Class Project: Client Info

- Our Client
- Age Now: 35
- Retirement Age: 65
- Presumed Longevity: 90
- Retirement Goal: $2,500,000

Class Project: Client Info

- Current Portfolio: $50,000
- Money to Buy Options: $10,000
- Current 401K Balance: $40,000
- Monthly 401K $: $500
- Current Roth IRA Balance: $12,000
- Current Yearly IRA $: $2,400

Client Info: Stock Option

- Company: Disney
- Strike Price: $32.00
- Option Period: 20 weeks
- Risk Free Rate: 4%
- Cash to Buy Options: $10,000
- Actual Closing Price: $35.00

Class Project: Client Info

- Rate of Return (Pre-Retire): 7.5%
- Rate of Return (In-Retire): 5.5%
- Inflation Rate: 3.2%

Options Analysis

- Our Fair Price for DIS: $1.85
- Total Available: $10,000
- Options Purchased: 10000/1.85 = 5405
- Value of Option

Options Analysis

- Value of Option = $3
- Profit per option = $3-$1.85 = $1.15
- Total Profit = ($1.15)(5405)
  = $6215.75
- New Portfolio Balance

Stock Portfolio Analysis: FV

- Current Amount: $66,215.75
- What is the Future Value at the age of Retirement?

Stock Portfolio Analysis: FV

- We will use $F = P(1+i)^n$
- What is i? What is n?

Stock Portfolio Analysis: FV

- Future Value =

$$F = 66215.75(1.00625)^{360}$$
$$= \$623,853.93$$

Stock Portfolio Analysis: PV

- What is the Present Value of this?
- Assume inflation acts yearly, not monthly.
- We will use the same formula, only in this form:

$$F = P(1+i)^n$$

$$P = \frac{F}{(1+i)^n}$$

Stock Portfolio Analysis: PV

- What is i and what is n?

Stock Portfolio Analysis: PV

- We now compute the PV:

$$P = \frac{\$623{,}853.93}{(1+.032)^{30}}$$

$$= \frac{\$623{,}853.93}{2.5727}$$

Annuities

- An annuity is a financial object that provides payments (called rents, R) at regular intervals over some period of time.
- An **ordinary annuity** makes payments at the end of each period.
- A **annuity due** makes payment at the start of each period.
- Annuites can be used to compute the amount of a loan payment (car, home, etc.) or the amount paid to someone from a retirement account.

FV of an Ordinary Annuity

- The formula for the FV of an ordinary annuity is:

$$F = R\left[\frac{(1+i)^n - 1}{i}\right]$$

Example

- Suppose you invest $1000 a year for 30 years and earn interest once a year at an annual rate of 5%. What is in the account at the end of the 30 years.

$$F = R\left[\frac{(1+i)^n - 1}{i}\right]$$

$$= 1000\left[\frac{(1+.05)^{30} - 1}{.05}\right]$$

$$\approx 1000\left[\frac{3.321942}{.05}\right] \approx 1000[66.4388475] =$$

Our Client: 401K FV

- Current Balance is $40,000
- Monthly contribution: $500
- $i = 0.00625$, $n = 360$
- We want to compute the FV of this account. To do this by hand, we will need to do TWO calculations. Why? What are they?

401K FV: Part 1

- What is the FV of the client's series of payments?

$$F = R\left[\frac{(1+i)^n - 1}{i}\right]$$

$$= 500\left[\frac{(1+0.00625)^n - 1}{.00625}\right]$$

401K FV: Part 2

- What is the FV of the client's initial balance?

$$F = P(1+i)^n$$

$$= 40{,}000(1.00625)^{360}$$

401K FV: Total

- Hence, the future value of the 401K account at the age of retirement is:

$$FV = \$673{,}722.7\ 1 + \$376{,}861.3\ 6$$

401K FV: Excel

- To check our work in Excel, we use the FV command:
- =FV(*i*, *n*, *R*, Initial Balance)
  - Note: Excel calls the Initial Balance PV, for present value.

401K in Today's Dollars

- What is our client's potential balance worth in today's dollars after taking into account inflation?
- Inflation rate = 3.2%

401K in Today's Dollars

- Here's the calculation:

$$P = \frac{\$1{,}050{,}584 \ .07}{(1+.032)^{30}}$$

$$= \frac{\$1{,}050{,}584 \ .07}{2.5727}$$

- For the purposes of our project, we will call this the "Present Value" of the 401K at retirement age after adjusting for inflation.

PV of an Annuity

- The text talks about the Present Value of an Ordinary Annuity from a different perspective.
- Recall that by saving $500 a month for 30 years, the future value was $673,722.71 .
- If we wanted to have $673,722.71 in the account by depositing a lump sum today, what would that amount be? This amount is what the text calls the Present Value of the account.

PV of an Annuity

- Formula:

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

PV of an Annuity

- For our client

$$P = 500\left[\frac{1-(1+0.00625)^{-360}}{0.00625}\right]$$

$$= 500\left[\frac{0.89386017\ 1}{0.00625}\right] = 500(143.01763)$$

- Instead of $500 a month for 30 years, our client could deposit a lump sum of $71,508.81.

PV of an Annuity

- Check:

$$F = P(1+i)^n$$

$$= \$71,508.81\ \ (1.00625)^{\ 360}$$

$$= \$673,722.7\ \ 1$$

- We will assume, however, cannot come up with this lump sum, so will make monthly contributions as originally assumed

Our Client: Roth IRA FV

- The steps to compute the FV and the inflation-adjusted value of the Roth IRA is the **same** as for the 401K.
- Current Roth IRA Balance: $12,000
- Current Yearly IRA $: $2,400 ($200 per month)
- By Hand:
  - $113,058.41 + $269,489.08 = $382,547.49
- In Excel:
  - =FV(.00625, 360, 200, 12000)=$382,547.49

Our Client at Retirement

- Our client, then, has the following available at retirement:
  - Stock: $623,853.93
  - 401K: $1,050,584.07
  - Roth IRA: $382,547.49
  - **TOTAL**: $2,056,985.49
- Our client's goal was to have $2,500,000, so that goal was NOT met.

What Is It Worth in Today's $?

$$P = \frac{\$2{,}056{,}985\ .49}{(1+.032)^{30}}$$

$$= \frac{\$2{,}056{,}985\ .49}{2.5727}$$

- Our client's retirement account will be equal to this amount in today's dollars, after adjusting for inflation.

How Much Income?

- Our client has $2,056,985.49 in future dollars at income.
- If we annuitize this amount over the course of his/her expected lifespan…
- What monthly and annual income will he/she receive?
- Now we assume a new rate of return, r = 5.5%
- We also have a new t = (90–65) = 25 years.

How Much Income?

- Our post-retirement investments will compound monthly, so we have a new i and n.

How Much Income?

- We can use the Ordinary Annuity PV Formula to compute R, the monthly payment:

$$R = \frac{Pi}{1-(1+i)^{-n}}$$

$$= \frac{(\$2{,}056{,}985\,49)(0.00458333)}{0.746364873}$$

- This yields $151,580.29 in annual income.

What's It Really Worth?

- After we factor in the effects of inflation, what is this monthly/annual income worth in today's dollars?

$$P = \frac{\$151{,}580.2\ 9}{(1+.032)^{25}}$$

$$= \frac{\$151{,}580.2\ 9}{2.5727}$$

What's It Worth Over Time?

- Our client can expect the equivalent of $58,918.52 per year (or $4909.88 per month) in his/her first year/month of retirement.
- Keep in mind that inflation will continue to eat into your client's spending power.

What's It Worth Over Time?

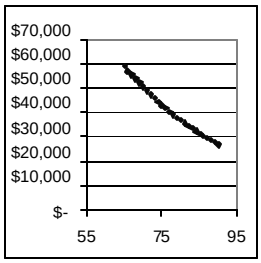
- For example, 10 years into retirement, that annual income is worth the following (in today's dollars):

$$P = \frac{\$151{,}580.2\ 9}{(1+.032)^{35}}$$

$$= \frac{\$151{,}580.2\ 9}{3.011545}$$

What's It Worth Over Time?

- Here's a graph of the value (in today's $) of your client's annual income over time:



Advice

- Our client's goal at retirement was $2,500,000, so he/she will be $2,500,000 - $2,056,985.49 = $443,014.51 short.
- How much money should our client invest monthly at 7.5% (the assumed growth rate) to make up this difference?
- Basically, we need to the monthly payment needed to make up this difference.
- Hence, we need to know R given F

Advice

$$F = R\left[\frac{(1+i)^n - 1}{i}\right]$$

$$\Rightarrow$$

$$R = \frac{Fi}{(1+i)^n - 1}$$

Advice

$$R = \frac{Fi}{(1+i)^n - 1}$$

$$= \frac{(\$443{,}014.51)(.00625)}{1347.45}$$

$$= \$328.78$$

- Hence, if our client saves about $330 more per month, if that's possible, he/she can reach the stated retirement goal of $2,500,000.