Strategic Financial Planning over the Lifecycle

Chapter #4: Consumption Smoothing

Narat Charupat, Huaxiong Huang and Moshe A. Milevsky

Ch. #4: Lecture Notes

Background

- For most of the material, questions and answers in this lecture, I will assume that cash-flows for wages (w_j) and consumption (c_j) occur once at the end of the year. So, all interest rates and valuation rates are quoted as an effective annual rate.

Background

- For most of the material, questions and answers in this lecture, I will assume that cash-flows for wages (w_j) and consumption (c_j) occur once at the end of the year. So, all interest rates and valuation rates are quoted as an effective annual rate.
- We are interested in three very important quantities:

Background

- For most of the material, questions and answers in this lecture, I will assume that cash-flows for wages (w_j) and consumption (c_j) occur once at the end of the year. So, all interest rates and valuation rates are quoted as an effective annual rate.
- We are interested in three very important quantities:
  1. the optimal savings rate $s_j^* := (w_j - c_j^*)/w_j$ during your working years;

Background

- For most of the material, questions and answers in this lecture, I will assume that cash-flows for wages (w_j) and consumption (c_j) occur once at the end of the year. So, all interest rates and valuation rates are quoted as an effective annual rate.
- We are interested in three very important quantities:
    1. the optimal savings rate $s_j^* := (w_j - c_j^*)/w_j$ during your working years;
    2. the optimal trajectory of financial capital F_j^* over your lifecycle, and;

Background

- For most of the material, questions and answers in this lecture, I will assume that cash-flows for wages (w_j) and consumption (c_j) occur once at the end of the year. So, all interest rates and valuation rates are quoted as an effective annual rate.
- We are interested in three very important quantities:
  1. the optimal savings rate $s_j^* := (w_j - c_j^*)/w_j$ during your working years;
  2. the optimal trajectory of financial capital F_j^* over your lifecycle, and;
  3. the optimal retirement spending rate $c_j^*/(F_j^* + c_j^*)$ once your wage income is zero, i.e. $j > R$ (more on this in later lectures.)

Background

- For most of the material, questions and answers in this lecture, I will assume that cash-flows for wages (w_j) and consumption (c_j) occur once at the end of the year. So, all interest rates and valuation rates are quoted as an effective annual rate.
- We are interested in three very important quantities:
  1. the optimal savings rate $s_j^* := (w_j - c_j^*)/w_j$ during your working years;
  2. the optimal trajectory of financial capital F_j^* over your lifecycle, and;
  3. the optimal retirement spending rate $c_j^*/(F_j^* + c_j^*)$ once your wage income is zero, i.e. $j > R$ (more on this in later lectures.)
- These three values will depend on your personal patience rate, denoted by k, your retirement horizon R (in years) and the overall length of life D (in years.)

Remember the Timelines

- The value of human capital at time zero is the present value of wages until retirement:

$$H_0 = \sum_{j=1}^{R} \frac{w_j}{(1+v)^j} = w_0 \sum_{j=1}^{R} \frac{(1+g_w)^j}{(1+v)^j} = w_0 \cdot \mathbf{PVA}(g_w, v, R).$$

Remember that the first payment is at end of year $j = 1$. The last payment is at end of year $j = R$.

Remember the Timelines

- The value of human capital at time zero is the present value of wages until retirement:

$$H_0 = \sum_{j=1}^{R} \frac{w_j}{(1+v)^j} = w_0 \sum_{j=1}^{R} \frac{(1+g_w)^j}{(1+v)^j} = w_0 \cdot \mathbf{PVA}(g_w, v, R).$$

  Remember that the first payment is at end of year $j = 1$. The last payment is at end of year $j = R$.

- Pay careful attention to the evolution of financial capital:

$$\begin{aligned} F_1 &= F_0(1+v) + w_1 - c_1 \\ F_2 &= F_1(1+v) + w_2 - c_2 \\ F_R &= F_{R-1}(1+v) + w_R - c_R \\ F_{R+1} &= F_R(1+v) - c_{R+1}. \end{aligned}$$

Question #1a:

- Interest (valuation) rates are $v = 3\%$ in real (inflation adjusted) terms. Make sure you understand what this means.

Question #1a:

- Interest (valuation) rates are $v = 3\%$ in real (inflation adjusted) terms. Make sure you understand what this means.
- You are just about to turn 25 (tomorrow) and have just received your annual paycheck of $w_0 = \$50,000$ which is expected to grow at a real rate of $g_w = 1\%$ per year.

Question #1a:

- Interest (valuation) rates are $v = 3\%$ in real (inflation adjusted) terms. Make sure you understand what this means.
- You are just about to turn 25 (tomorrow) and have just received your annual paycheck of $w_0 = \$50,000$ which is expected to grow at a real rate of $g_w = 1\%$ per year.
- You spent your entire paycheck on a wild birthday party, and woke up (hung over) the next morning (broke) realizing that you are about to turn 25 and should start planning your financial future.

Question #1a:

- Interest (valuation) rates are $v = 3\%$ in real (inflation adjusted) terms. Make sure you understand what this means.
- You are just about to turn 25 (tomorrow) and have just received your annual paycheck of $w_0 = \$50,000$ which is expected to grow at a real rate of $g_w = 1\%$ per year.
- You spent your entire paycheck on a wild birthday party, and woke up (hung over) the next morning (broke) realizing that you are about to turn 25 and should start planning your financial future.
- After careful thought you have determined that you would like to enjoy a constant real standard of living for the rest of your life, which you estimate to be: $(90 - 25) = 65$ years.

Question #1a:

- Interest (valuation) rates are $v = 3\%$ in real (inflation adjusted) terms. Make sure you understand what this means.
- You are just about to turn 25 (tomorrow) and have just received your annual paycheck of $w_0 = \$50,000$ which is expected to grow at a real rate of $g_w = 1\%$ per year.
- You spent your entire paycheck on a wild birthday party, and woke up (hung over) the next morning (broke) realizing that you are about to turn 25 and should start planning your financial future.
- After careful thought you have determined that you would like to enjoy a constant real standard of living for the rest of your life, which you estimate to be: $(90 - 25) = 65$ years.
- **Question**: What is your optimal consumption amount c_1^* and optimal savings amount s_1^* at the end of the first year of savings?

Question #1a: (solved)

- **Answer**: The value of your human capital (today) is:

$$H_0 = 50,000 \cdot \mathbf{PVA}(0.01, 0.03, 40) = 50,000(27.45072) = \$1,372,536$$

Question #1a: (solved)

- **Answer**: The value of your human capital (today) is:

  $$H_0 = 50,000 \cdot \mathbf{PVA}(0.01, 0.03, 40) = 50,000(27.45072) = \$1,372,536$$

- You have no financial capital, so your economic net worth (ENW) is $W_0 = \$1,372,536$ as well.

Question #1a: (solved)

- **Answer**: The value of your human capital (today) is:

$$H_0 = 50,000 \cdot \mathbf{PVA}(0.01, 0.03, 40) = 50,000(27.45072) = \$1,372,536$$

- You have no financial capital, so your economic net worth (ENW) is $W_0 = \$1,372,536$ as well.
- You would like to spend W_0 evenly over the next 65 years of life, so the optimal baseline consumption rate is:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(0.0, 0.03, 65)} = \frac{1,372,536}{28.45289} = \$48,239.$$

Question #1a: (solved)

- **Answer**: The value of your human capital (today) is:

$$H_0 = 50,000 \cdot \textbf{PVA}(0.01, 0.03, 40) = 50,000(27.45072) = \$1,372,536$$

- You have no financial capital, so your economic net worth (ENW) is $W_0 = \$1,372,536$ as well.
- You would like to spend W_0 evenly over the next 65 years of life, so the optimal baseline consumption rate is:

$$c_0^* = \frac{1,372,536}{\textbf{PVA}(0.0, 0.03, 65)} = \frac{1,372,536}{28.45289} = \$48,239.$$

- This leads to a optimal savings rate at (year end) of:

$$s_1^* = \frac{50,000(1+0.01) - 48,239(1+0.0)}{50,000(1+0.01)} = \frac{2,261}{50,500} = 4.48\%$$

Question #1a: (solved)

- **Answer**: The value of your human capital (today) is:

$$H_0 = 50,000 \cdot \mathbf{PVA}(0.01, 0.03, 40) = 50,000(27.45072) = \$1,372,536$$

- You have no financial capital, so your economic net worth (ENW) is $W_0 = \$1,372,536$ as well.
- You would like to spend W_0 evenly over the next 65 years of life, so the optimal baseline consumption rate is:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(0.0, 0.03, 65)} = \frac{1,372,536}{28.45289} = \$48,239.$$

- This leads to a optimal savings rate at (year end) of:

$$s_1^* = \frac{50,000(1+0.01) - 48,239(1+0.0)}{50,000(1+0.01)} = \frac{2,261}{50,500} = 4.48\%$$

- So, at the end of your 25th year of life, just before your 26th birthday, make sure to save $2,261 and enjoy the rest.

Question #1b:

- **Question**: How much financial capital (F^*_{10}) will you accumulate over 10 years, just as you are about to turn 35?

Question #1b:

- **Question**: How much financial capital (F^*_{10}) will you accumulate over 10 years, just as you are about to turn 35?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

Question #1b:

- **Question**: How much financial capital (F^*_{10}) will you accumulate over 10 years, just as you are about to turn 35?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital at time j,

$$\begin{aligned} H_j &= w_0(1+g_w)^j \cdot \mathbf{PVA}(g_w, v, R - j) \\ H_{10} &= 50,000(1.01)^{10} \cdot \mathbf{PVA}(0.01, 0.03, 30) \\ &= (55231.11)(22.457557) = \$1,240,356 \end{aligned}$$

Question #1b:

- **Question**: How much financial capital (F_{10}^*) will you accumulate over 10 years, just as you are about to turn 35?
- **HINT**: Remember the fundamental identity:

$$F_j^* + H_j = c_j^* \cdot \textbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital at time j,

$$\begin{aligned} H_j &= w_0(1+g_w)^j \cdot \textbf{PVA}(g_w, v, R - j) \\ H_{10} &= 50,000(1.01)^{10} \cdot \textbf{PVA}(0.01, 0.03, 30) \\ &= (55231.11)(22.457557) = \$1,240,356 \end{aligned}$$

- The present value of optimal (remaining) lifetime consumption is:

$$c_0^*(1+k)^j \cdot \textbf{PVA}(k, v, D - j) = (48,238.9)(26.77443) = \$1,291,569$$

Question #1b:

- **Question**: How much financial capital (F^*_{10}) will you accumulate over 10 years, just as you are about to turn 35?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital at time j,

$$\begin{aligned} H_j &= w_0(1+g_w)^j \cdot \mathbf{PVA}(g_w, v, R - j) \\ H_{10} &= 50,000(1.01)^{10} \cdot \mathbf{PVA}(0.01, 0.03, 30) \\ &= (55231.11)(22.457557) = \$1,240,356 \end{aligned}$$

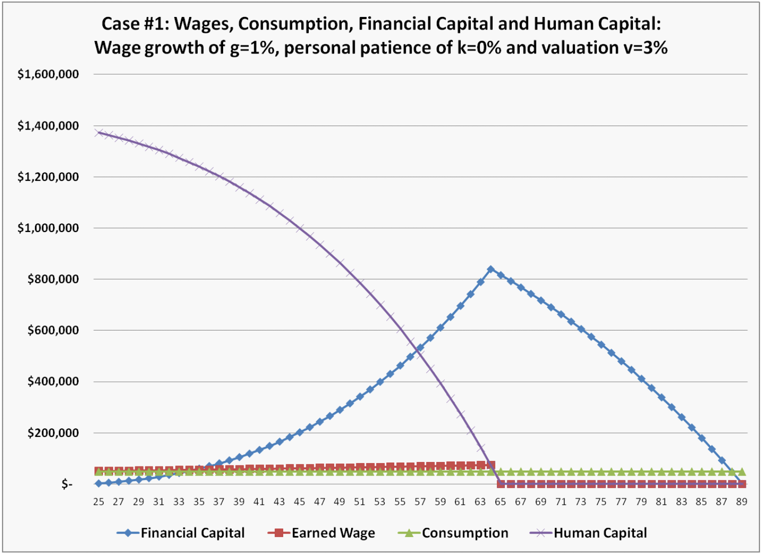
- The present value of optimal (remaining) lifetime consumption is:

$$c^*_0(1+k)^j \cdot \mathbf{PVA}(k, v, D - j) = (48,238.9)(26.77443) = \$1,291,569$$

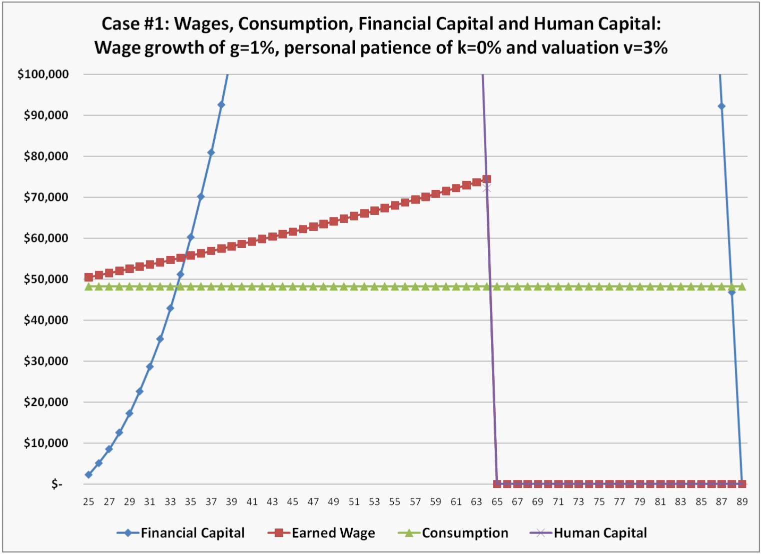
- The optimal value of financial capital at time $j = 10$ is:

$$F^*_{10} = 1,291,569 - 1,240,356 = \$51,213$$

LifeCycle Model: Case #1



LifeCycle Model: Case #1 (zoom)



Question #1c

- **Question**: How much financial capital (F^*_{40}) will you accumulate over $j = 40$ years, just as you are about to turn 65?

Question #1c

- **Question**: How much financial capital (F^*_{40}) will you accumulate over $j = 40$ years, just as you are about to turn 65?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

Question #1c

- **Question**: How much financial capital (F^*_{40}) will you accumulate over $j = 40$ years, just as you are about to turn 65?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital.

$$H_{40} = \$0$$

Question #1c

- **Question**: How much financial capital (F^*_{40}) will you accumulate over $j = 40$ years, just as you are about to turn 65?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital.

$$H_{40} = \$0$$

- The present value of optimal (remaining) lifetime consumption is:

$$c^*_0(1 + k)^j \cdot \mathbf{PVA}(k, v, D - j) = (48,238.9)(17.41315) = \$839,991$$

Question #1c

- **Question**: How much financial capital (F_{40}^*) will you accumulate over $j = 40$ years, just as you are about to turn 65?
- **HINT**: Remember the fundamental identity:

$$F_j^* + H_j = c_j^* \cdot \mathbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital.

$$H_{40} = \$0$$

- The present value of optimal (remaining) lifetime consumption is:

$$c_0^*(1 + k)^j \cdot \mathbf{PVA}(k, v, D - j) = (48, 238.9)(17.41315) = \$839, 991$$

- The optimal value of financial capital at time $j = 40$ is (by definition):

$$F_{40}^* = \$839, 991$$

Question #1c

- **Question**: How much financial capital (F^*_{40}) will you accumulate over $j = 40$ years, just as you are about to turn 65?
- **HINT**: Remember the fundamental identity:

$$F^*_j + H_j = c^*_j \cdot \mathbf{PVA}(k, v, D - j)$$

- **Answer**: Compute the present value of human capital.

$$H_{40} = \$0$$

- The present value of optimal (remaining) lifetime consumption is:

$$c^*_0 (1 + k)^j \cdot \mathbf{PVA}(k, v, D - j) = (48,238.9)(17.41315) = \$839,991$$

- The optimal value of financial capital at time $j = 40$ is (by definition):

$$F^*_{40} = \$839,991$$

- This is often called your retirement nest egg.

Summary Values Question #1

Summary values for wages, optimal consumption, optimal savings amount, optimal savings rate and financial capital, assuming $v = 3\%$ and $k = 0\%$.

Year #	Wage	Consume	Saving	Rate	Fin. Cap.
j	w_j	c_j^*	s_j^*	s_j^* / w_j	F_j^*
0	$50,000	$48,239	$1,761	3.52%	$0
1	$50,500	$48,239	$2,261	4.48%	$2,261
10	$55,231	$48,239	$6,992	12.66%	$51,213
25	$64,122	$48,239	$15,883	24.77%	$289,894
40	$74,443	$48,239	$26,204	35.20%	$839,991
41	$0	$48,239	$0	N.A.	$816,952
65	$0	$48,239	$0	N.A.	$0
Note: Time zero are baseline consumption amounts.					

Question #2:

- Question: Assume that instead of $k = 0$, that $k = 1\%$ and you would like your standard of living to increase (smoothly) by 1% per year. What is the optimal baseline consumption rate?

Question #2:

- Question: Assume that instead of $k = 0$, that $k = 1\%$ and you would like your standard of living to increase (smoothly) by 1% per year. What is the optimal baseline consumption rate?
- **Answer**: The value of your human capital (today) and ENW is still $\$1,372,536$

Question #2:

- Question: Assume that instead of $k = 0$, that $k = 1\%$ and you would like your standard of living to increase (smoothly) by 1% per year. What is the optimal baseline consumption rate?
- **Answer**: The value of your human capital (today) and ENW is still $\$1,372,536$
- You would like to spend H_0 evenly over the next 65 years of life, so the optimal baseline consumption rate:

$$c_0^* = \frac{1,372,536}{\textbf{PVA}(0.01, 0.03, 65)} = \$37,725$$

which is obviously lower than the previous $48,239. Why?

Question #2:

- Question: Assume that instead of $k = 0$, that $k = 1\%$ and you would like your standard of living to increase (smoothly) by 1% per year. What is the optimal baseline consumption rate?
- **Answer**: The value of your human capital (today) and ENW is still $\$1,372,536$
- You would like to spend H_0 evenly over the next 65 years of life, so the optimal baseline consumption rate:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(0.01, 0.03, 65)} = \$37,725$$

which is obviously lower than the previous $48,239. Why?
- This leads to an optimal savings rate at (year end) of:

$$s_1^* = \frac{50,000(1.01) - 37,725(1.01)}{50,000(1.01)} = \frac{50000 - 37725}{50000} = 24.55\%$$

Question #2:

- Question: Assume that instead of $k = 0$, that $k = 1\%$ and you would like your standard of living to increase (smoothly) by 1% per year. What is the optimal baseline consumption rate?
- **Answer**: The value of your human capital (today) and ENW is still $\$1,372,536$
- You would like to spend H_0 evenly over the next 65 years of life, so the optimal baseline consumption rate:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(0.01, 0.03, 65)} = \$37,725$$

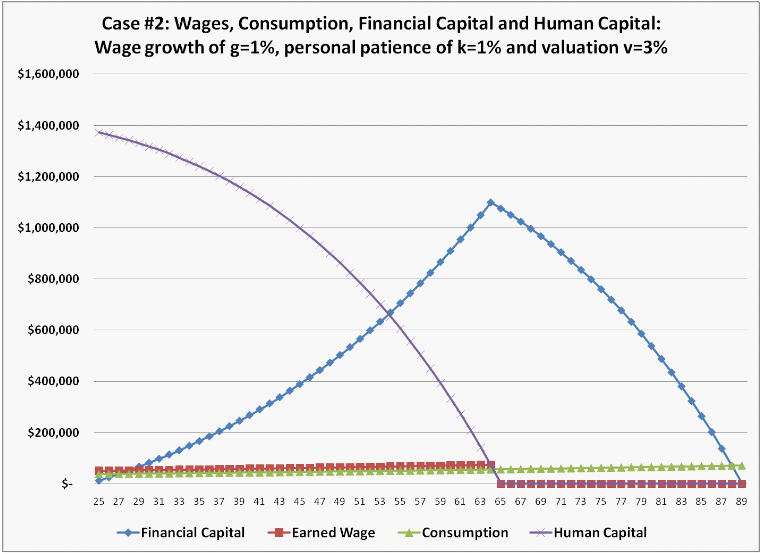
which is obviously lower than the previous $48,239. Why?

- This leads to an optimal savings rate at (year end) of:

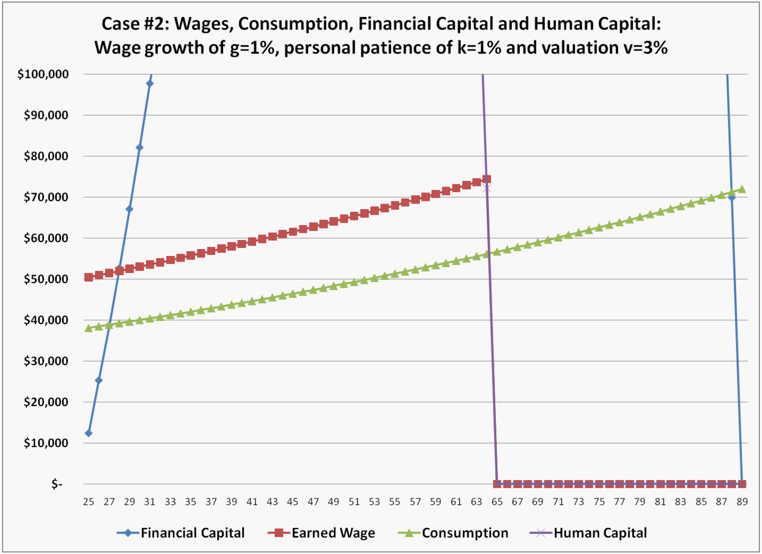
$$s_1^* = \frac{50,000(1.01) - 37,725(1.01)}{50,000(1.01)} = \frac{50000 - 37725}{50000} = 24.55\%$$

- Notice that the savings rate does not depend on time (or age.)

LifeCycle Model: Case #2



LifeCycle Model: Case #2 (zoom)



Summary Values Question #2

Summary values for wages, optimal consumption, optimal savings amount, optimal savings rate and financial capital, assuming $v = 3\%$ and $k = 1\%$.

Year #	Wage	Consume	Saving	Rate	Fin. Cap.
j	w_j	c_j^*	s_j^*	s_j^* / w_j	F_j^*
0	$50,000	$37,725	$12,275	24.55%	$0
1	$50,500	$38,103	$12,397	24.55%	$12,397
10	$55,231	$41,672	$13,559	24.55%	$148,332
25	$64,122	$48,380	$15,741	24.55%	$502,932
40	$74,443	$56,168	$18,275	24.55%	$1,099,143
41	$0	$56,729	$0	N.A.	$1,075,388
65	$0	$72,031	$0	N.A.	$0
Note: Time zero are baseline consumption amounts.					

Question #3:

- Question: Now assume that $k = -1\%$ and you would like your standard of living to start very high and then decline (smoothly) by 1% per year. What is the optimal initial consumption rate?

Question #3:

- Question: Now assume that $k = -1\%$ and you would like your standard of living to start very high and then decline (smoothly) by 1% per year. What is the optimal initial consumption rate?
- **Answer**: Value of your human capital is still $\$1,372,536$

Question #3:

- Question: Now assume that $k = -1\%$ and you would like your standard of living to start very high and then decline (smoothly) by 1% per year. What is the optimal initial consumption rate?
- **Answer**: Value of your human capital is still $\$1,372,536$
- You would like to spend H_0 evenly over the next 65 years of life, so the baseline consumption rate is:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(-0.01, 0.03, 65)} = \$60,029,$$

which is obviously much higher than your baseline wage of $w_0 = \$50,000$.

Question #3:

- Question: Now assume that $k = -1\%$ and you would like your standard of living to start very high and then decline (smoothly) by 1% per year. What is the optimal initial consumption rate?
- **Answer**: Value of your human capital is still $\$1,372,536$
- You would like to spend H_0 evenly over the next 65 years of life, so the baseline consumption rate is:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(-0.01, 0.03, 65)} = \$60,029,$$

which is obviously much higher than your baseline wage of $w_0 = \$50,000$.

- This leads to a negative savings rate at (year end) of:

$$s_1^* = \frac{50,000(1.01) - 60,029(0.99)}{50,000(1.01)} = \frac{-8,929}{50,500} - 17.68\%$$

Question #3:

- Question: Now assume that $k = -1\%$ and you would like your standard of living to start very high and then decline (smoothly) by 1% per year. What is the optimal initial consumption rate?
- **Answer**: Value of your human capital is still $\$1,372,536$
- You would like to spend H_0 evenly over the next 65 years of life, so the baseline consumption rate is:

$$c_0^* = \frac{1,372,536}{\mathbf{PVA}(-0.01, 0.03, 65)} = \$60,029,$$

which is obviously much higher than your baseline wage of $w_0 = \$50,000$.
- This leads to a negative savings rate at (year end) of:

$$s_1^* = \frac{50,000(1.01) - 60,029(0.99)}{50,000(1.01)} = \frac{-8,929}{50,500} - 17.68\%$$

- You will spend almost 18% more than what you make, by taking on debt.

When Will You Start Saving?

- **Question**: When will the optimal savings rate be positive?

When Will You Start Saving?

- **Question**: When will the optimal savings rate be positive?
- Answer: You must solve the following equation:

$$s_j^* = \frac{w_0(1+g_w)^j - c_0^*(1+k)^j}{w_0(1+g_w)^j} = 0.$$

When Will You Start Saving?

- **Question**: When will the optimal savings rate be positive?
- Answer: You must solve the following equation:

$$s_j^* = \frac{w_0(1+g_w)^j - c_0^*(1+k)^j}{w_0(1+g_w)^j} = 0.$$

- This leads to:

$$\left(\frac{1+k}{1+g_w}\right)^j = \frac{w_0}{c_0^*}.$$

When Will You Start Saving?

- **Question**: When will the optimal savings rate be positive?
- Answer: You must solve the following equation:

$$s_j^* = \frac{w_0(1+g_w)^j - c_0^*(1+k)^j}{w_0(1+g_w)^j} = 0.$$

- This leads to:

$$\left(\frac{1+k}{1+g_w}\right)^j = \frac{w_0}{c_0^*}.$$

- In our case it results in:

$$j \ln\left[\frac{0.99}{1.01}\right] = \ln\left[\frac{50000}{60029}\right]$$

When Will You Start Saving?

- **Question**: When will the optimal savings rate be positive?
- Answer: You must solve the following equation:

$$s_j^* = \frac{w_0(1+g_w)^j - c_0^*(1+k)^j}{w_0(1+g_w)^j} = 0.$$

- This leads to:

$$\left(\frac{1+k}{1+g_w}\right)^j = \frac{w_0}{c_0^*}.$$

- In our case it results in:

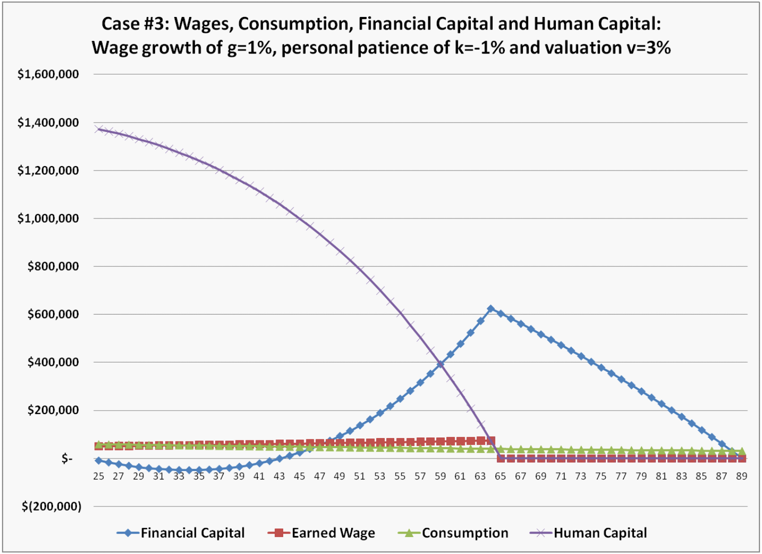
$$j \ln\left[\frac{0.99}{1.01}\right] = \ln\left[\frac{50000}{60029}\right]$$

- So that:

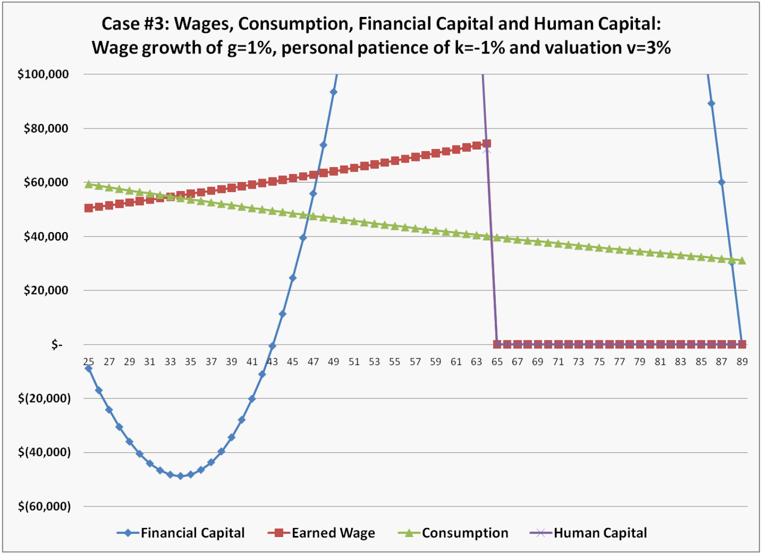
$$j = \ln\left[\frac{50000}{60029}\right] / \ln\left[\frac{0.99}{1.01}\right] = 9.139,$$

and in the 10th year (at age 35) the savings rate is positive for the first time.

LifeCycle Model: Case #3



LifeCycle Model: Case #3 (zoom)



Summary Values Question #3

Summary values for wages, optimal consumption, optimal savings amount, optimal savings rate and financial capital, assuming $v = 3\%$ and $k = -1\%$.

Year #	Wage	Consume	Saving	Rate	Fin. Cap.
j	w_j	c_j^*	s_j^*	s_j^* / w_j	F_j^*
0	\$50,000	\$60,029	-\$10,029	-20.06%	\$0
1	\$50,500	\$59,429	-\$8,929	-17.68%	-\$8,929
10	\$55,231	\$54,289	\$942	1.7%	-48,809
25	\$64,122	\$46,692	\$17,430	27.18%	\$93,498
40	\$74,443	\$40,158	\$34,285	46.06%	\$624,680
41	\$0	\$39,756	\$0	N.A.	\$603,664
64	\$0	\$31,236	\$0	N.A.	\$0
Note: Time zero are hypothetical (baseline) amounts.					

Take-aways

Here are some qualitative facts about consumption and savings rate, given the same H_0 and v (as well as R and D.)

- Tell me your k and I'll show you your c_0^*.

Take-aways

Here are some qualitative facts about consumption and savings rate, given the same H_0 and v (as well as R and D.)

- Tell me your k and I'll show you your c_0^*.
- Show me your c_0^* and I can figure-out your k.

Take-aways

Here are some qualitative facts about consumption and savings rate, given the same H_0 and v (as well as R and D.)

- Tell me your k and I'll show you your c_0^*.
- Show me your c_0^* and I can figure-out your k.
- Impatient consumers borrow money and live in debt early in life.

Take-aways

Here are some qualitative facts about consumption and savings rate, given the same H_0 and v (as well as R and D.)

- Tell me your k and I'll show you your c_0^*.
- Show me your c_0^* and I can figure-out your k.
- Impatient consumers borrow money and live in debt early in life.
- They will accumulate less wealth at retirement.

Take-aways

Here are some qualitative facts about consumption and savings rate, given the same H_0 and v (as well as R and D.)

- Tell me your k and I'll show you your c_0^*.
- Show me your c_0^* and I can figure-out your k.
- Impatient consumers borrow money and live in debt early in life.
- They will accumulate less wealth at retirement.
- The must save a higher percentage of their final-years salary.

Take-aways

Here are some qualitative facts about consumption and savings rate, given the same H_0 and v (as well as R and D.)

- Tell me your k and I'll show you your c_0^*.
- Show me your c_0^* and I can figure-out your k.
- Impatient consumers borrow money and live in debt early in life.
- They will accumulate less wealth at retirement.
- The must save a higher percentage of their final-years salary.
- They obviously are taking on some risk...