RETIREMENT ADEQUACY GOALS REVISITED: THE SOUTH AFRICAN EXPERIENCE OF GOAL ESTIMATION FOR ONE- AND TWO-ADULT HOUSEHOLDS

By MBJ Butler

ABSTRACT

Retirement adequacy goals, or how much is required to retire comfortably, are important for financial planning. The primary purpose of this paper was to produce updated retirement adequacy goals for one- and two-adult households using IES 2010-2011 data, updated economic assumptions and updated tax rules. It was found that consumption does not change at or in retirement. The calculated retirement adequacy goals were dependent on a number of different factors including household composition and retirement age. There was evidence that home ownership was associated with higher goals and both higher levels of income and retirement savings rates were associated with lower goals.

For retirement adequacy goals to be useful for planning purposes, they should be relatively stable over a short period of time. A further aim of the paper was to assess the change in the results between this and a previous study. Using consistent methodology, single females required approximately one times annual salary less than previously while single males and couples required 0,3 times annual salary and one times annual salary more respectively. These changes were driven by economic factors, sensitivity to tax and demographic data changes. This highlights that retirement adequacy goals will evolve at a household level due to tax changes and as the demographics of the household change, emphasising the importance of regular financial planning incorporating tax modelling. At an aggregate level, this volatility is even greater which makes setting a single long-term goal in a retirement fund extremely difficult.

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1. INTRODUCTION

1.1 BACKGROUND

How much households must save in order to retire comfortably is an important element of household financial planning (Bernheim et al., 2000; Tacchino & Saltzman, 1999; Groyer & Holtzhausen, unpublished). This savings rate may depend on how much wealth needs to be accumulated by the retirement date in order to secure an adequate retirement income (Mitchell & Moore, 1998). This wealth level can be termed a retirement adequacy goal.

Given their importance in determining overall contribution rates to retirement saving, determining retirement fund benefit design (Groyer & Holtzhausen, op. cit.) and setting investment strategies (Groyer & Holtzhausen, op. cit.; Dietz, 1968), it would be desirable if the

retirement adequacy goals themselves were relatively stable and avoided large swings in goal levels over relatively short time periods (Schieber, 1996).

The AON/GSU RETIRE project documented in Palmer (1989; 1992; 1994; unpublished)('the Palmer Papers') has produced seven waves of retirement adequacy goals for US data estimated from cross-sectional Consumer Expenditure Survey (CES) data (Palmer, unpublished). These retirement adequacy goals have shown considerable variation for the same nominal earnings level, as was noted by Schieber (op. cit.).

1.2   AIMS

Butler & Van Zyl (2012b) estimated retirement adequacy goals for South African households from Income and Expenditure Survey (IES) 2005-2006 data collected by Statistics South Africa.

The primary aim of this paper is to present a second wave of South African estimates of retirement adequacy goals for one- and two-adult households. This required an investigation into the change in consumption at and in retirement. The updated estimates were derived using IES data from 2010-2011, the revised estimate of the changes in consumption at and in retirement, an updated projection basis and revised tax assumptions.

A secondary aim is to investigate factors that had a statistically significant impact on the retirement adequacy goals.

A further aim is to compare the updated retirement adequacy goals to those in Butler & Van Zyl (2012b) in order to understand the level of variation in the goals over time, particularly as significant variation has been observed in the US goals developed by Palmer.

The final aim of the paper is to suggest reasons for changes in the estimated retirement adequacy goals.

1.3   SCOPE

Only one- and two-person households were considered in order to be consistent with the first wave of the study. In addition, the study was restricted to people who can and do save. In theory, the retirement savings rate has a large impact on retirement adequacy goals (Mitchell & Moore, op. cit.). A large percentage of South African households do not save for retirement and including them in the sample would reduce the applicability of results for trustees of retirement funds and households preparing for retirement who would arguably be the most interested in the results.

1.4   PLAN OF DEVELOPMENT

Section 2 sets out the principal technical issues in estimating retirement adequacy goals from cross-sectional data. Section 3 presents the revised estimates of the changes in consumption at and in retirement. The methodology and data used for estimating the goals are presented in sections 4 and 5 respectively before the results are presented in section 6. The variability of the goals is discussed in section 7 before the implications of the research are set out in section 8.

2. TECHNICAL ISSUES IN ESTIMATING RETIREMENT ADEQUACY GOALS

This section, which draws on Butler & Van Zyl (2012a; 2012b), presents the literature on some of the core methodological issues in estimating retirement adequacy goals. The choice of model is discussed in ¶ 2.1, the treatment of housing consumption and mortgages is discussed in ¶ 2.2, the choice of real or hypothetical households for which to calculate the goals is set out in ¶ 2.3 while ¶ 2.4 discusses the presentation of the goals themselves.

2.1 TAX AND SAVINGS MODELS AND TAX, SAVINGS AND EXPENDITURE MODELS

Where retirement adequacy goals are based on the premise that consumption is smoothed between the pre- and post-retirement phases, the literature suggests the use of tax and savings (TS) models and tax, savings and expenditure (TSE) models (Palmer, 1989; Mitchell & Moore op. cit.; Yuh, Hanna & Montalto, 1998).

2.1.1 DESCRIPTION OF THE TS AND TSE MODELS

Comprehensive descriptions can be found in Palmer (1989) and can be summarized as follows. Both models take current consumption for working households and project it to retirement given a pre-retirement tax regime and a given savings rate. At retirement, the TSE model adjusts consumption for certain work-related expenditure that will not be required in retirement as well as age-related expenditure which may not have been incurred in the pre-retirement period but will be incurred during retirement. The TS model does not adjust for work-related or age-related expenditure. For both the TS and TSE models, the post-retirement consumption level is funded from income net of post-retirement savings and post-retirement taxation. The equation for calculating the income required immediately after retirement is given in equation 1.

$$Y_R - T_R - S_R = Y_W - T_W - S_W + E_R; \tag{1}$$

where
Y_R represents post-retirement income;
T_R represents post-retirement taxation;
S_R represents post-retirement savings;
Y_W represents working (pre-retirement) income;
T_W represents working (pre-retirement) taxation;
S_W represents working (pre-retirement) savings; and
E_R represents the net increased expenditure in retirement due to the difference between age-related and work-related expenditure. In a TS model this is set to 0. Estimation of this net increased expenditure is discussed further in ¶2.1.2.

The present value of the incomes required for each year of retirement is then found and the expected value of this discounted income stream is then calculated to give the wealth required at retirement.

2.1.2 ESTIMATING CHANGES IN CONSUMPTION AT AND IN RETIREMENT FOR TSE MODELS

The change in expenditure component of the TSE model is difficult to assess from cross-sectional data, which would involve comparing consumption across households that differ with respect to age and retirement status while controlling for other variables that might affect consumption (Butler & Van Zyl, 2012a).

Jianakoplos, Menchik & Irvine (1989) warned of the dangers of using cross-sectional data and argued that wealthier households would be over-represented in the retired samples due to lighter mortality, which they termed 'mortality bias'. This may be offset in part by the fact that if wages increased in real terms then workers would have higher incomes in real terms than their retired counterparts would have had during their working lifetimes (ibid.).

Hence comparing households of similar wealth-levels is important to prevent misleading comparisons. Other important control variables include income (Chia & Tsui, 2003; Case & Deaton; 2005), socio-economic status (Chia & Tsui, op. cit.; Case & Deaton, op. cit.; Robb & Burbidge, 1989), household composition (Hurd & Rohwedder, unpublished) and health-status (ibid.).

Mitchell & Moore (op. cit.) and Yuh, Hanna & Montalto (op. cit.) avoided this difficulty altogether by using TS models.

The Palmer Papers used a matched-pairs methodology described in Palmer (1989). Households were divided into one of two groups: working with a household head aged 50-64 and retired with a head aged 62-74 (Palmer, 1989). For each group, disposable income was defined in terms of income less pre-retirement savings less applicable tax (Palmer, 1989). Households were then matched by disposable income and the differences in work-related and age-related expenditures were examined (Palmer, 1989).

A significant problem with the methodology in the Palmer Papers was that property taxes were found to be significantly higher in the retired group despite the rebates for retirees. This indicated that the retirees perhaps earned more while working than the working group, highlighting the mortality bias suggested by Jianakoplos, Menchik & Irvine (op. cit). This mortality bias suggested the drop in consumption at retirement may have been under-estimated (Palmer, 1989; Schieber, op. cit.).

In contrast, Butler & Van Zyl (2012a: 5) describe estimating the change in consumption at retirement using a Chi-Squared Automatic Interaction Detection (CHAID). CHAID is a tree methodology that results in the data being subdivided into groups ('leaves') where the distribution of the dependent variable is statistically significantly different to other groups (Kass, 1980). Provided there are sufficient observations, the predictive significance of each independent variable or factor is estimated using a chi-square test. The data is split using the factor with the highest *p*-value and the process repeats. When no further splits are possible, the algorithm stops and the leaf is created at this terminal point.

CHAID is used by statistical agencies in South Africa[1] and New Zealand (Kuzmicich & Wigbout, 2001) to identify households with similar profiles. Hence, the CHAID methodology allows for more sophisticated matching of similar households than by just income and household composition (Butler & Van Zyl, 2012a). In Butler & Van Zyl (2012a) the CHAID results suggested highly complex matching was required and that that matching by income (including

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[1] Income & Expenditure of Households 2005/2006: Statistical Release P0100. Statistics South Africa, Pretoria, 2008

income in-kind), medical-scheme membership, home-ownership status, dwelling value and education of household head was necessary.

2.2 THE TREATMENT OF MORTGAGES AND HOUSING CONSUMPTION

Models of consumption require adjustments for the difference between consumption and expenditure. Consumption refers to the usage of a good or service while expenditure refers to its payment date (Kay, Keen & Morris, 1984). A timing difference may arise on durables such as housing and vehicle consumption (Robb & Burbidge, op. cit.). In order to adjust for this, housing consumption for home owners is typically defined as an imputed rental (Mitchell & Moore, op. cit.). Mortgage payments for home-owners are thus split between this consumption element and savings and hence would need to be adjusted.

Palmer (1989) made no adjustment for expenditure on housing being lower than actual housing consumption after mortgages were repaid, and treated mortgage payments entirely as savings, which under-estimated pre-retirement consumption (Schieber, op. cit.).

Butler & Van Zyl (2012b) used self-reported savings levels from the IES data with mortgage payments adjusted to reflect only the interest component of loan installments. However, it is still probable that the data contains errors and double-counting with respondents being unable to distinguish between current levels of debt and changes in debt over the past year[2]. In addition, Butler & Van Zyl (2012b) did not assume that all mortgage debts will be repaid by retirement which was in line with Aizcorbe, Kennickell & Moore (2003). Hence the mortgage outstanding at retirement for mortgage holders was calculated and used to increase the wealth required at retirement. Vehicle expenditure was similarly adjusted (Butler & Van Zyl, 2012b).

2.3 ACTUAL VERSUS HYPOTHETICAL HOUSEHOLDS

Both the Palmer Papers and Mitchell & Moore (op. cit.) used these models to estimate retirement adequacy goals for hypothetical households at different income levels and with different household compositions. Butler & Van Zyl (2012b) used their model to estimate retirement adequacy goals for actual households.

2.4 EXPRESSION OF THE RESULTS

In the Palmer Papers the retirement adequacy goals are calculated as replacement ratios or the ratio of annualized income in the month after retirement to annualized income in the month before retirement by finding Y_R as a percentage of Y_W.

However, this assumes that the required income levels are constant in retirement (Schieber, op. cit.). Healthcare expenditure generally increases in retirement (Petertil, 2005; Cook & Settersten, 1995; Stoller & Stoller, 2003; Madrian, Burtless & Gruber, 1994) and has been increasing in real terms over time (Paulin, 2000; Acs & Sabelhaus, 1995). The level of wealth required to purchase an increasing income stream will be greater than that required to purchase a level income stream with the same initial income level even though the calculated replacement ratios would be the same.

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[2] Personal communication with Nozipho Shabalala in her capacity as an employee of Statistics South Africa and a member of the Income and Expenditure Survey team, 14/07/2010

For this reason, Butler & Van Zyl (2012b) proposed the use of the wealth-earnings ratio, where earnings refer to earnings at retirement and wealth was defined as the expected present value of adequate consumption over the full retirement period. Apart from being theoretically sound (Moore & Mitchell, unpublished; Burns & Widdows, 1990), it is also easily comparable with replacement ratio measures (Engen, Gale & Uccello, 1999). Specifically, Butler & Van Zyl (2012b) estimate the expected present value of the post-retirement income needed for each year in retirement allowing for increases in the real cost of healthcare and allowing for a minimum consumption level derived from the Older Person's Grant in each year. The wealth level is then divided by the gross of tax earnings at retirement to give a wealth-earnings ratio. This can be divided by a suitable annuity factor to give a replacement ratio.

The minimum income underpin that was used in the calculation of the wealth-earnings ratio was suggested, but not investigated, by Palmer (1989) and Moore & Mitchell (op. cit.).

3. CONSUMPTION CHANGE AT AND IN RETIREMENT

Given the methodological considerations presented in section 2, estimation of retirement adequacy goals in this study proceeded in two phases. In the first phase, consumption change at and in retirement was estimated. In the second phase, this consumption change item was used in a TSE model to estimate the retirement adequacy goals. This section sets out the first phase in the process.

3.1 FINDINGS FROM THE LITERATURE

Previous research using South African data is limited to Butler & Van Zyl (2012a) who concluded that non-healthcare consumption did not change with age or work-status, although healthcare consumption increased for some households on retirement. This was in contrast with literature from the US, UK and Italy which suggested that consumption may decline in retirement (Hamermesh, 1984; Banks, Blundel & Tanner, 1998; Miniaci, Monfardini & Weber, 2010).

Given that estimates of consumption change are sensitive to the data set used (Palmer, 1992; 1994; unpublished; Bernheim, Skinner & Weinberg, 2001; Haider & Stephens, 2007), it was necessary to estimate the change in consumption at and in retirement using IES 2010-2011 data as opposed to using the estimates in Butler & Van Zyl (2012a) which were based on IES 2005-2006 data.

3.2 DATA

3.2.1 BACKGROUND

The data for ascertaining both the change in consumption estimate for the TSE model, and for calculating the retirement adequacy goals were derived from IES 2010-2011[3]. The survey was conducted between September 2010 and August 2011. Each month, a number of households were interviewed and asked to keep a consumption diary for two weeks. This information together with recalled expenditure on durable items was used to estimate an annual expenditure figure in March 2011 rands. The IES 2005-2006 data was based on a similar methodology except

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[3] Income and Expenditure of Households 2010/2011: P0100. Statistics South Africa, Pretoria, 2012

that diaries were kept for four weeks[4]. The data, which were obtained directly from Statistics South Africa, consisted of 25 328 household records.

3.2.2 CLEANING AND REFINING THE DATA SAMPLE

Many of the households in the IES 2010-2011 dataset were not relevant to this study which focused only on one- and two-person households. As the intention was to model stable household structures involving two adults, households with non-partner relationships were removed. These restrictions on the household structure were intended to reflect the household composition typically experienced in retirement, however it may limit the applicability of the results, which is discussed further in ¶ 8.1.

Households that are self-employed or involved in farming often have misreported income and consumption (Robb & Burbidge, op. cit.; Aliber, 2009) and hence were also removed. Given that unemployment can result in large, temporary changes in household consumption, households which contained at least one unemployed person were removed in line with Banks, Blundell & Tanner (op. cit.) in order to assess work-status related changes in consumption more accurately. Thereafter, households with missing data or entries that were probably incorrect were removed. The remaining entries were classified as retired, semi-retired or working. In a retired or working household, everyone in the household is retired or working, respectively. In a semi-retired household, one person is working and the other is retired.

These households formed the model development sample which was used to estimate changes in consumption at and in retirement. A full reconciliation is given in Appendix A.

3.2.3 ADJUSTMENTS TO THE DATA

IES 2010-2011 data already contained an adjustment for owner's imputed rental. However, an adjustment was then required so that the extent to which mortgage payments contributed to non-retirement savings reflected only the amount in excess of the owner's imputed rental, as discussed in ¶ 2.2. Missing mortgage data was imputed using the mathematics of finance behind mortgage loans and using average values for similar households where necessary.

A similar adjustment was made in terms of vehicle consumption.

3.2.4 DESCRIPTION OF THE MODEL DEVELOPMENT SAMPLE

The model development sample consisted of 2 438 households. There were 2 313 working households and 115 retired households. The remaining 10 households were semi-retired.

The average age in a retired household was 69,9 years while working households had an average age of 38,4 years and semi-retired households had an average age of 61,6 years.

An analysis of educational attainments suggested that retired households had more people with completed secondary education and fewer people with incomplete secondary education as shown in Figure 1.

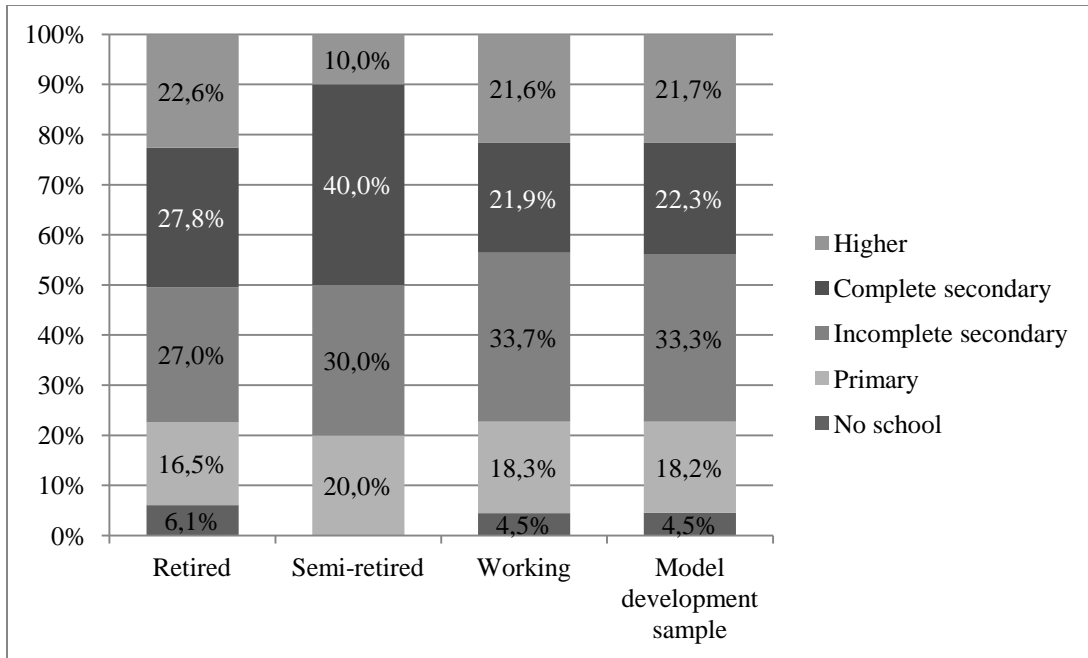[4] Statistics South Africa, 2008, supra

Figure 1. Distribution of highest educational attainment for the household head in the model development sample

Similarly, retired households had higher levels of medical scheme membership than working households as shown in Figure 2. Full coverage meant every person in the household was insured while incomplete coverage meant that one person was covered and one was not.

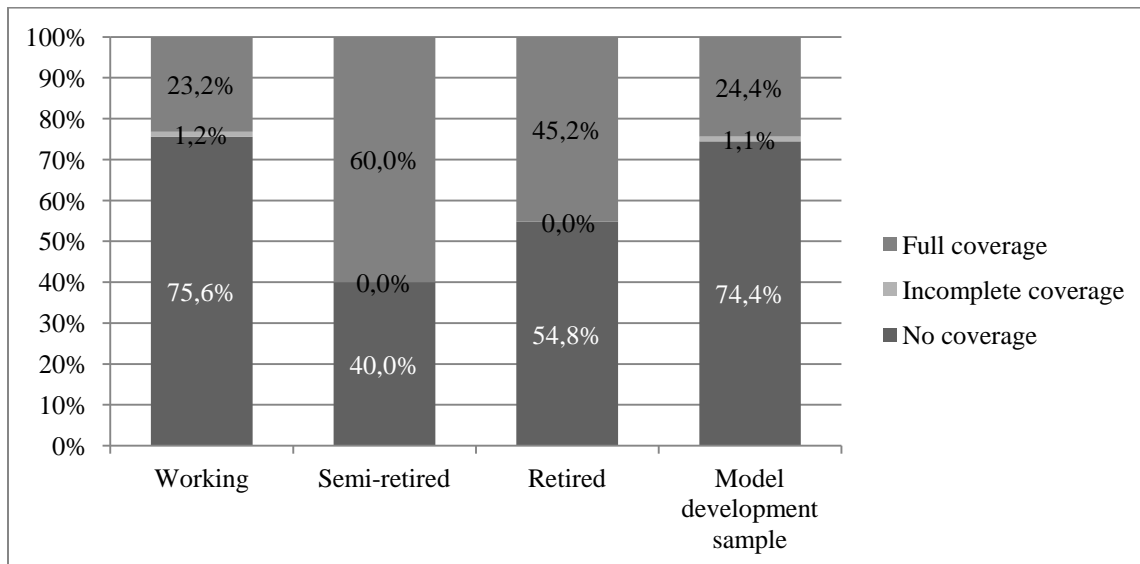Figure 2. Distribution of medical scheme coverage in model development sample

The average working household lived in a dwelling valued at R227 653 in March 2011 rands while the average dwelling values for semi-retired and retired households were R822 477 and R692 465 respectively. In addition, 87,0% of retired households are home owners while only 40,2% of working households own their home outright or with a mortgage.

The retired households also had higher levels of income and income including income in kind as shown in Table 1.

Table 1. Income levels by work-status in the model development sample

	Income per person per year	Income including income in-kind per person per year
Working	R83 085	R85 970
Semi-retired	R115 444	R119 861
Retired	R132 127	R138 540

It is important to note that the retired households had higher income levels, higher property ownership rates, higher property values, more education and greater levels of medical scheme coverage than working households. This was not unexpected given the observation by Jianakoplos, Menchik & Irvine (op. cit.) that wealthier households are more likely to survive to retirement but would invalidate a direct comparison of consumption levels between the two groups. However, the use of a tree methodology like CHAID means that these differences are controlled for in the comparisons. In other words, these differences highlight the value of the tree methodology in allowing valid comparisons to be made.

3.3   METHOD

The non-healthcare and healthcare consumption rates are then calculated for each household. Similarly, the non-retirement savings rate is calculated. As a precautionary measure, the percentage of the household income spent on gifts—a type of non-healthcare consumption—is calculated separately. This is done because Palmer (1992) found that the gifting rate tended to change dramatically at retirement.

These consumption and savings rates are then analysed using a tree methodology in order to identify factors that influence their levels. Where age or work-status appear in the tree then one can conclude that they are statistically significant factors and the change between different ages or work-statuses can be estimated by comparing the means of leaves where these variables appear in the hierarchy.

The advantages of using CHAID are discussed in ¶2.1.2. However, CHAID requires a categorical dependent variable and hence the increased sophistication comes at the cost of having to convert continuous consumption rates to consumption rate categories (Butler & Van Zyl, 2012a). In this study, a continuous version of CHAID, XAID, was applied using SPSS. The use of XAID avoids the loss of statistical power arising from using CHAID with continuous variables.

3.4   RESULTS
3.4.1   GIFTING

Sudden increases in gifting during retirement prompted the capping of gifting at pre-retirement levels in Palmer (1992) and subsequent Palmer models. This was done in order to prevent the retirement adequacy goals from increasing dramatically, and was justified by asserting that gifting expenditure was discretionary.

The observed gifting rates in the model development sample were 7,9% and 1,7% of household budgets for working and retired households respectively.

In Butler & Van Zyl (2012b) neither age nor work status was found to be a significant predictor of gifting. Using the new model development sample and XAID methodology, a highly complex gifting hierarchy emerged where age was a significant factor as shown in Figure 3.

For certain household groups, gifting does seem to increase at the ages of 24 and 30. However, there is no sharp increase at an age commonly associated with retirement and hence this change could be attributable to these households acquiring more dependents living outside of their home, such as a worker housed away from home who has a partner and a growing family. It was hence decided not to suppress this effect.

3.4.2   NON-HEALTHCARE CONSUMPTION
In Butler & Van Zyl (2012b) non-healthcare consumption, which included gifting, was unaffected by age or work-status.

Using the new model development sample and XAID, it was found that for households with per person incomes of between R25 607 and R34 954, the non-healthcare consumption rate dropped from 75,5% to 61,5% as the geometric average age moved past 46. This pattern confirmed that any increase in gifting simply crowded out other non-healthcare consumption. It also suggested that decreased non-healthcare consumption had little to do with the retirement decision.
An abridged dendrogram is given in Figure 4.

In each of the three branches not shown in full in Figure 4, it is noted that higher dwelling values are associated with significantly higher non-healthcare consumption rates.
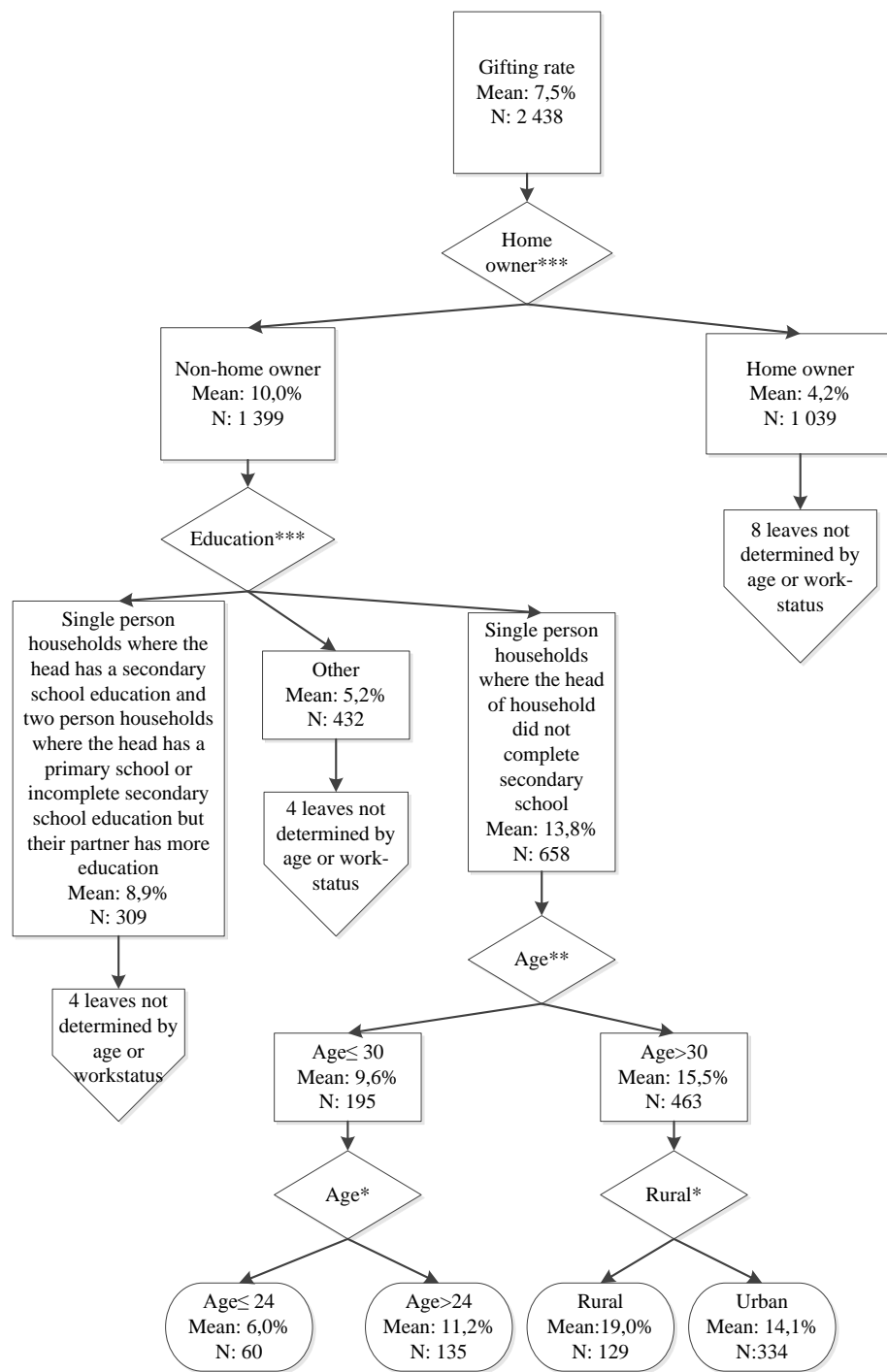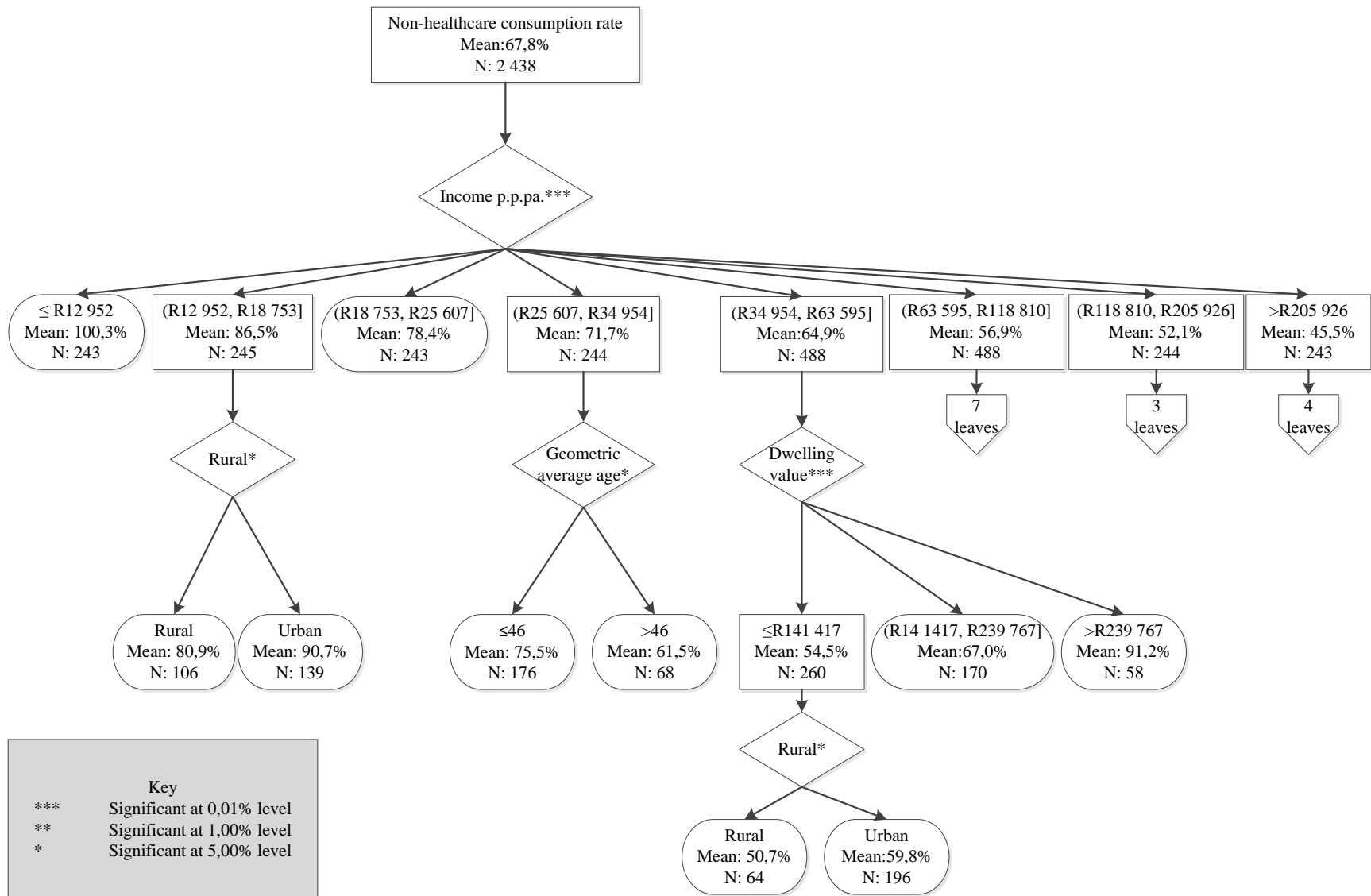
Figure 3. Gifting dendrogram

Figure 4. Abridged non-healthcare consumption dendrogram

3.4.3 HEALTHCARE CONSUMPTION

In Butler & Van Zyl (2012b) it was found that for male-headed households without medical scheme coverage, healthcare expenditure increased when the last person in the household retired. The extent of the increase depended on the level of income with higher incomes being associated with higher increases.

Using the new model development sample, it was found that work-status was not significant at the 5% level. However, for two-person male headed households without medical scheme coverage, there is a significant difference in healthcare expenditure once the oldest person reaches 42. This age-related increase is shown in Figure 5. Once again, this appears to be due to change in family circumstances rather than a retirement-related change.

3.4.4 NON-RETIREMENT SAVINGS RATE

As is observed from equation 1, traditional TS and TSE models ignore the possibility of saving after retirement. There is mixed evidence as to whether pensioners save or spend accumulated savings (Bernheim, 1987; Tacchino & Saltzman, op. cit.; Disney, 1996).

Butler & Van Zyl (2012b) found there was no age or work-status effect on the non-retirement savings rate. This was also observed with the new model development sample. However, as is consistent with Butler & Van Zyl (2012b) it was decided not to allow for post-retirement savings in the retirement adequacy goal.

3.5 SUMMARY

Valid comparisons of consumption levels between retired and working households require careful matching of like households, particularly given the wealth differences between retired and working households. XAID was used to make these comparisons.

Relatively few people in the model development sample have consumption levels that differ significantly by age. Approximately 9,6% of the sample would have an age-related increase in healthcare expenditure and 10,0% would have an age-related decrease in non-healthcare consumption. However, these increases tended to occur for households with members in their 40s and were hence unlikely to be related to retirement. Work-status did not have a statistically significant impact on consumption.

The results were thus similar, but not identical, to Butler & Van Zyl (2012b).
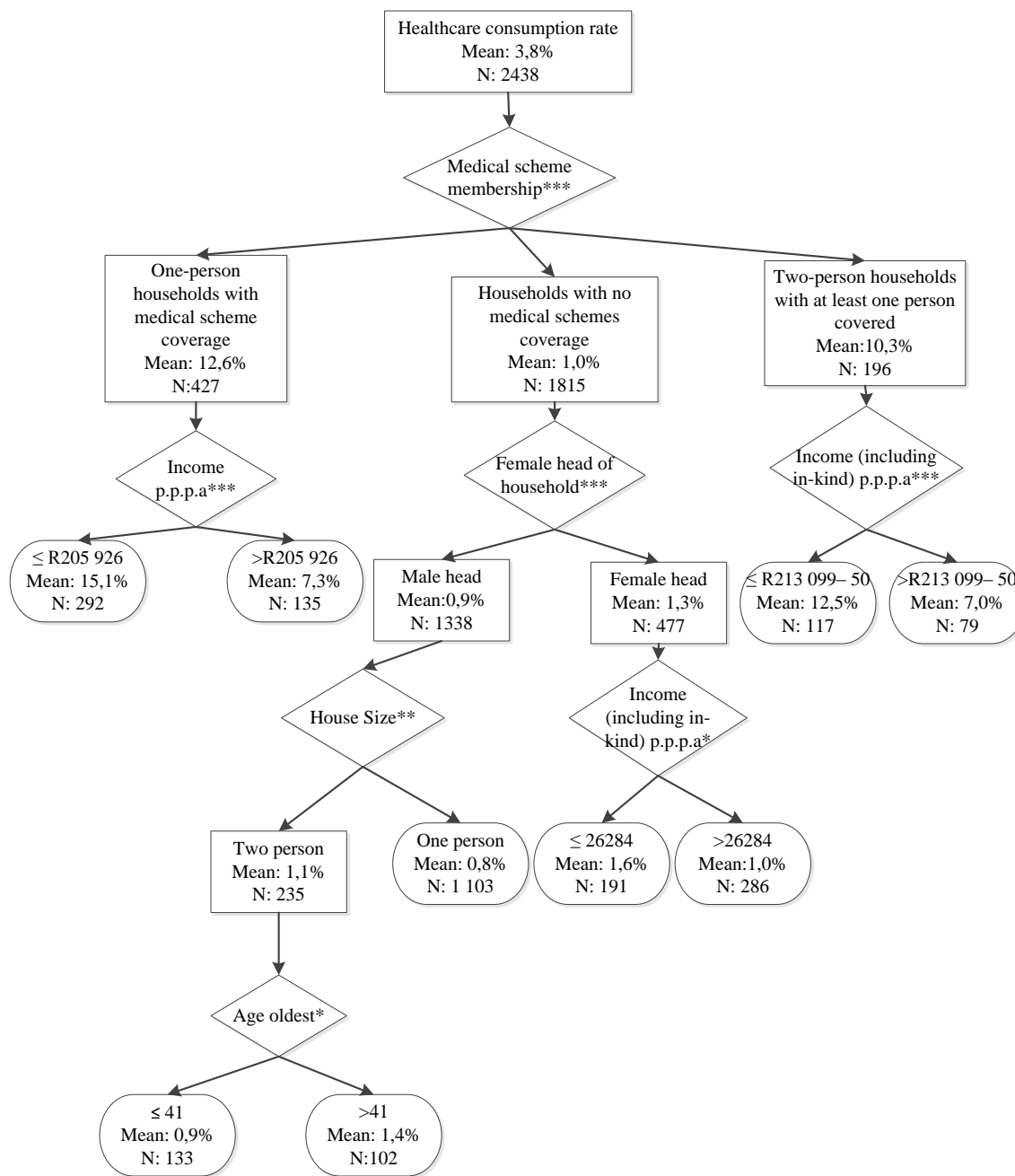
Figure 5. Healthcare consumption dendrogram

4. METHODOLOGY FOR CALCULATING RETIREMENT ADEQUACY GOALS

This section describes the second phase of the modeling of the retirement adequacy goals and draws on the theoretical considerations in section 2 and the estimated changes in consumption at and in retirement presented in section 3.

4.1 OVERVIEW

Butler & Van Zyl (2012b) used an eight-step model to estimate retirement adequacy goals:
- step 1: estimation of current consumption from expenditure;
- step 2: estimation of consumption at retirement projected using salary inflation;
- step 3: calculation of outstanding mortgage at retirement and associated tax;
- step 4: adjustment for the change in consumption at and during retirement;
- step 5: estimation of the comfortably adequate income required at each age of retirement allowing for different inflation rates for heathcare and non-healthcare expenditure;
- step 6: calculation of the expected present value of comfortably adequate incomes;
- step 7: adjustment of the expected present value of comfortably adequate incomes for the mortgage outstanding at retirement; and
- step 8: calculation of the adequacy levels.

4.2 CHANGES

The model required updating in six areas:
- change 1: The projection basis used in steps 5, 6 and 7 required updating for economic changes;
- change 2: changes to the Older Person's Grant impacted on the calculations in step 5;
- change 3: tax changes impacted the calculations in steps 2, 3 and 5;
- change 4: An updated household dataset meant that the change estimates for step 4 needed to be re-estimated;
- change 5: the updated IES data set also meant the goal estimation model needed to be re-run; and
- change 6: the projection formula in Step 4 could be altered in order to account for over- and underspending in a different way.

These changes are discussed in turn.

4.2.1 CHANGE 1: ECONOMIC UPDATES

The projection basis applied in Butler & Van Zyl (2012b) was developed in 2010. The appropriate after-retirement discount rate was developed with reference to the expected real returns on conservative, moderate and moderately aggressive market-linked portfolio. Falling bond yields have resulted in the interest rate estimates declining considerably between 2010 and the second quarter of 2013.

Healthcare inflation in South Africa continues to exceed inflation on other items and this differential has increased since 2010[5].

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[5] Consumer Price Index (CPI): 2012 Weights (Total Country): P0141.5. Statistics South Africa, Pretoria, 2013

The economic bases adopted in Butler & Van Zyl (2012b) and the current study are given in Table 2.

Table 2. Economic assumptions in current study relative to the original study

	New basis	Original basis
Salary inflation	2,00%	2,00%
Healthcare inflation margin above CPI	2,50%	2,50%
Healthcare CPI budget share	8,51%	6,90%
Non-healthcare inflation margin above CPI	-0,23%	-0,19%
Pessimistic discount rate	2,50%	3,00%
Best estimate discount rate	3,25%	4,00%
Optimistic discount rate	3,50%	5,00%

4.2.2 CHANGE 2: OLDER PERSON'S GRANT CHANGES

Adequate consumption is defined to be the higher of smoothed consumption and a minimum socially acceptable standard of living. The latter was defined as the income level below which a person becomes eligible for income support from the Older Person's Grant. This is a means-tested benefit and the means-test formula was updated in March 2011[6], which has resulted in the level rising 41,7% in real terms from R22 224 p.p.pa in March 2006 rand terms to R44 400 p.p.pa in March 2011 rand terms.

It is proposed that the means test will be scrapped in its entirety by 2016 with the cost to be funded via adjustments to the tax rebates[7]. Given that the tax threshold for a 60 year old was R59 750 and the annual Older Person's Grant payable from age 60 is R12 960, it implies that people earning less than R46 790 would receive full income support in future. It was decided not to adapt the Older Person's Grant level or the tax structure in light of the proposed phasing out of the means test given that the implied minimum income levels were not dissimilar.

4.2.3 CHANGE 3: TAX CHANGES

South African personal income tax has changed considerably since 2010. Some of the significant changes have occurred after March 2011 which is the effective date of the data set. It was decided to incorporate all changes to personal income taxation that have occurred between March 2010 and March 2013. These are shown in Table 3.

In addition, the rate at which tax brackets have changed has slowed from CPI+2% to CPI on average. The rebates have been relatively constant in real terms since 2010 whereas the primary and secondary rebates used to progress at about 2% p.a. and 1,5% p.a. respectively in real terms.

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[6] Government Notice R286, Amendment: Regulations Relating to the Application for and Payment of Social Assistance and the Requirements or Conditions in Respect of Eligibility For Social Assistance. Government Gazette 34169, 31 March 2011, 4-5

[7] National Budget Speech, delivered 27 February 2013. Available http://www.treasury.gov.za/documents/national%20budget/2013/speech/speech.pdf, 27/05/2013

Table 3. Tax rule changes

Area	Old tax rule	New tax rule
Healthcare expenditure	Medical scheme contributions were tax deductible up to a limit per person per month for all taxpayers. Other medical expenditure could be deducted from taxable income in full if the taxpayer is 65 or older or up to 7,5% of income for younger tax payers.	The following changes were effective from 1 March 2012. For taxpayers under 65, medical scheme contributions reduce the tax payable via a tax credit that increases the tax rebate. However, if medical scheme contributions exceed a threshold level, taxpayers under 65 may claim the contributions above the threshold to reduce their taxable income. The 7,5% rule for other qualifying deductions still holds. Taxpayers 65 and older may reduce their taxable income by the full value of their healthcare expenditure.
Tertiary rebate	Two rebates applied to reduce the calculated tax bill. The primary rebate applied to all taxpayers. The secondary rebate applied in addition to the primary rebate for taxpayers 65 and older.	From 1 March 2011, a tertiary rebate has been applied for taxpayers 75 and older.
Retirement fund contributions	Depending on the vehicle used and the way salary is defined, contributions of up to 17,5% of pensionable salary to pension funds are tax-deductible without special dispensation from SARS.	From T-day ("on or after 2015")[8], taxation is to be simplified so that 27,5% of taxable income is tax deductible on or after 2015 with a cap of R350 000 per annum.

4.2.4   CHANGE 4: CHANGE IN CONSUMPTION

The investigation into the change in consumption at and in retirement is given in Section 3. It was established that consumption does not change significantly at and in retirement. In Butler & Van Zyl (2012b) increase factors were applied at retirement to the healthcare consumption for male-headed households without medical scheme coverage according to Table 4.

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[8] 2013 Retirement Reform Proposals For Further Consultation , pg 3. National Treasury consultation document, Financial Planning Institute Webpage, http://www.fpi.co.za/Portals/30/docs/2013%20Retirement%20Reforms.pdf, 27/05/2013

Table 4. Healthcare consumption increases on retirement in first wave

Income per person per year (in March 2006 terms)	Increase
R24 424–50—R99 341–00	187,1%
R99 341–00 or more	184,3%

There was no change in consumption at and in retirement detected using the updated data set. However, for two-person, male-headed households without medical scheme cover, healthcare consumption increased 66,1% when the oldest person in the household reached the age of 42, as discussed in ¶3.4.3.

4.2.5 CHANGE 5: DATA CHANGE

Household data were taken from IES 2010-2011. The preliminary data filtering to obtain the model development sample was discussed in Section 3. The 2010-2011 goal estimation sample was derived from the model development sample by excluding all the retired and semi-retired households. Thereafter non-savers were removed as this study is concerned with finding goals for people who can and do save. Thereafter households with a 30 year gap or more were removed as they could possible indicate a parent-child relationship that was miscoded. Households where the oldest person was already over 70 were removed as 70 is the oldest hypothetical retirement age modelled. One record was deleted due to salary income probably being understated. The reconciliation is given in Appendix A and the characteristics of the goal estimation sample are discussed in Section 5.

4.2.6 CHANGE 6: FORMULA CHANGE

It was intended that the model projects consumption in line with net of tax salary growth. However, because income is often poorly reported in official data (Klasen, 2000) and South African tax rules are complex, the tax approximation may be very crude.

In Butler & Van Zyl (2012b), the formula adopted ('Formula A') effectively resulted in households consuming all their disposable income after tax and retirement savings. In other words, consumption was allowed to crowd out non-retirement savings and if households used debt to finance their pre-retirement consumption, this was assumed not to continue into retirement. This would naturally reduce volatility arising from non-retirement savings being misreported.

In this paper, it was decided to try an alternative formula ('Formula B') that kept the total consumption level constant as a percentage of net income and did not allow crowding out of savings to occur. Goals for households that overspent before retirement were predicated on the fact that they would want to sustain these lifestyles in retirement.

5.   DATA FOR CALCULATING RETIREMENT ADEQUACY TARGETS

Given that that one of the aims of this paper is to track how retirement adequacy goals have changed, major changes in the composition of the goal estimation sample between the two waves may cause volatility in the estimates. Hence the analysis of the 2010-2011 goal estimation sample includes commentary on statistics from the 2005-2006 goal estimation sample. All currency amounts are shown in March 2011 rands.

There were 749 households in the 2010-2011 goal estimation sample relative to 625 in the 2005-2006 sample.

The composition by household groups is shown in Figure 6. Given that there were so few female-head–male-partner and two-male households, in much of the analysis all two-person households have been grouped together. It was noted that only 22,3% of households have a female head.
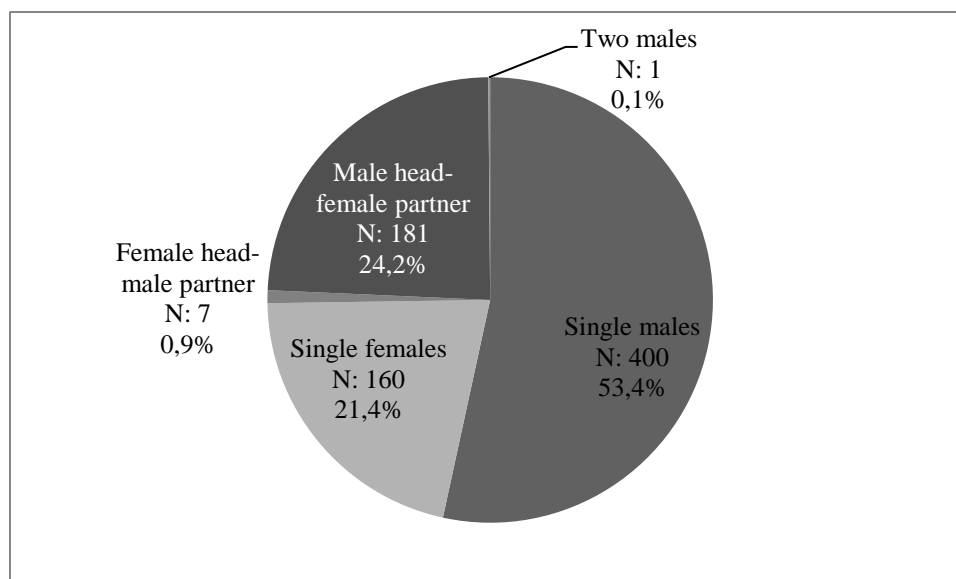
Figure 6. 2010-2011 goal estimation sample by household composition

Single males had an average age of 38,4 whereas couples and single females had average ages of 39,3 and 40,1 respectively. The age profiles of the various household compositions were thus similar.

Couples in the 2010-2011 goal estimation sample demonstrated a higher degree of housing wealth than single person households. The same pattern was observed in the 2005-2006 goal estimation sample, however in the earlier sample, dwelling values were considerably lower. Couples who were home owners were less likely to own their homes outright than single-person– home-owner households. This is presumably due to the fact that, on average, home-owner couples have homes with higher dwelling values than other groups. The comparison is shown in Table 5 and Table 6.

Table 5. Housing metrics for the 2010-2011 goal estimation sample

	Average dwelling value	% with dwelling values of R750 000 or less	% home owners	% homeowners with a mortgage
Single females	R297 728	94,4%	33,1%	24,5%
Single males	R247 785	95,0%	34,5%	21,7%
All couples	R596 489	78,8%	56,1%	50,0%
Female head-male partner	R478 369	71,4%	28,6%	100,0%
Male head-female partner	R603 028	79,0%	57,5%	49,0%
Two males	R239 767	100,0%	0,0%	N/A
Goal estimation sample	R346 445	90,8%	39,7%	32,3%

Table 6. Housing metrics 2005-2006 goal estimation sample

	Average dwelling value	% with dwelling values of R750 000 or less	% home owners	% homeowners with a mortgage
Single females	R199 088	91,8%	30,3%	45,9%
Single males	R75 934	98,6%	22,3%	30,4%
All couples	R469 338	77,0%	60,1%	55,1%
Female head-male partner	R409 358	75,0%	56,3%	66,7%
Male head-female partner	R558 582	73,2%	68,0%	57,6%
Two females	R460 075	72,7%	45,5%	20,0%
Two males	R152 877	95,8%	37,5%	44,4%
Goal estimation sample	R193 131	92,2%	32,8%	43,9%

The level of reported mortgage indebtedness has fallen since 2005-2006, despite the fact that South African Reserve Bank statistics[9] suggests that household indebtedness as a percentage of income have risen from 71,8% to 77,8% between the sampling dates.

Medical scheme membership followed a similar pattern to housing wealth. Single women had marginally better coverage than single men. Couples were likely to have at least one person in the household covered by a medical scheme, as shown in Table 7.

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[9] South African Reserve Bank. KBP6525L: Household debt to disposable income of households. 06/09/2013

Table 7. Medical scheme coverage

	2010-2011			2005-2006	
	No coverage	Incomplete coverage	Full coverage	No coverage	Incomplete or full coverage
Single females	40,0%	0,0%	60,0%	32,8%	67,2%
Single males	56,0%	0,0%	44,0%	63,7%	36,3%
All couples	29,6%	11,1%	59,3%	26,4%	73,6%
Female head-male partner	28,6%	14,3%	57,1%	12,5%	87,5%
Male head-female partner	29,8%	11,0%	59,1%	19,6%	80,4%
Two females	N/A	N/A	N/A	72,7%	27,3%
Two males	0,0%	0,0%	100,0%	41,7%	58,3%
Goal estimation sample	45,9%	2,8%	51,3%	48,8%	51,2%

Couples had higher income levels than single households, which was consistent with the housing and medical scheme data. However, it was noted that this result was driven by very high income levels in female-head–male-partner households. In terms of real income levels, single females have similar income levels in the two studies but couples and single males have higher income levels in 2010-2011. The statistics for two samples are shown in Tables 8 and 9 respectively.

Table 8. Income metrics in 2010-2011 goal estimation sample

	Average income p.p.p.a	Income (including income inkind) p.p.p.a	Income share earned by the head of the household
Single females	R157 952	R164 876	100,0%
Single males	R130 279	R134 671	100,0%
All couples	R175 729	R168 227	58,0%
Female head-male partner	R271 250	R314 814	37,5%
Male head -emale partner	R164 705	R170 802	58,8%
Two males	R84 517	R93 935	63,3%
Goal estimation sample	R145 766	R151 484	89,4%

Table 9. Income metrics in the 2005-2006 goal estimation sample

	Average income p.p.p.a	Income (including income inkind) p.p.p.a	Income share earned by the head of the household
Single females	R153 011	R166 378	100,0%
Single males	R109 554	R117 397	100,0%
All couples	R167 171	R176 427	61,7%
Female head-male partner	R168 328	R173 669	58,2%
Male head-female partner	R188 928	R200 426	62,0%
Two females	R123 872	R126 900	58,5%
Two males	R98 312	R103 966	64,3%
Goal estimation sample	R131 681	R140 936	90,9%

The relatively high salaries for women were somewhat surprising given that administrator data over the same period suggests that salaries for women are lower than those for men[10]. However, the data sample was confined to one- or two-person households and so working mothers who may work part-time were excluded.

On average, households consumed about 61,7% of their income in 2010-2011, down from 69,2% in 2005-2006. Consumption for single males has decreased the most significantly which is in line with their increased income levels. Single females had the highest consumption rates in each sample. The consumption rates are shown in Table 10.

Table 10. Consumption metrics

	2010-2011			2005-2006		
	Non-health consumption rate	Health consumption rate	Total consumption rate	Non-health consumption rate	Health consumption rate	Total consumption rate
Single females	57,7%	7,6%	65,3%	60,3%	9,0%	69,3%
Single males	55,3%	5,5%	60,8%	67,2%	4,3%	71,5%
All couples	53,1%	7,5%	60,6%	57,9%	5,8%	63,7%
Female head male partner	53,5%	10,6%	64,1%	58,6%	6,8%	65,4%
Male head female partner	53,3%	7,3%	60,6%	56,7%	6,1%	62,9%
Two females	N/A	N/A	N/A	58,6%	4,7%	63,3%
Two males	27,3%	12,9%	40,2%	58,6%	4,7%	63,3%
Goal estimation sample	55,3%	6,5%	61,7%	61,8%	4,1%	65,9%

Non-retirement savings rates were 3,2%, which is considerably lower than the 10,4% observed for the goal estimation sample derived from IES 2005-2006 data. The retirement savings rates were similar to those from the 2005-2006 goal estimation sample as shown in Table 11.

It was noted that the retirement savings rates were low relative to industry statistics that suggest contributions of approximately 13% of pensionable salary[11]. However, these figures were not unreasonable given that they are expressed as a percentage of the total income including income in kind. If pensionable salaries are approximately 75% of total salary, the retirement contribution rate in the 2010-2011 goal estimation sample is approximately 11%.

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[10] Alexander Forbes Member Watch[TM] 2012 dataset
[11] ibid.

Table 11. Savings metrics

	2010-2011			2005-2006		
	Non-retirement savings rate	Retirement savings rate	Total savings rate	Non-retirement savings rate	Retirement savings rate	Total savings rate
Single females	3,1%	8,2%	11,3%	11,6%	9,3%	21,0%
Single males	3,4%	7,9%	11,3%	9,6%	8,8%	18,4%
All couples	2,8%	7,5%	10,2%	11,3%	3,8%	15,1%
Female head male partner	3,4%	8,3%	11,7%	7,5%	3,5%	11,0%
Male head female partner	2,8%	7,4%	10,2%	13,7%	4,0%	17,7%
Two females	N/A	N/A	N/A	7,8%	3,3%	11,1%
Two males	0,0%	10,9%	10,9%	5,8%	3,3%	9,1%
Goal estimation sample	3,2%	7,9%	11,1%	10,4%	7,7%	18,1%

6. RETIREMENT ADEQUACY GOAL RESULTS

In this section, the retirement adequacy goals are presented using best estimate interest rate assumptions in ¶ 6.1, the factors influencing the retirement adequacy goals are then identified in ¶ 6.2 before a sensitivity analysis is presented in ¶ 6.3.

6.1 BEST ESTIMATE RETIREMENT ADEQUACY GOALS

Given the non-normality of retirement adequacy goals it was decided to analyse the results in terms of inter-quartile ranges. That is, the results are presented as a range where the lower bound is the 25th percentile and the upper bound is the 75th percentile. The ranges for Formula A— which allows for crowding out of any non-retirement savings—are given in Table 12, while the results for Formula B—which does not allow consumption to rise when non-retirement savings falls to nil in retirement—are given in Table 13. From Table 12 and Table 13 it is noted that the wealth-earnings ratio targets decrease with deferring retirement while the replacement ratio targets are relatively stable. This is consistent with Mitchell & Moore (op. cit.).

Table 12. Inter-quartile ranges (Formula A)

	Retirement age	Single females	Single males	Couples (no salary support)	Couples (with salary support)
Wealth earnings ratios	60	14,4-17,0	12,6-14,7	14,4-17,7	12,7-16,9
	63	13,4-15,9	11,6-13,5	13,6-16,4	11,5-15,6
	65	12,8-15,5	11,2-13,2	13,1-15,9	10,7-14,6
	67	12,1-14,6	10,5-12,5	12,4-15,2	10,0-13,8
	70	11,0-13,2	9,5-11,3	11,3-14,0	8,9-12,6
Gross of tax replacement ratios	60	79,5%-94,8%	81,6%-94,6%	80,4%-100,2%	69,4%-94,4%
	63	79,4%-94,7%	80,9%-94,1%	80,8%-99,6%	67,5%-93,2%
	65	80,5%-96,8%	82,1%-97,4%	81,3%-101,4%	66,6%-94,0%
	67	79,5%-94,8%	81,6%-94,6%	80,4%-100,2%	69,4%-94,4%
	70	79,2%-96,2%	80,8%-96,4%	81,0%-102,8%	63,7%-92,7%

Table13. Inter-quartile ranges (Formula B)

	Retirement age	Single females	Single males	Couples (no salary support)	Couples (with salary support)
Wealth earnings ratios	60	8,8-20,2	8,1-14,0	7,9-15,3	6,7-14,5
	63	8,2-18,7	7,2-13,0	7,4-14,5	6,0-13,1
	65	7,9-17,8	6,9-12,5	7,2-13,6	5,8-12,3
	67	7,4-16,7	6,4-11,8	6,8-12,9	5,3-11,6
	70	6,8-15,2	5,7-10,7	6,2-11,7	4,7-10,3
Gross of tax replacement ratios	60	48,9%-112,2%	51,7%-90,5%	43,8%-86,1%	37,8%-80,4%
	63	48,9%-109,4%	50,7%-90,4%	44,7%-87,7%	37,5%-79,3%
	65	49,1%-110,2%	51%-91,5%	45%-86,2%	36,1%-78,6%
	67	48,9%-112,2%	51,7%-90,5%	43,8%-86,1%	37,8%-80,4%
	70	49,2%-108,9%	49,2%-90,8%	45,2%-84,5%	33,4%-76,7%

Wealth-earnings ratio goals were highest for single women and lowest for single males. However on a replacement ratio basis using Formula A, the difference between the two groups is small suggesting this may be attributable mainly to a longevity effect.

It was noted that the 75th percentile of the Formula B results for single females were considerably higher than the Formula A results, whereas this pattern did not hold for other groups. This result arose due to the fact that 16,3% of single women in the sample spent more than they earned whereas only 8,8% and 11,6% of single men or couples sustained their lifestyle through decumulating savings or going into debt.

The difference between the Formula A goal and Formula B goal represents the extent to which over-spending to fund a certain lifestyle that one expects to be maintained in retirement, increases the goal. Conversely, for those who live within their means and no longer need to save in retirement, it represents how much less they would need than if they spent every rand earned pre-retirement. These differences are shown in Table 14. Although the sample size of overspending households is small there are sufficient numbers of underspending households to assert that households that live within their means reduce their retirement adequacy goals by 3,6 to 5,2 times annual salary for a retirement age of 65.

Table 14. Difference between Formula A and Formula B result for retirement at age 65

		Reduction in target due to living within the household income (Households that underspend only)	Increase in target due to overspending (Households that overspend only)
Change	Single females	4,6	4,8
	Single males	3,6	6,8
	All couples	5,2	10,4
	Total	4,2	7,2
N	Single females	134	26
	Single males	365	35
	All couples	167	22
	Total	666	83

Couples where one partner continues to work after the older partner has retired were estimated to require about 1 times annual salary less at retirement than couples who both retire when the oldest partner reaches retirement age.

6.2   FACTORS INFLUENCING THE RETIREMENT ADEQUACY GOALS

Given the width of the inter-quartile ranges in Tables 13 and 14, it was important to understand the factors that influence the retirement adequacy goals so that households can better gauge their own goals. A regression analysis was carried out on the natural log of the goals at age 65 in order to identify statistically significant factors that influence the goals.

The explanatory variables in the dataset were highly correlated with each other. In order to avoid multicollinearity, a principle components analysis was carried out first in order to understand the relationships between the explanatory variables. This process was used to create a shortlist of variables to use in forwards and backwards regression models.

6.2.1   FORMULA A

The regression parameters for the linear model of the log of the retirement adequacy goals for people retiring at age 65 are given in Table 15 below.

Table 15. Regression coefficients (Formula A)

	β
Intercept	2,570***
Female head	0,155***
Home owner	0,1***
Two-person household	0,091***
Per person income including income in kind	$-2,473\times 10^{-7}$***
Retirement savings rate	-1,036***
R^2	0,503
Adjusted R^2	0,499
Model F	133,642***

*** Significant at the 0,01% level

The positive coefficient for female headship was not surprising given that having a woman in the household would increase the wealth earnings ratio goals due to a longevity effect. This may also explain why two-person households have a positive coefficient given that most couples consist of one male and one female.

The fact that homeownership is associated with higher targets suggests that unpaid mortgage debt at retirement may be increasing the goals. Alternatively, it could suggest increased overall consumption due to maintenance costs which are not borne by renters.

The negative coefficient for income was not surprising given the well documented inverse relationship between income and retirement adequacy goals (Hatcher, 1997; Yuh, Hanna &

Montalto, op. cit). Similarly the negative coefficient for retirement savings rate was not surprising and was previously documented in Mitchell & Moore (op. cit.).

6.2.2 FORMULA B

For Formula B, a regression model was obtained with a very poor R^2 of 0,045. This model suggested two statistically significant factors; namely having a female household head and living in a rural area. A female head of household influenced the goals while living in a rural area decreased the goals. The latter effect was not surprising given that rural and urban households consume 54,33% and 62,90 % of their income respectively. The inter-quartile ranges for the four groups are given in Table 16.

Table 16. Inter-quartile ranges by sex of household head and location (Formula B)

Variable	Range	N
Female-headed rural	6,1-14,8	26
Male-headed rural	6,5-11,8	82
Female-headed urban	8,0-17,7	139
Male-headed urban	7,0-12,9	498

6.3 SENSITIVITY OF THE RETIREMENT ADEQUACY GOALS TO THE POST-RETIREMENT DISCOUNT RATE

The wealth-earnings ratio results were sensitive to the discount rate applied to the post-retirement income stream. Tables 17 and 18 give the sensitivity analysis on a wealth-earnings ratio basis.

Table 17. Sensitivity of wealth-earnings ratios to the post-retirement discount rate (Formula A)

Retirement age	60	63	65	67	70
Single females					
Pessimistic	15,8-18,6	14,6-17,3	13,9-16,8	13,0-15,7	11,8-14,2
Best estimate	14,4-17,0	13,4-15,9	12,8-15,5	12,1-14,6	11,0-13,2
Optimistic	14,0-16,5	13,0-15,4	12,5-15,1	11,8-14,2	10,7-13,0
N	155	157	158	160	160
Single males					
Pessimistic	13,7-15,9	12,5-14,6	12,0-14,2	11,3-13,3	10,2-12,1
Best estimate	12,6-14,7	11,6-13,5	11,2-13,2	10,5-12,5	9,5-11,3
Optimistic	12,3-14,3	11,3-13,2	10,9-12,9	10,3-12,2	9,4-11,1
N	390	397	400	400	400
Couples (no salary support)					
Pessimistic	15,9-19,4	14,8-17,9	14,2-17,3	13,4-16,5	12,1-15
Best estimate	14,4-17,7	13,6-16,4	13,1-15,9	12,4-15,2	11,3-14
Optimistic	14,0-17,2	13,2-15,9	12,7-15,5	12,0-14,9	11,0-13,7
N	178	185	186	188	188

Table18. Sensitivity of wealth-earnings ratios to post-retirement discount rate (Formula B)

Retirement Age	60	63	65	67	70
Single Females					
Pessimistic	9,7-22,2	8,9-20,4	8,6-19,4	8,0-18,1	7,3-16,4
Best estimate	8,8-20,2	8,2-18,7	7,9-17,8	7,4-16,7	6,8-15,2
Optimistic	8,6-19,6	7,9-18,2	7,7-17,3	7,2-16,3	6,6-14,9
N	155	157	158	160	160
Single Males					
Pessimistic	8,8-15,2	7,8-14,1	7,4-13,4	6,8-12,6	6,1-11,4
Best estimate	8,1-14,0	7,2-13,0	6,9-12,5	6,4-11,8	5,7-10,7
Optimistic	7,8-13,7	7,1-12,7	6,7-12,2	6,2-11,6	5,6-10,5
N	390	397	400	400	400
Couples (No salary support)					
Pessimistic	8,7-16,7	8,1-15,7	7,8-14,9	7,3-13,9	6,7-12,6
Best estimate	7,9-15,3	7,4-14,5	7,2-13,6	6,8-12,9	6,2-11,7
Optimistic	7,7-14,8	7,2-14,1	7-13,3	6,6-12,6	6,1-11,4
N	178	185	186	188	188

Households would need approximately one to two times annual salary more than the best estimate targets if the pessimistic basis were used. However, the later the retirement the smaller the interest rate effect is due to the shortening duration of the payment stream. Given the narrow margin between the best estimate and optimistic interest rates, households would require half a year's income less if the optimistic as opposed to best estimate interest rates were used.

The replacement ratio goals were insensitive to the post-retirement discount rate. Although mathematically intuitive, this was confirmed by the sensitivity analysis.

7.   VARIABILITY OF RETIREMENT ADEQUACY TARGETS
As mentioned in ¶ 1.1, there have been seven waves of retirement adequacy goals emerging from the Palmer Papers with a timespan from 1989 to 2008. Each wave uses updated tax information and consumer savings and expenditure data. The timespan covered by the Palmer Papers and their extensive use in the literature make them a useful case study in the levels of volatility found in estimated retirement adequacy goals. The level of volatility in the Palmer Papers is documented in ¶ 7.1 while ¶ 7.2 sets out the degree of change in the South African estimates and reasons for the variability in the South African results are given in ¶ 7.3.

7.1   OBSERVED VARIABILITY IN THE PALMER PAPERS
When Schieber (op. cit.) compared the early results of Palmer, no allowance was made for the fact that the same nominal income level had been used over a six year time span. However, even after adjusting for inflation, the goals derived using the TSE model show considerable variability as shown in Figure 7.
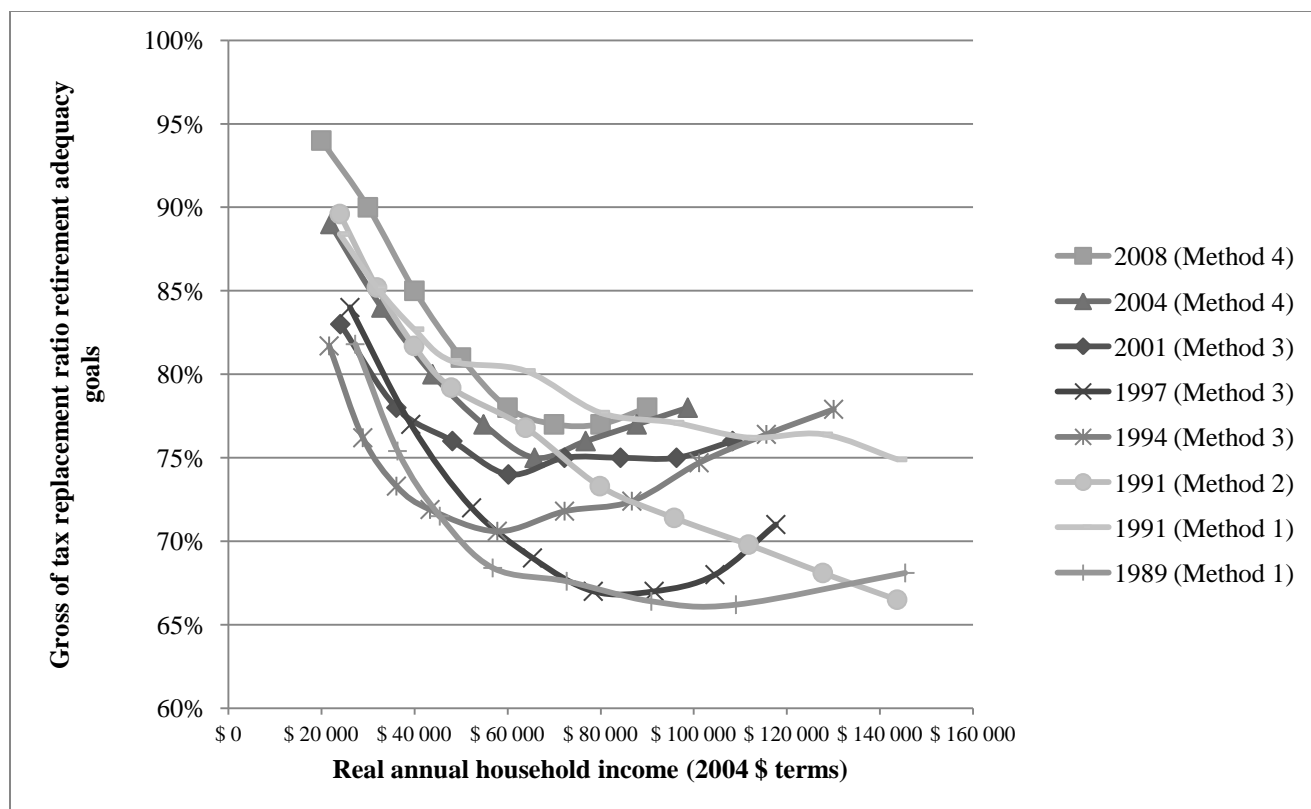
Figure 7. TSE model results from the Palmer papers for a male wage-earner aged 65 at retirement with a non-wage-earner spouse aged 62 at retirement[12]

For households with incomes of $30 000 in 2004 $ terms, this variability has led to estimates ranging from approximately 76% in Palmer (1994) to 90% in Palmer (unpublished). The sample standard deviation across all income levels is 4,3%-4,8%[13]. However, the retirement adequacy goals estimated using the TS models are more stable, with a sample standard deviation of 2,5% to 3,9%. Using TS models, the retirement adequacy goal for one income group increased from 73% in 1989 to 82% in 2008 where this was the largest observed increase.

It should be noted that Palmer made three methodological changes between Palmer (1989) and Palmer (unpublished). In Palmer (1992), a substantial increase in gifting was noted at retirement which would have increased the retirement adequacy goals significantly. The methodology was then adapted to suppress increases in gifting at retirement. This change was carried forward to subsequent studies and is the only difference between Method 1 and Method 2. In Palmer (1994), a national wage index was used to project salary growth instead of a fixed rate increase. This was carried forward to future studies and is the only difference between Method 2 and Method 3. From 2004 onwards, savings rates have been averaged over approximately a decade instead of using snapshot savings rates (Palmer, unpublished). This is the only difference between Method 3 and Method 4.

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[12] Author's calculations using the Palmer Papers and inflation data from the Bureau of Labor Statistics
[13] Own calculations

7.2   OBSERVED VARIABILITY IN THE SOUTH AFRICAN ESTIMATES

The attribution analysis was somewhat surprising in that the results were highly dependent on whether wealth-earnings ratios or gross replacement ratios were used to measure retirement adequacy targets. For single females, for example, the 75th percentile of the wealth-earnings ratios were stable from one study to the next while the gross replacement ratio was very volatile as shown in Table 19.

Table 19. Attribution analysis for single females

Wealth-earnings ratio results					
	60	63	65	67	70
Results as per Butler & Van Zyl (2012b)	18,2	16,9	16,6	15,7	14,3
Update of economic assumptions	19,7	18,3	17,9	16,8	15,2
Increase in minimum income level	19,7	18,3	17,9	16,8	15,2
Tax changes	18,7	17,6	16,9	16,0	14,6
New goal estimation sample	17,0	16,0	15,5	14,6	13,3
New age and work-related expense (Formula A result)	17,0	15,9	15,5	14,6	13,2
Formula B result	20,1	18,4	17,5	16,4	15,0
Change between studies (Formula A)	-1,2	-1,0	-1,1	-1,1	-1,0
Change between studies (Formula B)	1,9	1,5	0,9	0,7	0,7
Replacement ratio results					
	60	63	65	67	70
Results as per Butler & Van Zyl (2012b)	106,3%	106,5%	109,9%	109,3%	106,5%
Update of economic assumptions	105,7%	105,8%	109,0%	108,8%	106,0%
Increase in minimum income level	105,7%	105,8%	109,0%	108,8%	106,0%
Tax changes	100,1%	101,4%	101,7%	101,6%	103,4%
New goal estimation sample	94,8%	95,7%	97,2%	94,8%	96,8%
New age and work-related expense (Formula A result)	94,8%	94,7%	96,8%	94,8%	96,2%
Formula B result	109,6%	108,9%	108,7%	109,6%	108,3%
Change between studies (Formula A)	-11,5%	-11,8%	-13,1%	-14,5%	-10,3%
Change between studies (Formula B)	3,3%	2,4%	-1,2%	0,3%	1,8%

For single males, the results were relatively stable irrespective of the measure used as shown in Table 20 below

Table 20. Attribution analysis for single males

Wealth-earnings ratio results					
	60	63	65	67	70
Results as per Butler & Van Zyl (2012b)	14,3	13,2	12,9	12,2	11,1
Update of economic assumptions	15,4	14,1	13,7	12,9	11,7
Increase in minimum income level	15,4	14,1	13,7	12,9	11,7
Tax changes	15,0	13,7	13,4	12,6	11,5
New goal estimation sample	14,8	13,6	13,3	12,6	11,4
New age and work-related expense (Formula A result)	14,7	13,5	13,2	12,5	11,3
Formula B result	13,9	11,7	12,9	12,2	11,1
Change between studies (Formula A)	0,3	0,3	0,3	0,3	0,3
Change between studies (Formula B)	-0,4	-1,5	0,0	0,0	0,0
Replacement ratio results					
	60	63	65	67	70
Results as per Butler & Van Zyl (2012b)	98,4%	98,2%	100,0%	99,6%	99,1%
Update of economic assumptions	97,8%	97,7%	99,4%	99,1%	98,7%
Increase in minimum income level	97,9%	97,7%	99,4%	99,1%	98,7%
Tax changes	94,7%	94,4%	97,1%	96,9%	96,9%
New goal estimation sample	95,4%	95,1%	98,2%	95,4%	97,7%
New age and work-related expense (Formula A result)	94,6%	94,1%	97,4%	94,6%	96,4%
Formula B result	89,5%	89,4%	90,9%	89,5%	90,1%
Change between studies (Formula A)	-3,8%	-4,1%	-2,6%	-5,0%	-2,7%
Change between studies (Formula B)	-8,9%	-8,8%	-9,1%	-10,1%	-9,0%

For couples, the results were much more stable on a gross replacement ratio basis than on a wealth-earnings ratio basis as shown in Table 21.

Table 21. Attribution analysis for couples

Wealth-earnings ratio results					
	60	63	65	67	70
Results as per Butler & Van Zyl (2012b)	16,3	15,2	14,8	14,0	12,7
Update of economic assumptions	17,6	16,4	15,9	15,0	13,6
Increase in minimum income level	17,6	16,4	15,9	15,0	13,6
Tax changes	18,3	17,1	16,6	15,7	14,5
New goal estimation sample	17,7	16,4	16,0	15,3	14,0
New age and work-related expense (Formula A result)	17,7	16,4	15,9	15,2	14,0
Formula B result	15,2	14,4	13,6	12,5	11,5
Change between studies (Formula A)	1,4	1,2	1,2	1,3	1,3
Change between studies (Formula B)	-1,1	-0,7	-1,2	-1,4	-1,2
Replacement ratio results					
	60	63	65	67	70
Results as per Butler & Van Zyl (2012b)	98,7%	97,7%	100,5%	99,9%	99,2%
Update of economic assumptions	98,1%	97,2%	99,9%	99,2%	98,7%
Increase in minimum income level	98,1%	97,2%	99,9%	100,4%	98,7%
Tax changes	103,0%	103,8%	105,4%	105,2%	106,3%
New goal estimation sample	100,2%	99,8%	101,4%	100,2%	102,7%
New age and work-related expense (Formula A result)	100,2%	99,6%	101,4%	100,2%	102,8%
Formula B result	85,2%	85,8%	84,3%	85,2%	83,7%
Change between studies (Formula A)	1,5%	1,9%	0,9%	0,3%	3,6%
Change between studies (Formula B)	-13,5%	-11,9%	-16,2%	-14,7%	-15,5%

7.3   REASONS FOR VARIABILITY IN THE SOUTH AFRICAN ESTIMATES

The change in the South African wealth-earnings estimates is driven primarily by the change in the economic assumptions, tax changes and the change in the goal estimation sample. The change in gross replacement ratio targets is driven predominantly by the latter two factors.

For single women, the tax changes reduced the retirement adequacy goals because the marginal tax rate increased for women. This was because single women have relatively high incomes and poor medical-scheme coverage and retirement savings rates. Higher tax rates mean lower consumption and hence lower targets. The effect was more muted for men, who have lower incomes. For couples, the tax changes increased the targets. It is hypothesised that this is due to couples having relatively high rates of medical-scheme coverage and falling in the income band that benefitted from the transition to a medical-scheme-contribution tax-credit system. The lower tax bill increased consumption and hence the targets.

Single women in the 2010-2011 goal estimation sample had lower consumption rates than their counterparts in the previous wave, which may explain why the change in the goal estimation sample reduced the goals for this group. There would have been an offsetting effect due to higher levels of medical-scheme coverage in 2010-2011.

Couples had a large drop in medical-scheme coverage between the two waves and an increase in retirement savings rates with only a small decline in overall consumption. This means the impact that changing the goal estimation sample had on the tax bill was relatively small. The similar consumption rates meant that the estimated goals were relatively similar.

Changing the goal estimation sample for single men resulted in increased goals on a replacement ratio basis and decreased or similar goals on a wealth-earnings basis. This is in part attributable to the age patterns of the male lives and hence the varying annuity costs. Younger lives have higher annuity costs due to longevity improvements assumed in the annuity pricing.

What is most notable is the small impact of updating the change in age- and work-related consumption item. This has generated significant volatility in the results of the Palmer Papers as shown in Figure 8. This implies that it is possible that using tree methodologies can eliminate this source of variability in retirement adequacy targets over time.
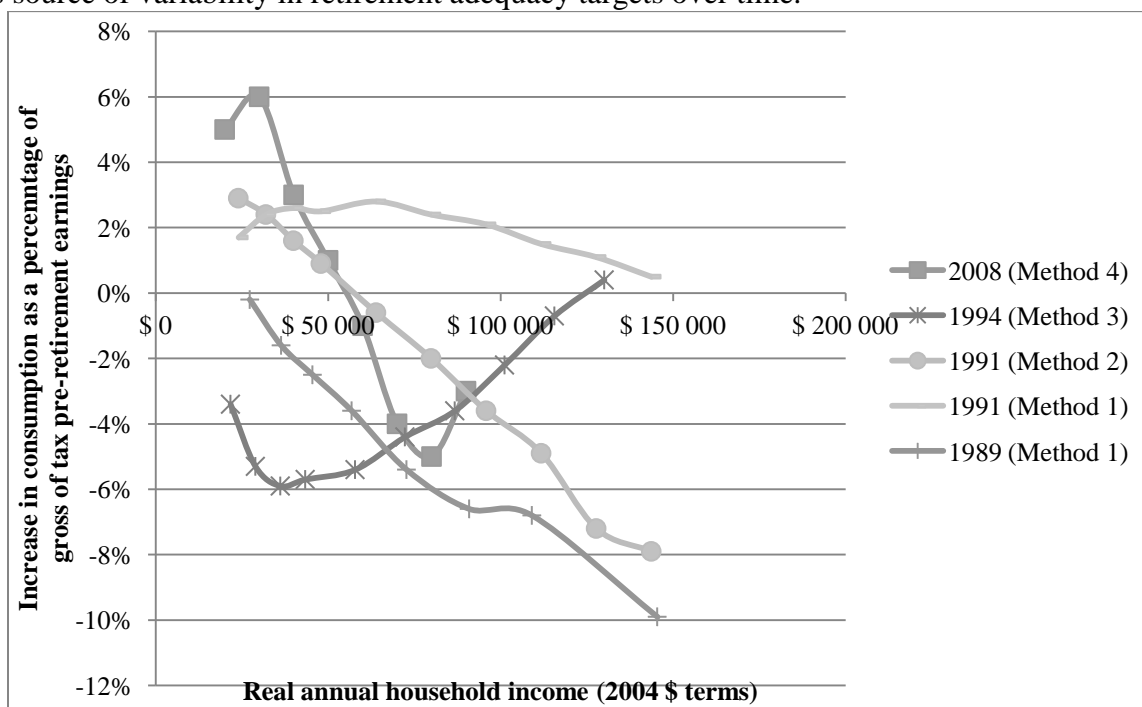

Figure 8. Change in Consumption at Retirement from the Palmer Papers for a couple with one male wage earner aged 65 and one female non-wage earner aged 62 at retirement[14]

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[14] Author's Calculations using the Palmer Papers and Inflation data from the Bureau of Labor Statistics

8. LIMITATIONS AND IMPLICATIONS

8.1 LIMITATIONS

Before drawing conclusions from these results it is important to bear in mind that they were derived from a small sample drawn from another sample. The results may not apply to all households.

The study is restricted to one- or two-adult households. Only 35,8% of the surveyed households in IES 2010-2011, and 46,1% of households surveyed in the 2011 Census[15] consisted of one or two people, including adults living with children. Given the sensitivity of the results to household composition, these results may not be applicable to larger households.

The study is also restricted to households not experiencing a period of unemployment. According to the Labour Force Survey[16], 25,6% of working-age South Africans were unemployed in the second quarter of 2013. However, this restriction reduced the sample size by less than 9,0%. This suggests that unemployment is typically associated with larger households, possibly due to the unemployed being forced to share living costs with family members and rely on their charity. The full-employment restriction may thus reduce the applicability to a small number of one- or two-person households but may substantially reduce the applicability to larger households.

8.2 IMPLICATIONS: CHANGE IN CONSUMPTION AT AND IN RETIREMENT

The results on the updated data and methodology confirm that there are very few households where consumption differs materially by age or work-status. This is consistent with the TS models used by Yuh, Hanna & Montalto (op. cit.) and Mitchell & Moore (op. cit.).

Where these changes in consumption occur, they tend to happen between the ages of 40 and 50 and it is hypothesised that they are due to lifecycle changes other than retirement.

This confirms that it is inappropriate to set retirement adequacy goals assuming consumption will drop at retirement.

8.3 IMPLICATIONS: THE LEVEL OF RETIREMENT ADEQUACY GOALS

The 75th percentile of the retirement adequacy goals lie above the 75% gross replacement ratio level, although for couples with salary support, a 75% replacement ratio may be adequate in some cases. A 100% replacement ratio may achieve better income adequacy in retirement. This result is fully consistent with Butler & Van Zyl (2012b).

8.4 IMPLICATIONS: FACTORS INFLUENCING RETIREMENT ADEQUACY GOALS

Retirement adequacy goals are generally complex functions and it may be difficult to develop rules of thumb or sensibly adjusted targets at a retirement fund level.

Having a female household head was found to increase the goals on a wealth-earnings ratio basis, possibly due to longevity. For the Formula A goals, being part of a two-person household

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[15] Statistics South Africa, Census 2011 Community Profiles in SuperCross, http://www.statssa.gov.za/Census2011/Products.asp, 01/09/2013
[16] Statistcs South Africa, Quarterly Labour Force Survey Q2 2013, http://beta2.statssa.gov.za/?page_id=737&id=1, 01/09/2013

and being homeowners increased the goals while higher income levels and retirement savings rates decreased the goals. The Formula B goals decreased if households lived in rural areas.

A further notable result was how sensitive the goals are to households living within their means and not expecting to consume the money put towards non-retirement savings in retirement. This alone can reduce the retirement adequacy goals by 3,6 to 5,2 times annual salary.

It was also noted that single women had the highest retirement adequacy goals but the lowest retirement savings rates suggesting that more awareness of the need to save for retirement should be created among this demographic.

8.5   IMPLICATIONS: VARIABILITY OF SOUTH AFRICAN RETIREMENT ADEQUACY TARGETS

The retirement adequacy goals were relatively stable as wealth-earnings ratios for all three groups although the replacement ratio results were less stable for single women.

However, the analysis of the change revealed that retirement adequacy goals are highly sensitive to tax changes. To the extent that financial planning is performed on a net-of-tax basis, this source of volatility in how much households need to save could be overlooked, resulting in sub-optimal outcomes.

The tree methodology produced a stable estimate of the change in consumption at and in retirement, despite very different demographic profiles in IES 2005-2006 and IES 2010-2011. This consumption change item has been a significant obstacle to goal stability in the Palmer papers. This result supports the hypothesis that the tree methodology is superior to the matched-pairs methodology.

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APPENDIX A .DEVELOPMENT OF DATA SAMPLES

Table A.1. Derivation of the model development sample

	Household records	Person records
Full IES dataset	25 328	95 042
Households with 3 or more people	-1 6247	-81 531
Two person households with non-partner relationships	-2 592	-5 096
Self-employed, commercial farming and subsistence farming households	-2 994	-4 360
Households with one or more people unemployed	-314	-347
Households relevant to estimating change in consumption	3 181	3 708
Households with missing or impossible data	-663	-819
Households where consumption was more than twice income	-80	-88
Model development sample	2 438	2 801

Table A.2. Derivation of the goal estimation sample

	Household records	Person records
Model development sample	2 438	2 801
Retired and semi-retired households	-125	-150
Non-savers	-1 559	-1 788
Households with a 30 year age gap or more	-1	-3
Oldest person over 70	-3	-9
Incorrect salary data	-1	-1
Goal estimation sample	749	850