An Excel Spreadsheet for Lifetime Consumption Smoothing

Paper presented at the October, 2008 conference of the Academy of Financial Services

Please cite this paper as: Hanna, S. D. (2008). An Excel spreadsheet for lifetime consumption smoothing. *Proceedings of the Academy of Financial Services.*

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The consumption smoothing implications of the life cycle model are an important part of normative household finance (Campbell, 2006), yet this is not an issue discussed much in financial planning courses. There are a few financial planning software packages that focus on consumption smoothing, most notably Esplanner (available at esplanner.com.) Hanna and Zink (2000) reviewed an early version of Esplanner and compared it to a much simpler computer program that focused mainly on consumption smoothing, the Life Cycle Savings program. Skinner (2007) used Esplanner to analyze retirement savings adequacy. Hanna, Fan, and Chang (1995) discussed the assumptions behind the Life Cycle Savings program, which has been used in financial planning courses at several universities. The program includes a portfolio recommendation component based on assumptions discussed by Hanna and Chen (1997). As Hanna and Zink (2000) noted, Esplanner tries to provide a complete set of financial planning recommendations, but because of a lack of transparency and complexity of input and instructions, might not be an ideal teaching tool. The limited transparency and lack of updates are also limitations for the Life Cycle Savings program. This paper describes an Excel file that provides lifetime consumption smoothing recommendations, and preretirement portfolio allocation recommendations (stocks versus bonds). This Excel file will be available to anyone without restriction, and others will be able to modify the assumptions in terms of consumption smoothing and portfolio advice. The Excel file has been used by students in a financial planning class with actual client households they have found. The outputs from the Excel file are not given directly to clients, but used as inputs for the student planners to formulate their own recommendations in terms of saving, credit use, and portfolio allocations.

The basic consumption smoothing assumptions in the Excel file are similar to those described by Hanna et al. (1995). A two period model leading to the consumption smoothing results is shown below, but the results can be extended to a life cycle model

$$T = U[C_1] + U[C_2]/(1 + \varrho) \quad (1)$$

{The Objective Function: Maximize T}

The constraints are:

$$C_1 = I - S \quad (2)$$

$$C_2 = (1+g)I + (1+r)S \quad (3)$$

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Variables:
T = Total Lifetime Utility
C_1 = Consumption in Year 1 C_2 = Consumption in year 2
S = Savings in year 1 (negative value means take loan.)
g = Growth rate in income (may be negative)
r = Real aftertax interest rate or rate of return
I = Year 1 Income
Year 2 income = (1+g)I
ϱ = personal discount rate. A consumer may discount the future for various reasons, including the possibility of death or disability, and changes in household size. The possibility of death provides a simple illustration of personal discounting of the future. If there is a 10% chance I will not be alive next year, I might value utility from consumption in that year at 90% of the utility from consumption this year, so $1/(1 + \rho) = 90\%$.
Assume that utility from consumption in a particular year is a constant elasticity intertemporal utility function, and lifetime utility is additive and separable over time.

$$U(C_i) = [C_i^{(1+\epsilon)}]/(1+\epsilon) \qquad \text{for } \epsilon \neq -1\} \qquad (4a)$$

$$U(C_i) = \text{Ln}(C_i) \qquad \{\text{for } \epsilon = -1\} \qquad (4b)$$

The optimal growth rate in consumption is:

$$g_c = [(1+r)/(1+\varrho)]^{(-1/\epsilon)} \qquad (5)$$

As an approximation: $g_c \approx (r-\varrho)/(-\epsilon)$ (6)

For r= ϱ , the original simple life cycle model holds --- a consumer should plan to have the same real consumption each year, and the utility function elasticity parameter, ϵ, does not matter.

The life cycle model used is one of certainty, and the focus is on saving for retirement, so the default value of r is 4% before retirement and 3% after retirement.

General impatience is not assumed in the spreadsheet, as the goal is to provide prudent advice for saving. The discount factor for any given age is related to:

1. The probability of death in that year, and
2. The ratio of the natural logs of household size for next year to this year:
   Ratio= $(1 + \text{Ln}(H_{n+1}) / (1 + \text{Ln}(H_n)$
   For instance, if this year household size is 3 and next year household size is 4, the effect of this factor would be to value the utility from next year's consumption at 1.14 times as much as this year's consumption. This is an arbitrary assumption, and I plan to modify it after research into household equivalence scales, but for typical values of ϵ, e.g., -4, the exact assumption of the effect of household size changes does not make a substantial difference.

If no change in household size is projected, the spreadsheet will have slowly increasing suggested consumption until the annual risk of death reaches 3%, then decreasing consumption.

The user must make a conservative estimate of future aftertax income other than from financial investments. (All amounts are input in constant dollars.) The user must obtain estimates of Social Security and other defined benefit pensions. The user inputs future withdrawals, which are any substantial expenditure that is not a usual expense, such as paying for college costs in particular years in the future. The user starts with an estimate of spending in year 1, and the program calculates what would be left over at age 100, assuming that each year spending changes in accordance with a life cycle model. The user then uses the Excel Goal-Seeking Tool to change the initial spending so that the value of financial assets left at age 100 is equal to the client's goal, e.g., zero, or some amount consistent with precautionary and/or bequest goals. The amount recommended to be saved each year is simply the difference between aftertax income and suggested spending.

The Excel file does not need to be updated, since it is up to the user to calculate income taxes currently and in the future, and to use outside sources such as ssa.gov or a client's actual Social Security Earnings statement to obtain estimates of defined benefit pensions. There are separate sheets for changing assumptions, such as the rate of return on investments. The user should give the client the subjective risk tolerance questions described in Hanna and Lindamood (2004), although the default value is probably appropriate for most clients.

The Excel file and the instruction file are available at the web page http://hec.osu.edu/people/shanna/lcsprogram.htm. Anyone is free to use this program, though please include the authorship information in the Excel file and the instructions. (If you modify the program or instructions, include a statement such as "based on version created by Sherman D. Hanna, Ohio State University." I welcome suggestions.

Below are the instructions for using the Excel file, followed by an example of output for a hypothetical couple.

Instructions for Using the Life Cycle Savings Excel File

Sherman D. Hanna, August 9, 2008. Copyright 2008.[2]

The purpose of this Excel file is to obtain a rational spending/saving plan for the future, based on conservative projections of household income. In order to use this Excel file, you will need to obtain estimates of Social Security and other pensions, as the spreadsheet will not calculate those (use http://ssa.gov/OACT/quickcalc/index.html). Note in general: all amounts should be in today's dollars, so think about what a salary or item would be today. Once you open the file, save with a meaningful file name, e.g., HannaClient. Save the file frequently. NOTE: the LCS_Example file has a relatively complicated example for a couple. You should start with the LCS file, so that all you have to change are the names, initial salaries, and final salaries. (When working in the Excel file, never insert rows or columns.)

The Excel file has five sheets, which can be reached by clicking on the corresponding tab at the bottom of each sheet:

[2] I grant the right for others to reproduce this file as long as the authorship of the original version is listed in any new versions, and descriptions of any uses and improvements are emailed to hanna.1@osu.edu.

1. **Input0**. This is for the main input of household characteristics. There is more discussion below.
2. **Input1**. This is for the input of subjective risk tolerance. It also has instructions for using the Goal-Seeking Tool of Excel to find the optimal spending pattern over the lifetime.
3. **Input2**. This is for input of a future home purchase if the household does not already own a home, plus other "withdrawals." A withdrawal is any substantial expenditure which is not for a usual spending item and will not typically continue indefinitely. An example is payment of college costs for children. You should never enter planned contributions to investment accounts – the purpose of this program is to tell you the total amount to save each year for all goals. There is also a column for "additions." An example of an addition is an expected inheritance. You should be extremely conservative in including additions, as the program assumes that there is a 100% probability that amounts will be received. It is much more prudent to assume that expected inheritances will not be received. For instance, a widower grandfather could remarry and leave all assets to his new wife.
4. **Input3**. This is for input of future aftertax income. The spreadsheet is set up to estimate employment income each year in the future based on inputs in the Input0 sheet, but you can type over the numbers to allow for a less steady pattern in salaries. The spreadsheet will fill in Social Security pension income in the future based on your inputs in sheet Input0. There are also columns for input of defined benefit pensions, plus income other than from pensions and employment. An example of other income would be rental income. Remember to always be pessimistic in projecting future real income.
5. **Main**. This is mostly for printing the output. Most of this sheet is based on inputs in the other sheets. The only action you take in this sheet is using the Tools/Goalseek feature on the menu bar to find the initial spending level that will smooth spending over the lifetime in a way consistent with total resources and the assumptions of the model.

Input0 Sheet

(Note that as part of self-documentation, information for a case is already in the sheets, so you will need to type over the information in each input cell.)

Cell B1: enter your name
Cell B2: enter the pseudonym you will be using for the client household.
Cell B3: enter the age of the head (or of the older spouse/partner for a couple household) as of Jan. 1 of the initial year. (Note --- we refer to the "head" but for couple households, think of the older spouse/partner when the term "head" is used.)
Cell B4: enter the age of the younger spouse/partner for a couple household) as of Jan. 1 of the initial year. Enter 0 if the household is not a couple household. (Note – you cannot use a couple household if you can obtain information only from one partner.)
Cell B5: enter the net investments as of Jan. 1 of the initial year. Add up value of all financial assets and non-financial investments such as investment real estate (other than the primary residence,) then subtract balances on student loans, credit cards, and any loans for investments other than the primary residence. (Do NOT include personal residence, or assets that client would never sell. Do NOT subtract vehicle or mortgage debt.) Include only investment assets that would be eventually sold or liquidated. Enter total value of investments that would never be sold in cell E5.
Cell B6: enter initial annual aftertax employment income for the head, total from all jobs and self-employment income. You need to estimate the federal, state, and local income taxes, plus Medicare/FICA taxes, and subtract them from pretax income. You should base your estimate of aftertax employment income from Box 1 of the W2 form, which will not include most mandatory

defined benefit pension contributions and contributions to most employer defined contribution plans. For self-employment income, estimate based on net self-employment income entered on the 1040 form.

Cell B7: enter initial annual aftertax employment income for the younger partner/spouse, total from all jobs and self-employment income. (Enter 0 if there is no partner/spouse.)

Cell B8: first full calendar year. Generally use current year, although if your clients will not start living together until next year, you could use that year.

Cell B9: enter the age at which the head (or of the older spouse/partner for a couple household) will be retired from his/her main career.

Cell B10: enter the age at which the younger spouse/partner will be retired from his/her main career. Enter 0 if the household is not a couple household.

Cell B11: If your client has his/her Social Security Benefits statement (typically received 3 months before the last birthday) then enter the monthly retirement pension estimate shown. Otherwise, go to ssa.gov and use the Quick Calculator. (See instructions in lower part of Input0 sheet.) If your client is young, it might be better to use the Quick Calculator, as the statement might assume very low salaries.

Cell B12: If younger partner/spouse has his/her Social Security Benefits statement (typically received 3 months before the last birthday) then enter the monthly retirement pension estimate shown. Otherwise, go to ssa.gov and use the Quick Calculator. (Enter 0 if there is no partner/spouse.)

Cell B13: If your client is covered by a defined benefit pension, get an estimate of the monthly pension that would be received at retirement, subtract your estimate of federal, state, and local income taxes, and enter.

Cell B14: If the younger partner is covered by a defined benefit pension, get an estimate of the aftertax monthly pension amount and enter.

Cell C15: This is calculated as the age when the head will start receiving Social Security benefits, assuming the client will start receiving benefits at retirement from the regular career, as the age you input in cell B9, but adjusted to 62 if you entered an age under 62 in cell B9.

Cell C16: Input the age at which the head will start receiving a defined benefit pension.

Cell C17: Input the age at which the spouse/partner will start receiving a defined benefit pension. (Enter 0 if there is no partner/spouse.)

Cell E1: This is the assumed real rate of return on retirement investments (and other investments) before retirement. Do not change without discussing with instructor.

Cell E2: This is the assumed real rate of return on investments after retirement. Do not change without discussing with instructor.

Cell E3: This is aftertax household income other than from pensions or employment income. Example: income from rental properties. The spreadsheet does not do anything with the number you input here, so you will have to input amounts for each year in column J of sheet Input3. Note that the issue of allocation of income taxes is somewhat complex for households with multiple sources of income. Do not be overly concerned about exact calculation of income taxes for each source, just be prepared to explain your assumptions. **Do NOT enter income from assets that you input elsewhere!** Example – if you input $10,000 for a savings account, do not include $400 for interest income. Only input non-employment income that is not connected to assets you enter, e.g., a disability benefit, or alimony or child support payments.

Cell E4: This is a calculated cell, so do not type anything. It is taken from cell K4 of sheet Input3. (It will not include non-employment income until you input it in sheet Input3.)

Cell E5: Enter total value of investments that would never be sold in cell E5.

Example of assets to include: investment real estate, but only if client would never sell the asset.

Cell E6: This is the projected aftertax employment income from the head's job just before retirement, total from all jobs and self-employment income. Note that if the client anticipates a transition from full-time employment to part-time employment, use only the aftertax income just before retirement from full-time employment. Be VERY conservative in projecting future salaries --- it is rare that somebody can be 95% sure that real income will more than double between the start of a career and end of a career. You will need to do a rough estimation of changes in income and payroll taxes if real household income is projected to change very much. For instance, assume that your client has a gross salary of $30,000 today, is single with no dependents, and does not itemize for federal income taxes. Consider the following example: a single person living in Ohio, with a 2% local income tax.

Gross income=	$30,000	$60,000	$90,000	$120,000
Total of federal, state, and local income tax, plus FICA/Medicare taxes	$6,663	$17,835	$30,207	$42,069
Taxes as % of gross income	22%	30%	34%	35%
Aftertax income	$23,337	$42,165	$59,793	$77,931
Aftertax income as % of gross income	78%	70%	66%	65%

I assumed that the standard deduction would be used for federal income taxes, but if a home were purchased when income was higher, that would lower the federal income tax, plus the state and local income taxes could also be used as itemized deductions. At any rate, if the projected changes in income were conservative, e.g., change from $30,000 today to $60,000 at the end of the career (all in today's dollars) you could use the budget spreadsheet for a rough calculation, and you would enter $42,165 as the aftertax employment income just before retirement.

Note that as with cell B6, you should also subtract mandatory pension contributions but do not subtract contributions to Defined Contribution Plans such as 401K plans.

Cell E7: This is the projected aftertax employment income from the younger spouse/partner's job just before retirement. See instructions for Cell E6. Enter 0 if there is no spouse/partner.

Cell E8: This is projected aftertax employment income after the head retires from full-time employment. The spreadsheet does nothing with this number, so you will need to make some reasonable assumptions for inputs in sheet Input3, for instance, in how many years the head would work part-time. If your client prefers not to work part-time after retirement from a full-time job, you should just assume zero income.

Cell E9: This is the age at which the head will no longer be working at any job or self-employment. The spreadsheet does nothing with this number.

Cell E10: This is projected aftertax employment income after the younger spouse/partner retires from full-time employment. See instructions for Cell E8.

Cell E11: This is the age at which the younger spouse/partner will no longer be working at any job or self-employment.

Cell E12: This is the calculated number of years until the head's retirement from full-time employment.

Cell E13: This is the calculated number of years until the younger spouse/partner's retirement from full-time employment.

Cell E14: This is the calculated number of years until the first retirement from full-time employment.
Cell E15: This shows the age at which the younger spouse/partner will start receiving Social Security benefits. See instructions for cell C15.
Cell E16: This is the assumed annual real rate of return for investments entered in cell E5. You can change this but better to leave it at 4%.
Cell E17: Enter initial value of other long-lasting assets not entered elsewhere in sheets INPUT0 or INPUT2. Do not include home, vehicles, furniture, etc. Example of assets to include: investment real estate and a business if client would consider selling the asset

The rest of sheet INPUT0 has a discussion of using ssa.gov to obtain estimates of Social Security pensions. If you use pessimistic projections of future salaries, and do not optimistically assume that your client can work full-time at a high salary until age 67 (roughly half of retired people retired sooner than planned) the ssa.gov estimates should be reasonable.

Input1 Sheet

Have your client go to http://hec.osu.edu/people/shanna/rts/
The first two screens are for some demographic information – your client can skip those screens, although the information will not be connected to your client and will only be used for general tabulations on risk tolerance. Have your client answer the hypothetical pension gamble questions and report to you the final Subjective Risk Tolerance level, e.g., Moderate.
If your client household includes a couple, have them both independently take the survey.
Cells B5-B11: Type a 1 in cell that corresponds to your client's subjective risk tolerance level. For a couple, enter 1 for each level if different, and spreadsheet will use the lower of the two responses. Example: the husband has Low and the wife has Moderate subjective risk tolerance. Enter a 1 in cell B7, and a 1 in B8.
Cell B15: Calculated number for subjective risk tolerance.
Cell B16: This is the "thriftiness level", initially set at 5. Do not change unless you discuss with the instructor. A number less than 5 typically results in less spending initially, and more than 5, more spending initially. So, a lower number means more "thriftiness."
Cell B20: Enter the amount of precautionary/bequest funds for retirement. This is how much the client would want to have if he/she lived to be age 100 and had no assisted living expenses, etc. The higher the amount, the more that will be needed to save earlier in life. The spreadsheet does not do anything with this number, but you should keep it in mind when using the Tools/Goalseek feature on the Menu Bar in the Main sheet.
{Note that if the client owns a home, then at the time of death of the client and any spouse/partner, whether at age 100 or earlier, the value of the home will be included in the estate, plus the value you input in cell E5 of sheet Input0, which represents other assets that will not be sold while the client is alive.}
The rest of the Input1 sheet shows a screen shot of the Main sheet when using the Goal Seek Tool. Note that in the popup box you will see after clicking on the Tools/Goal Seeking on the Menu Bar, you will see a cell for Value. For this, type in the target precautionary fund at age 100, e.g., $100,000, or whatever is appropriate for your client.

Input2 Sheet

This sheet is for inputs related to buying a home, unusual major expenses, and possible future additions such as inheritances.
Cell D2: If your client owned a home at the beginning of the current year, type in the market value of the home. (Ignore loan balances.)
Cell A11: Type in description of withdrawals for year 1, e.g., college tuition. (Just keep typing if it more than fills the space --- do not insert extra rows ever, anywhere in the LCS Excel sheet.)

Cell A12: Type in description of withdrawals for year 2. Etc.
Column C. Enter the total purchase price of a home. Everything should be in today's dollars. If your client plans on buying more expensive homes in the future, the program will use the highest value entered as of a particular year in calculating total household wealth. If a previously owned home will be sold, you should take into account a conservative, inflation-adjusted estimate of the home equity that could be used for a down payment, and net that out of the amount you enter in column D for the down payment. (The program will assume that the down payment amount represents additional financial resources that need to be accumulated by that year.)

However, do NOT enter the value of second homes, vacation homes, etc. in column B. The full purchase price of such items should be entered in column E.
Note that in the example Excel file, the client will buy a $200,000 home in the year 2010 and will make $20,000 down payment.

Column D: Down payment for home purchased in that year. Note, after the initial home purchase, when another primary residence is purchased, assume net equity after costs goes for down payment, so you might have zero for subsequent home purchases.
Columns E: Enter full purchase price of permanent assets other than for the purchase of a primary residence, e.g., business, land, second home.
Columns F-H: These are for withdrawals other than for the purchase of a primary residence. Note that in the example Excel file in rows 29-34, college costs are entered in the year the children will be attending college. Do NOT enter planned contributions to college funds. The program will include in its recommendations for savings each year the total of all savings for retirement and other future goals.
In the example Excel file in row 43, the client wants to buy a super RV in the year 2040, and today such an RV would cost $100,000. Therefore, it is a savings goal.

Column K: This is for total household size. Enter 1 and copy down the spreadsheet if the client will be a one-person household forever. If children are planned, increase household size by 1 when planned children are added to the household, and decrease household size by 1 when a child will no longer be supported.
Column L: Calculated value of current home in constant dollars.
Column N: Calculated value of non-financial assets, other than investment assets that might be eventually sold.

Input3 Sheet

This sheet is for entry of income amounts. For salaries and Social Security pensions, the spreadsheet calculations based on the amounts you put in sheet Input0 might be reasonable. If you included the initial aftertax salary and final aftertax salary, plus Social Security pension amount, in sheet Input0, the spreadsheet will assume a steady increase in salary until the year before the retirement age input in Input0, then start the Social Security pension at age 62 (or later if specified in Input0.)

However, if the client will have other sources of income, you will need to input these as appropriate in sheet Input3. Make sure that you use conservative estimates of aftertax income in terms of today's dollars. **Do NOT enter income from assets that you input elsewhere!**

Example – if you input $10,000 for a savings account, do not include $400 for interest income. Only input non-employment income that is not connected to assets you enter, e.g., a disability benefit, or alimony or child support payments. Unlike the employment income and pensions entered in sheet Input0, other income will not automatically be calculated for future years, so you will have to enter this year by year or copy a constant amount down column J. For employment income after the retirement age you input in sheet Input0, you will have to input the amounts year by year in column D (head) or E (partner).

Main Sheet

After inputs in sheets Input0, Input1, Input2, and Input3, the only action left is to use the Goal-Seeking Tool in the Main sheet, and then print the Main sheet.

The instructions for using the Goal Seek Tool are in the Input1 sheet. When you are in the Main sheet, place the cursor in cell N2. Click on Tools, then Goal Seek. You will see a pop-up box like the one shown in the screen shot in Input1. It should show N2 for "set cell." For the "To value" box, type in the target precautionary/bequest fund at age 100. (If you type 0 as shown in the example, the household will spend all of its resources if it lives to be 100. Note that the LCS program does NOT assume that the client will live to be 100, and the suggested spending amounts are discounted by the chance that the client die before age 100, but it does show what would happen if the client did live to be 100. If a 30 year old lives to be 65, there is a good chance of living to be 100.)

For the "By changing cell" box, type e4. Then click OK, and you should see "Goal seeking has found a solution." Click OK. You are done with all inputs, and now you should simply print the Main sheet. Do NOT make any adjustments to Print Setup, though it might be prudent to click File/Print Preview. You should see 4 pages. Then just click print. (If you make any adjustments, you are very likely to end up with a huge number of pages.)
The four pages include:

Page 1:
Aftertax household income each year
Suggested spending each year (not counting withdrawals)
Suggested amount to save out of income each year. (Note that this includes all contributions for all savings goals, so, for instance, if the client is contributing $10,000 to a 401K plan and the employer is contributing an additional $5,000, you should compare the LCS suggested amount to the total of $15,000 that will be contributed.) Suggested saving=income-suggested spending-withdrawals+additions
Accumulated financial investments at the end of each year.
Total household wealth at the end of each year, including human wealth.
Ratio of financial assets to total wealth.
Suggested percent of the retirement portfolio that should be allocated to stocks (large + small)
Total of non-financial assets.
Suggested amount to save each year as a percent of aftertax household income.
Suggested percent of the portfolios for other goals that should be allocated to stocks (large + small), assuming that each goal is 5 years away. (Use a more conservative allocation if the goal is within 5 years.)

Page 2:
Rest of table from page 1, if you had a very young client. The information you input in sheet Input0 and Input1, plus the initial estimate of human wealth. Graph showing LCS suggested amount to spend, and aftertax income. Typically the spending pattern will be very smooth, with a slight increase over time except when household size is expected to decrease. Graph showing financial assets over time, assuming that LCS spending/saving suggestions are followed. In the Example File, financial assets decrease with the purchase of a home, and then with payment of college costs for the children.

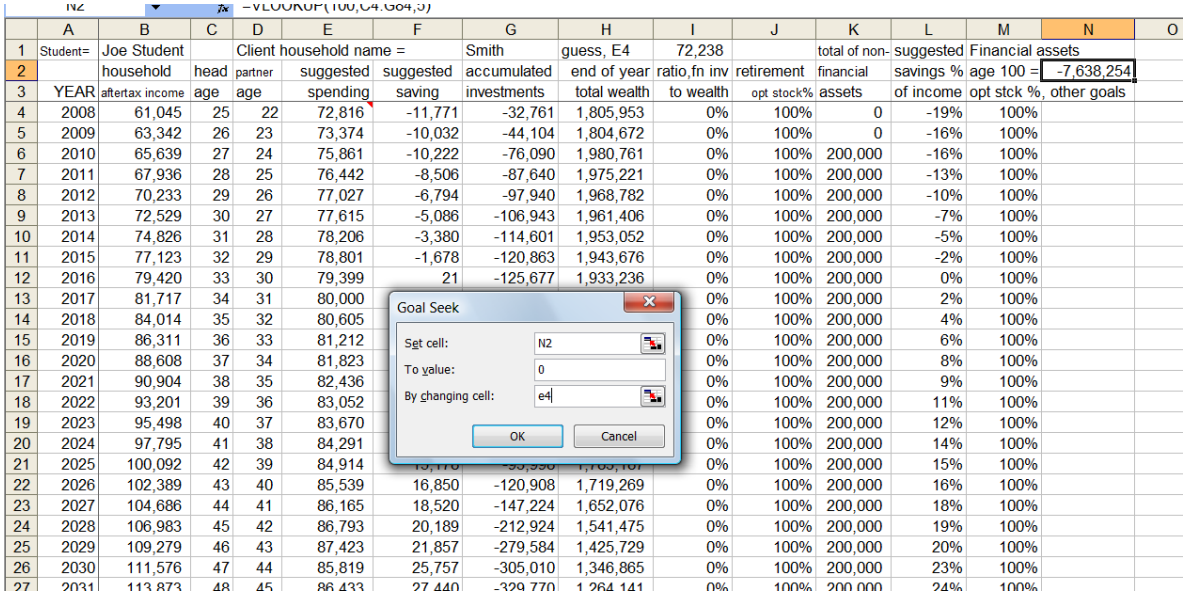
Page 3:
Graph showing suggested annual saving as a percent of income.
Graph showing suggested stock percent of the retirement and other portfolios.
Table showing different aftertax income components for each year.

Page 4:
Rest of table from page 3.
Table showing home purchases, withdrawals, and additions for each year. (This table does not include the columns from sheet Input2 with Withdrawals #2 and #3, though it does show the total of withdrawals for each year. If you had more than 1 withdrawal for a year, you would need to also print sheet Input2. **Otherwise, there is no need to print the other sheets.**

Portion of Input Screen, Example Household

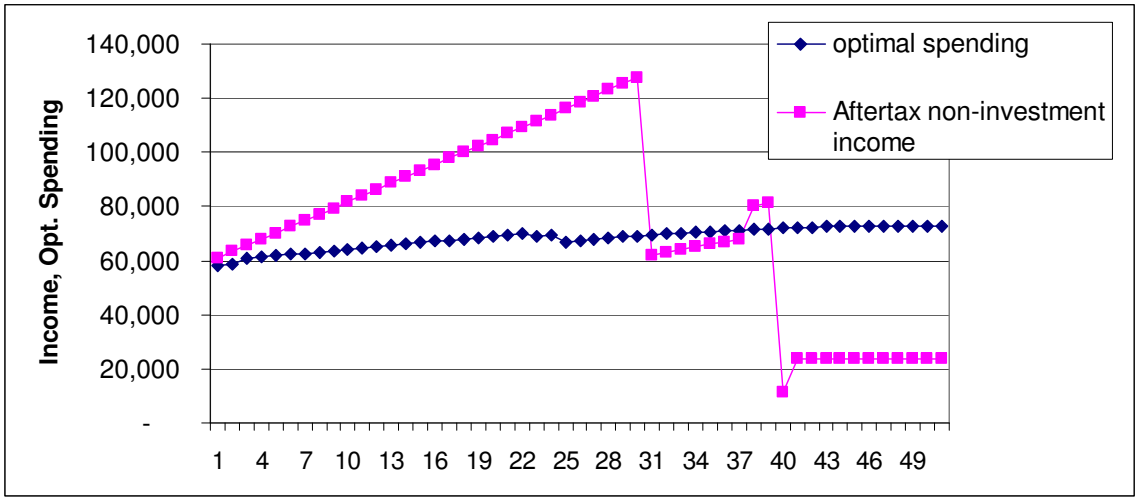
Year	head age	partner age	aftertax employment income,head	aftertax employment income,partner	Social Security pension income,head	Social Security pension income,partner	other DB pension income,head	other DB pension income,partner	not counting pensions, household non-employment income
2008	25	22	29,256	31,789		0			
2009	26	23	30,547	32,794		0			
2010	27	24	31,839	33,800		0			
2011	28	25	33,130	34,805		0			
2012	29	26	34,422	35,811		0			
2013	30	27	35,713	36,816		0			
2014	31	28	37,005	37,821		0			
2015	32	29	38,296	38,827		0			
2016	33	30	39,588	39,832		0			
2017	34	31	40,879	40,838		0			
2018	35	32	42,171	41,843		0			
2019	36	33	43,462	42,849		0			
2020	37	34	44,754	43,854		0			
2021	38	35	46,045	44,859		0			
2022	39	36	47,337	45,865		0			
2023	40	37	48,628	46,870		0			
2024	41	38	49,919	47,876		0			
2025	42	39	51,211	48,881		0			
2026	43	40	52,502	49,886		0			
2027	44	41	53,794	50,892		0			
2028	45	42	55,085	51,897		0			
2029	46	43	56,377	52,903		0			
2030	47	44	57,668	53,908		0			
2031	48	45	58,960	54,913		0			
2032	49	46	60,251	55,919		0			
2033	50	47	61,543	56,924		0			
2034	51	48	62,834	57,930		0			
2035	52	49	64,126	58,935		0			
2036	53	50	65,417	59,940		0			
2037	54	51	66,709	60,946		0			
2038	55	52	-	61,951	0	0			
2039	56	53	-	62,957	0	0			
2040	57	54	-	63,962	0	0			
2041	58	55	-	64,968	0	0			
2042	59	56	-	65,973	0	0			
2043	60	57	-	66,978	0	0			
2044	61	58	-	67,984	0	0			
2045	62	59	-	68,989	11256	0			
2046	63	60	-	69,995	11256	0			
2047	64	61	-	-	11256	0			
2048	65	62	-	-	11256	12264			
2049	66	63	-	-	11256	12264			

Using the Excel Goal-Seeking Tool to find the highest feasible initial spending that meets the assumptions of the life cycle model.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Student=	Joe Student		Client household name =			Smith	guess, E4	72,238		total of non-	suggested	Financial assets		
2		household	head	partner	suggested	suggested	accumulated	end of year	ratio,fn inv	retirement	financial	savings %	age 100 =	-7,638,254	
3	YEAR	aftertax income	age	age	spending	saving	investments	total wealth	to wealth	opt stock%	assets	of income	opt stck %,	other goals	
4	2008	61,045	25	22	72,816	-11,771	-32,761	1,805,953	0%	100%	0	-19%	100%		
5	2009	63,342	26	23	73,374	-10,032	-44,104	1,804,672	0%	100%	0	-16%	100%		
6	2010	65,639	27	24	75,861	-10,222	-76,090	1,980,761	0%	100%	200,000	-16%	100%		
7	2011	67,936	28	25	76,442	-8,506	-87,640	1,975,221	0%	100%	200,000	-13%	100%		
8	2012	70,233	29	26	77,027	-6,794	-97,940	1,968,782	0%	100%	200,000	-10%	100%		
9	2013	72,529	30	27	77,615	-5,086	-106,943	1,961,406	0%	100%	200,000	-7%	100%		
10	2014	74,826	31	28	78,206	-3,380	-114,601	1,953,052	0%	100%	200,000	-5%	100%		
11	2015	77,123	32	29	78,801	-1,678	-120,863	1,943,676	0%	100%	200,000	-2%	100%		
12	2016	79,420	33	30	79,399	21	-125,677	1,933,236	0%	100%	200,000	0%	100%		
13	2017	81,717	34	31	80,000				0%	100%	200,000	2%	100%		
14	2018	84,014	35	32	80,605				0%	100%	200,000	4%	100%		
15	2019	86,311	36	33	81,212				0%	100%	200,000	6%	100%		
16	2020	88,608	37	34	81,823				0%	100%	200,000	8%	100%		
17	2021	90,904	38	35	82,436				0%	100%	200,000	9%	100%		
18	2022	93,201	39	36	83,052				0%	100%	200,000	11%	100%		
19	2023	95,498	40	37	83,670				0%	100%	200,000	12%	100%		
20	2024	97,795	41	38	84,291				0%	100%	200,000	14%	100%		
21	2025	100,092	42	39	84,914				0%	100%	200,000	15%	100%		
22	2026	102,389	43	40	85,539	16,850	-120,908	1,719,269	0%	100%	200,000	16%	100%		
23	2027	104,686	44	41	86,165	18,520	-147,224	1,652,076	0%	100%	200,000	18%	100%		
24	2028	106,983	45	42	86,793	20,189	-212,924	1,541,475	0%	100%	200,000	19%	100%		
25	2029	109,279	46	43	87,423	21,857	-279,584	1,425,729	0%	100%	200,000	20%	100%		
26	2030	111,576	47	44	85,819	25,757	-305,010	1,346,865	0%	100%	200,000	23%	100%		
27	2031	113,873	48	45	86,433	27,440	-329,770	1,264,141	0%	100%	200,000	24%	100%		

Student=	Joe Student		Client household name =			Smith
YEAR	household aftertax income	head age	partner age	suggested spending	suggested saving	accumulated investments
2008	61,045	25	22	58,357	2,688	-18,303
2009	63,342	26	23	58,805	4,537	-14,497
2010	65,639	27	24	60,798	4,841	-30,236
2011	67,936	28	25	61,263	6,672	-24,773
2012	70,233	29	26	61,732	8,501	-17,264
2013	72,529	30	27	62,203	10,326	-7,628
2014	74,826	31	28	62,677	12,149	4,215
2015	77,123	32	29	63,154	13,969	18,353
2016	79,420	33	30	63,633	15,787	34,874
2017	81,717	34	31	64,115	17,602	53,871
2018	84,014	35	32	64,600	19,414	75,440
2019	86,311	36	33	65,086	21,224	99,682
2020	88,608	37	34	65,576	23,032	126,701
2021	90,904	38	35	66,067	24,837	156,606
2022	93,201	39	36	66,561	26,641	189,511
2023	95,498	40	37	67,056	28,442	225,533
2024	97,795	41	38	67,554	30,241	264,796
2025	100,092	42	39	68,053	32,039	307,427
2026	102,389	43	40	68,554	33,835	313,559
2027	104,686	44	41	69,056	35,630	321,731
2028	106,983	45	42	69,559	37,423	292,023
2029	109,279	46	43	70,064	39,216	262,920
2030	111,576	47	44	68,778	42,798	276,235
2031	113,873	48	45	69,270	44,603	291,887
2032	116,170	49	46	66,830	49,340	352,903
2033	118,467	50	47	67,299	51,168	418,187
2034	120,764	51	48	67,767	52,997	487,912
2035	123,061	52	49	68,231	54,829	562,257
2036	125,358	53	50	68,693	56,664	641,412
2037	127,654	54	51	69,152	58,503	725,571
2038	61,951	55	52	69,472	-7,521	747,072
2039	62,957	56	53	69,786	-6,830	770,126
2040	63,962	57	54	70,094	-6,131	694,799
2041	64,968	58	55	70,392	-5,424	717,167
2042	65,973	59	56	70,679	-4,706	741,147
2043	66,978	60	57	70,953	-3,975	766,818
2044	67,984	61	58	71,213	-3,229	794,262
2045	80,245	62	59	71,457	8,788	834,821
2046	81,251	63	60	71,685	9,565	877,779
2047	11,256	64	61	71,899	-60,643	852,247
2048	23,520	65	62	72,097	-48,577	837,760
2049	23,520	66	63	72,280	-48,760	822,511
2050	23,520	67	64	72,445	-48,925	806,487
2051	23,520	68	65	72,588	-49,068	789,678



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