

Total Assets	\$,000	\$,000	Total Liabilities
Cash/Investments			Bank Overdraft
Car			Personal Loans
House			Mortgage
Other			Net Worth

Table 5: Net Worth of an Individual

4 Life-cycle financial planning (B&M 5)

- An individual's net worth is defined by what he owns less what he owes, it is a bit like an accounting balance (see Table 5) sheet. Although a useful start point for defining our study of personal finance, we will see that this analysis only represents the past and current situation and can not tell us much about what the future holds for our finance.
- How much do you need to save to secure a happy and prosperous retirement? Assuming the following: Age 35, retirement age 65, age of death 80, current

income \$30,000 current savings and asset nil. Ignoring taxes and assuming that your real income remains at \$30,000 but that the real asset return is 3%, we can estimate how much to save.

4.1 Replacement Rule

- Assuming you want 75% of your salary on retirement from age 65 to 80 we need a PV age 65 that will produce an annuity of \$22,500

n	i	PV	PMT	FV
15	3	\$268,604	\$22,500	0

- Next we say that we must produce a FV of this amount over the next 30 years with 3% real returns

n	i	PV	PMT	FV
30	3	0	\$5,646	\$268,604

So in order to produce sufficient savings to generate 75% of your salary on retirement (\$22,500) you need to save \$5,646pa over 30 years if real rates of return are 3%. This is some 19%! You may not like the figures but try it with your own inputs (NB you may have savings already in which case decrease the PV in the second calculation from zero since you already have some of the terminal amount saved). Don't be tempted to simply increase the real rate of return, we will show that more return requires taking more risk!

4.2 Constant Consumption

- How about choosing a replacement rate that leaves your salary net of saving the same? Assume that the salary net of saving is C . The amount saved for each of the first 30 years is $\$30,000 - C$. One dollar saved each year is worth $\$47.58$ in 30 years time

n	i	PV	PMT	FV
30	3	0	\$1	\$47.58

so $\$C$ pa will yield $\$47.58 \times (\$30,000 - C)$

- The amount drawn each year from the retirement account is C for each year of 15 one dollar a year has a PV of

n	i	PV	PMT	FV
15	3	\$11.94	\$1	0

so that C dollars a year requires a lump sum of $\$11.94 \times C$. Now solve for C

$$\begin{aligned} \$47.58 \times (30,000 - C) &= \$11.94 \times C \\ C &= \$23,982 \end{aligned}$$

Savings over each of the first 30 years is now $\$30,000 - C = \$6,018$ or 20%

4.3 Income and Human Capital

$$\sum_{t=1}^{45} \frac{C}{(1+r)^t} = \sum_{t=1}^{30} \frac{\text{Income of } 30,000}{(1+r)^t} \iff C * 24.52 = 30k\$ * 19.60$$

- C also solves this equation $((45, 3, -24.52, 1, 0), (30, 3, -19.60, 1, 0))$ which says that the Present value of lifetime consumption (over 45 years) is equal to the

present value of labour income (over 30 years), terms which have become known as Human Capital and Permanent Income (consumption). They are related

$$PV(\text{Human Capital}) + PV(\text{Financial Capital}) = PV(\text{Permanent Income})$$

Since financial markets value the present value of financial instruments every day, $PV(\text{Financial Capital})$ is given by their market value so the present value of our Permanent Income (Consumption) is equal to our Human Capital plus the market value of whatever Financial Capital we own. The more Human Capital or Financial Capital you own, the higher your Permanent Income or Consumption (assuming you leave no bequest to you children).

- What is known as the budget constraint can be expanded to include a Bequest B and initial wealth W_0 , labelling income Y . If T is the number of years of life and R the numbers of years to retirement (See Table 6)

$$W_0 + \sum_{t=1}^R \frac{Y}{(1+r)^t} = \sum_{t=1}^T \frac{C}{(1+r)^t} + \frac{B}{(1+r)^T}$$

PV Income	\$,000	\$,000	PV Outgoings
Current (net) Financial Wealth			PV Permanent Consumption
PV Working Income			PV Bequest

Table 6: PV Balance for an Individual

- You can increase your consumption if you...
 - Have higher income Y
 - Lower the bequest B you anticipate leaving your children
 - Can raise your real rate of return r
 - Lengthen the time you expect to work R
 - Expect to die earlier ($T > R$ is lower)
 - Have more initial wealth W_0 . W_0 may be negative (borrowing) as it may be possible to borrow limited amounts against your future human capital,

however an individuals borrowing capacity declines with his or her human capital and is strictly limited after retirement

4.4 Valuing your Education

- Why are you sitting here studying finance? (something you have probably pondered greatly!)
- You can either treat this education as a consumption good (like watching a very long and expensive movie!), if this is the case I hope you enjoy it because it will not necessarily increase your wealth or income.
- You can treat this education as an investment good which will reap valuable returns in years to come. What benefits might you expect from studying?

- Increased employment opportunities, greater job flexibility and satisfaction
- In short you expect this study (which is costly and reducing your W_0 or making it more negative if you are already in debt) to increase your Human Capital and therefore increase your expected consumption, otherwise you are just watching an expensive movie!
- By how much might income have to increase to make a years study a profitable ($NPV > 0$) activity? Well the explicit study costs may be around \$20,000 for the year, on top of that you have given up your job for a year so you have an opportunity cost of not working for the year (say \$30,000). Consumption costs over the year can safely be ignored, you would have had to be housed (pay rent), eat, drink and socialise anyway, this level of consumption may be different now compared to last year when you were working but we will ignore that.
- If your Human Capital depends on the next 30 years of income we clearly need

an investment of some \$50,000 to pay off over 30 years with a real return of 3%

n	i	PV	PMT	FV
30	3	-\$50,000	\$2,551	0

That is we only need a base salary rise of \$2,551 on \$30,000 (and the subsequent indexation to be based on the new level[†]). Take heart, this is only 8.5% while most studies show that students can increase their salary by more than this.

- Conclusion? Studying is great value, it increases your Human Capital by more than it costs!
- Corollary? We are clearly not charging enough for our courses! In competitive markets the price of any good rise to its marginal benefit ;-).

[†]Or your MBA may allow you to consume more cheaply; 45 year annual savings of \$2,039 will pay for your MBA (45, 3, -50k, 2.039k, 0). Finally it may reduce your career risk (reducing 3% to 2%).