ordinary Time Earnings (AWE) in the future. The choice of index used is significant and materially affects the results. Using AWE rather than the Consumer Price Index (CPI) is justified by the following:

- Using AWE reflects an aspiration that living standards of retirees keep pace with those of the working community; and
- The Government Age Pension is indexed annually at AWE. With the Age Pension indexed at AWE, indexing the total target income at CPI (generally assumed to be 1-2% lower than AWE) results in a "crowding out" of the account based pension components of the retiree's income at later ages, so that the longevity and investment risk for such a retiree is limited because the Age Pension quickly becomes a greater proportion of target income.

## 1.8 Lifetime Annuity Rates

Challenger has provided us with a table of Lifetime Annuity Rates for use in this research. We understand that the rates provided are appropriate for a female retiree and have been provided on a number of different interest rates to enable their use in the stochastic model. We have assumed that the rates provided by Challenger are appropriate for the purpose of this research and have not performed any reasonableness or consistency checks.

A summary of the annuity rates used in this investigation is set out below.

Table 6: Annuity Rates for a 65 year old female - CPI indexed Lifetime annuity

| Swap Rate (Real) | Annuity Rate<br>(\$ pa per \$100,000) |
|------------------|---------------------------------------|
| 1%               | 4,266                                 |
| 2%               | 5,116                                 |
| 3%               | 6,017                                 |
| 4%               | 6,950                                 |
| 5%               | 7,893                                 |
| 6%               | 8,828                                 |
| 7%               | 9,737                                 |
| 8%               | 10,608                                |
| 9%               | 11,429                                |
| 10%              | 12,195                                |





The Watson Wyatt Global Asset Model does not generate swap rates. We have therefore agreed with Challenger that real swap rates used to determine the CPI indexed annuities should be derived from the model at the start of the projection period as follows:

- the yield on 10 year Commonwealth Government Bonds; plus
- two thirds of the AA corporate bond spread; less
- expected long term price inflation.

The average real swap rate generated is 4.1% pa, which implies an average annuity rate of \$7,044 pa per \$100,000.

## **1.9 Asset Allocation**

The fundamental objective of this project is to compare modelled outcomes for various growth/defensive asset allocations where the defensive element of the portfolio is invested either in a lifetime annuity product or in the usual defensive asset classes.

We have modelled a number of different investment allocations with a varying exposure to defensive asset classes. In the scenarios where a lifetime annuity is purchased as the defensive portion of the allocation, it is assumed that the remaining assets are fully invested in growth type asset classes.

We note that this assumption takes no account of the risk appetite of retirees. For example, it is possible that, even with the safety net of a lifetime annuity, a retiree may still be cautious about investing their account based pension assets fully in growth type assets and so may choose to still hold a further portion of defensive assets to back their account based pension. We have considered this point further in the results set out in Table 3.1 of Appendix 3.

The account based pension account is rebalanced annually to maintain the desired asset allocations over time.

## **1.10 Account based Pension Fees**

As part of the project objectives, Challenger has requested that the model is extended to incorporate projections both with and without the inclusion of platform, administration and investment management fees. No additional fees are to be incorporated into the lifetime annuity element of the calculations as we understand that the annuity rates already include a margin for expenses.

We have not included an explicit assumption for investment management fees. Returns from the Global Asset Model are assumed to be net of these fees.

As agreed with Challenger, we have assumed the fees to be those set out in the Superannuation Fees Report 2008 prepared for IFSA by Rice Warner Actuaries. The table below sets out an extract from that report detailing the average fees for Retail Retirement Income Products which we have incorporated into our model.

We have also created a second set of fee assumptions which has been based on a survey of 12 industry fund super pension divisions. These entities tend to charge lower fees than public offer retail funds and we have therefore identified this as our low fee assumption. Details of the fees assumed are set out below.

Table 7: Account Based Pension Fees

| Account Balance         | High Fee Assumption* |              | Low Fee Assumption# |            |
|-------------------------|----------------------|--------------|---------------------|------------|
|                         | Administration (%)   | Platform (%) | Administration %    | Platform % |
| >\$1 million            | 0.01                 | 0.33         | 0.16                | 0          |
| \$500,000 - \$1 million | 0.01                 | 0.38         | 0.18                | 0          |
| \$250,000 - \$500,000   | 0.02                 | 0.44         | 0.23                | 0          |
| \$100,000 - \$250,000   | 0.05                 | 0.51         | 0.27                | 0          |
| \$50,000 - \$100,000    | 0.10                 | 0.58         | 0.32                | 0          |
| \$25,000 - \$50,000     | 0.22                 | 0.67         | 0.46                | 0          |
| <\$25,000               | 0.99                 | 0.77         | 0.75                | 0          |

\* - Allocated pension Open Products Expense Rate (%) – Retail Retirement Income Products, Superannuation Fees Report 2008, Rice Warner Actuaries

# - Based on research across 12 industry super pension divisions.

## 1.11 Age Pension

In all scenarios modelled, we have integrated the income provided by the Age Pension. When calculating the Age Pension income in each future projection year, the model allows appropriately for the remaining account based pension balance and any annuity purchased at retirement in the means test calculation for that projection year.



Table 8: Age Pension rules

| Age Pension<br>(effective from 20 March 2009) available from age 65 | Singles   | Couples   |            |
|---|-----------|-----------|------------|
| Full Age Pension Rate (per fortnight)                               | \$569.80  | \$475.90  | (each)     |
| Income Test   |           |           |            |
| Threshold (per fortnight)   | \$138.00  | \$240.00  | (combined) |
| Rate of Reduction (per dollar over threshold)                       | \$0.40    | \$0.20    | (each)     |
| Assets Test   |           |           |            |
| Threshold: Homeowners   | \$171,750 | \$243,500 | (combined) |
| Threshold: Non-homeowners   | \$296,250 | \$368,000 | (combined) |
| Rate of Reduction (per fortnight per \$1,000 over threshold)        | \$1.50    | \$1.50    | (combined) |
| Pharmaceutical Allowance (per fortnight)                            | \$6.00    | \$3.00    | (each)     |





## Appendix 2: A summary of the Watson Wyatt asset modelling assumptions as at 31 March 2009

The tables and charts in this Appendix show the summary statistics for the major asset classes included in the Watson Wyatt Global Asset Model as at 31 March 2009 from the perspective of an Australian investor who is valuing his or her investments in Australian dollars.

We believe that we are currently in an abnormal economic environment and in a number of areas our short term expectations differ from our views of longer term central outcomes. However, this investigation is looking at the long term impact of incorporating annuities into retirement incomes and we have therefore removed the short term assumptions from our standard asset model in order to reflect a long term view.

The tables below show the arithmetic average, median and standard deviation of return in the first year of projection. We also show the median and standard deviation of annualized returns over a 10-year period and in the long-term – median returns behave similarly to longer-term geometric average returns, and are therefore a more natural basis for comparison with past history. These assumptions are *before* allowing for the effects of tax and investment management expenses.

The return assumptions given for each mainstream asset class (i.e. equities, property, bonds, credit and cash) and certain alternatives (i.e. commodity futures, local currency emerging market debt) represent the expected market average (index) returns that an institutional investor could expect to achieve through a passive investment management approach. As such, they do not include expected premia for active investment management, or any offsets for the risks and costs of managing active strategies.

The return assumptions for private equity, infrastructure and fund of hedge funds are based on the return net of fees that could be expected from a low (active) risk, well diversified exposure such as through a fund of funds.





Table 9: Watson Wyatt Assumptions as at 31 March 2009  
Denominated in AUD, nominal, gross of tax

| Asset class                             | Actual             |        |                    | 10-year annualized |                    |
|---|--------------------|--------|--------------------|--------------------|--------------------|
|   | Arithmetic average | Median | Standard deviation | Median             | Standard deviation |
| <b>Price Inflation (CPI)</b>            | 2.5                | 2.5    | 1.6                | 2.5                | 0.4                |
| <b>Wage Inflation (AWE)</b>             | 4.1                | 4.0    | 2.6                | 4.1                | 0.8                |
| <b>Cash &amp; Bonds</b>                 |                    |        |                    |                    |                    |
| Cash                                    | 5.1                | 5.1    | 1.2                | 5.1                | 0.4                |
| Australian 10yr Govt Bonds Return       | 5.9                | 5.4    | 7.9                | 5.6                | 0.5                |
| Australian 10yr Govt Bonds Yield        | 5.6                | 5.5    | 1.3                | 5.6                | 0.5                |
| Australian Fixed Interest               | 5.9                | 5.7    | 4.0                | 5.9                | 0.5                |
| Australian Inflation-Linked Bonds       | 4.9                | 4.8    | 4.2                | 4.8                | 0.4                |
| Global Bonds (Govt, hedged)             | 5.5                | 5.3    | 3.8                | 5.4                | 0.5                |
| Global Bonds (Aggregate, hedged)        | 6.1                | 5.9    | 4.0                | 6.0                | 0.5                |
| Global Inflation-Linked Bonds (hedged)  | 5.5                | 5.3    | 4.4                | 5.4                | 0.4                |
| Australian All Corp Bond Spread         | 1.5                | 1.5    | 0.6                | 1.5                | 0.1                |
| <b>Equities</b>                         |                    |        |                    |                    |                    |
| Australian Equities                     | 9.7                | 8.3    | 18.4               | 8.2                | 2.5                |
| Australian Small Cap Equities           | 10.6               | 8.2    | 23.3               | 8.3                | 3.2                |
| Global Equities (ex Aus, unhedged)      | 9.8                | 8.7    | 15.6               | 8.8                | 2.1                |
| Global Equities (ex Aus, hedged)        | 10.5               | 9.5    | 15.4               | 9.5                | 2.1                |
| Emerging Market Equities (unhedged)     | 13.3               | 9.0    | 32.6               | 8.9                | 4.0                |
| <b>Property</b>                         |                    |        |                    |                    |                    |
| Australian Unlisted Property            | 7.6                | 7.1    | 10.0               | 7.1                | 1.4                |
| Australian Listed Property              | 8.1                | 6.5    | 18.7               | 6.5                | 2.6                |
| Global Listed Property (hedged)         | 8.2                | 7.1    | 15.2               | 7.1                | 2.1                |
| <b>Credit</b>                           |                    |        |                    |                    |                    |
| Emerging Market Debt (hedged)           | 7.6                | 7.6    | 15.9               | 6.4                | 2.3                |
| High Yield Debt (hedged)                | 8.8                | 8.4    | 10.2               | 8.4                | 1.5                |
| Australian Investment Grade Credit      | 6.6                | 6.4    | 4.7                | 6.5                | 0.5                |
| Global Investment Grade Credit (hedged) | 6.8                | 6.6    | 4.7                | 6.7                | 0.5                |
| <b>Alternative assets</b>               |                    |        |                    |                    |                    |
| Fund of Hedge Funds (hedged)            | 7.7                | 7.5    | 6.7                | 7.5                | 1.0                |
| Private Equity (global, unhedged)       | 9.8                | 7.5    | 23.4               | 7.4                | 3.0                |
| Global Infrastructure (hedged)          | 9.6                | 9.1    | 13.7               | 8.8                | 1.8                |
| Commodity Futures (hedged)              | 7.5                | 5.6    | 20.3               | 5.6                | 2.8                |
| Timber (unhedged)                       | 9.3                | 7.1    | 22.1               | 7.1                | 3.9                |
| Emerging Market Cash (unhedged)         | 7.1                | 6.9    | 7.3                | 6.9                | 2.3                |
| Local Currency EMD (unhedged)           | 8.2                | 6.8    | 17.2               | 6.9                | 5.3                |
| <b>Equity Risk Premium</b>              |                    |        |                    |                    |                    |
| Aus equities – Aus govt bonds           | 3.8                |        |                    |                    |                    |
| Aus equities – Aus ILBs                 | 4.8                |        |                    |                    |                    |

Table 10: Assumptions underlying the Account based pension at 31 March 2009  
Denominated in AUD, nominal, gross of tax

| Portfolio   | Arithmetic average | Actual |                    | 10-year annualized |                    |
|-------------|--------------------|--------|--------------------|--------------------|--------------------|
|             |                    | Median | Standard deviation | Median             | Standard deviation |
| 0% Growth   | 5.8                | 5.6    | 2.7                | 5.7                | 0.4                |
| 30% Growth  | 6.9                | 6.6    | 4.4                | 6.8                | 0.6                |
| 50% Growth  | 7.6                | 7.2    | 6.5                | 7.4                | 0.9                |
| 70% Growth  | 8.4                | 7.8    | 8.7                | 8.0                | 1.2                |
| 90% Growth  | 9.1                | 8.4    | 11.1               | 8.5                | 1.6                |
| 100% Growth | 9.5                | 8.7    | 12.3               | 8.8                | 1.7                |

Please note that our assumptions are intended to be long-term assumptions, and as such they are intended to be used in setting long term or strategic asset allocations. They are not intended to be representative of short term experiences (for example over the next year), but rather they could be considered to represent the experience of an "average" year over the next ten years.

## Correlation assumptions

Correlation is a statistical measure that describes the extent to which the returns from two asset classes are linked. The correlations of returns between the different asset classes describe important characteristics of the Global Asset Model in addition to the expected annual return and the standard deviation of annual returns.

Table 11 shows the key correlations of nominal 1-year returns between assets used in the Global Asset Model. To help in interpreting these numbers, a figure below 0.3 (positive or negative) is indicative of low correlation, a figure between 0.3 and 0.5 indicates moderate correlation and a figure of above 0.5 indicates a high degree of correlation.



Table 11: Watson Wyatt Correlation matrix as at 31 March 2009

|              |  | 10yr Govt Bond Yield | 10yr Real Yield | Price Inflation (CPI) | Wage Inflation (AWOTE) | Aus Cash | Aus 10yr Govt Bonds | Aus Fixed Interest | Aus Inflation-Linked Bonds | Global Bonds (Govt. b) | Global Bonds (Agg. b) | Global HLBs (b) | Aus Equities | Aus Small Cap Equities | Global Equities (ex Aus. unh) | Global Equities (ex Aus.b) | Emerging Mkts Eq (unh) | Aus Unlisted Property | Aus Listed Property | Emerging Market Debt (b) | High Yield Debt (b) | Loans (b) | Australian Investment Grade Credit | Global Investment Grade Credit | Fund of Hedge Funds Credit (b) | Private Equity (global, unh) | Global Infrastructure (b) | Commodity Futures (b) | Timber (unh) | Emerging Market Cash - LC | Emerging Market Debt - LC |      |
|--------------|--|----------------------|-----------------|-----------------------|------------------------|----------|---------------------|--------------------|----------------------------|------------------------|-----------------------|-----------------|--------------|------------------------|-------------------------------|----------------------------|------------------------|-----------------------|---------------------|--------------------------|---------------------|-----------|------------------------------------|--------------------------------|--------------------------------|------------------------------|---------------------------|-----------------------|--------------|---------------------------|---------------------------|------|
| #            | Asset class                                | 1                    | 2               | 3                     | 4                      | 5        | 6                   | 7                  | 8                          | 9                      | 10                    | 11              | 12           | 13                     | 14                            | 15                         | 16                     | 17                    | 18                  | 19                       | 20                  | 21        | 22                                 | 23                             | 24                             | 25                           | 26                        | 27                    | 28           | 29                        | 30                        | 31   |
| Yields & Int | 1 10yr Govt Bond Yield                     | 1.00                 |                 |                       |                        |          |                     |                    |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 2 10yr Real Yield                          | 0.48                 | 1.00            |                       |                        |          |                     |                    |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 3 Price Inflation (CPI)                    | 0.54                 | 0.39            | 1.00                  |                        |          |                     |                    |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 4 Wage Inflation (AWOTE)                   | 0.34                 | 0.22            | 0.55                  | 1.00                   |          |                     |                    |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
| Bonds & Cash | 5 Australian Cash                          | 0.87                 | 0.46            | 0.71                  | 0.42                   | 1.00     | -0.33               |                    |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 6 Australian 10yr Govt Bonds               | -0.35                | -0.19           | -0.25                 | -0.08                  | -0.33    | 1.00                |                    |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 7 Australian Fixed Interest                | -0.19                | -0.12           | -0.20                 | -0.03                  | -0.22    | 0.84                | 1.00               |                            |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 8 Australian Inflation-Linked Bonds        | 0.22                 | -0.29           | 0.21                  | 0.15                   | 0.22     | 0.15                | 0.17               | 1.00                       |                        |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 9 Global Bonds (Government, hedged)        | -0.18                | -0.23           | 0.02                  | 0.02                   | -0.08    | 0.73                | 0.59               | 0.31                       | 1.00                   |                       |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 10 Global Bonds (Aggregate, hedged)        | -0.15                | -0.21           | 0.03                  | 0.03                   | -0.06    | 0.67                | 0.68               | 0.29                       | 0.93                   | 1.00                  |                 |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 11 Global Inflation-Linked Bonds (hedged)  | 0.21                 | -0.23           | 0.12                  | 0.11                   | 0.21     | 0.18                | 0.21               | 0.85                       | 0.34                   | 0.32                  | 1.00            |              |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
| Equities     | 12 Australian Equities                     | -0.02                | 0.03            | 0.05                  | 0.02                   | 0.00     | 0.06                | 0.09               | 0.00                       | -0.01                  | 0.09                  | -0.01           | 1.00         |                        |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 13 Australian Small Cap Equities           | -0.03                | 0.02            | 0.04                  | 0.01                   | -0.01    | 0.04                | 0.07               | 0.00                       | -0.02                  | 0.07                  | -0.01           | 0.82         | 1.00                   |                               |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 14 Global Equities (ex Aus, unhedged)      | 0.11                 | 0.04            | 0.12                  | 0.05                   | 0.11     | -0.07               | -0.02              | 0.02                       | 0.04                   | 0.15                  | 0.01            | 0.65         | 0.54                   | 1.00                          |                            |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 15 Global Equities (ex Aus, hedged)        | 0.08                 | 0.05            | 0.05                  | 0.02                   | 0.08     | -0.03               | 0.01               | 0.00                       | 0.03                   | 0.16                  | 0.00            | 0.83         | 0.68                   | 0.80                          | 1.00                       |                        |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 16 Emerging Market Equities (unhedged)     | 0.07                 | 0.03            | 0.08                  | 0.04                   | 0.07     | -0.04               | -0.01              | 0.01                       | 0.01                   | 0.07                  | 0.01            | 0.43         | 0.36                   | 0.55                          | 0.48                       | 1.00                   |                       |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 17 Australian Unlisted Property            | 0.16                 | 0.00            | 0.51                  | 0.24                   | 0.27     | -0.15               | -0.15              | 0.14                       | 0.07                   | 0.06                  | 0.08            | 0.02         | 0.03                   | 0.07                          | 0.01                       | 0.03                   | 1.00                  |                     |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
| Property     | 18 Australian Listed Property              | 0.04                 | 0.02            | 0.03                  | 0.01                   | 0.05     | -0.01               | 0.01               | 0.03                       | 0.02                   | 0.06                  | 0.02            | 0.31         | 0.26                   | 0.28                          | 0.36                       | 0.18                   | 0.31                  | 1.00                |                          |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 19 Global Listed Property (hedged)         | 0.04                 | 0.02            | 0.01                  | -0.02                  | 0.05     | -0.03               | 0.00               | -0.02                      | -0.01                  | 0.06                  | -0.01           | 0.40         | 0.33                   | 0.35                          | 0.45                       | 0.25                   | -0.01                 | 0.18                | 1.00                     |                     |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 20 Emerging Market Debt (hedged)           | 0.05                 | 0.01            | 0.03                  | 0.01                   | 0.04     | -0.01               | 0.01               | 0.01                       | 0.02                   | 0.08                  | 0.01            | 0.39         | 0.32                   | 0.35                          | 0.45                       | 0.53                   | 0.02                  | 0.18                | 0.23                     | 1.00                |           |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 21 High Yield Debt (hedged)                | 0.06                 | 0.02            | 0.04                  | 0.02                   | 0.06     | -0.03               | 0.01               | 0.01                       | 0.04                   | 0.14                  | 0.01            | 0.73         | 0.59                   | 0.65                          | 0.83                       | 0.43                   | 0.02                  | 0.31                | 0.43                     | 0.41                | 1.00      |                                    |                                |                                |                              |                           |                       |              |                           |                           |      |
| Credit       | 22 Australian Investment Grade Credit      | -0.10                | -0.07           | -0.12                 | -0.01                  | -0.13    | 0.47                | 0.87               | 0.11                       | 0.32                   | 0.53                  | 0.13            | 0.16         | 0.08                   | 0.02                          | 0.05                       | 0.01                   | -0.10                 | 0.02                | 0.03                     | 0.02                | 0.04      | 1.00                               |                                |                                |                              |                           |                       |              |                           |                           |      |
|              | 23 Global Investment Grade Credit (hedged) | -0.11                | -0.16           | 0.02                  | 0.02                   | -0.04    | 0.53                | 0.68               | 0.24                       | 0.76                   | 0.94                  | 0.26            | 0.18         | 0.14                   | 0.21                          | 0.26                       | 0.11                   | 0.05                  | 0.10                | 0.11                     | 0.12                | 0.23      | 0.66                               | 1.00                           |                                |                              |                           |                       |              |                           |                           |      |
|              | 24 US Loans (hedged)                       | 0.05                 | 0.03            | 0.06                  | 0.05                   | 0.06     | -0.02               | -0.01              | 0.00                       | -0.01                  | 0.03                  | 0.00            | 0.18         | 0.14                   | 0.21                          | 0.23                       | 0.10                   | 0.04                  | 0.10                | 0.11                     | 0.11                | 0.20      | -0.01                              | 0.07                           | 1.00                           |                              |                           |                       |              |                           |                           |      |
|              | 25 Fund of Hedge Funds (hedged)            | 0.14                 | 0.09            | 0.09                  | 0.06                   | 0.15     | -0.04               | 0.00               | 0.02                       | 0.00                   | 0.08                  | 0.02            | 0.53         | 0.44                   | 0.48                          | 0.59                       | 0.30                   | 0.02                  | 0.24                | 0.29                     | 0.28                | 0.54      | 0.03                               | 0.15                           | 0.16                           | 1.00                         |                           |                       |              |                           |                           |      |
| Alt. assets  | 26 Private Equity (global, unhedged)       | 0.09                 | 0.03            | 0.10                  | 0.04                   | 0.09     | -0.05               | -0.02              | 0.02                       | 0.02                   | 0.09                  | 0.01            | 0.54         | 0.44                   | 0.76                          | 0.60                       | 0.46                   | 0.06                  | 0.23                | 0.29                     | 0.29                | 0.55      | 0.02                               | 0.14                           | 0.15                           | 0.39                         | 1.00                      |                       |              |                           |                           |      |
|              | 27 Global Infrastructure (hedged)          | 0.14                 | -0.10           | 0.11                  | 0.07                   | 0.16     | 0.07                | 0.10               | 0.43                       | 0.21                   | 0.24                  | 0.50            | 0.31         | 0.25                   | 0.36                          | 0.37                       | 0.23                   | 0.07                  | 0.16                | 0.16                     | 0.20                | 0.33      | 0.08                               | 0.24                           | 0.08                           | 0.25                         | 0.29                      | 1.00                  |              |                           |                           |      |
|              | 28 Commodity Futures (hedged)              | 0.03                 | 0.02            | 0.03                  | 0.02                   | 0.04     | -0.05               | -0.05              | -0.02                      | -0.02                  | 0.00                  | -0.01           | 0.14         | 0.10                   | 0.13                          | 0.17                       | 0.08                   | 0.01                  | 0.06                | 0.10                     | 0.09                | 0.15      | -0.03                              | 0.02                           | 0.04                           | 0.12                         | 0.10                      | 0.06                  | 1.00         |                           |                           |      |
|              | 29 Timber (unhedged)                       | 0.09                 | 0.08            | 0.11                  | 0.06                   | 0.09     | -0.05               | -0.05              | 0.02                       | -0.01                  | -0.03                 | 0.01            | -0.11        | -0.10                  | 0.22                          | -0.11                      | 0.09                   | 0.07                  | -0.03               | -0.06                    | -0.07               | -0.11     | -0.05                              | -0.06                          | -0.02                          | -0.07                        | 0.21                      | 0.02                  | -0.02        | 1.00                      |                           |      |
|              | 30 Emerging Market Cash - Local Currency   | 0.13                 | 0.07            | 0.10                  | 0.05                   | 0.15     | -0.02               | 0.01               | 0.05                       | 0.01                   | 0.05                  | 0.05            | 0.27         | 0.23                   | 0.23                          | 0.31                       | 0.28                   | 0.03                  | 0.13                | 0.14                     | 0.49                | 0.28      | 0.02                               | 0.08                           | 0.08                           | 0.19                         | 0.21                      | 0.15                  | 0.06         | -0.05                     | 1.00                      |      |
|              | 31 Emerging Market Debt - Local Currency   | 0.06                 | 0.03            | 0.04                  | 0.01                   | 0.07     | 0.00                | 0.01               | 0.02                       | 0.02                   | 0.05                  | 0.03            | 0.22         | 0.19                   | 0.22                          | 0.26                       | 0.38                   | 0.01                  | 0.11                | 0.12                     | 0.76                | 0.24      | 0.01                               | 0.07                           | 0.06                           | 0.15                         | 0.18                      | 0.14                  | 0.07         | -0.04                     | 0.70                      | 1.00 |





## **Watson Wyatt global asset model: Confidentiality and Disclaimer**

*The assumptions shown in this Appendix and used for this report have been derived by Watson Wyatt through a blend of economic theory, historical analysis and the views of investment managers. They inevitably contain an element of subjective judgment.*

*These assumptions are intended to be used in conjunction with Watson Wyatt's global asset model, for the purpose of setting long term or strategic asset allocations.*

*The key component of an asset allocation study is the way in which the assets are modelled. The structure of the Watson Wyatt global asset model is based on historical analysis of investment returns, although Watson Wyatt has incorporated its subjective judgement to complement the information provided by historical returns. The model is designed to illustrate the future range of returns stemming from different asset classes and their inter-relationship. It should be noted that no economic model could be expected to perfectly capture future uncertainty, particularly the risk of extreme events.*

*In particular it should be noted that our timeframe in establishing our asset model and the assumptions used in the model is long-term, and as such it is not meant to be precisely reflective of the likely course of the investment markets in the short-term. Furthermore, our opinions and return forecasts are not intended to imply, nor should be interpreted as conveying, any form of guarantee or assurance by Watson Wyatt, of the future performance of the asset classes in question, either favourable or unfavourable. Past performance should not be taken as representing any particular guide to future performance.*



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## Appendix 3: Supporting Tables

Table 1: Core scenario results – impact of purchasing an annuity

| Initial Balance (\$) | Target Income (\$) | Adequate Income (\$) | Strategy    | Pr (Inadequacy) | Remaining account balance at age 90 (\$) |        |         |
|----------------------|--------------------|----------------------|-------------|-----------------|--|--------|---------|
|                      |                    |                      |             |                 | Worst                                    | Median | Best    |
| 500,000              | 37,621             | 19,450               | Non-Annuity | 42%             | -167,867                                 | 18,682 | 348,781 |
| 500,000              | 37,621             | 19,450               | Annuity     | 4%              | -121,776                                 | 98,179 | 563,188 |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; High Fees.

Table 2: Sensitivities to variation in initial account balance

| Initial Balance (\$) | Target Income (\$) | Adequate Income (\$) | Strategy    | Pr (Inadequacy) | Remaining account balance at age 90 (\$) |          |           |
|----------------------|--------------------|----------------------|-------------|-----------------|--|----------|-----------|
|                      |                    |                      |             |                 | Worst                                    | Median   | Best      |
| 1,000,000            | 37,621             | 19,450               | Non-Annuity | 6%              | 179,815                                  | 721,061  | 1,982,340 |
|                      |                    |                      | Annuity     | 1%              | 266,579                                  | 851,057  | 2,407,016 |
| 500,000              | 37,621             | 19,450               | Non-Annuity | 42%             | -167,867                                 | 18,682   | 348,781   |
|                      |                    |                      | Annuity     | 4%              | -121,776                                 | 98,179   | 563,188   |
| 250,000              | 37,621             | 19,450               | Non-Annuity | 90%             | -447,941                                 | -344,376 | -221,845  |
|                      |                    |                      | Annuity     | 75%             | -409,464                                 | -314,140 | -194,829  |
| 100,000              | 37,621             | 19,450               | Non-Annuity | 98%             | -688,130                                 | -546,661 | -443,139  |
|                      |                    |                      | Annuity     | 98%             | -658,802                                 | -525,762 | -427,193  |
| 1,000,000            | 75,242             | 38,900               | Non-Annuity | 70%             | -788,096                                 | -422,117 | 417,291   |
|                      |                    |                      | Annuity     | 66%             | -712,485                                 | -351,164 | 825,758   |
| 100,000              | 19,450             | 14,971               | Non-Annuity | 24%             | -20,729                                  | 40,507   | 158,197   |
|                      |                    |                      | Annuity     | 0%              | -10,422                                  | 56,099   | 189,047   |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; High Fees.





Table 3: Sensitivities to variation in asset allocation

| Asset Allocation |           |             |                 | Remaining account balance at age 90 (\$) |          |         |
|------------------|-----------|-------------|-----------------|--|----------|---------|
| Growth           | Defensive | Strategy    | Pr (Inadequacy) | Worst                                    | Median   | Best    |
| 0%               | 100%      | Non-Annuity | 67%             | -180,359                                 | -103,035 | -2,698  |
|                  |           | Annuity     | 0%              | -115,676                                 | 28,296   | 254,911 |
| 30%              | 70%       | Non-Annuity | 57%             | -157,853                                 | -51,762  | 96,277  |
|                  |           | Annuity     | 0%              | -98,456                                  | 78,148   | 362,986 |
| 50%              | 50%       | Non-Annuity | 50%             | -160,139                                 | -18,006  | 204,226 |
|                  |           | Annuity     | 0%              | -102,315                                 | 96,905   | 462,624 |
| 70%              | 30%       | Non-Annuity | 42%             | -167,867                                 | 18,682   | 348,781 |
|                  |           | Annuity     | 4%              | -121,776                                 | 98,179   | 563,188 |
| 90%              | 10%       | Non-Annuity | 36%             | -183,093                                 | 55,496   | 594,990 |
|                  |           | Annuity     | 32%             | -163,898                                 | 84,891   | 691,012 |

Assumptions: Initial Balance \$500,000; Target income \$37,621 pa; Adequate income \$19,450 pa; High Fees.

Table 3.1: Sensitivities to variation in asset allocation - Annuity allocation capped at 30%

| Asset Allocation |       |           |                 | Remaining account balance at age 90 (\$) |         |         |
|------------------|-------|-----------|-----------------|--|---------|---------|
| Growth           | Bonds | Annuities | Pr (Inadequacy) | Worst                                    | Median  | Best    |
| 30%              | 70%   | 0%        | 57%             | -157,853                                 | -51,762 | 96,277  |
| 30%              | 40%   | 30%       | 5%              | -113,598                                 | 9,926   | 193,737 |
| 50%              | 50%   | 0%        | 50%             | -160,139                                 | -18,006 | 204,226 |
| 50%              | 20%   | 30%       | 4%              | -113,798                                 | 51,869  | 329,143 |
| 70%              | 30%   | 0%        | 42%             | -167,867                                 | 18,682  | 348,781 |
| 70%              | 0%    | 30%       | 4%              | -121,776                                 | 98,179  | 563,188 |

Assumptions: Initial Balance \$500,000; Target income \$37,621 pa; Adequate income \$19,450 pa; High Fees.



Table 4: Sensitivities to variation in account based pension fees

| Fee Level | Strategy    | Pr<br>(Inadequacy) | Remaining account balance<br>at age 90 (\$) |         |         |
|-----------|-------------|--------------------|---|---------|---------|
|           |             |                    | Worst                                       | Median  | Best    |
| High      | Non-Annuity | 42%                | -167,867                                    | 18,682  | 348,781 |
|           | Annuity     | 4%                 | -121,776                                    | 98,179  | 563,188 |
| Low       | Non-Annuity | 38%                | -155,860                                    | 44,091  | 397,819 |
|           | Annuity     | 4%                 | -114,612                                    | 118,879 | 614,206 |
| None      | Non-Annuity | 35%                | -145,790                                    | 64,068  | 437,111 |
|           | Annuity     | 4%                 | -105,871                                    | 138,170 | 662,611 |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; Initial Balance \$500,000; Target income \$37,621 pa; Adequate income \$19,450 pa

Table 4.1: Sensitivities to variation in initial account balance – High fees

| Initial<br>Balance<br>(\$) | Target<br>Income<br>(\$) | Adequate<br>Income<br>(\$) | Strategy    | Pr<br>(Inadequacy) | Remaining account balance<br>at age 90 (\$) |          |           |
|----------------------------|--------------------------|----------------------------|-------------|--------------------|---|----------|-----------|
|                            |                          |                            |             |                    | Worst                                       | Median   | Best      |
| 1,000,000                  | 37,621                   | 19,450                     | Non-Annuity | 6%                 | 179,815                                     | 721,061  | 1,982,340 |
|                            |                          |                            | Annuity     | 1%                 | 266,579                                     | 851,057  | 2,407,016 |
| 500,000                    | 37,621                   | 19,450                     | Non-Annuity | 42%                | -167,867                                    | 18,682   | 348,781   |
|                            |                          |                            | Annuity     | 4%                 | -121,776                                    | 98,179   | 563,188   |
| 250,000                    | 37,621                   | 19,450                     | Non-Annuity | 90%                | -447,941                                    | -344,376 | -221,845  |
|                            |                          |                            | Annuity     | 75%                | -409,464                                    | -314,140 | -194,829  |
| 100,000                    | 37,621                   | 19,450                     | Non-Annuity | 98%                | -688,130                                    | -546,661 | -443,139  |
|                            |                          |                            | Annuity     | 98%                | -658,802                                    | -525,762 | -427,193  |
| 1,000,000                  | 75,242                   | 38,900                     | Non-Annuity | 70%                | -788,096                                    | -422,117 | 417,291   |
|                            |                          |                            | Annuity     | 66%                | -712,485                                    | -351,164 | 825,758   |
| 100,000                    | 19,450                   | 14,971                     | Non-Annuity | 24%                | -20,729                                     | 40,507   | 158,197   |
|                            |                          |                            | Annuity     | 0%                 | -10,422                                     | 56,099   | 189,047   |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive; High Fees.



Table 4.2: Sensitivities to variation in initial account balance – Low fees

| Initial Balance (\$) | Target Income (\$) | Adequate Income (\$) | Strategy    | Pr (Inadequacy) | Remaining account balance at age 90 (\$) |          |           |
|----------------------|--------------------|----------------------|-------------|-----------------|--|----------|-----------|
|                      |                    |                      |             |                 | Worst                                    | Median   | Best      |
| 1,000,000            | 37,621             | 19,450               | Non-Annuity | 3%              | 206,911                                  | 794,661  | 2,118,643 |
|                      |                    |                      | Annuity     | 1%              | 283,397                                  | 906,553  | 2,545,671 |
| 500,000              | 37,621             | 19,450               | Non-Annuity | 38%             | -155,860                                 | 44,091   | 397,819   |
|                      |                    |                      | Annuity     | 4%              | -114,612                                 | 118,879  | 614,206   |
| 250,000              | 37,621             | 19,450               | Non-Annuity | 90%             | -442,426                                 | -338,200 | -208,470  |
|                      |                    |                      | Annuity     | 75%             | -408,174                                 | -312,075 | -185,834  |
| 100,000              | 37,621             | 19,450               | Non-Annuity | 98%             | -686,759                                 | -545,685 | -442,088  |
|                      |                    |                      | Annuity     | 98%             | -658,648                                 | -525,652 | -427,293  |
| 1,000,000            | 75,242             | 38,900               | Non-Annuity | 67%             | -768,171                                 | -383,603 | 534,918   |
|                      |                    |                      | Annuity     | 64%             | -705,188                                 | -331,173 | 961,981   |
| 100,000              | 19,450             | 14,971               | Non-Annuity | 19%             | -15,896                                  | 51,808   | 174,242   |
|                      |                    |                      | Annuity     | 0%              | -6,997                                   | 64,555   | 204,877   |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive.





Table 4.3: Sensitivities to variation in initial account balance – No fees

| Initial Balance (\$) | Target Income (\$) | Adequate Income (\$) | Strategy    | Pr (Inadequacy) | Remaining account balance at age 90 (\$) |          |           |
|----------------------|--------------------|----------------------|-------------|-----------------|--|----------|-----------|
|                      |                    |                      |             |                 | Worst                                    | Median   | Best      |
| 1,000,000            | 37,621             | 19,450               | Non-Annuity | 2%              | 228,428                                  | 846,431  | 2,203,154 |
|                      |                    |                      | Annuity     | 1%              | 297,834                                  | 950,612  | 2,638,033 |
| 500,000              | 37,621             | 19,450               | Non-Annuity | 35%             | -145,790                                 | 64,068   | 437,111   |
|                      |                    |                      | Annuity     | 4%              | -105,871                                 | 138,170  | 662,611   |
| 250,000              | 37,621             | 19,450               | Non-Annuity | 89%             | -437,650                                 | -332,807 | -197,612  |
|                      |                    |                      | Annuity     | 75%             | -405,178                                 | -308,984 | -178,350  |
| 100,000              | 37,621             | 19,450               | Non-Annuity | 98%             | -685,838                                 | -545,080 | -441,641  |
|                      |                    |                      | Annuity     | 98%             | -658,169                                 | -525,221 | -426,975  |
| 1,000,000            | 75,242             | 38,900               | Non-Annuity | 65%             | -753,776                                 | -358,709 | 618,126   |
|                      |                    |                      | Annuity     | 65%             | -693,358                                 | -310,026 | 1,044,261 |
| 100,000              | 19,450             | 14,971               | Non-Annuity | 15%             | -9,978                                   | 62,227   | 186,762   |
|                      |                    |                      | Annuity     | 0%              | -2,138                                   | 73,949   | 217,088   |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive.



Table 5: Core scenario results – Adverse event outcomes

| Outcomes | Strategy    | Pr<br>(Inadequacy) | Remaining account balance<br>at age 90 (\$) |          |         |
|----------|-------------|--------------------|---|----------|---------|
|          |             |                    | Worst                                       | Median   | Best    |
| All      | Non-Annuity | 42%                | -167,867                                    | 18,682   | 348,781 |
|          | Annuity     | 4%                 | -121,776                                    | 98,179   | 563,188 |
| Adverse  | Non-Annuity | 71%                | -252,260                                    | -150,650 | 738     |
|          | Annuity     | 5%                 | -205,358                                    | -98,312  | 91,900  |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive.

Table 5.1: Sensitivities to variation in initial account balance - adverse event outcomes

| Initial<br>Balance<br>(\$) | Target<br>Income<br>(\$) | Adequate<br>Income<br>(\$) | Strategy    | Pr<br>(Inadequacy) | Remaining account balance<br>at age 90 (\$) |          |          |
|----------------------------|--------------------------|----------------------------|-------------|--------------------|---|----------|----------|
|                            |                          |                            |             |                    | Worst                                       | Median   | Best     |
| 1,000,000                  | 37,621                   | 19,450                     | Non-Annuity | 20%                | 18,529                                      | 262,233  | 812,071  |
|                            |                          |                            | Annuity     | 0%                 | 122,311                                     | 371,321  | 906,020  |
| 500,000                    | 37,621                   | 19,450                     | Non-Annuity | 71%                | -252,260                                    | -150,650 | 738      |
|                            |                          |                            | Annuity     | 5%                 | -205,358                                    | -98,312  | 91,900   |
| 250,000                    | 37,621                   | 19,450                     | Non-Annuity | 92%                | -496,282                                    | -396,106 | -311,852 |
|                            |                          |                            | Annuity     | 70%                | -433,260                                    | -355,697 | -282,576 |
| 100,000                    | 37,621                   | 19,450                     | Non-Annuity | 97%                | -690,929                                    | -542,715 | -439,022 |
|                            |                          |                            | Annuity     | 98%                | -654,162                                    | -523,215 | -417,923 |
| 1,000,000                  | 75,242                   | 38,900                     | Non-Annuity | 87%                | -987,575                                    | -741,400 | -456,069 |
|                            |                          |                            | Annuity     | 86%                | -848,383                                    | -649,263 | -394,823 |
| 100,000                    | 19,450                   | 14,971                     | Non-Annuity | 61%                | -42,158                                     | -14,650  | 41,190   |
|                            |                          |                            | Annuity     | 0%                 | -31,603                                     | -3,344   | 54,570   |

Assumptions: Asset Allocation: 70% Growth / 30% Defensive.

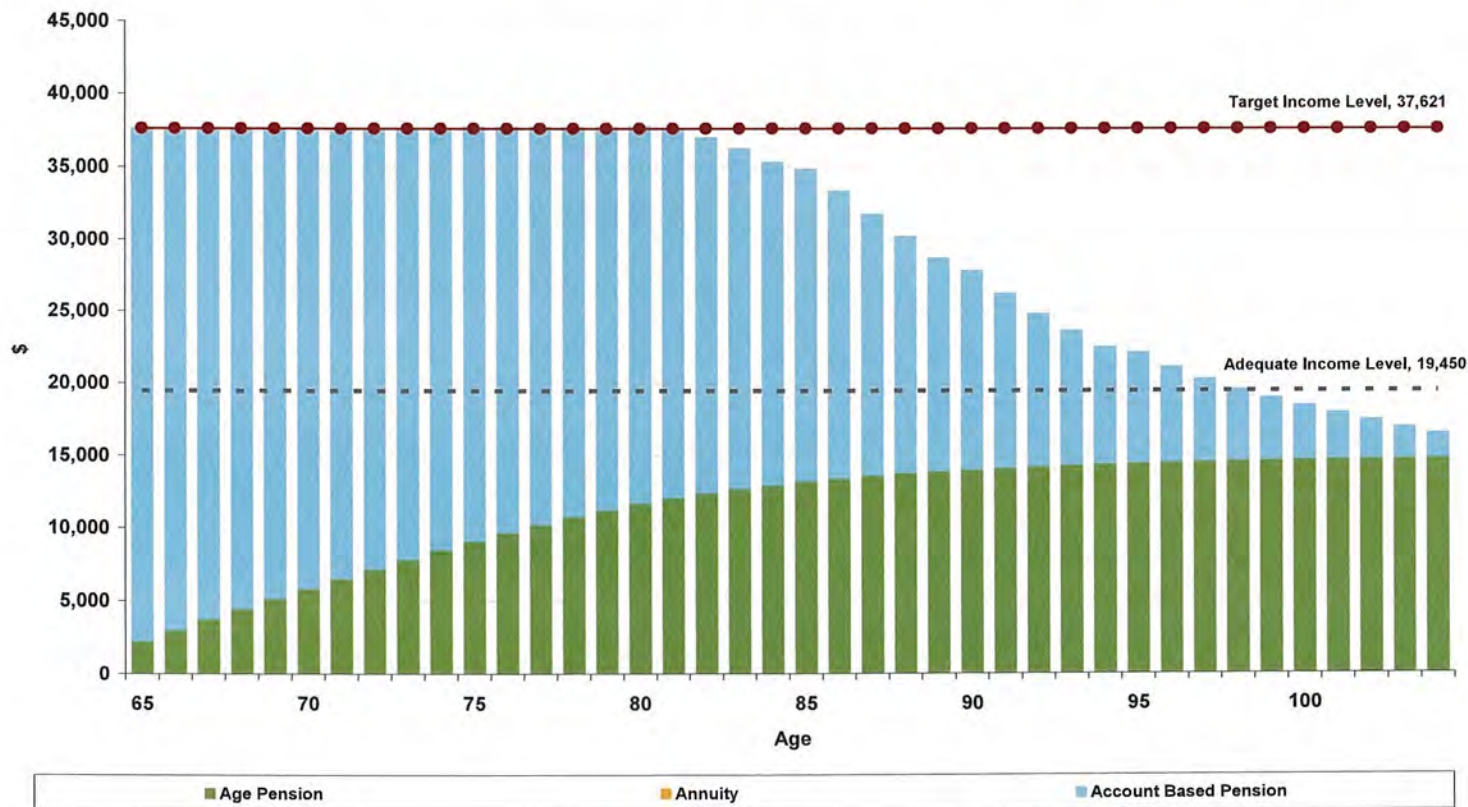


## Appendix 4: Supporting Charts



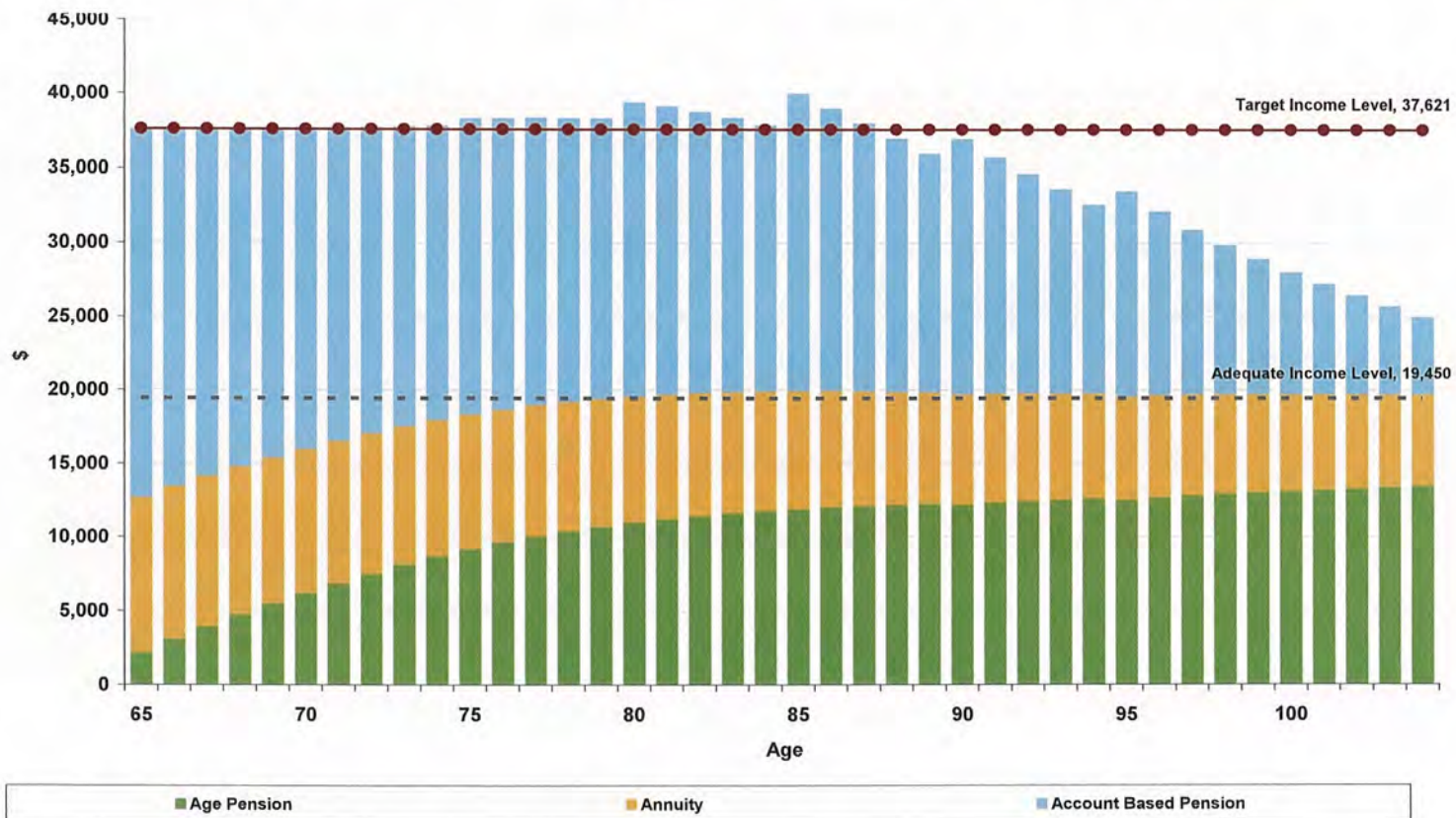


Figure 1.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; High Fees

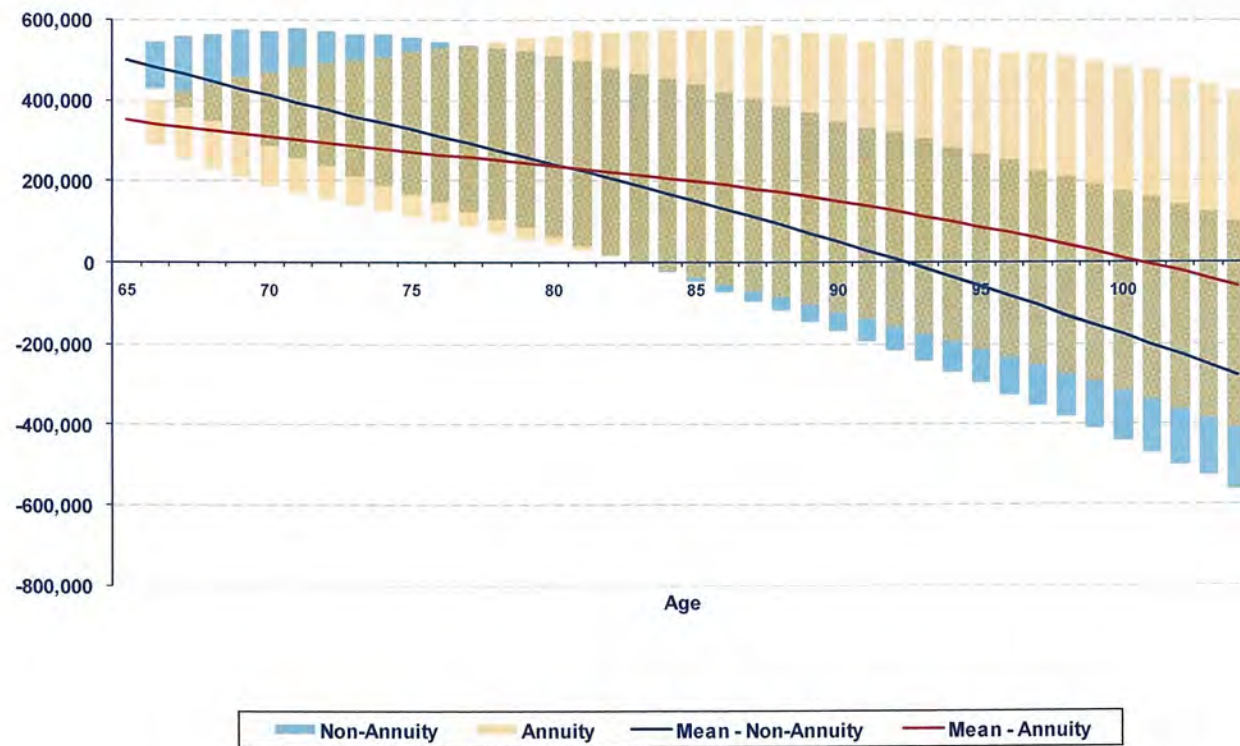
Figure 1.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; High Fees



Figure 1.3: Remaining account balance  
- 90% Confidence interval

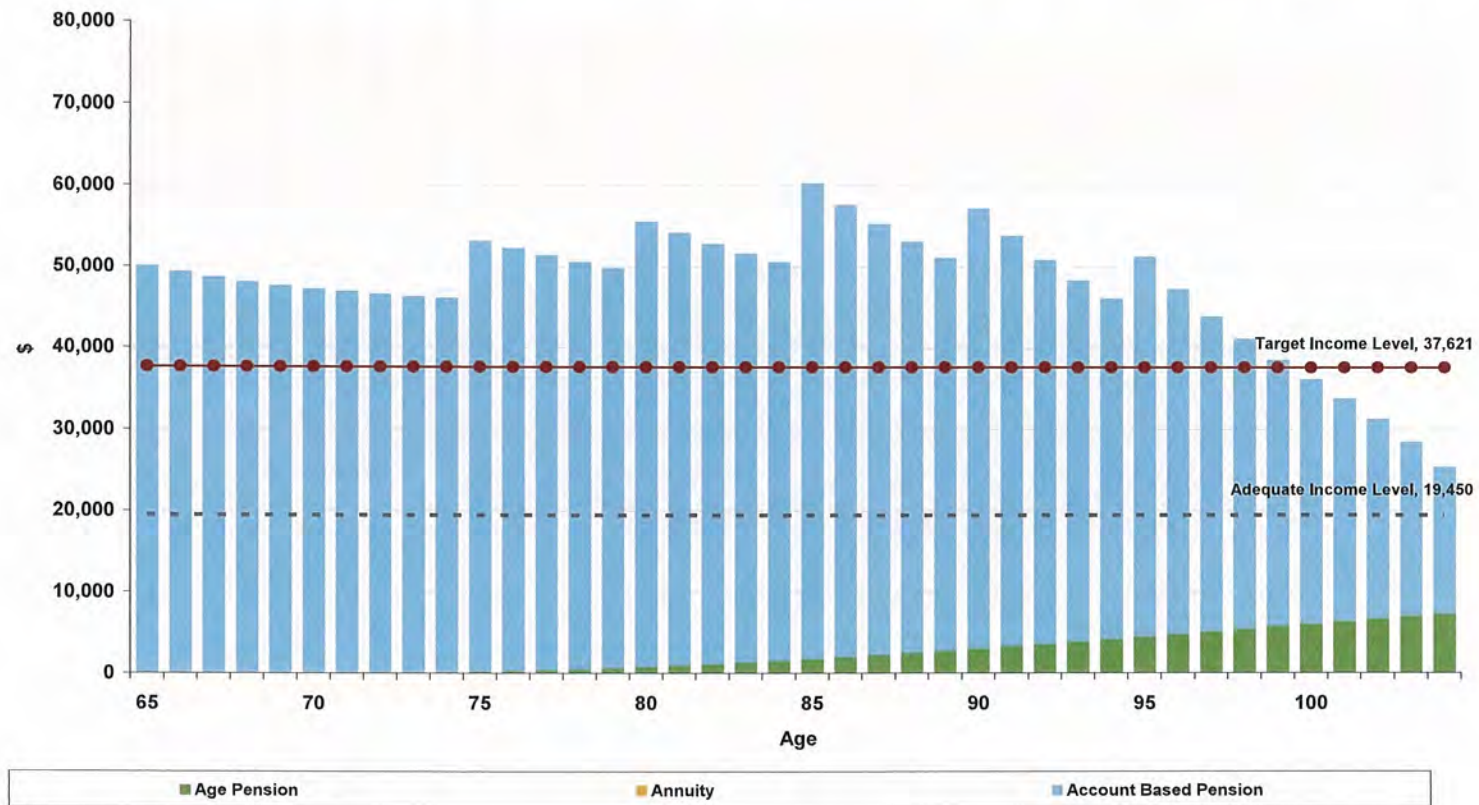


Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; High Fees





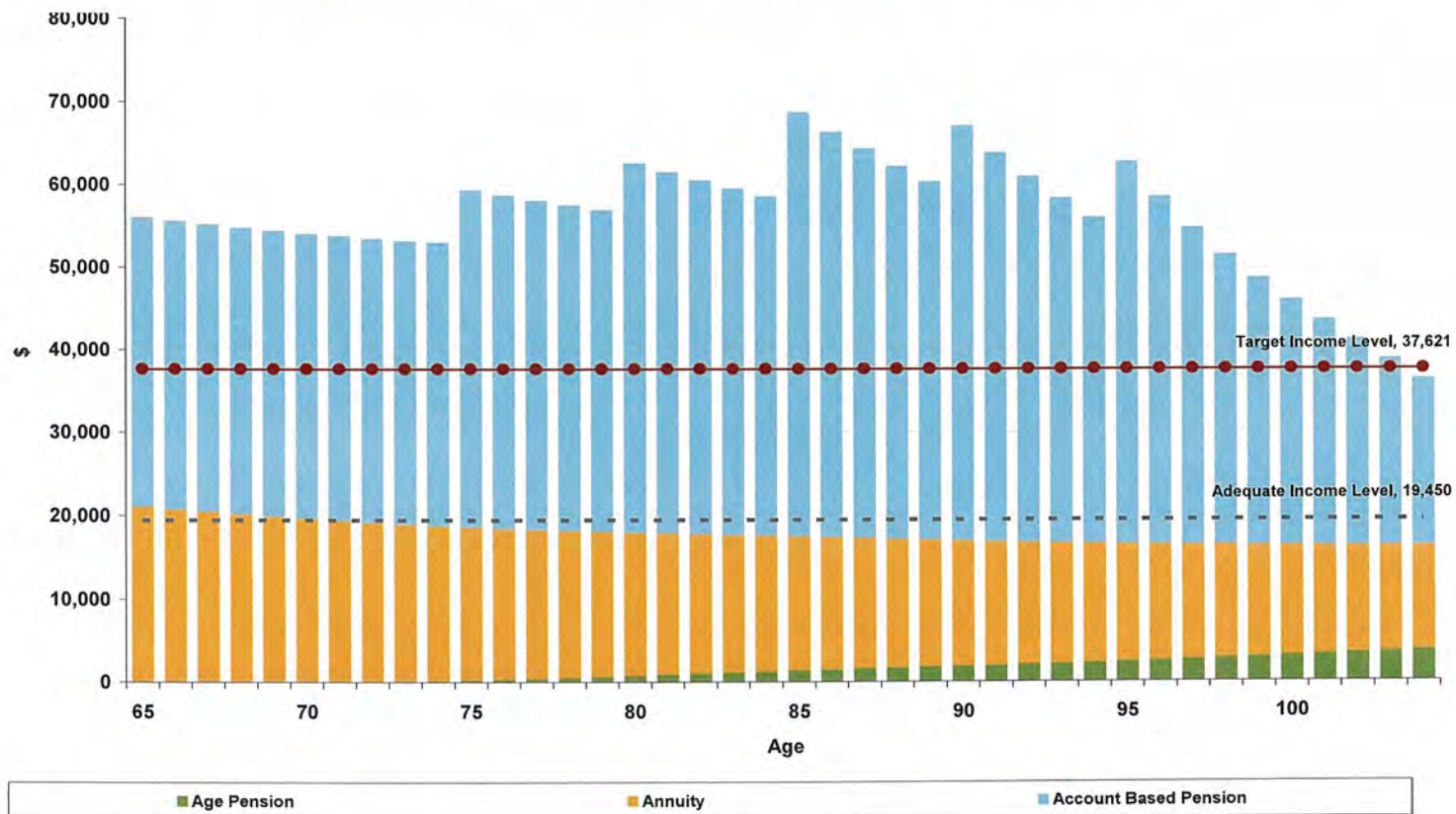
Figure 2.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$1,000,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; High Fees

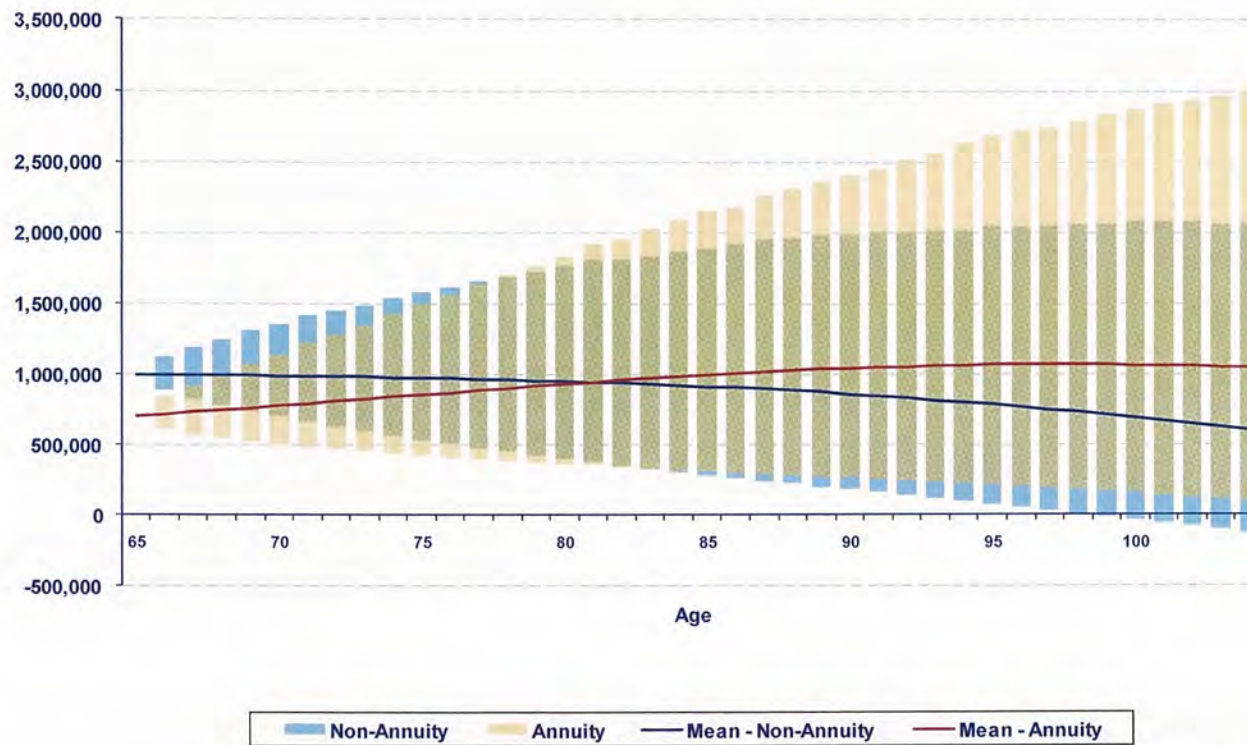


Figure 2.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$1,000,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; High Fees

Figure 2.3: Remaining account balance  
- 90% Confidence interval

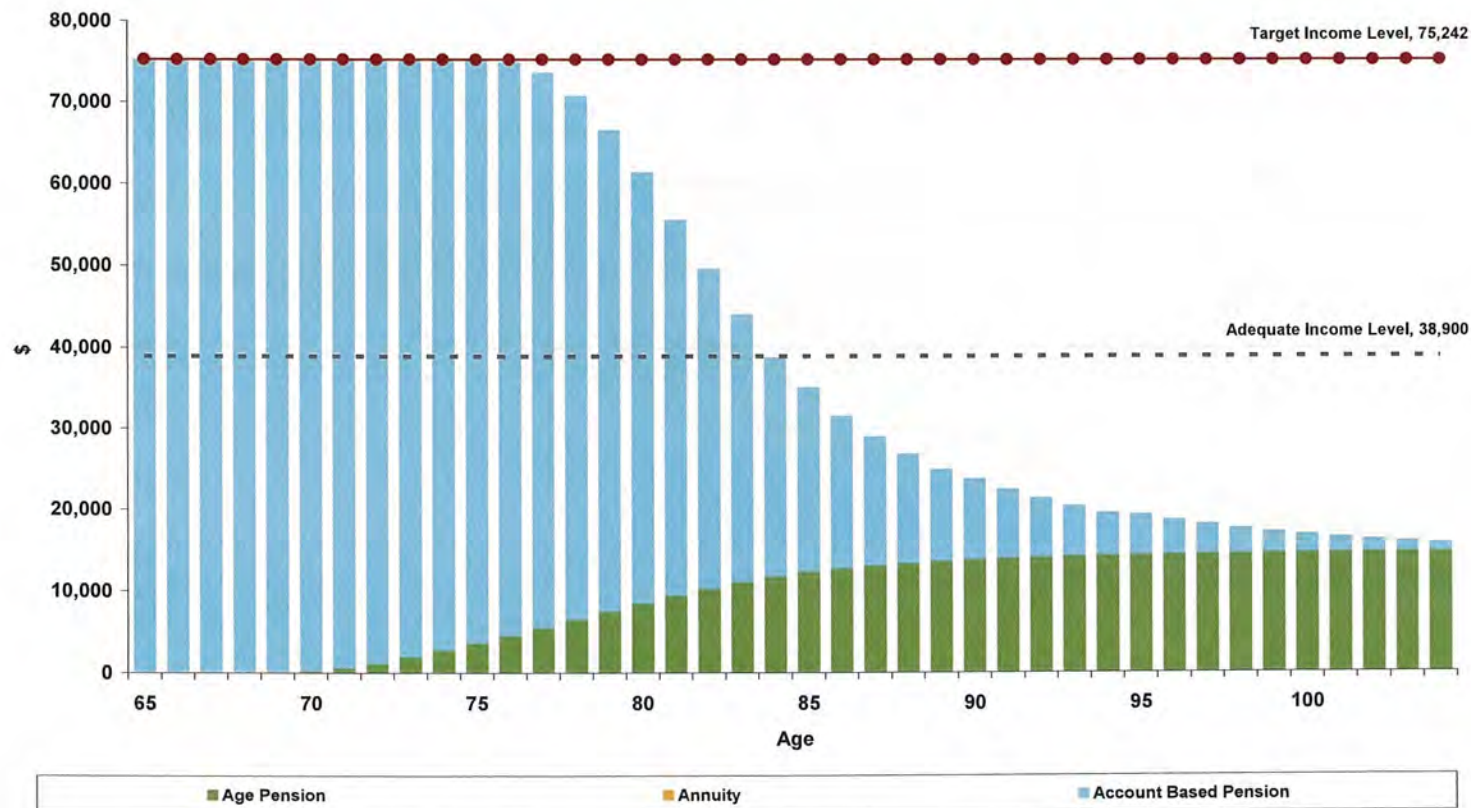


Assumptions: \$1,000,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; High Fees



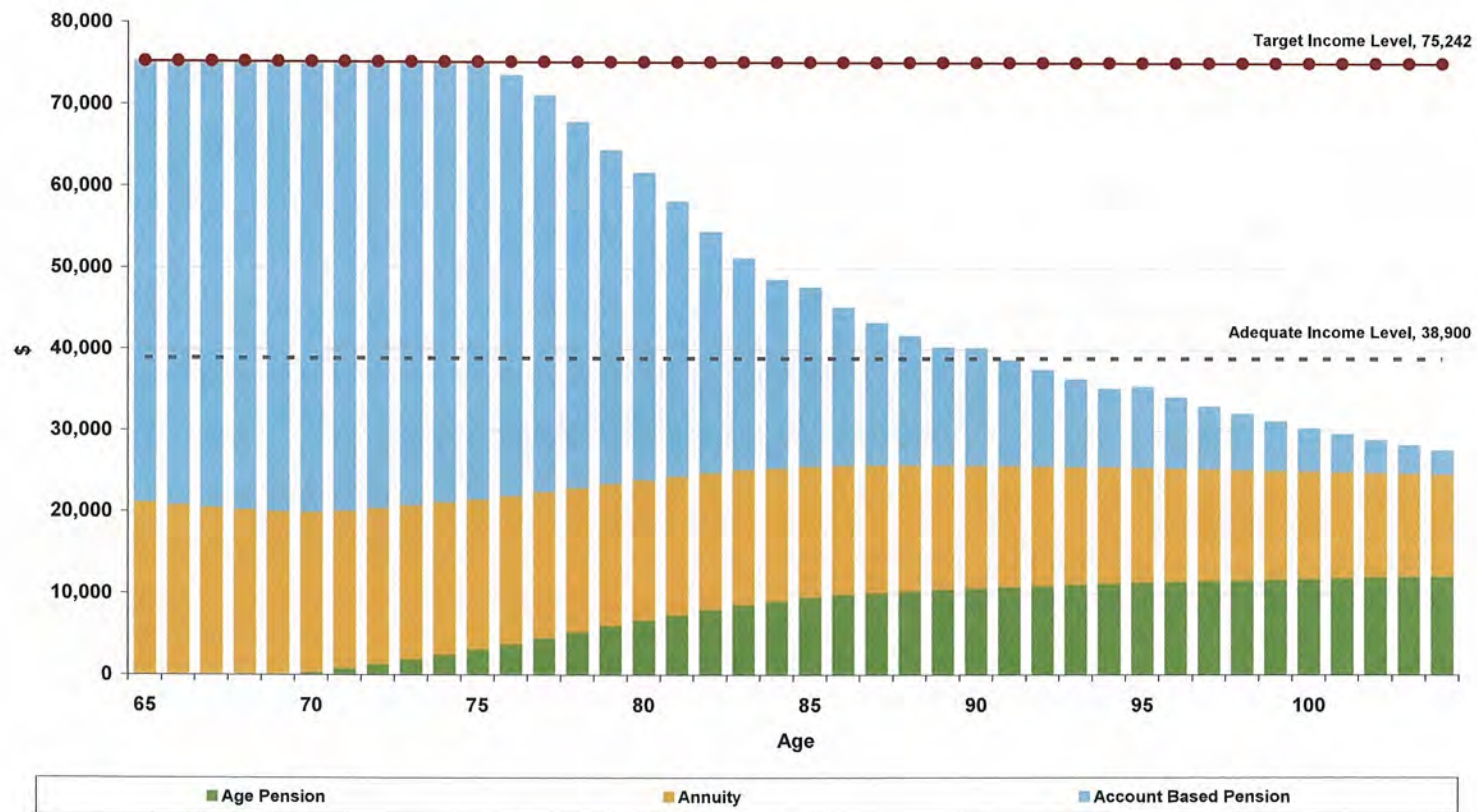


Figure 3.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$1,000,000 Initial account balance; \$75,242 pa Target income; \$38,900 pa Adequate income; 70% Growth, 30% Defensive; High Fees

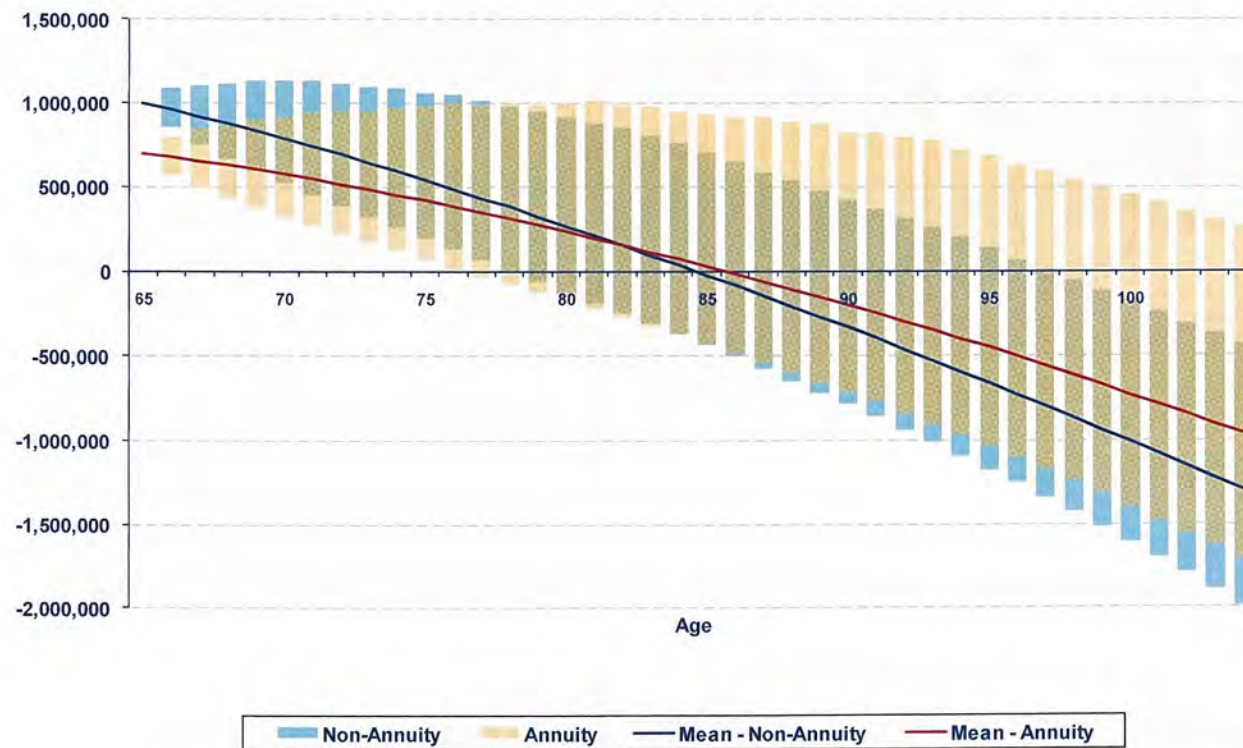
Figure 3.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$1,000,000 Initial account balance; \$75,242 pa Target income; \$38,900 pa Adequate income; 70% Growth, 30% Annuity; High Fees



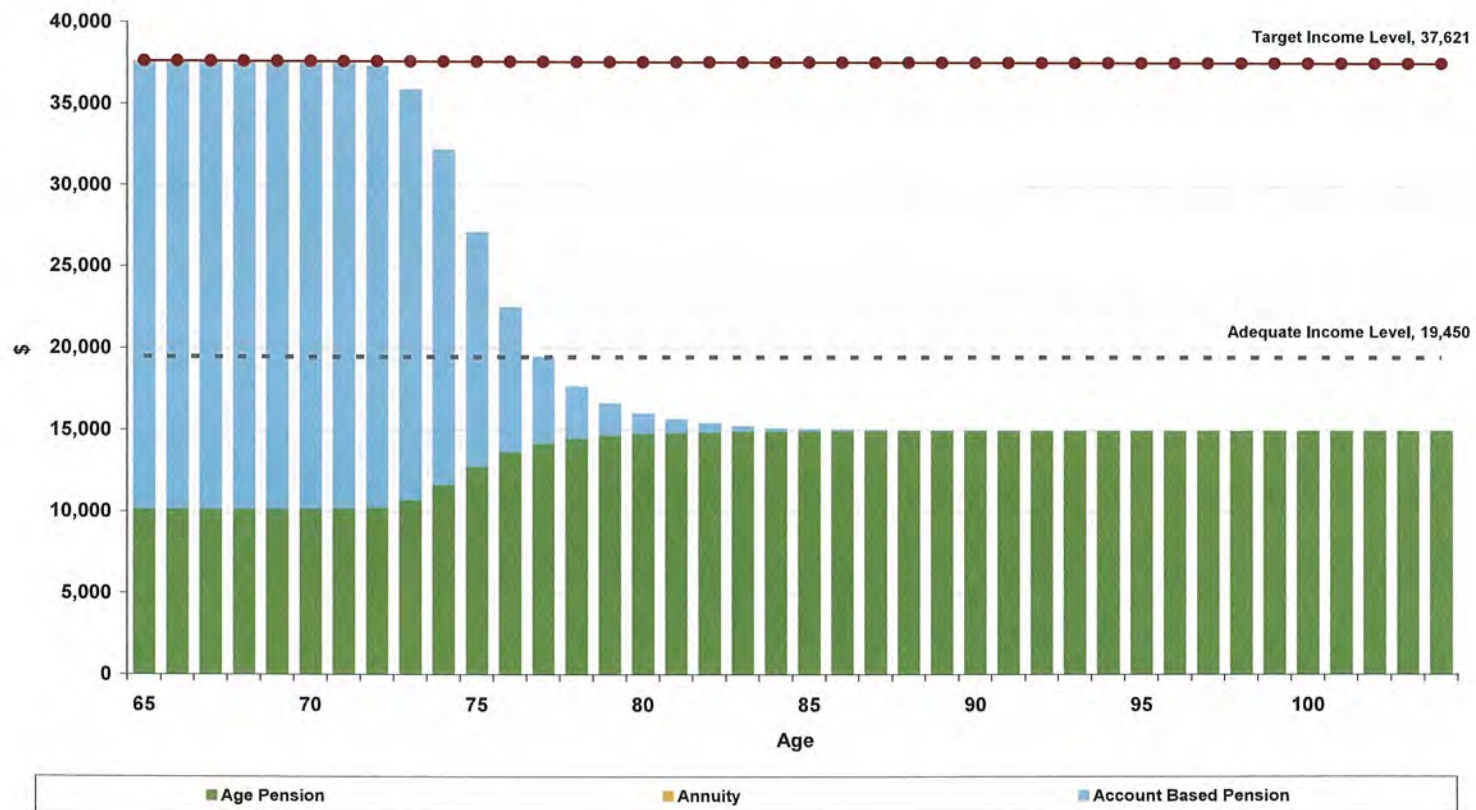
Figure 3.3: Remaining account balance  
- 90% Confidence interval



Assumptions: \$1,000,000 Initial account balance; \$75,242 pa Target income; \$38,900 pa Adequate income; 70% Growth; High Fees



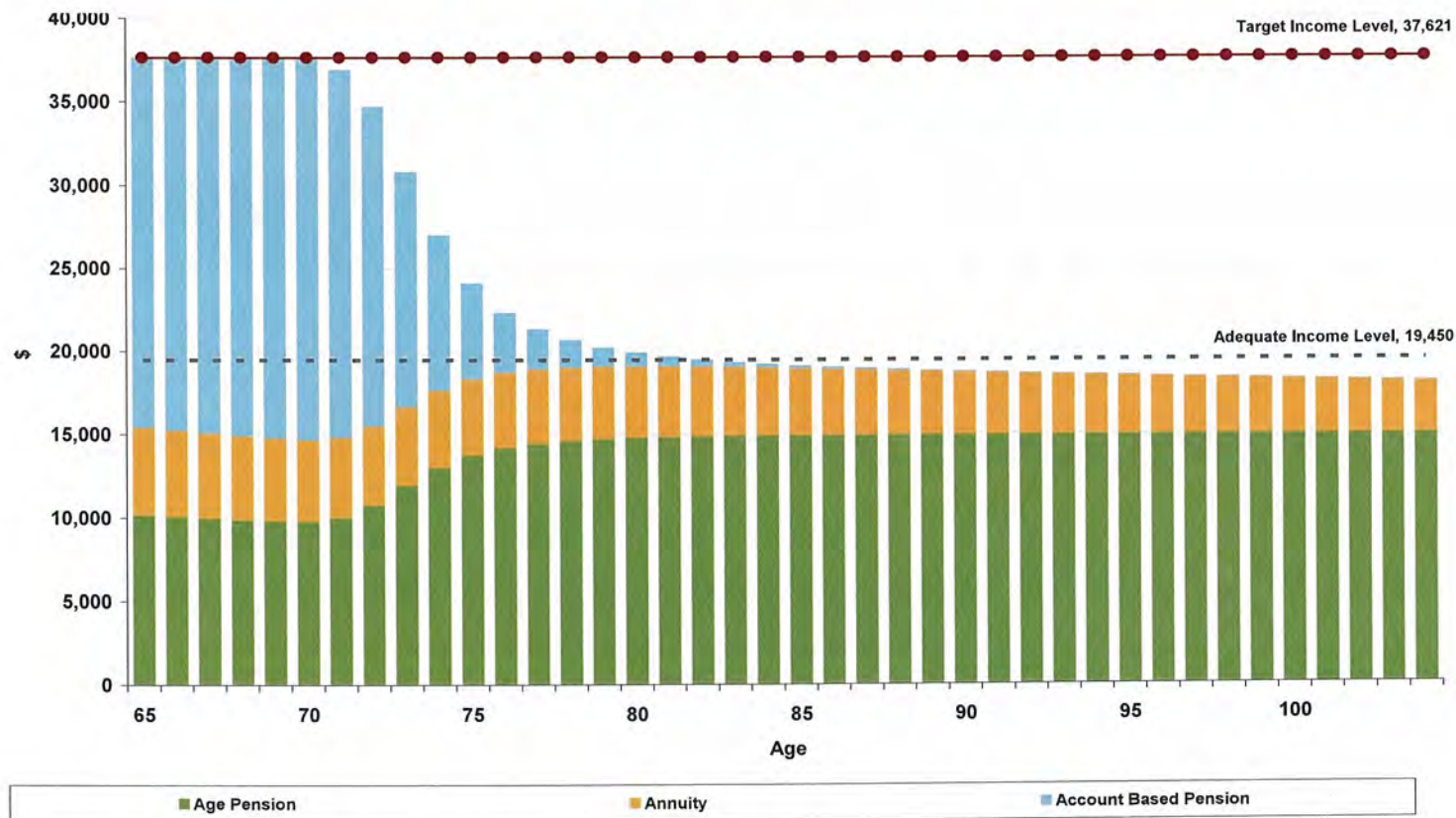
Figure 4.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$250,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; High Fees



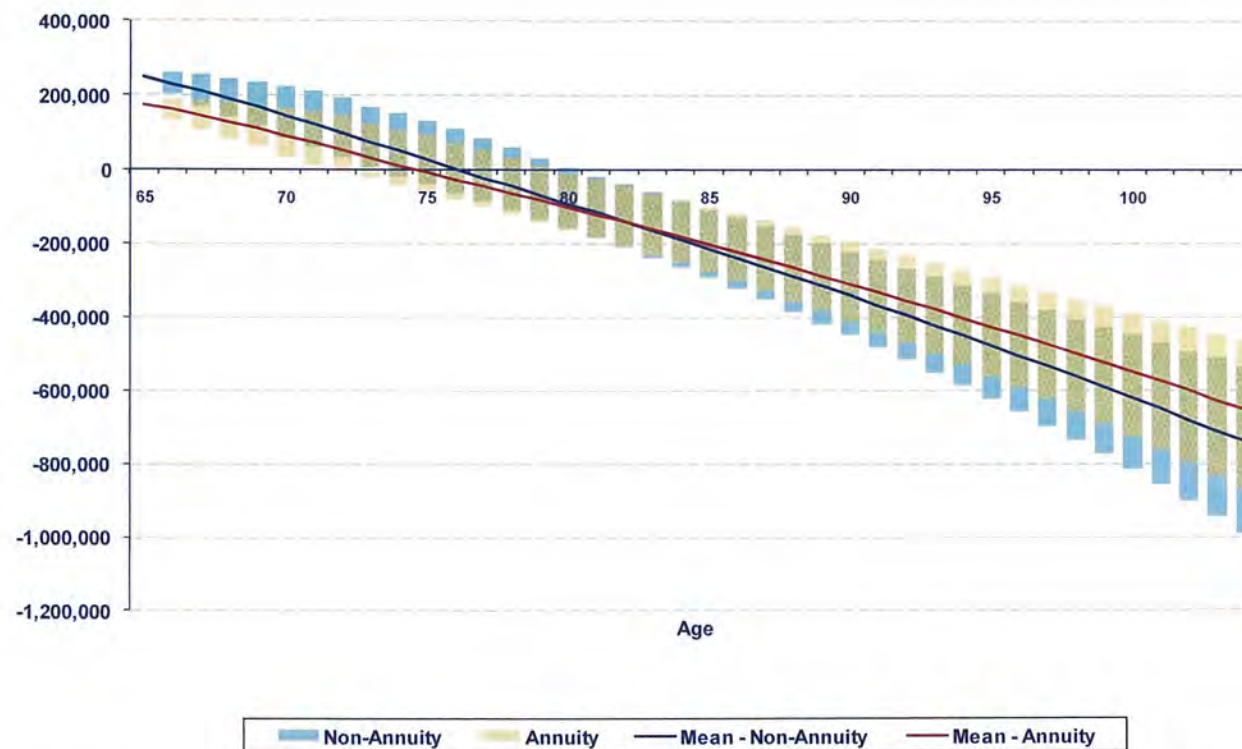
Figure 4.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$250,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; High Fees



Figure 4.3: Remaining account balance  
- 90% Confidence interval

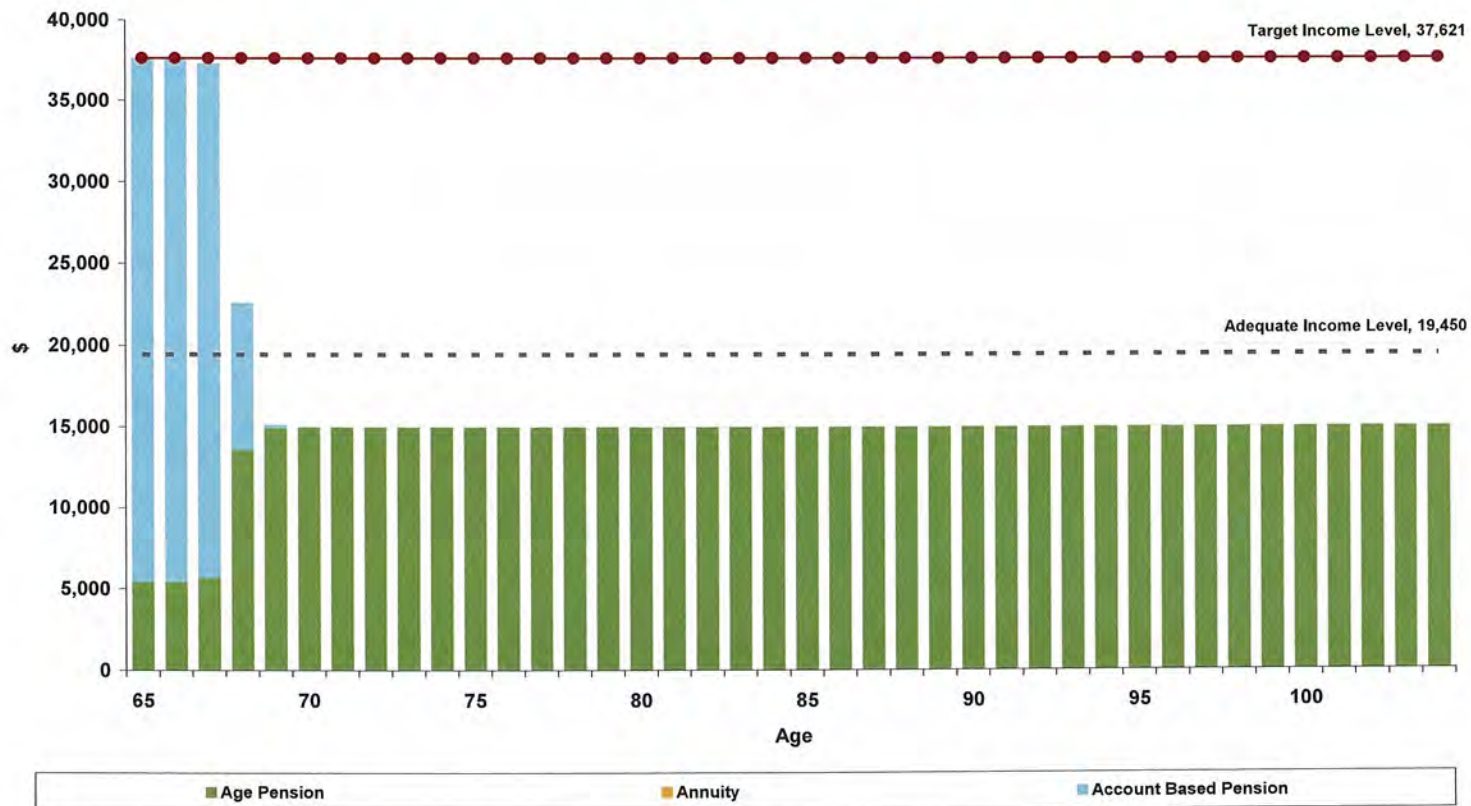


Assumptions: \$250,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; High Fees



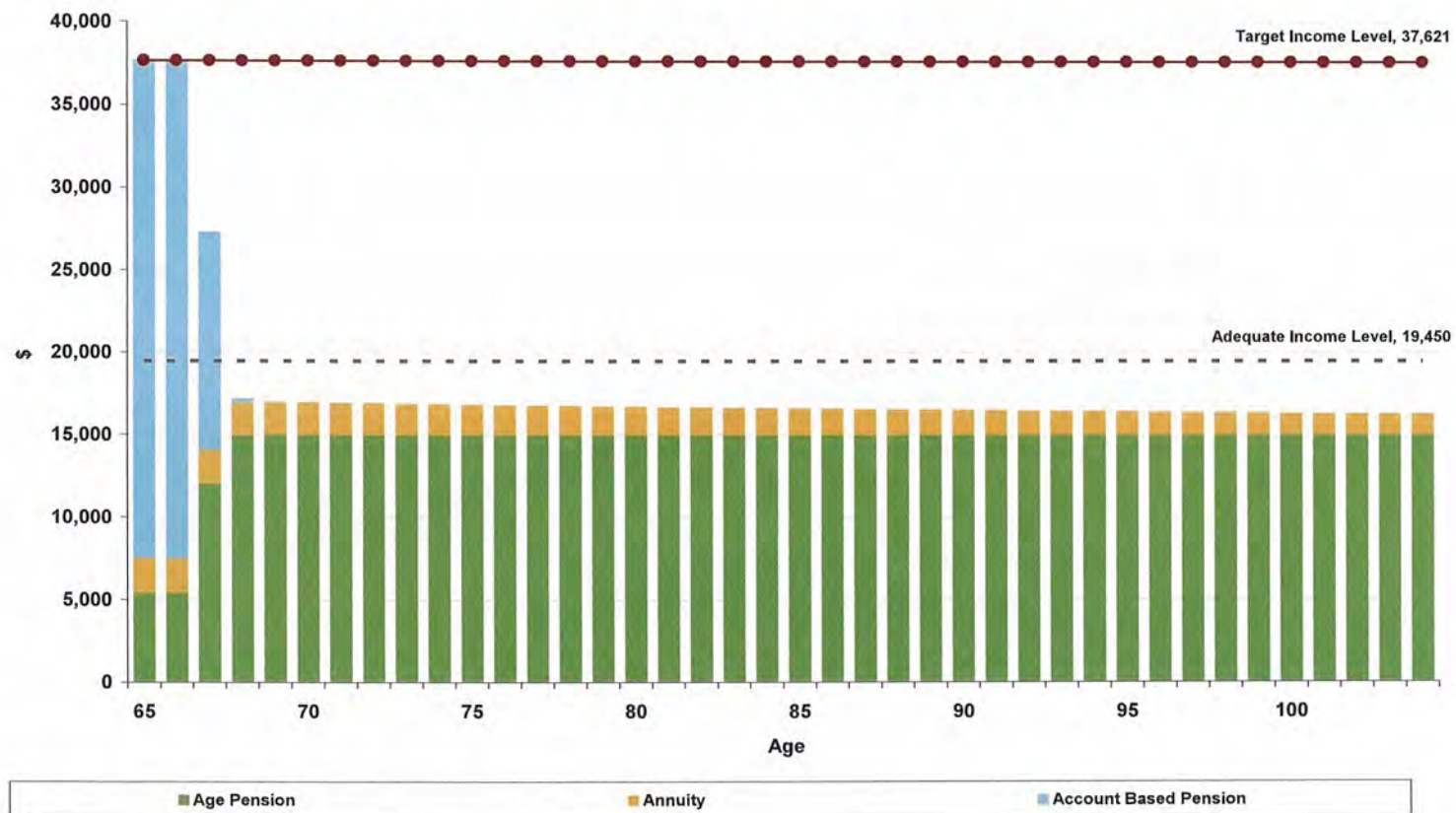


Figure 5.1: Average retirement income  
- No lifetime annuity purchased at retirement



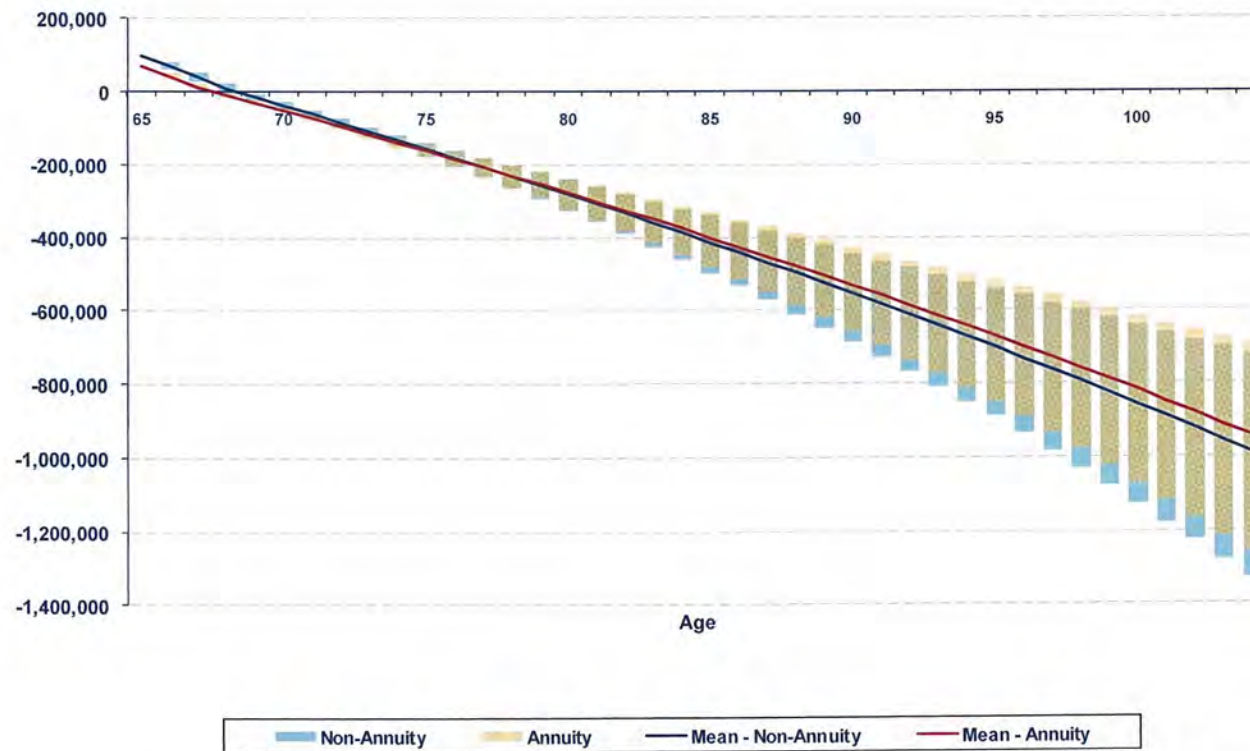
Assumptions: \$100,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; High Fees

Figure 5.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$100,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; High Fees

Figure 5.3: Remaining account balance  
- 90% Confidence interval

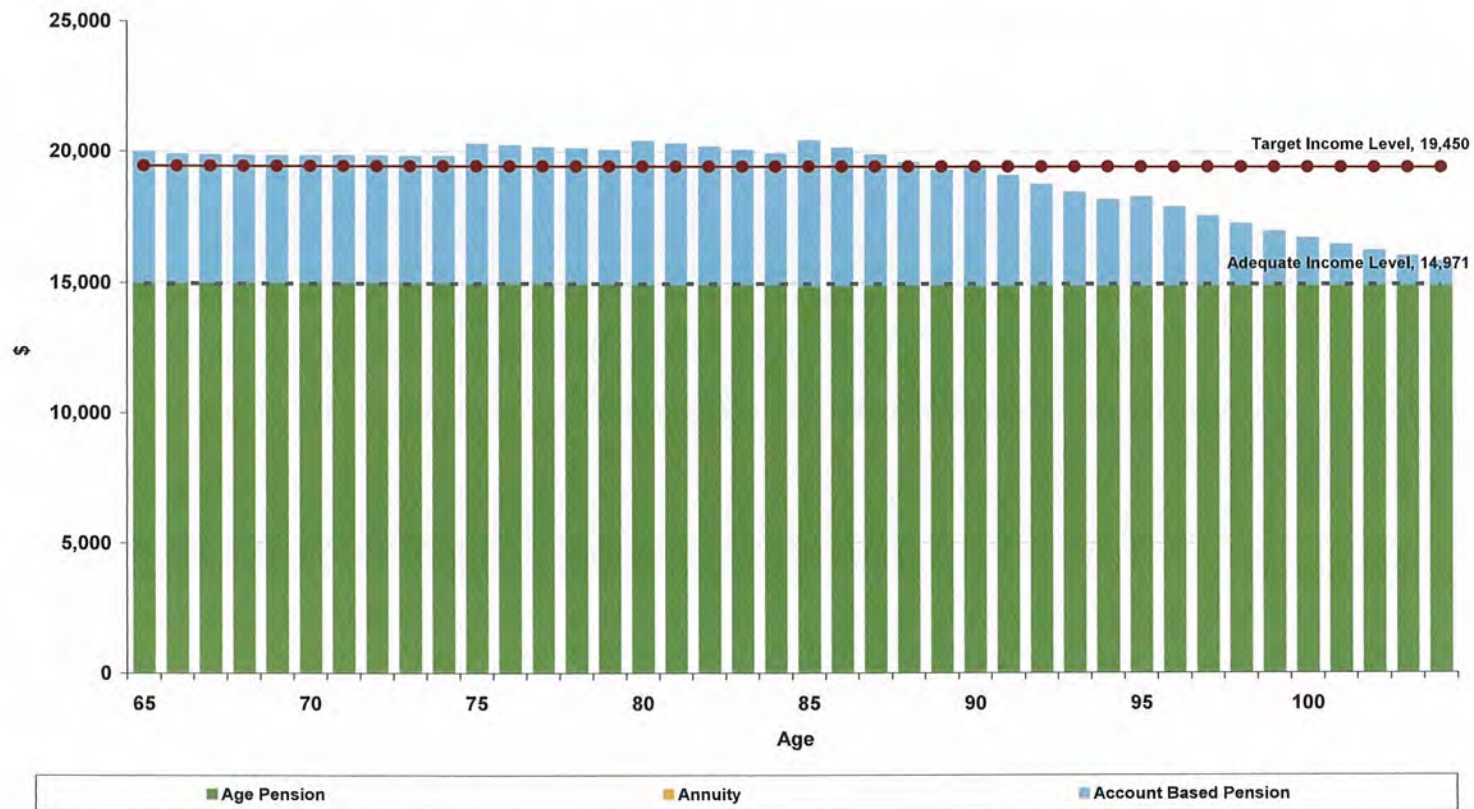


Assumptions: \$100,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; High Fees





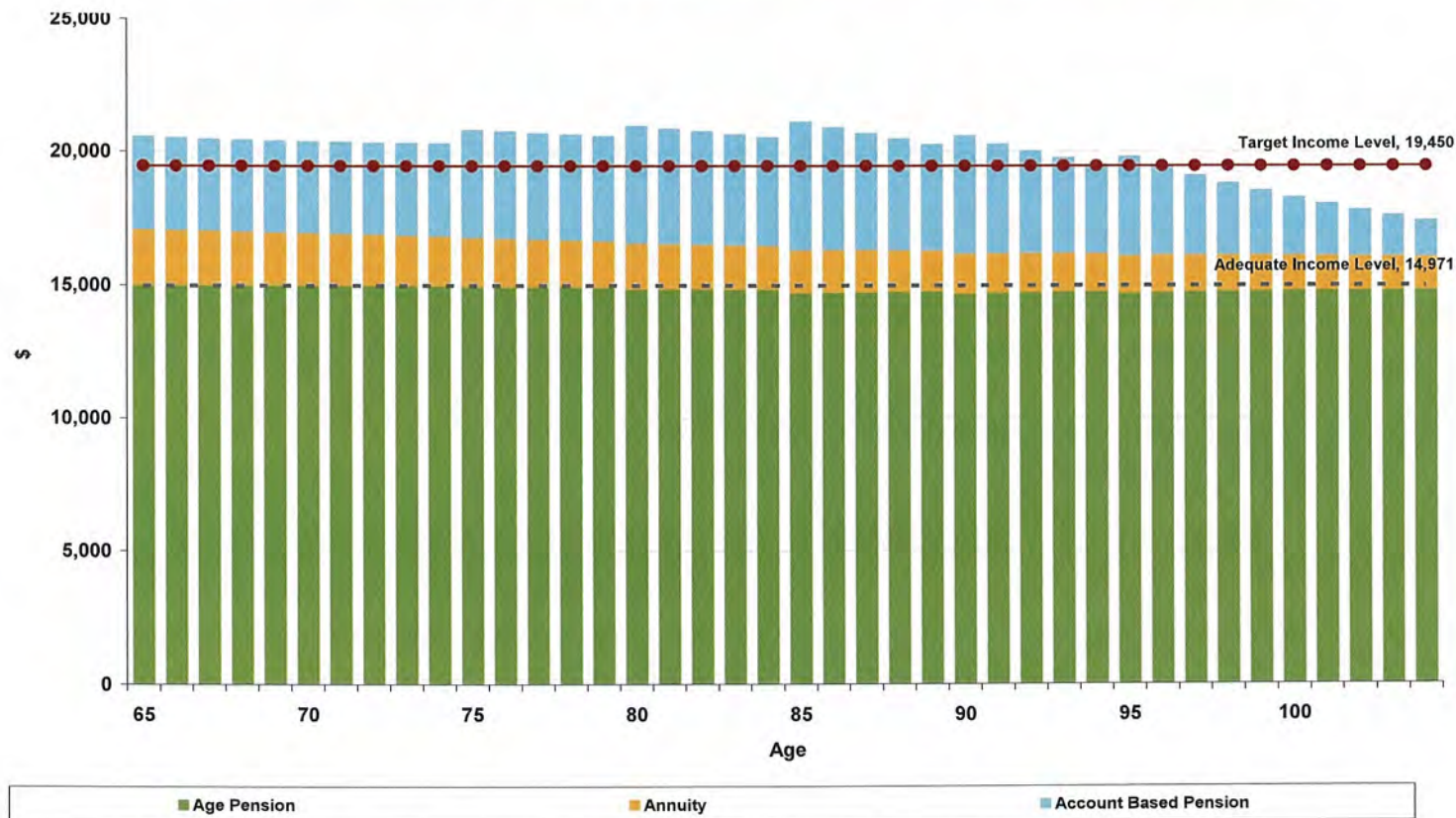
Figure 6.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$100,000 Initial account balance; \$19,450 pa Target income; \$14,971 pa Adequate income; 70% Growth, 30% Defensive; High Fees

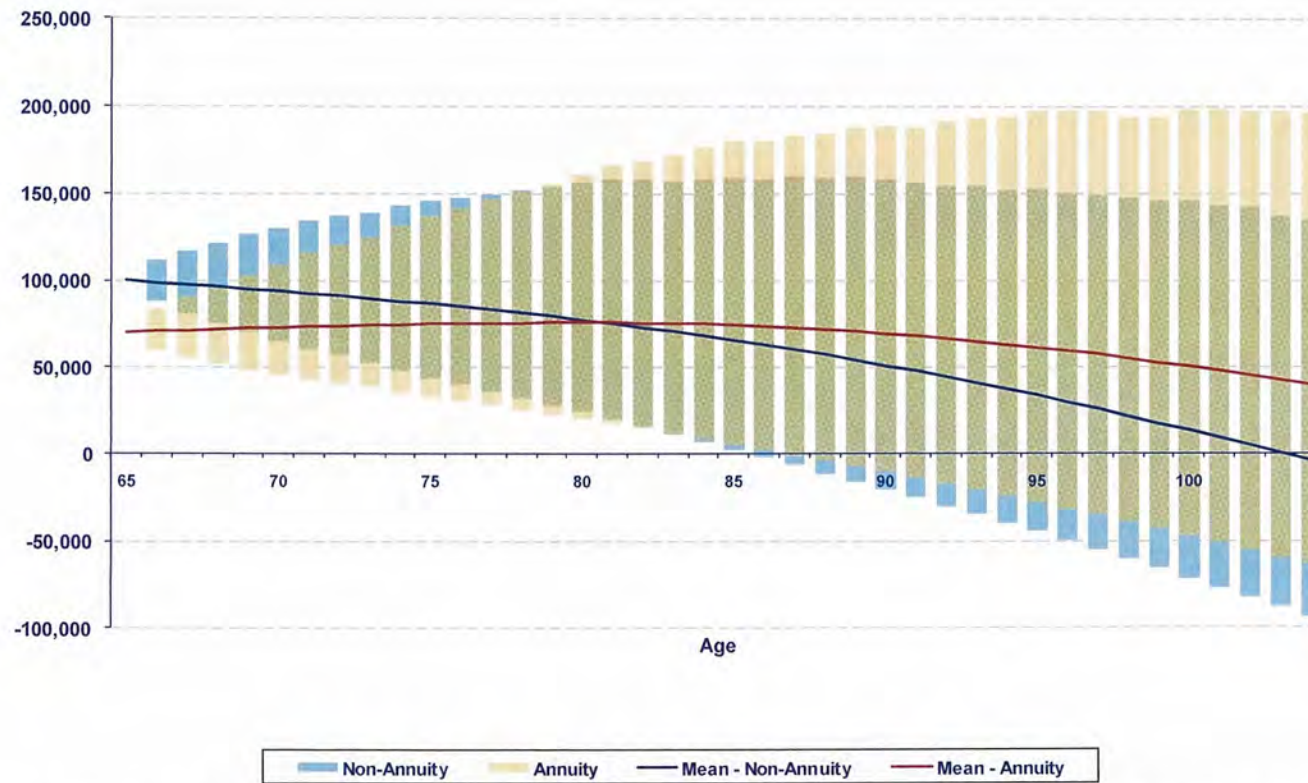


Figure 6.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$100,000 Initial account balance; \$19,450 pa Target income; \$14,971 pa Adequate income; 70% Growth, 30% Annuity; High Fees

Figure 6.3: Remaining account balance  
- 90% Confidence interval

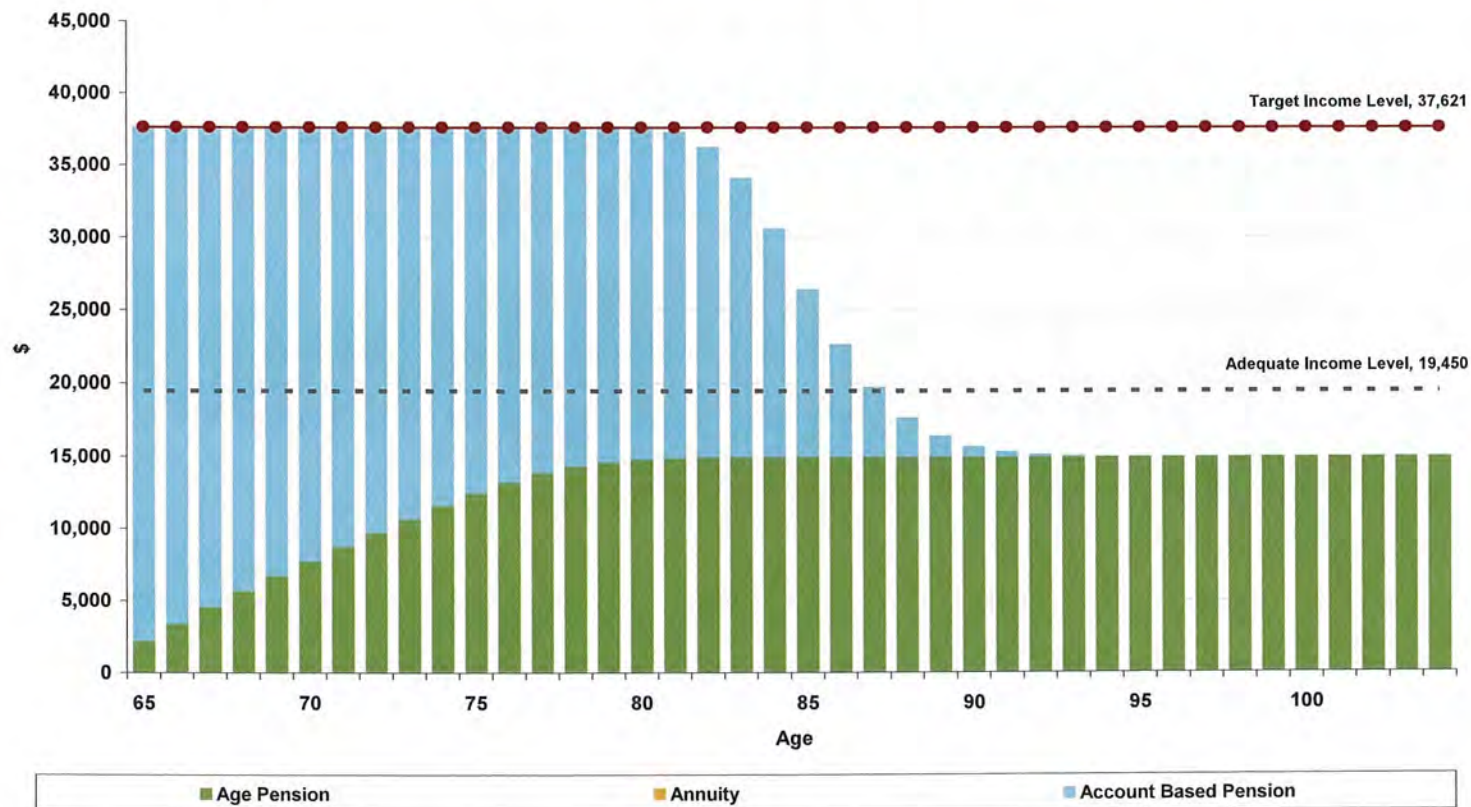


Assumptions: \$100,000 Initial account balance; \$19,450 pa Target income; \$14,971 pa Adequate income; 70% Growth; High Fees





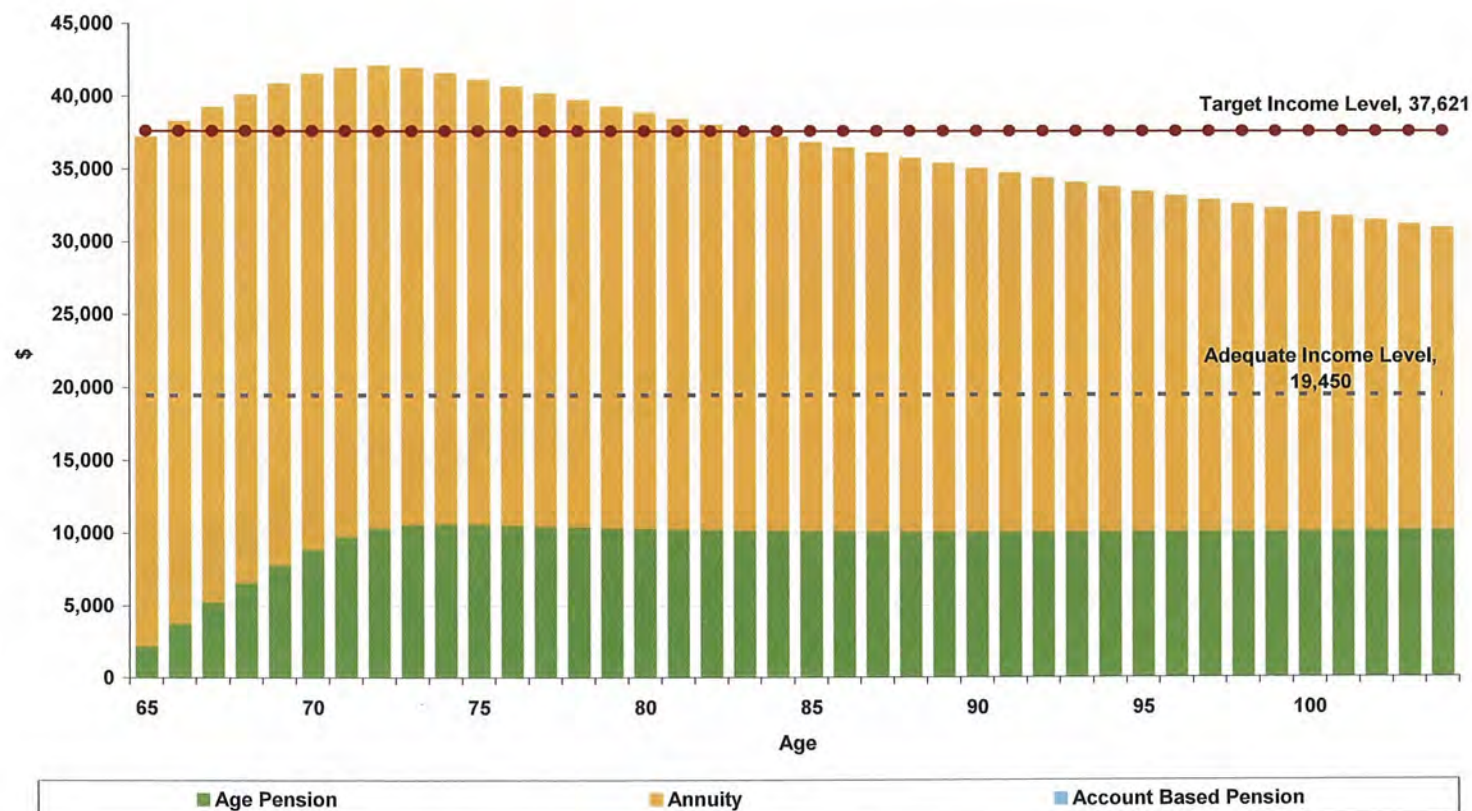
Figure 7.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 0% Growth, 100% Defensive; High Fees



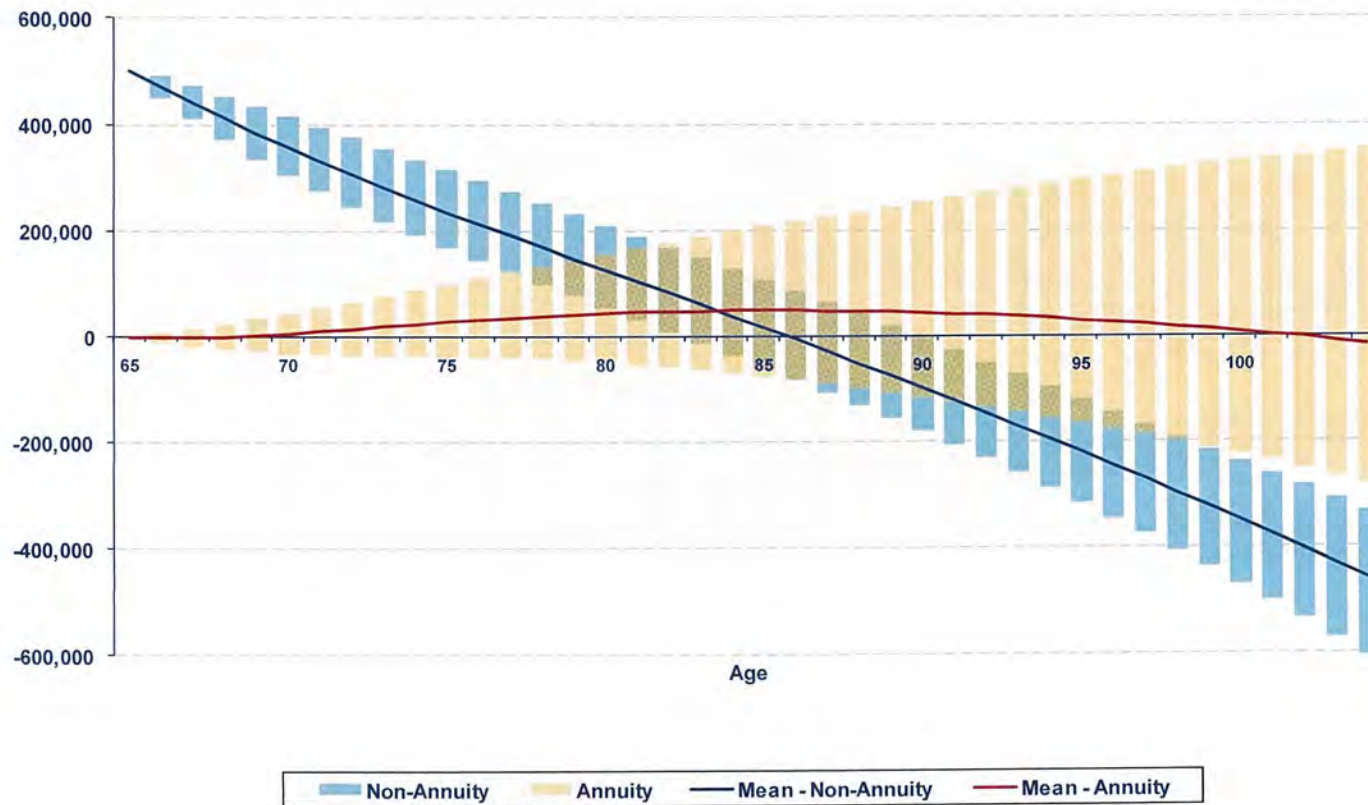
Figure 7.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 0% Growth, 100% Annuity; High Fees



Figure 7.3: Remaining account balance  
- 90% Confidence interval

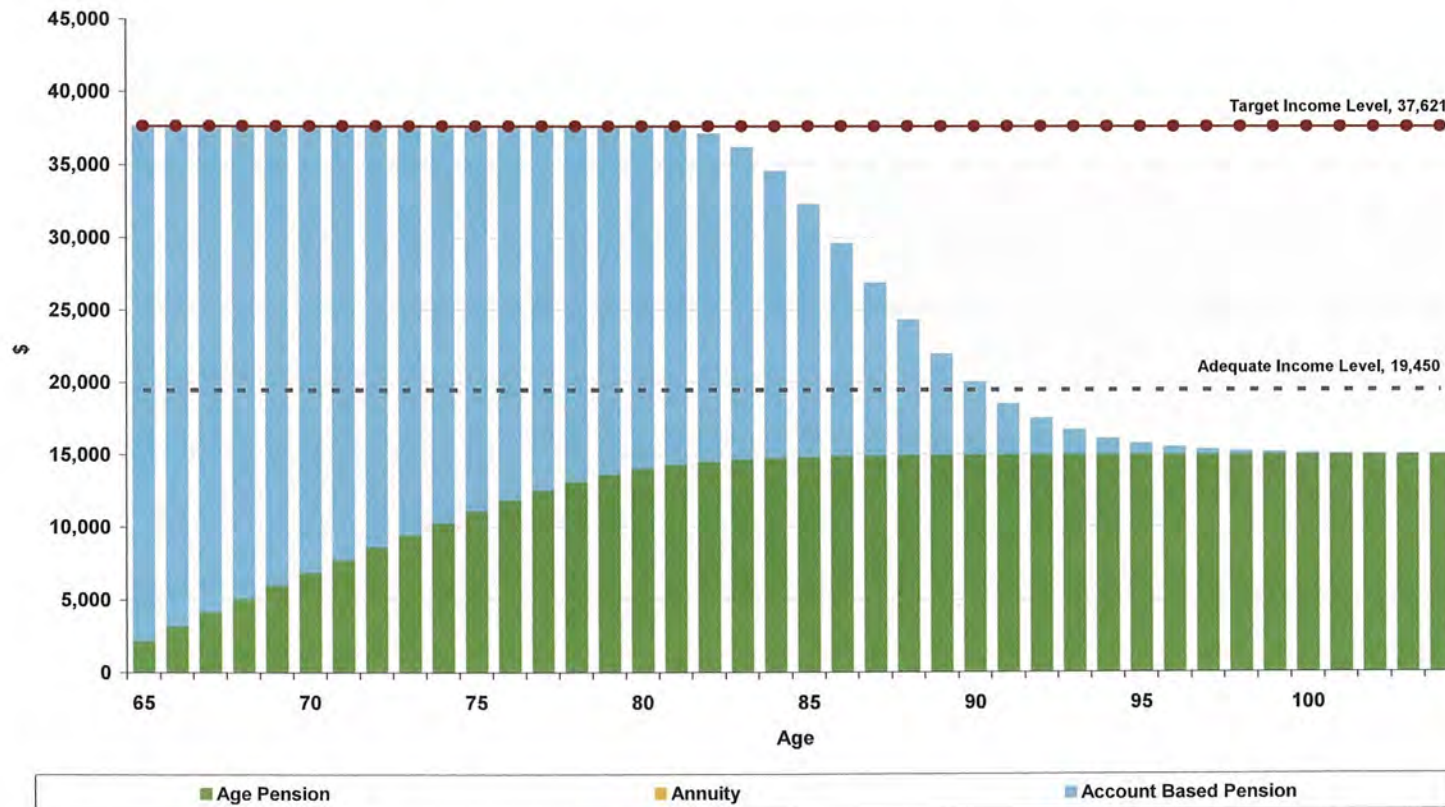


Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 0% Growth; High Fees





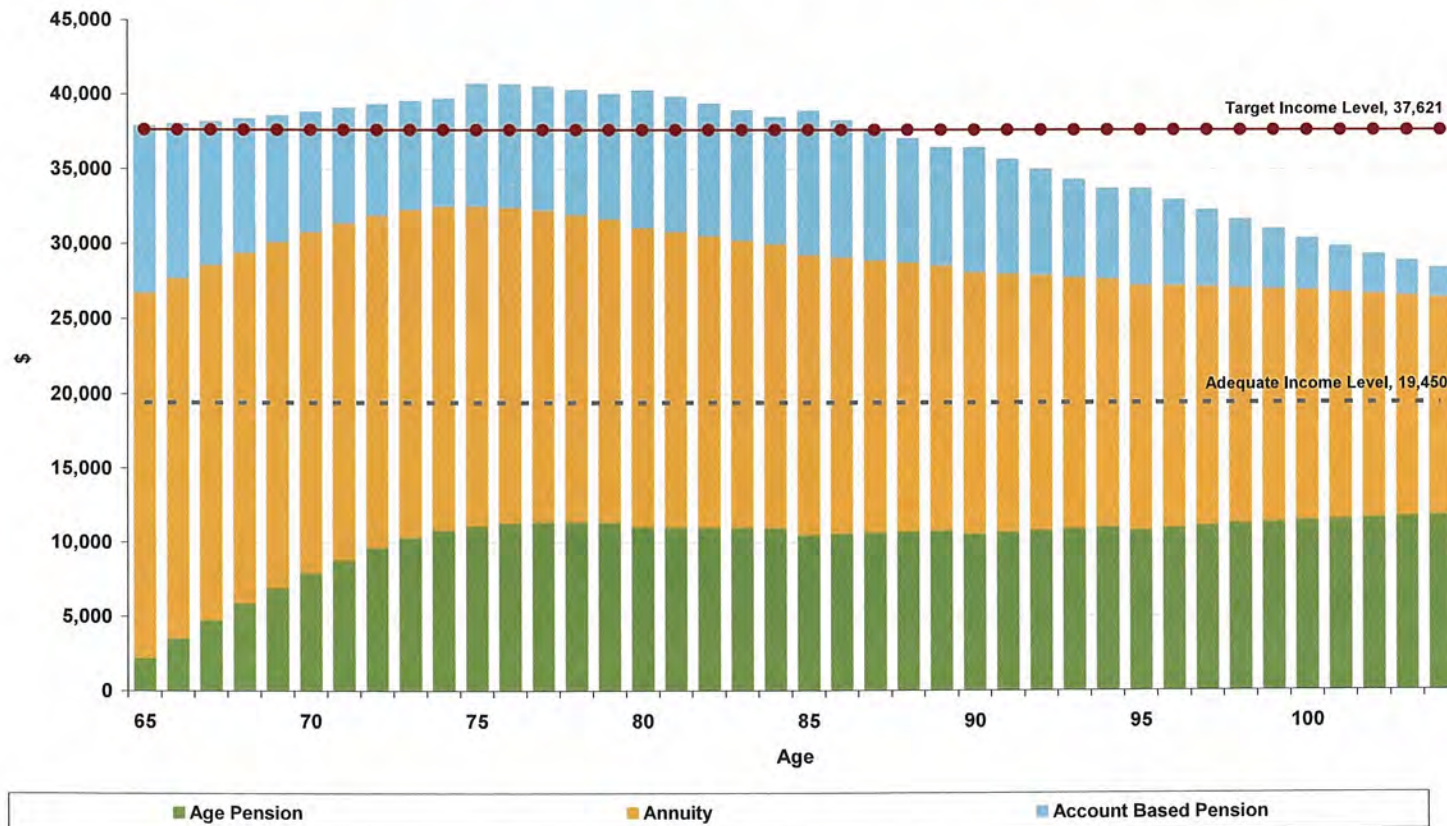
Figure 8.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 30% Growth, 70% Defensive; High Fees



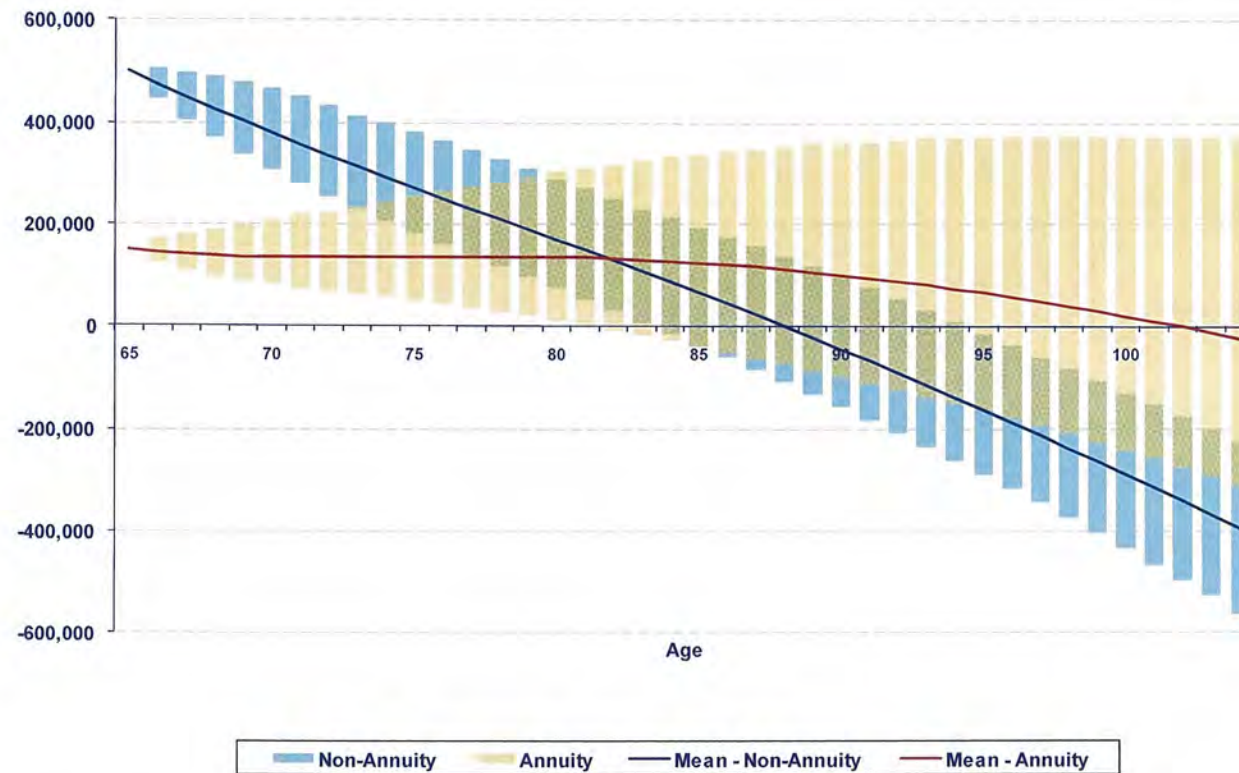
Figure 8.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 30% Growth, 70% Annuity; High Fees



Figure 8.3: Remaining account balance  
- 90% Confidence interval

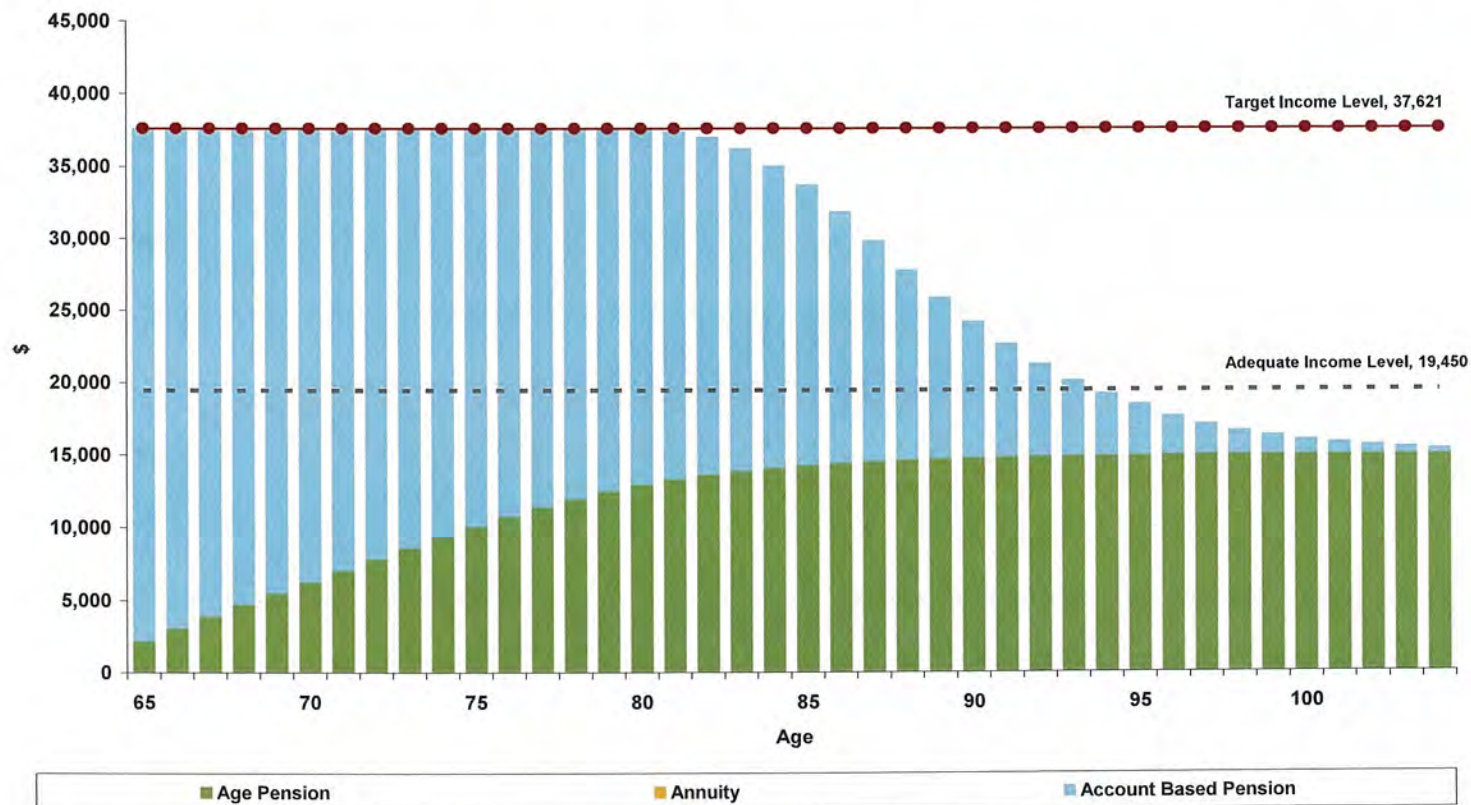


Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 30% Growth; High Fees



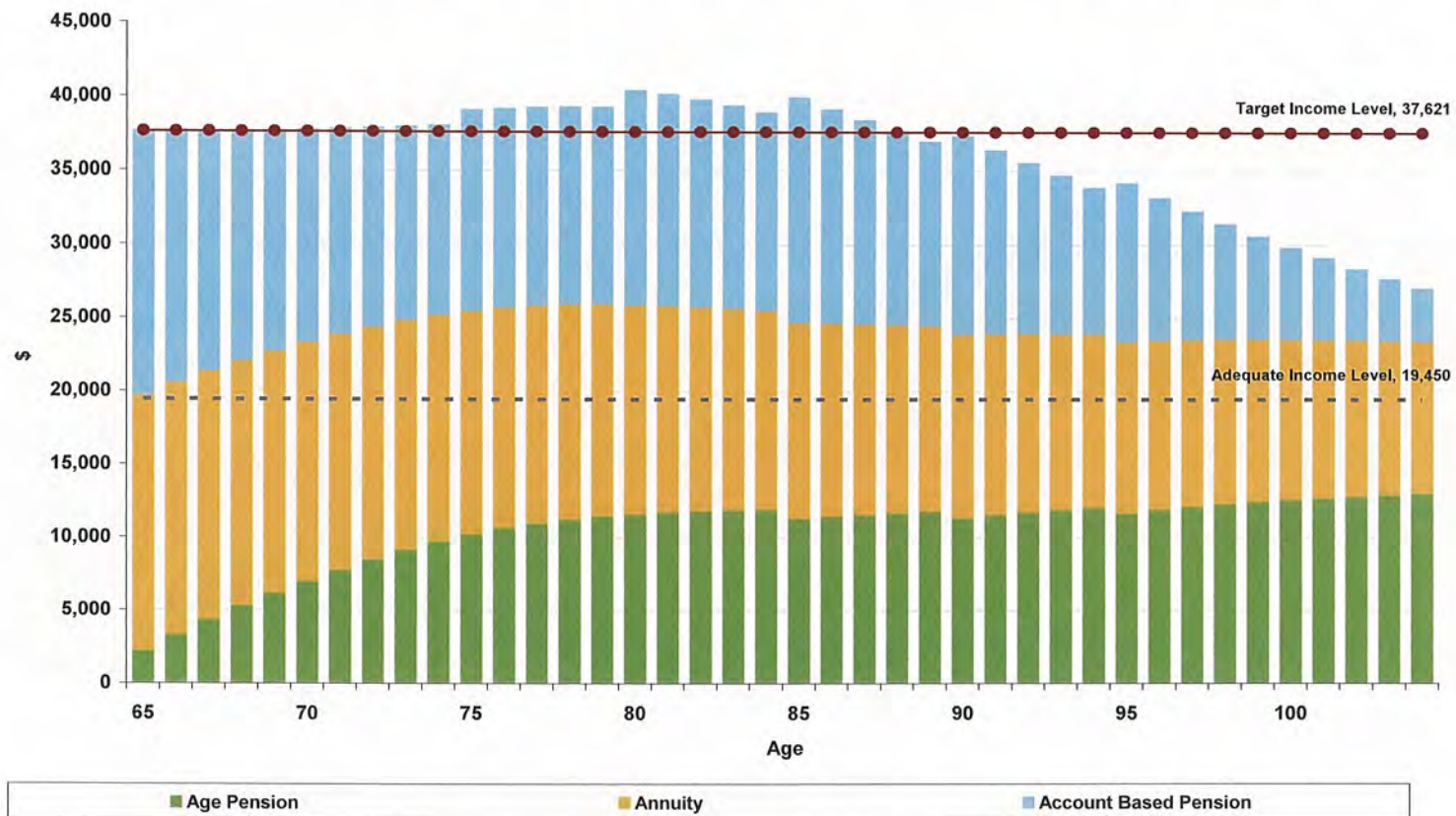


Figure 9.1: Average retirement income  
- No lifetime annuity purchased at retirement



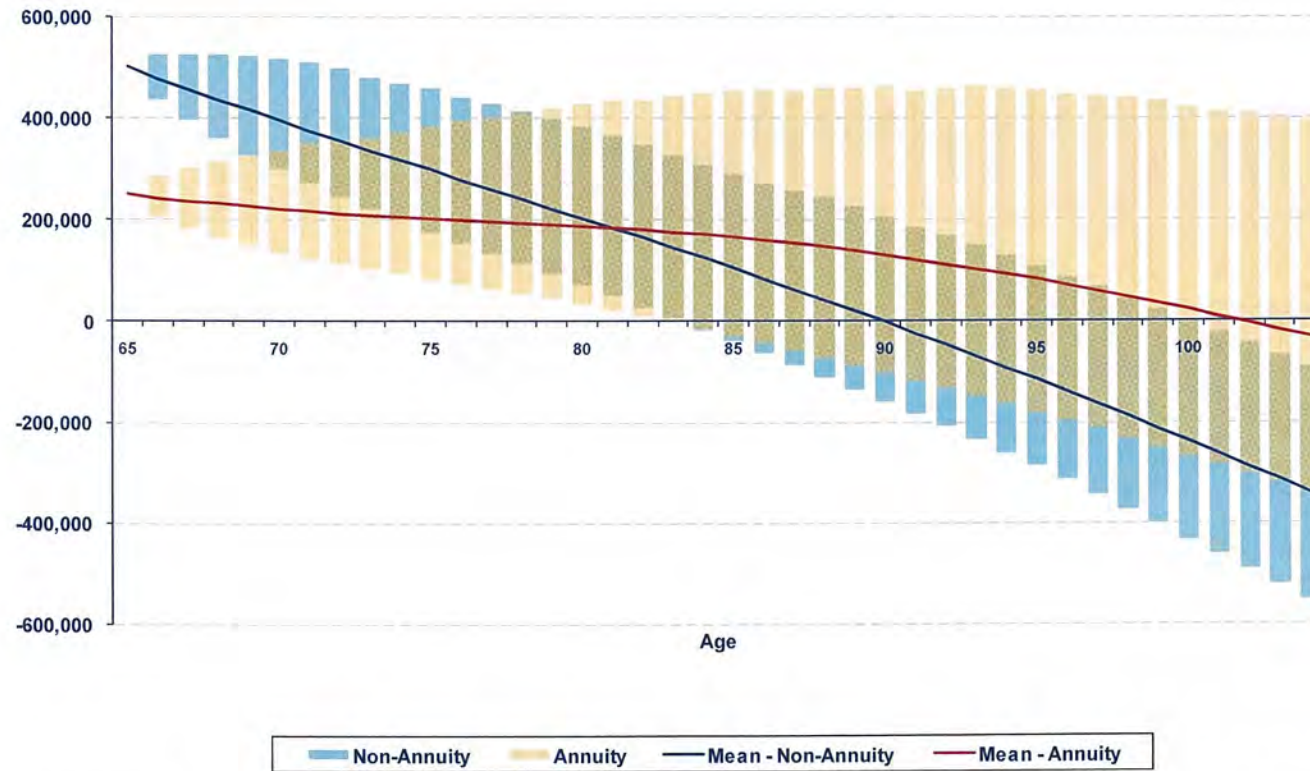
Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 50% Growth, 50% Defensive; High Fees

Figure 9.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 50% Growth, 50% Annuity; High Fees

Figure 9.3: Remaining account balance  
- 90% Confidence interval

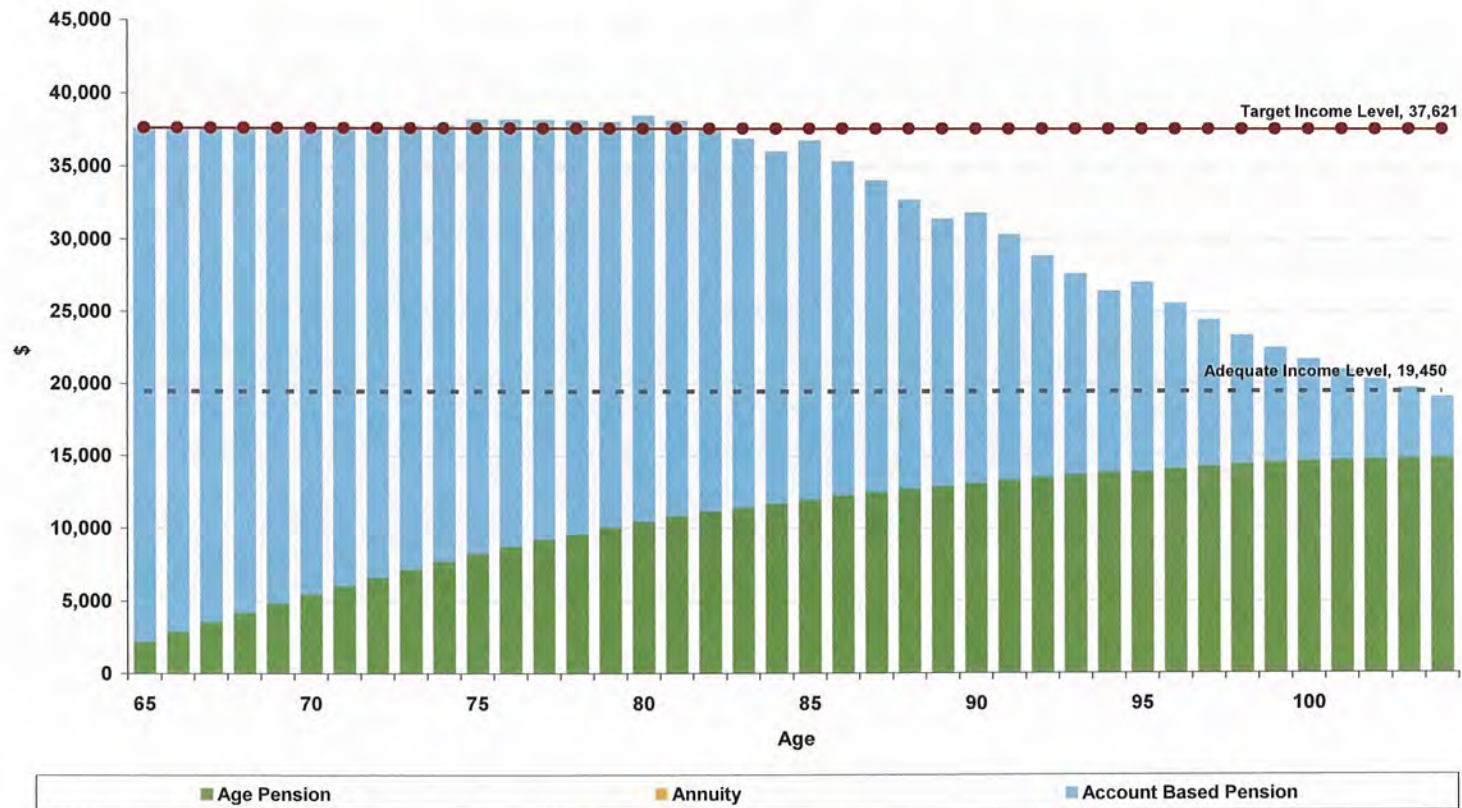


Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 50% Growth; High Fees





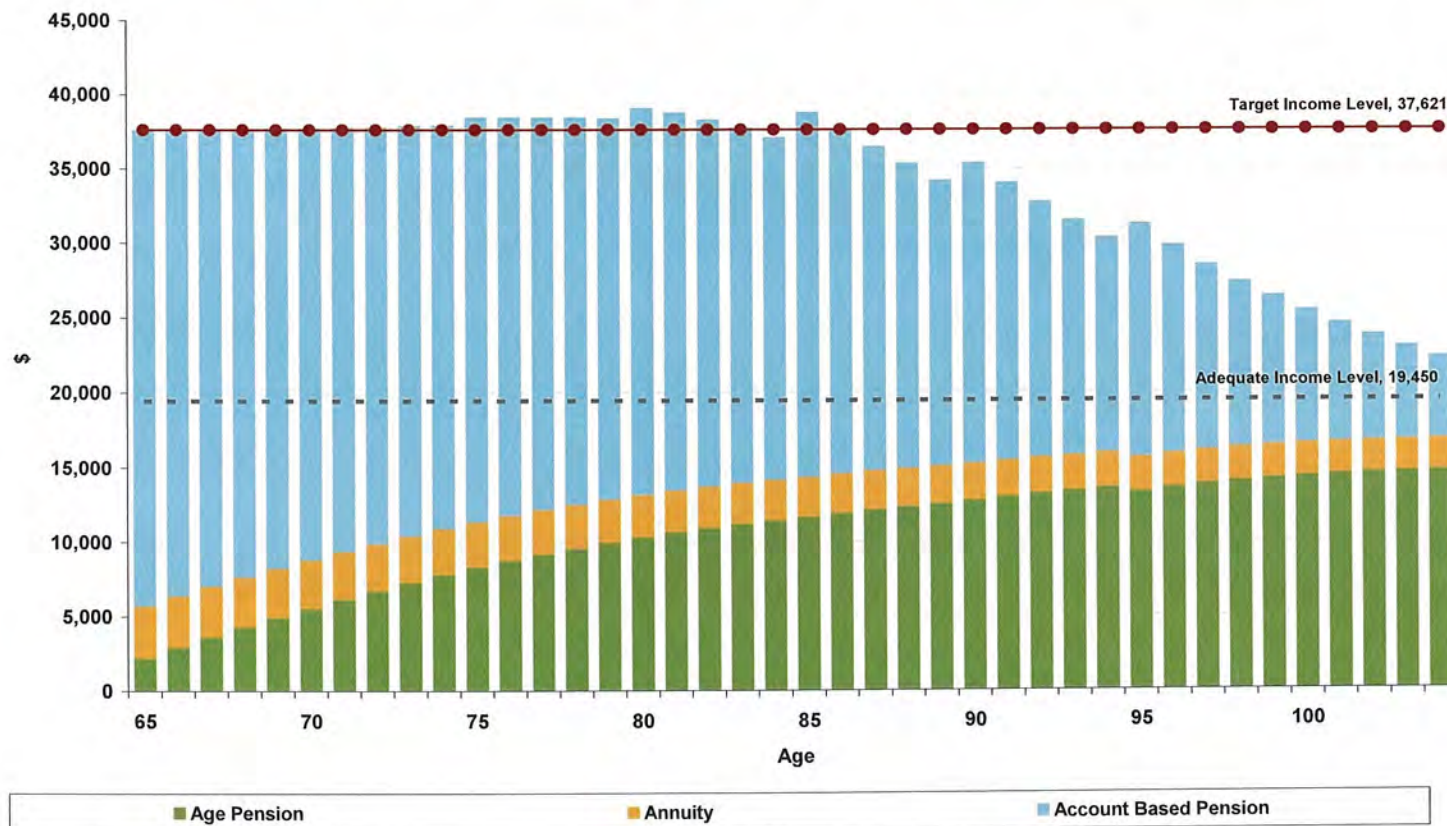
Figure 10.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 90% Growth, 10% Defensive; High Fees



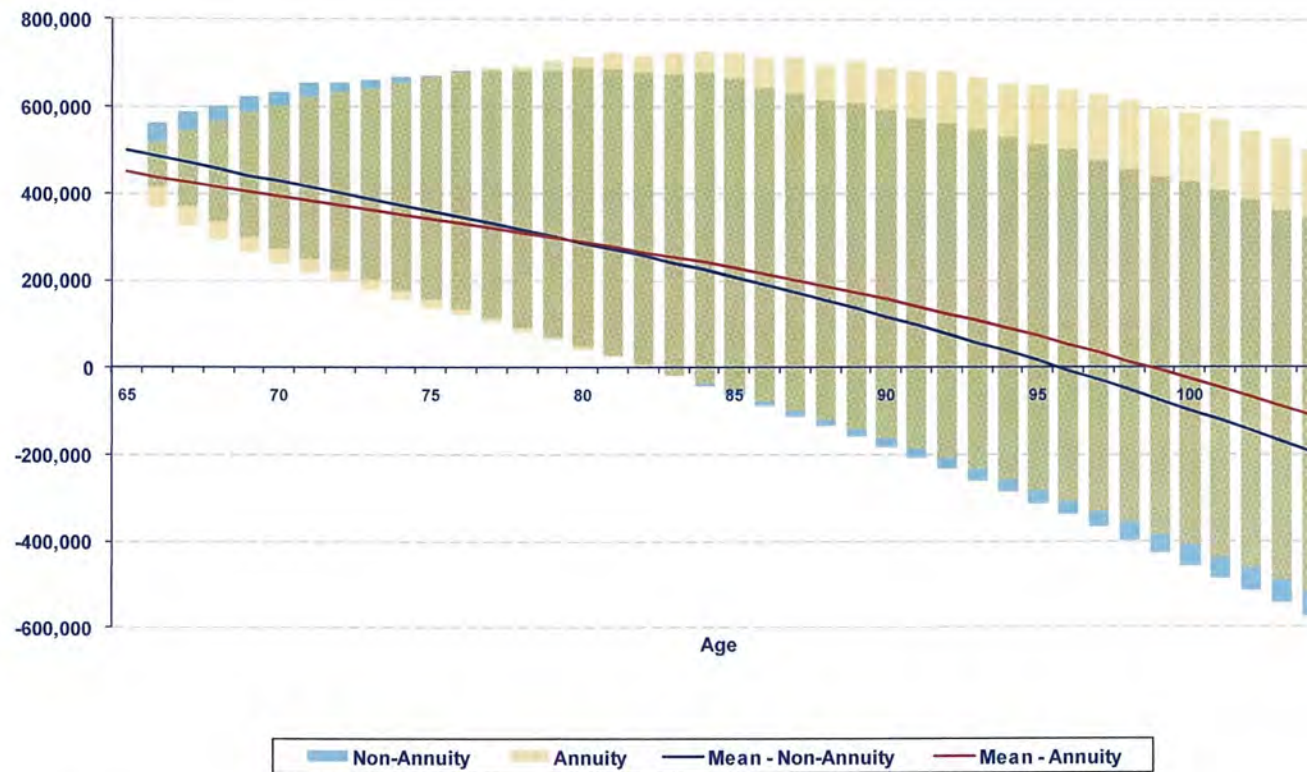
Figure 10.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 90% Growth, 10% Annuity; High Fees



Figure 10.3: Remaining account balance  
- 90% Confidence interval



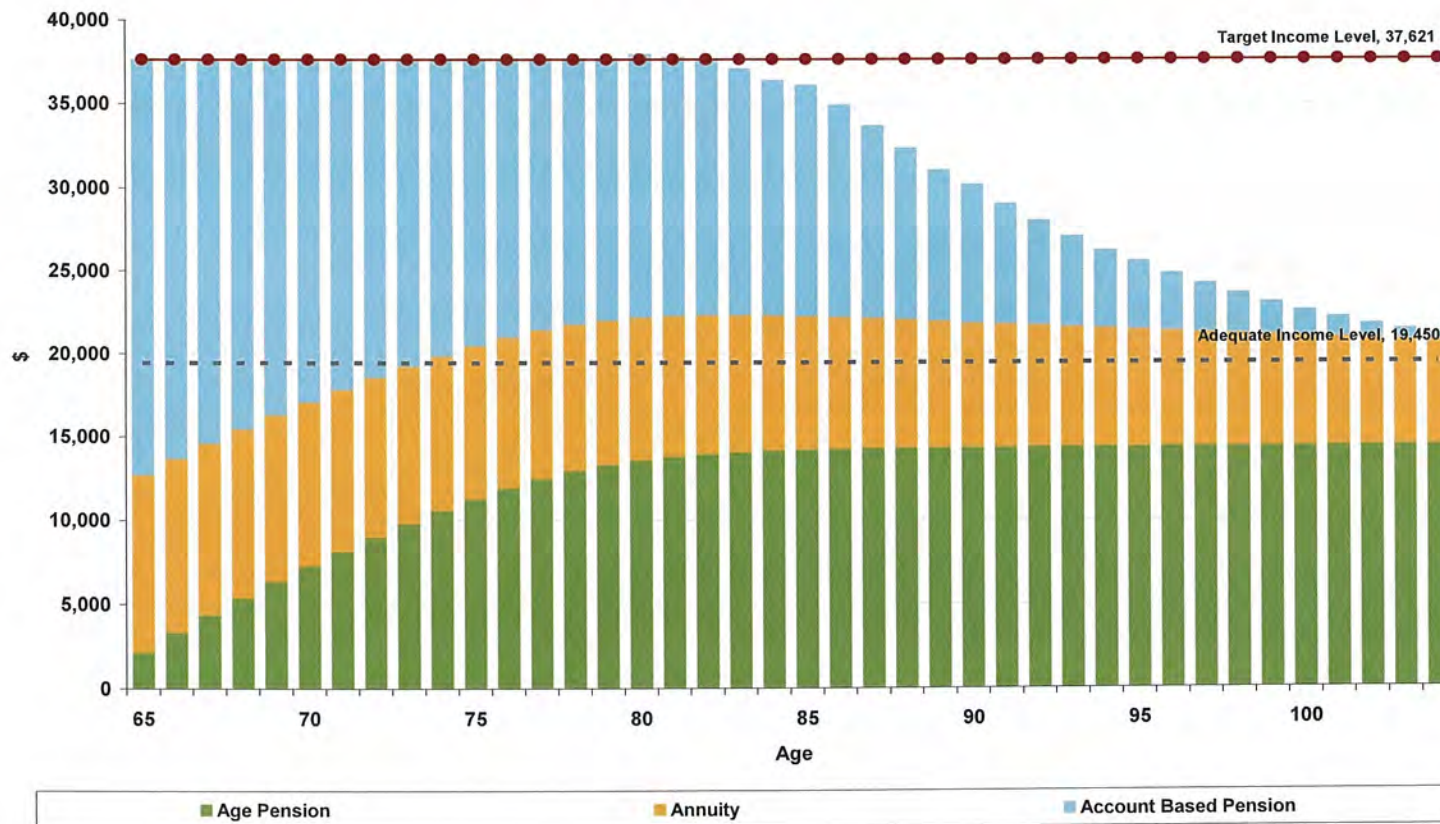
Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 90% Growth; High Fees





# Figure 11.1: Average retirement income

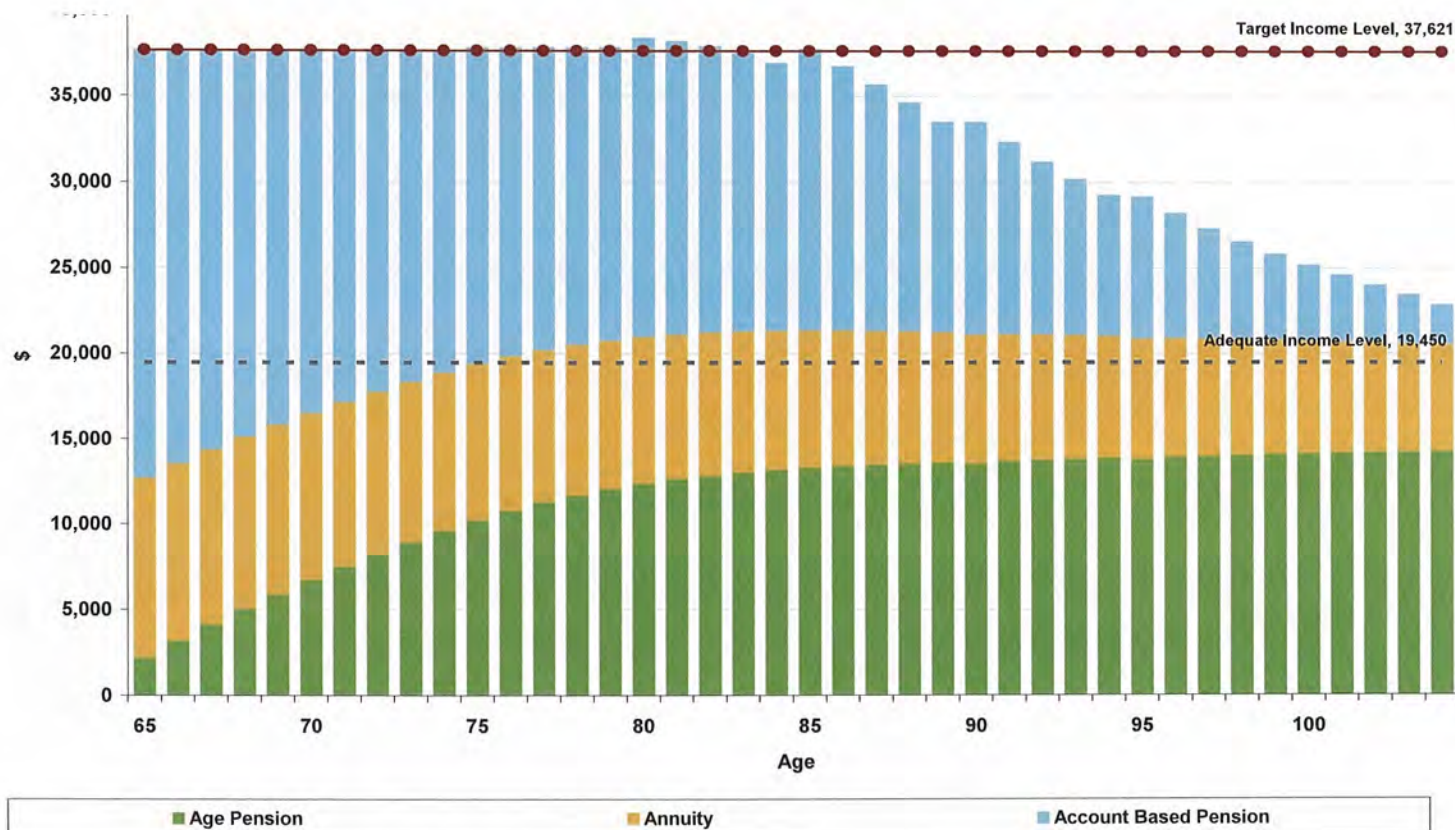
## - Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 30% Growth, 40% Bonds, 30% Annuity; High Fees

# Figure 12.1: Average retirement income

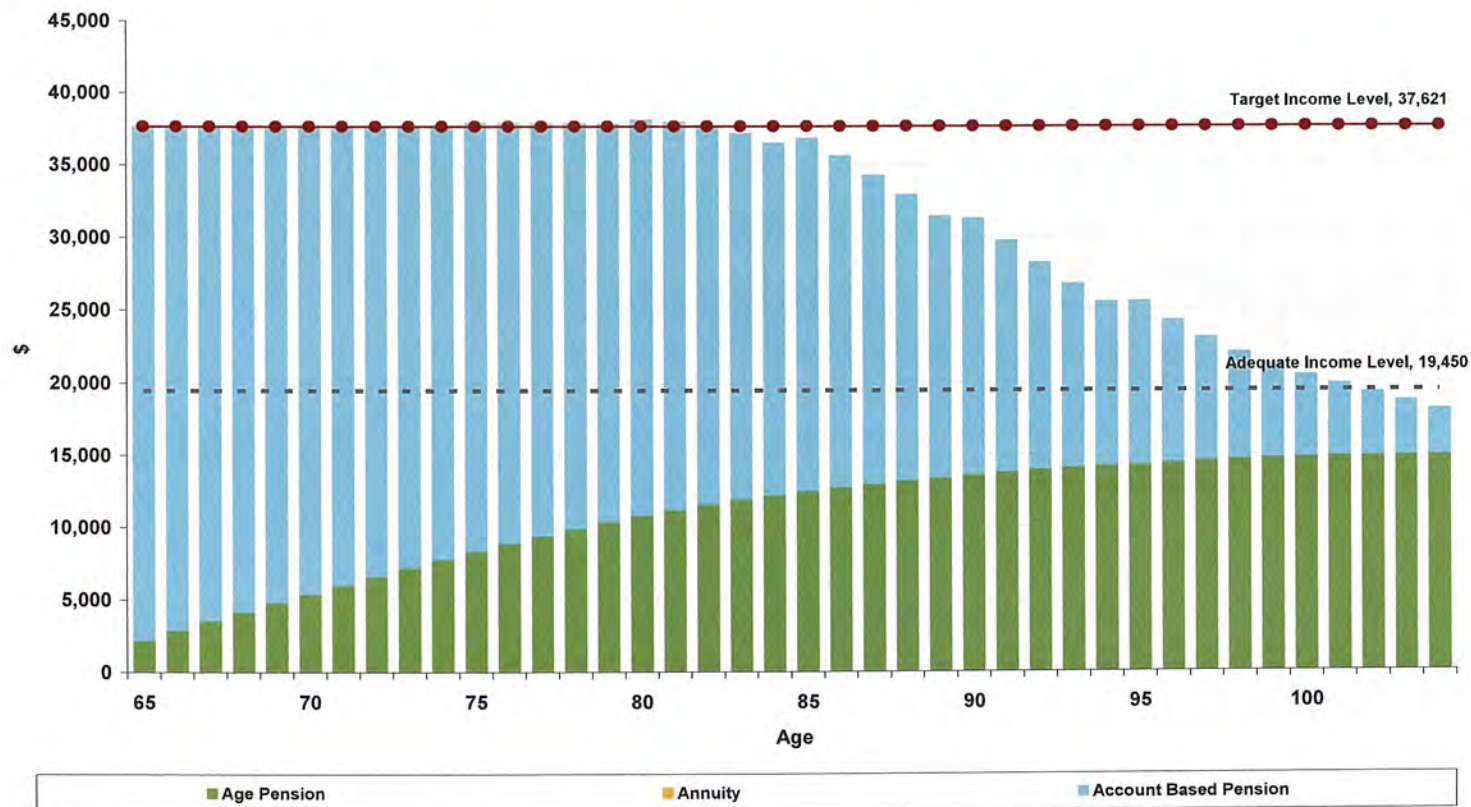
## - Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 50% Growth, 20% Bonds, 30% Annuity; High Fees



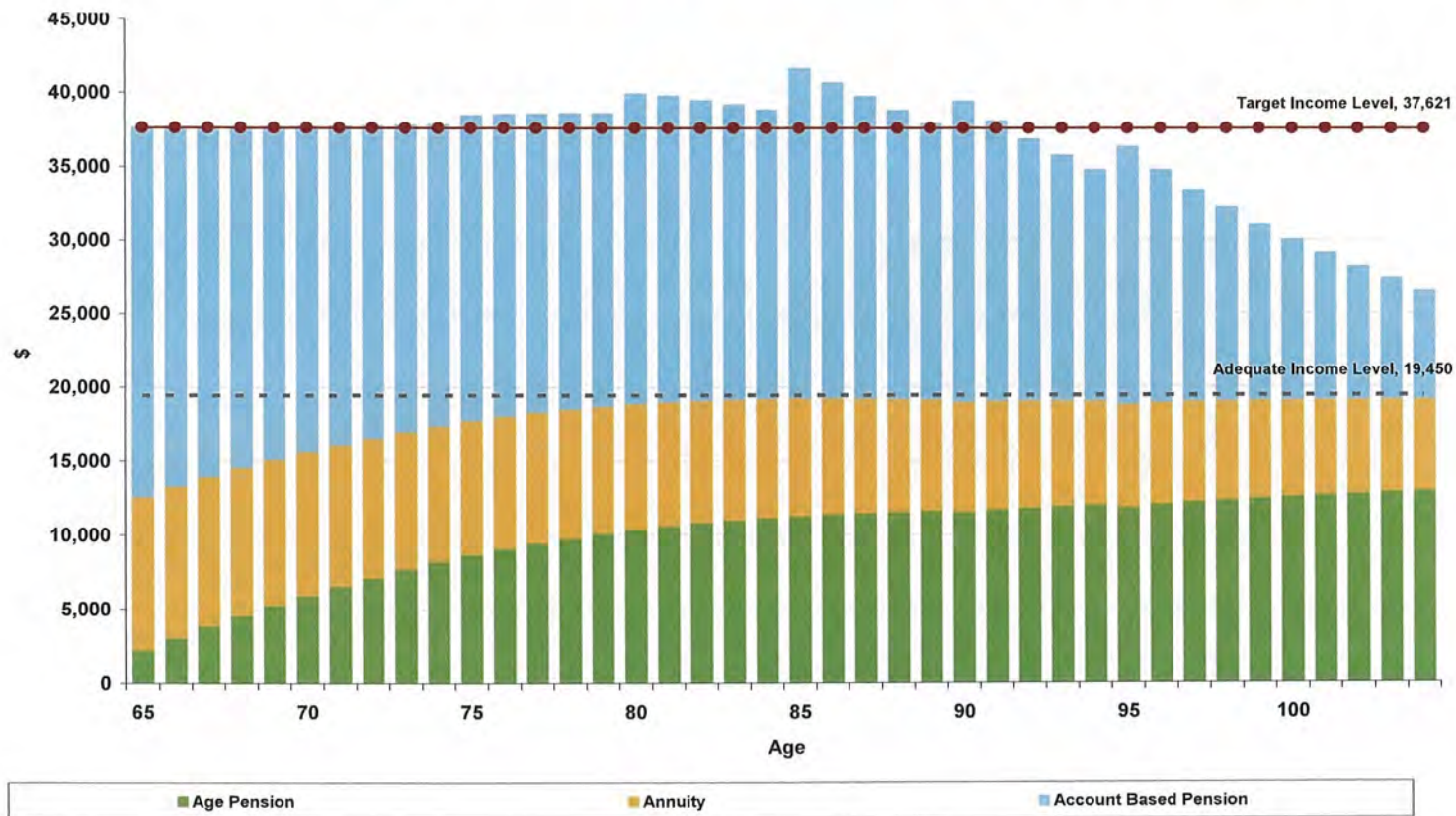
Figure 13.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; Low Fees

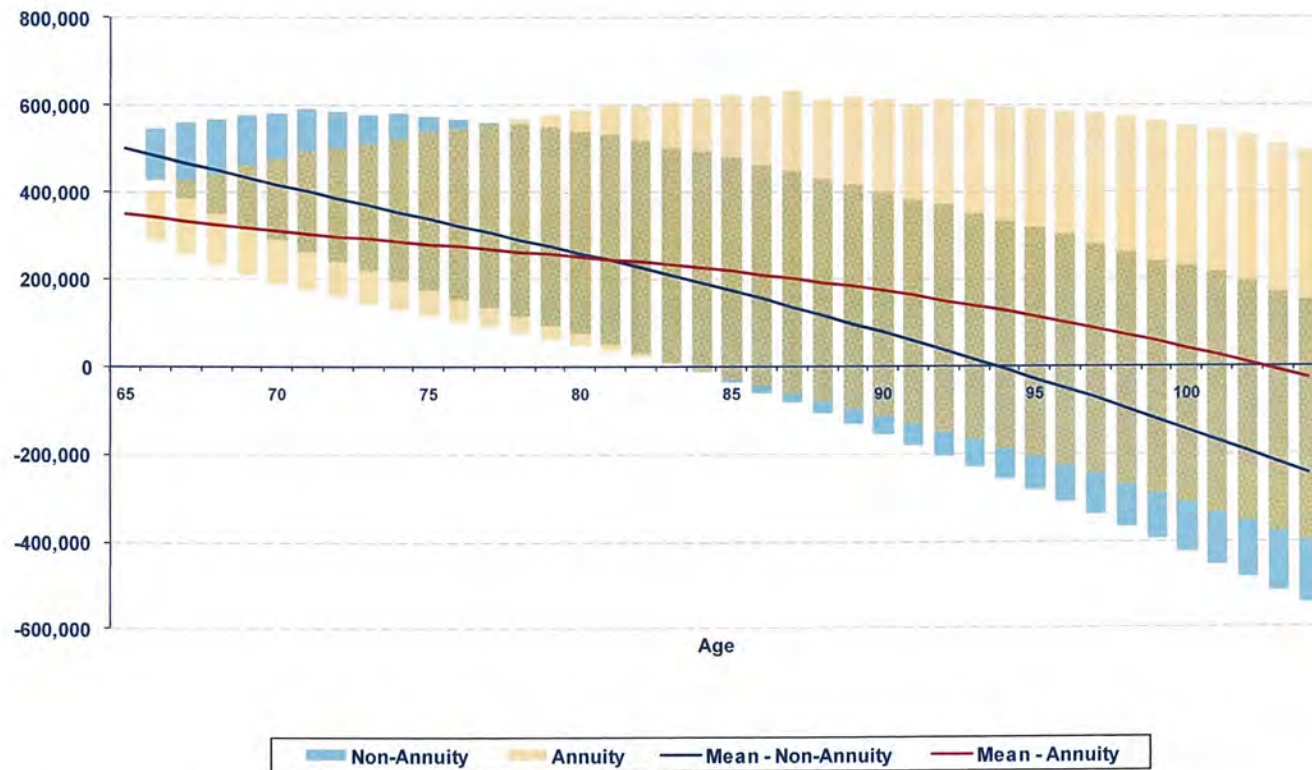


Figure 13.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; Low Fees

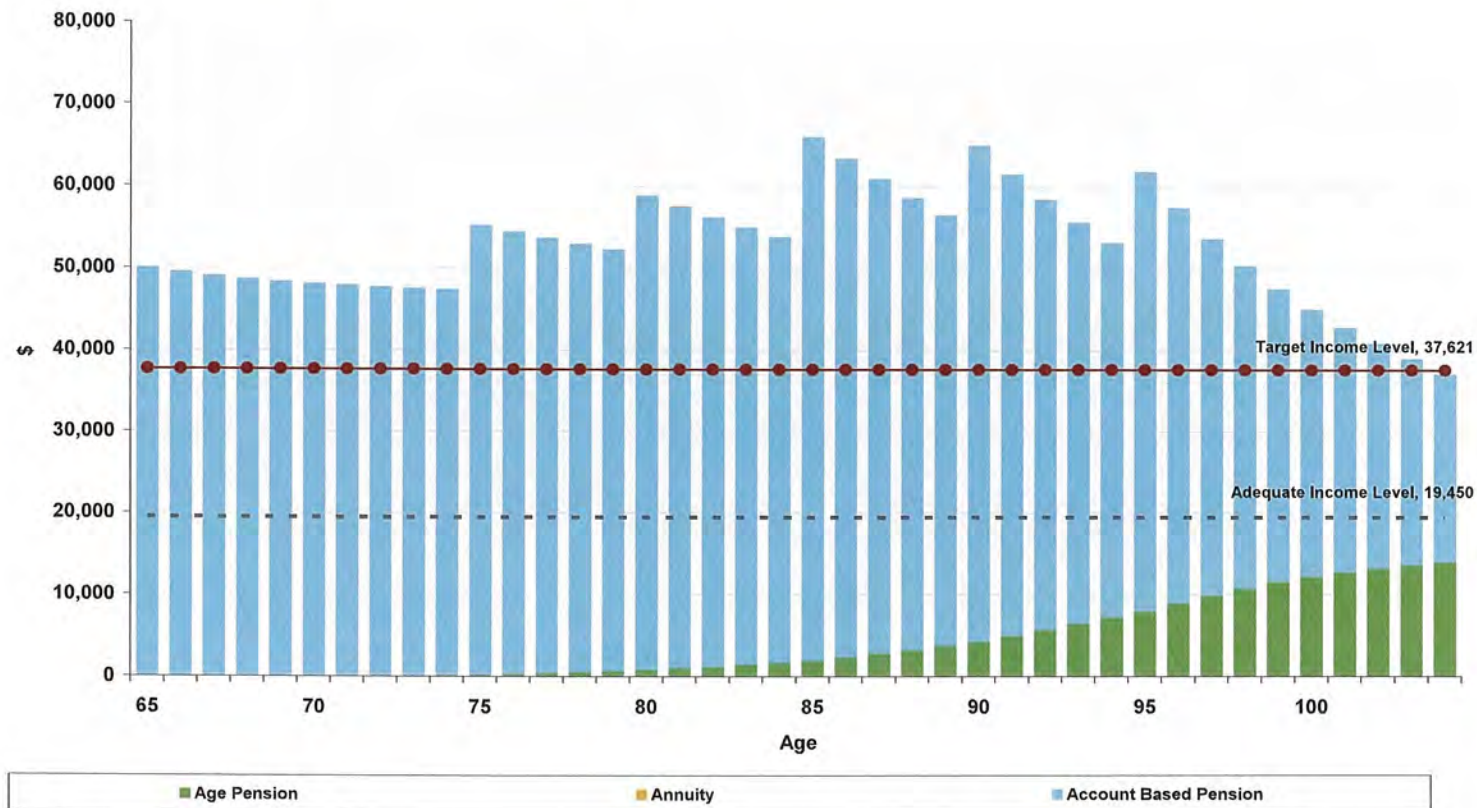
Figure 13.3: Remaining account balance  
- 90% Confidence interval



Assumptions: \$500,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; Low Fees



Figure 14.1: Average retirement income  
- No lifetime annuity purchased at retirement

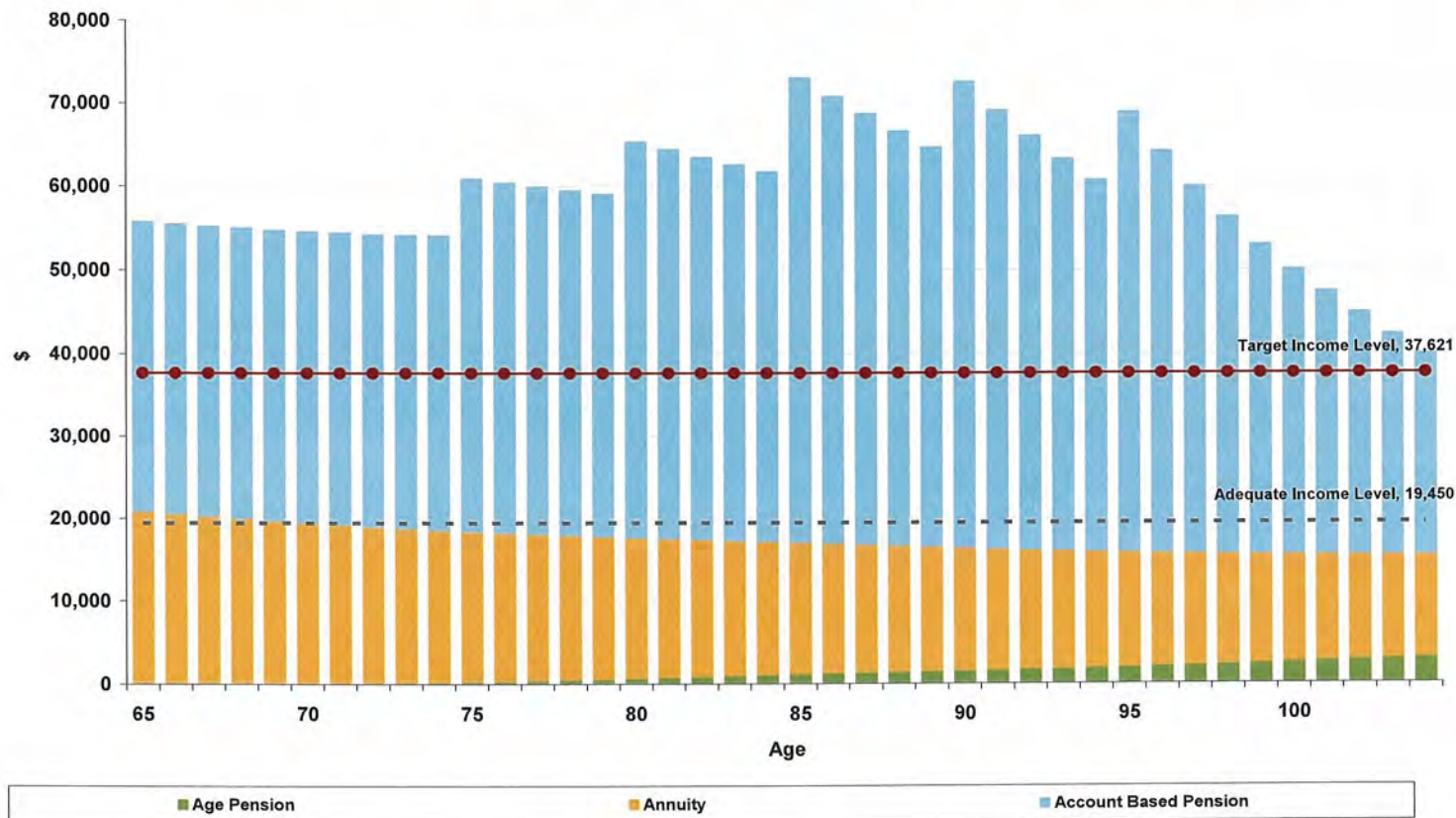


Assumptions: \$1,000,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; Low Fees



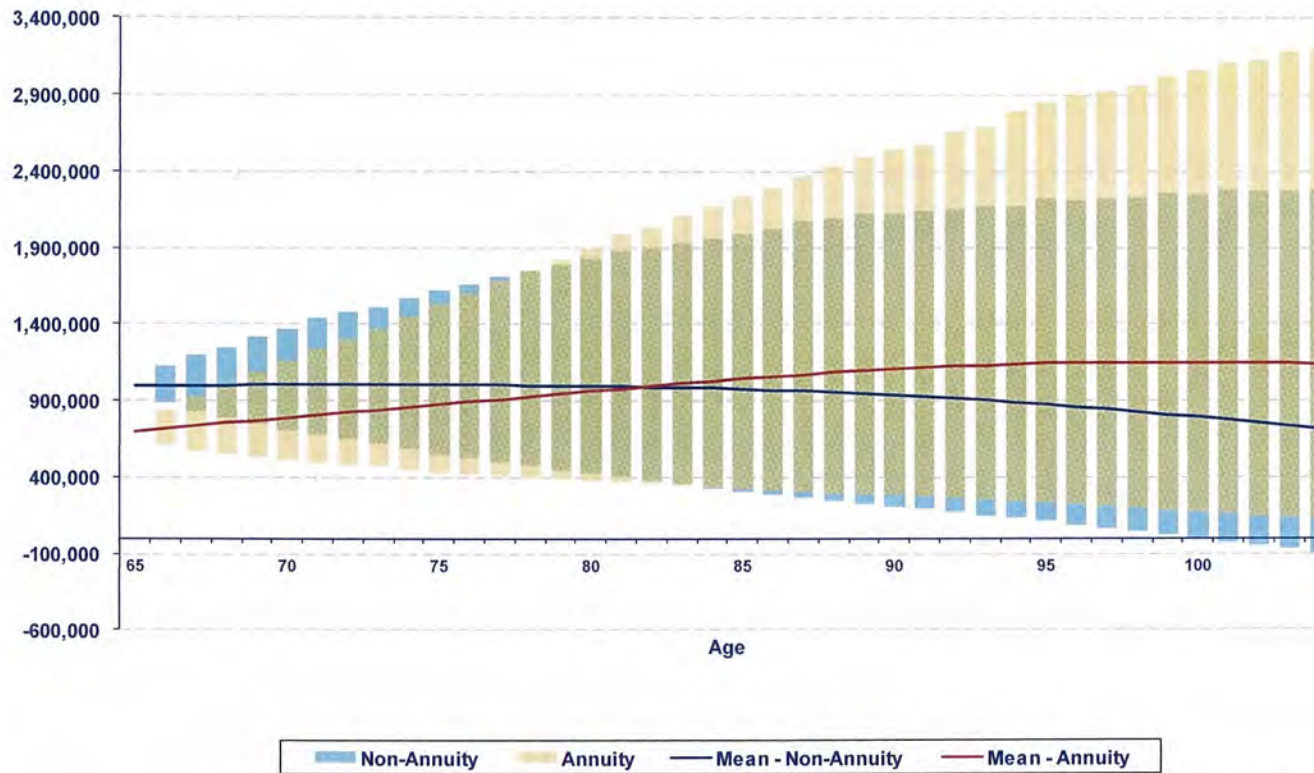


Figure 14.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$1,000,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; Low Fees

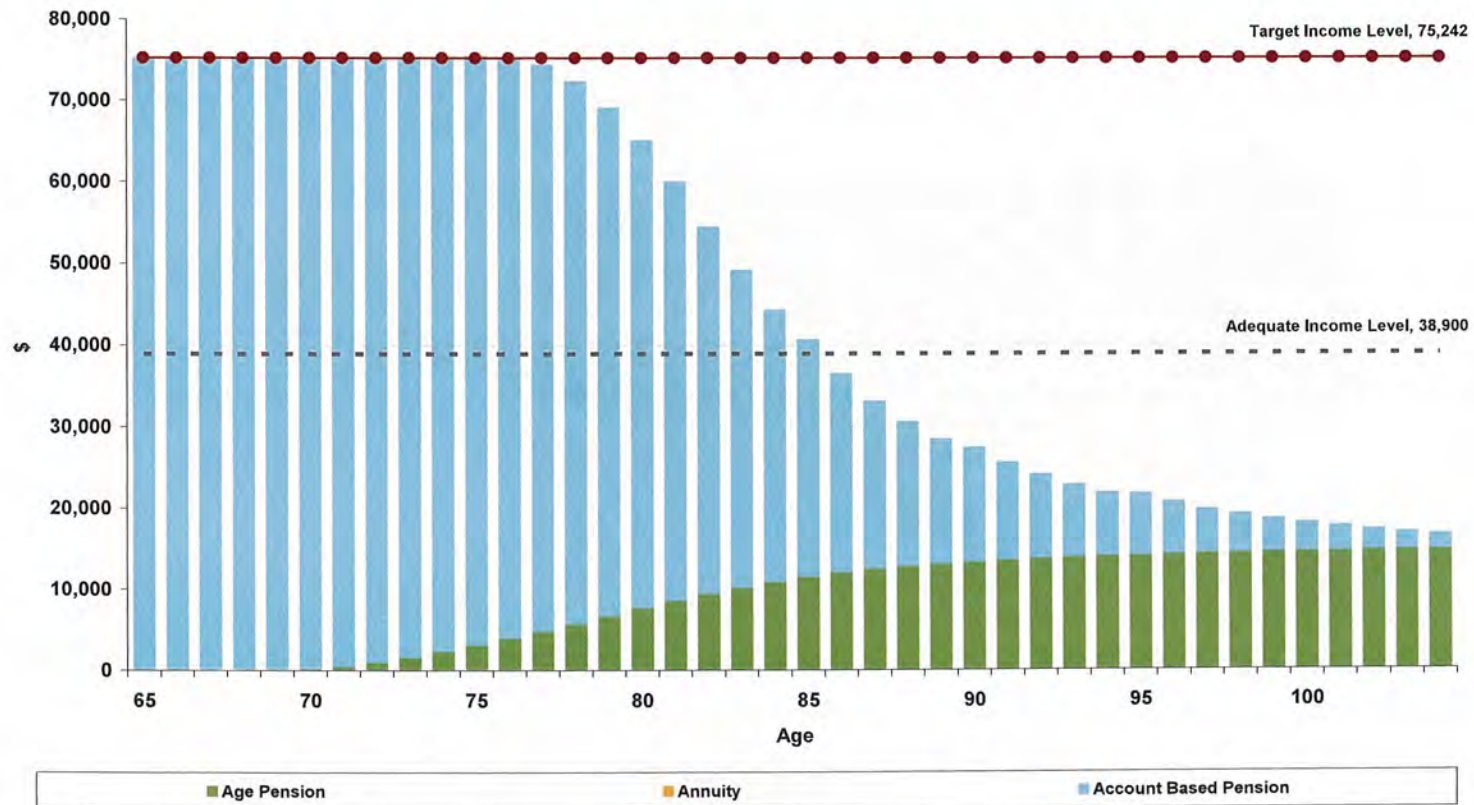
Figure 14.3: Remaining account balance  
- 90% Confidence interval



Assumptions: \$1,000,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; Low Fees



Figure 15.1: Average retirement income  
- No lifetime annuity purchased at retirement



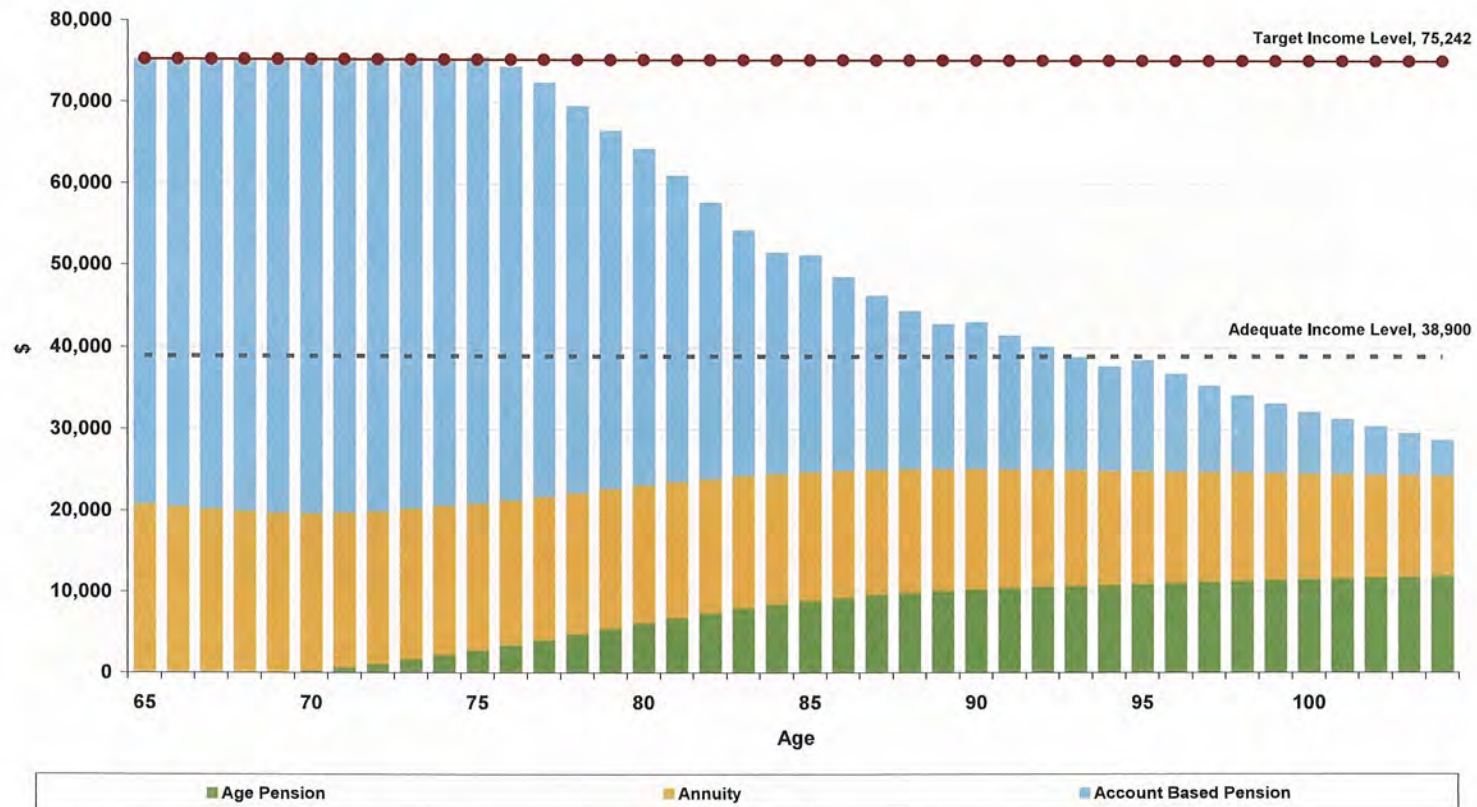
Assumptions: \$1,000,000 Initial account balance; \$75,242 pa Target income; \$38,900 pa Adequate income; 70% Growth, 30% Defensive; Low Fees





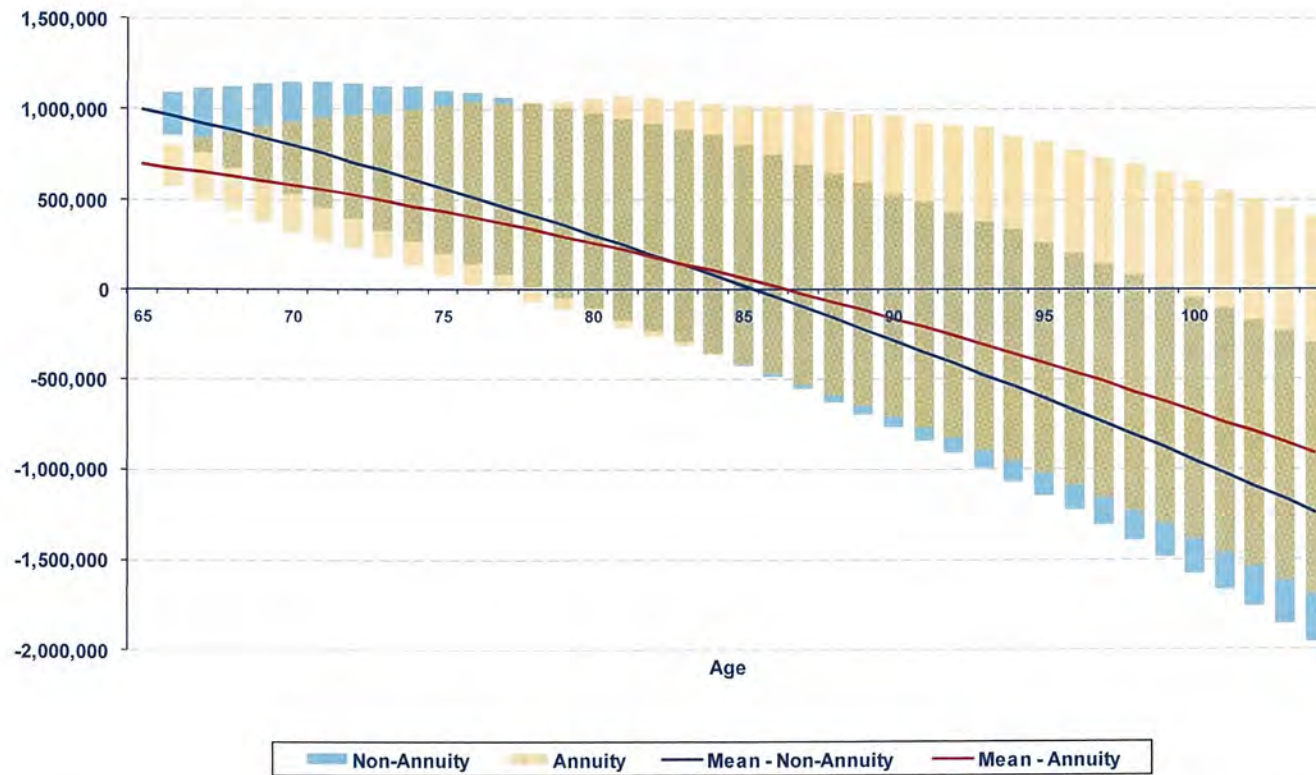
# Figure 15.2: Average retirement income

## - Lifetime annuity purchased at retirement



Assumptions: \$1,000,000 Initial account balance; \$75,242 pa Target income; \$38,900 pa Adequate income; 70% Growth, 30% Annuity; Low Fees

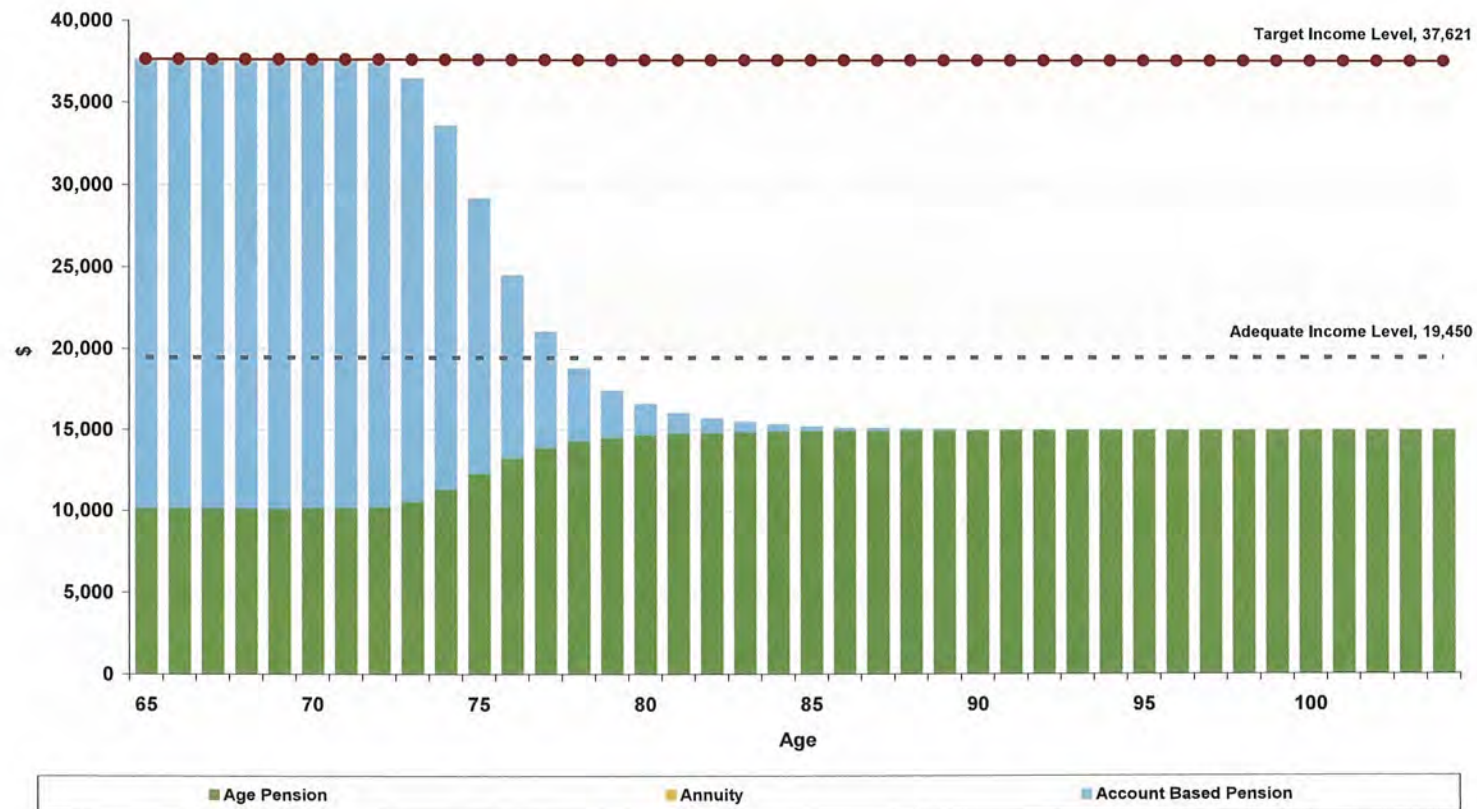
Figure 15.3: Remaining account balance  
- 90% Confidence interval



Assumptions: \$1,000,000 Initial account balance; \$75,242 pa Target income; \$38,900 pa Adequate income; 70% Growth; Low Fees



Figure 16.1: Average retirement income  
- No lifetime annuity purchased at retirement



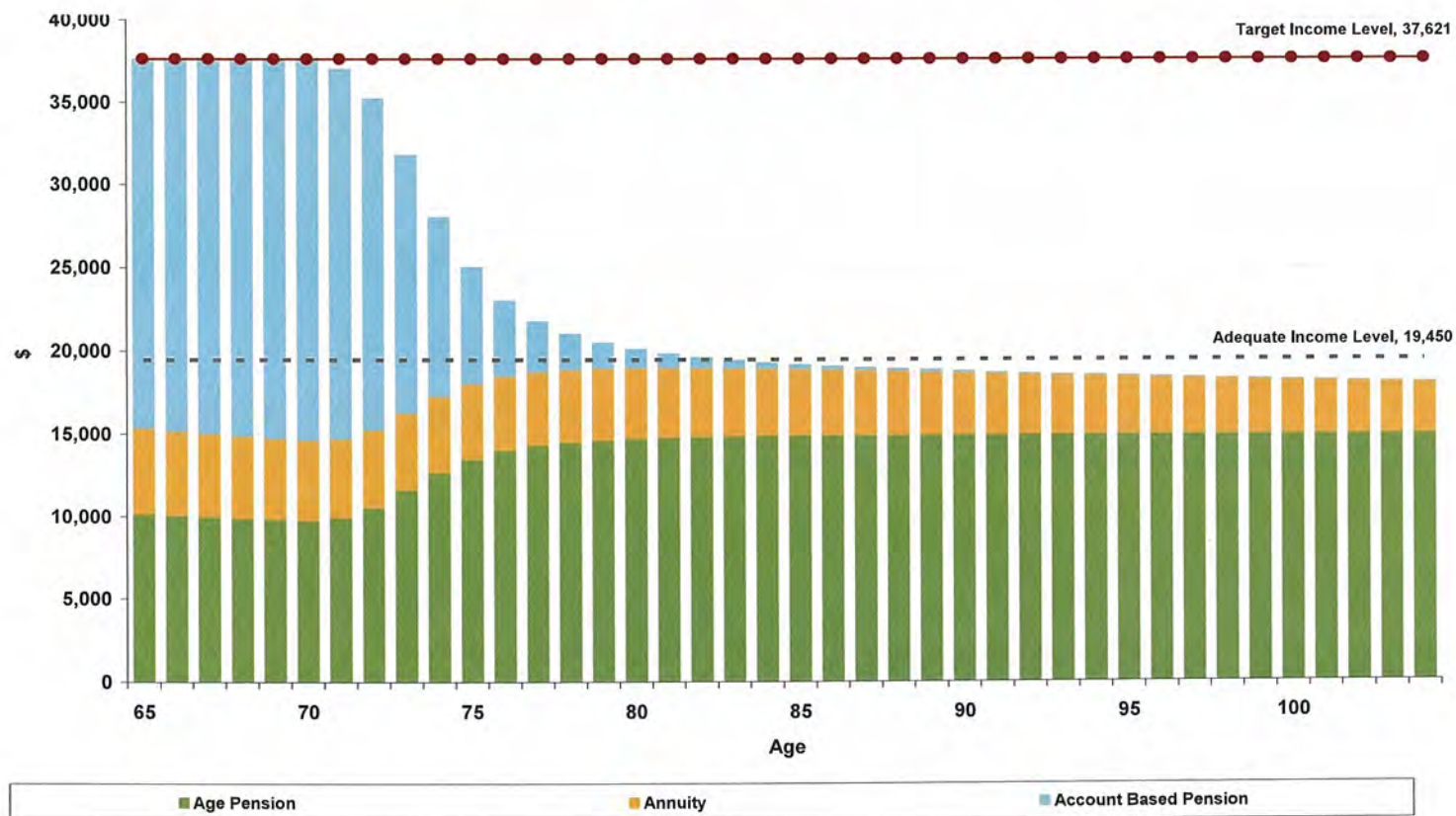
Assumptions: \$250,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; Low Fees





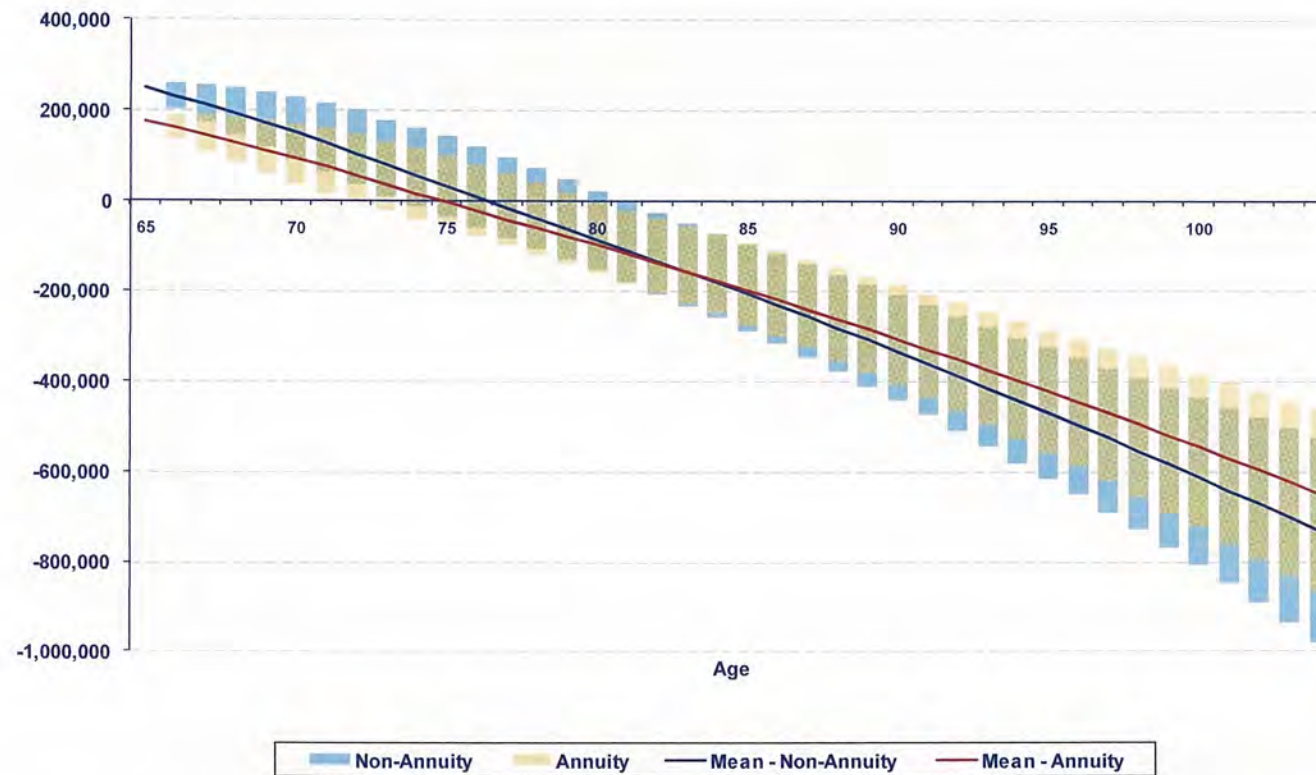
# Figure 16.2: Average retirement income

## - Lifetime annuity purchased at retirement



Assumptions: \$250,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; Low Fees

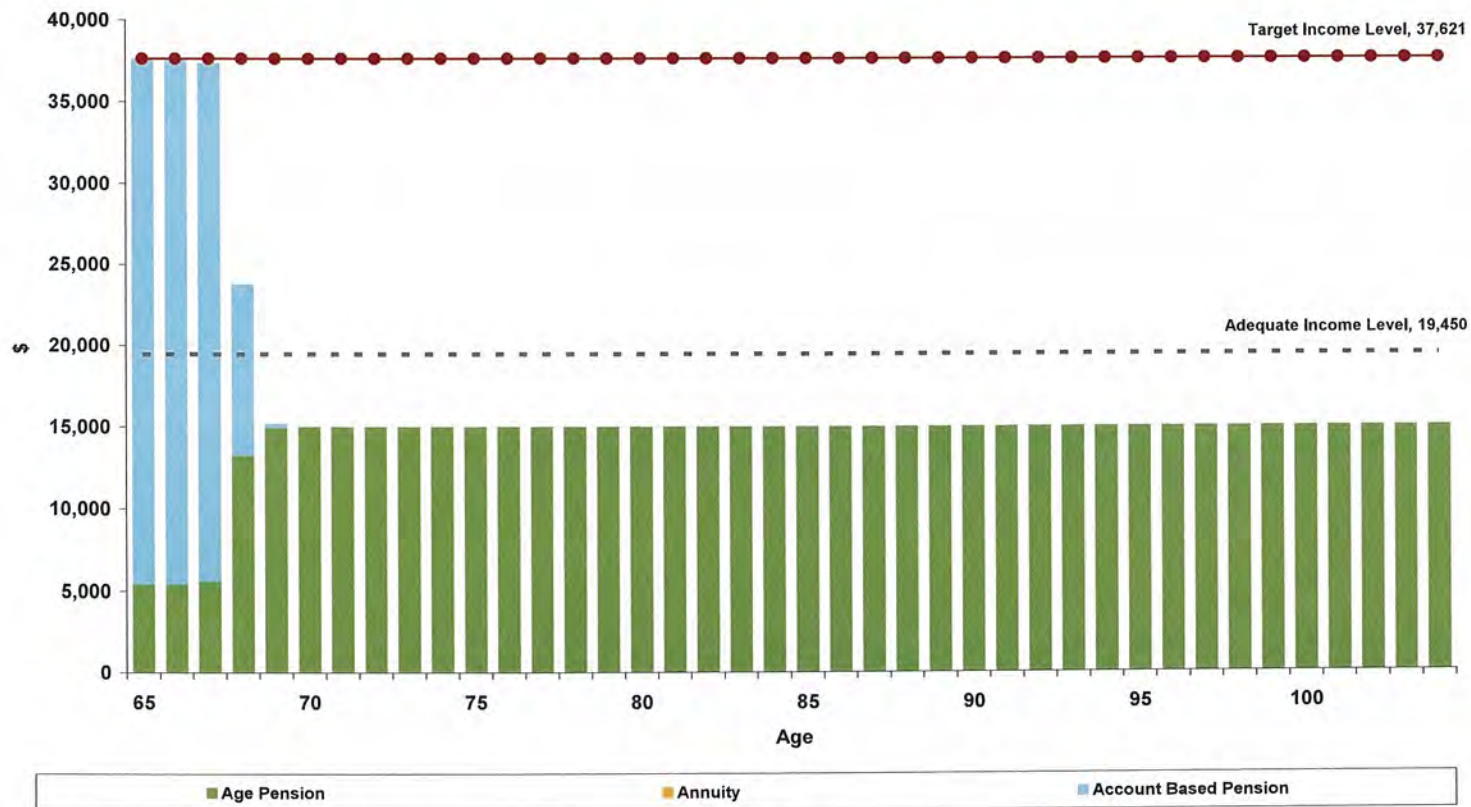
Figure 16.3: Remaining account balance  
- 90% Confidence interval



Assumptions: \$250,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; Low Fees



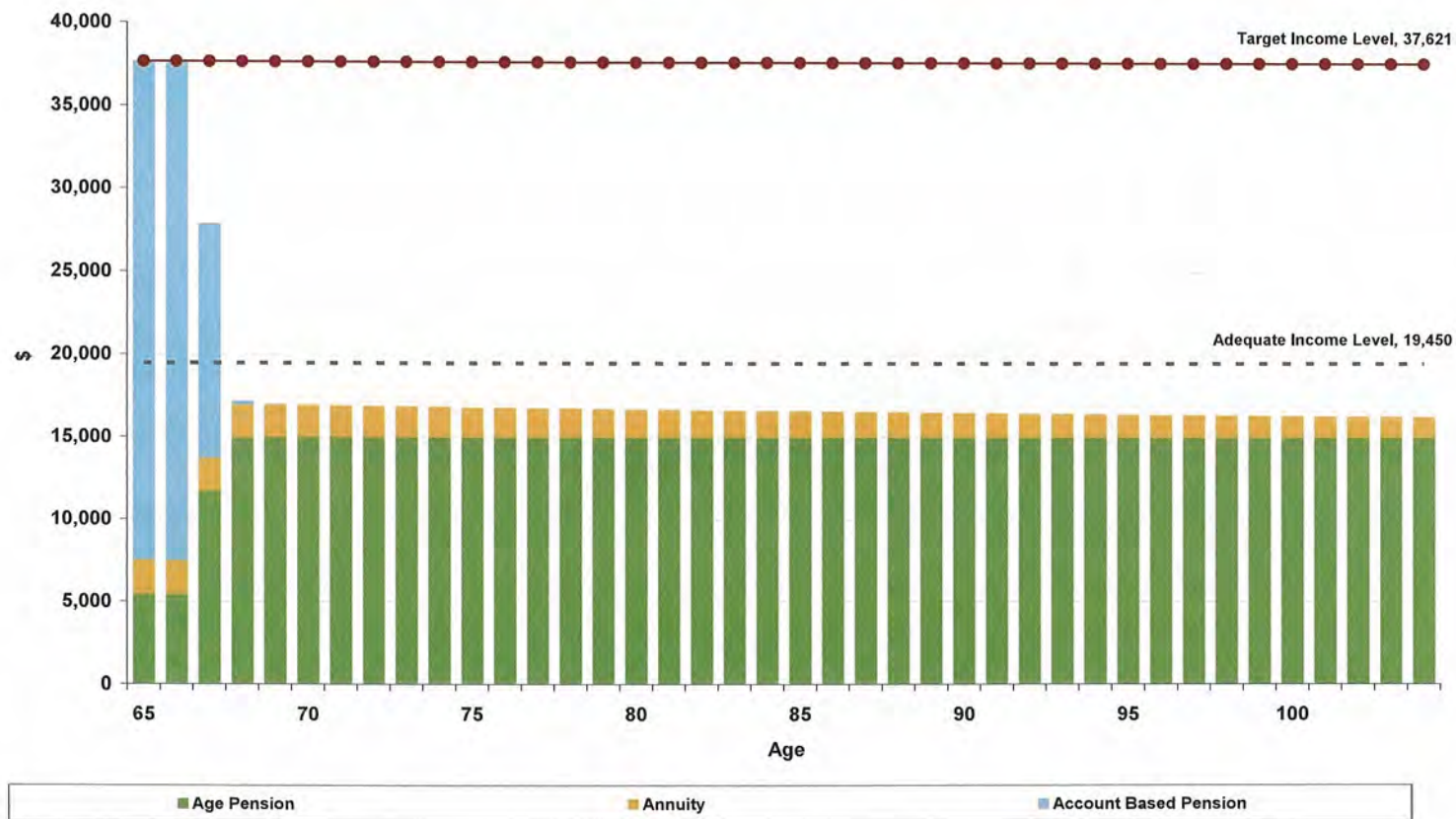
Figure 17.1: Average retirement income  
- No lifetime annuity purchased at retirement



Assumptions: \$100,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Defensive; Low Fees

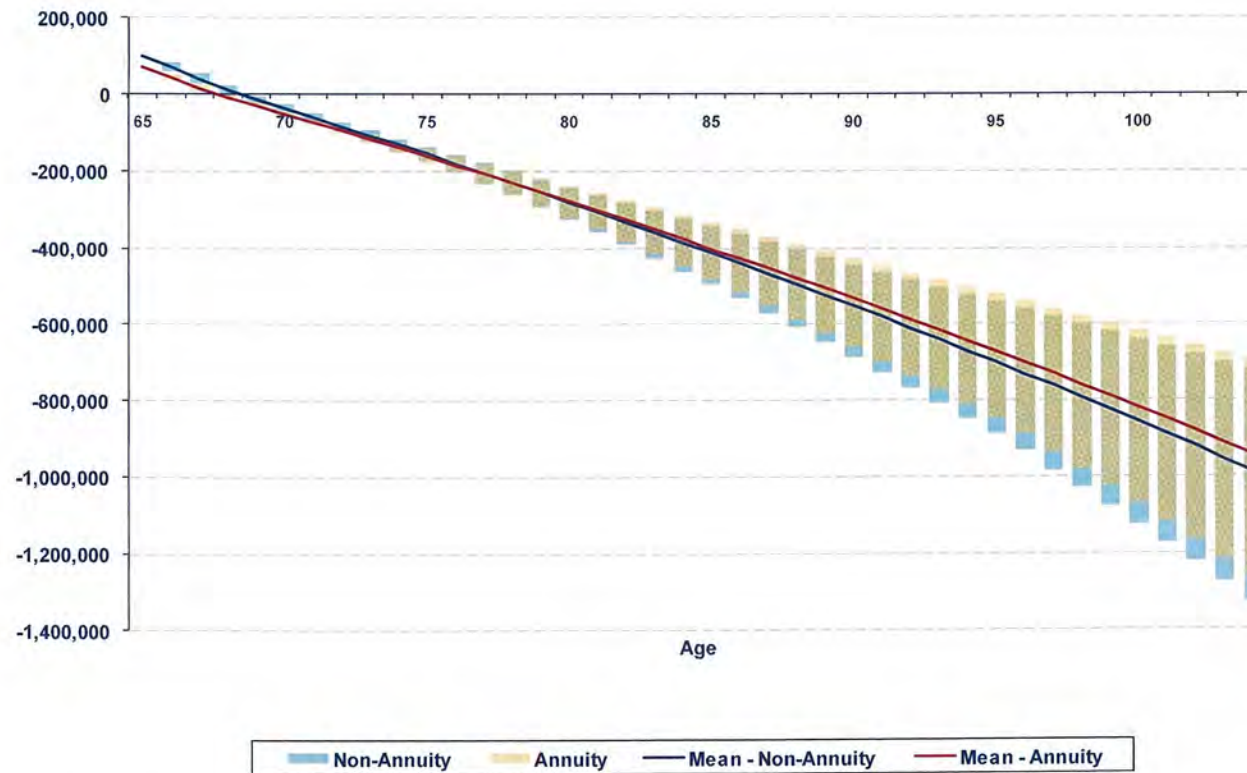


Figure 17.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$100,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth, 30% Annuity; Low Fees

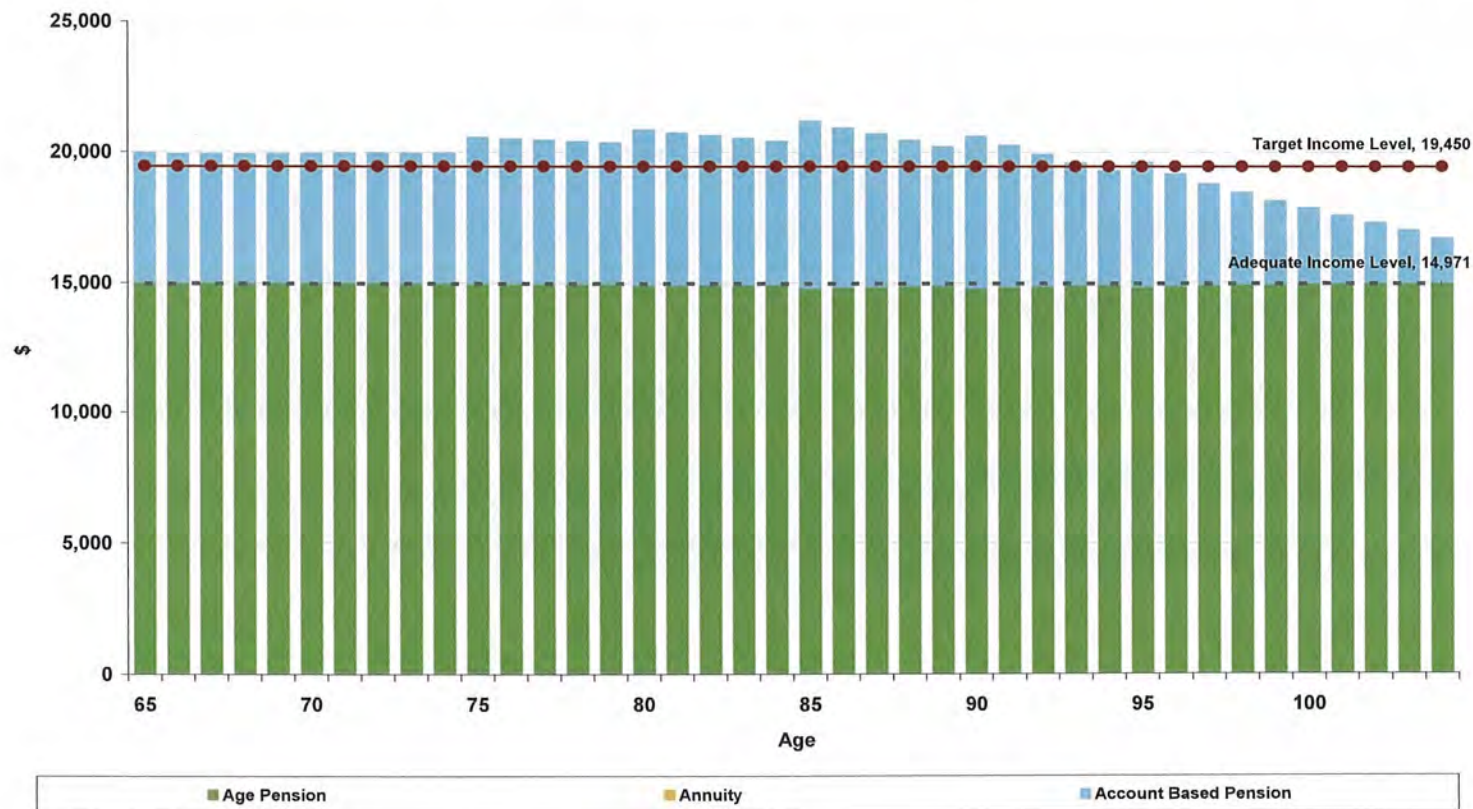
Figure 17.3: Remaining account balance  
- 90% Confidence interval



Assumptions: \$100,000 Initial account balance; \$37,621 pa Target income; \$19,450 pa Adequate income; 70% Growth; Low Fees



Figure 18.1: Average retirement income  
- No lifetime annuity purchased at retirement

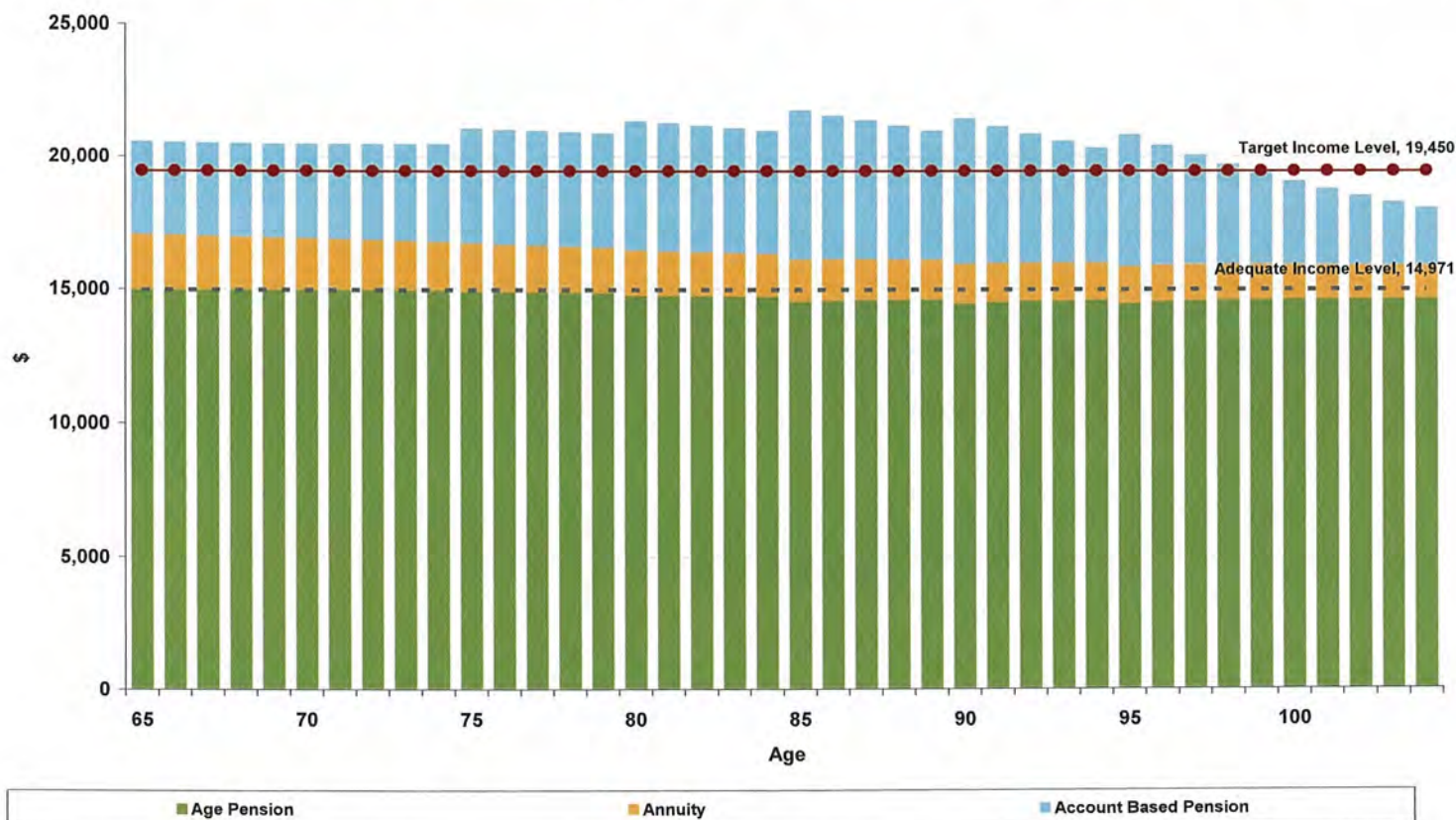


Assumptions: \$100,000 Initial account balance; \$19,450 pa Target income; \$14,971 pa Adequate income; 70% Growth, 30% Defensive; Low Fees



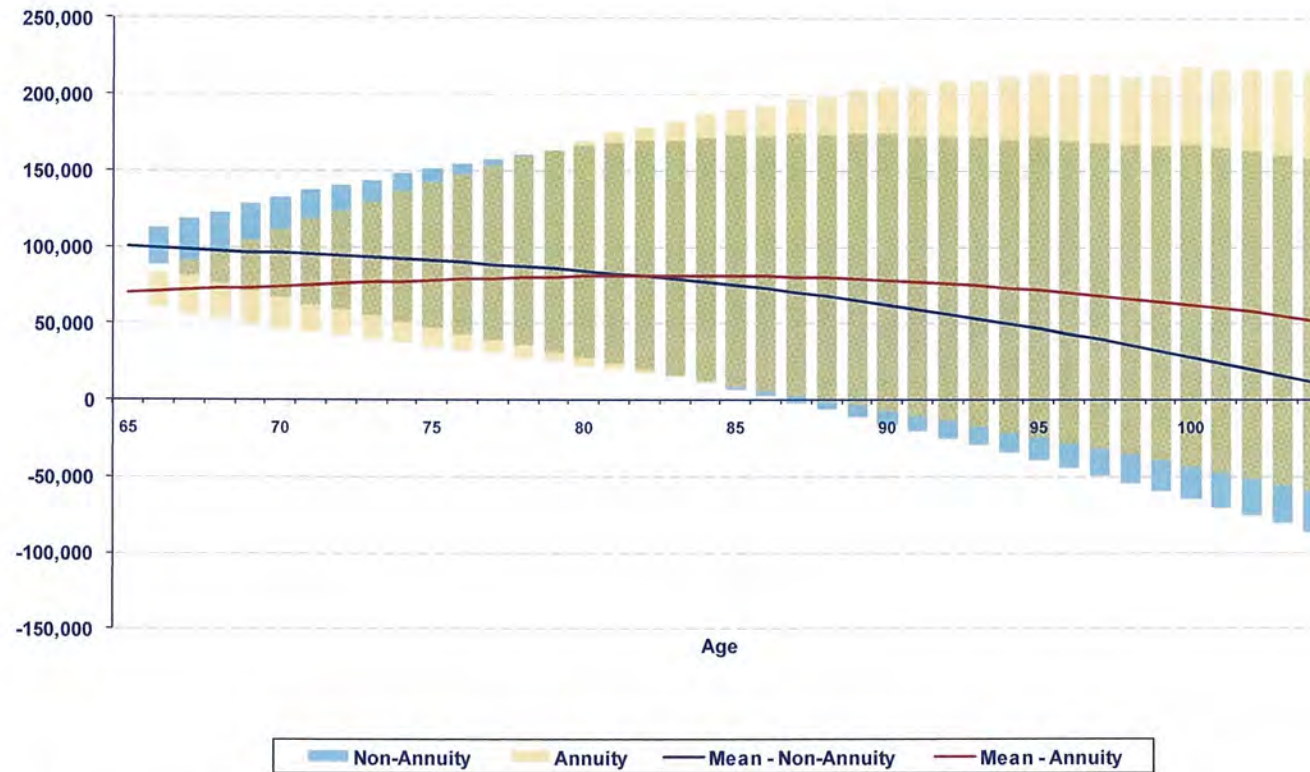


Figure 18.2: Average retirement income  
- Lifetime annuity purchased at retirement



Assumptions: \$100,000 Initial account balance; \$19,450 pa Target income; \$14,971 pa Adequate income; 70% Growth, 30% Annuity; Low Fees

# Figure 18.3: Remaining account balance - 90% Confidence interval



Assumptions: \$100,000 Initial account balance; \$19,450 pa Target income; \$14,971 pa Adequate income; 70% Growth; Low Fees

