A Simple Financial Planning Example

COMPUTERFIELD CORPORATION
Financial Statements

Income Statement		Balance Sheet			
Sales	$1,000	Assets	$500	Debt	$250
Costs	800			Equity	250
Net income	$ 200	Total	$500	Total	$500

Pro Forma
Income Statement

Sales	$1,200
Costs	960
Net income	$ 240

Pro Forma Balance Sheet

Assets	$600	(+100)	Debt	$300	(+50)
			Equity	300	(+50)
Total	$600	(+100)	Total	$600	(+100)

Pro Forma Balance Sheet

Assets	$600	(+100)	Debt	$110	(−140)
			Equity	490	(+240)
Total	$600	(+100)	Total	$600	(+100)

Another Financial Planning Example

ROSENGARTEN CORPORATION Income Statement		
Sales		$1,000
Costs		800
Taxable income		$ 200
Taxes (34%)		68
Net income		$ 132
Dividends	$44	
Addition to retained earnings	88	

ROSENGARTEN CORPORATION Pro Forma Income Statement	
Sales (projected)	$1,250
Costs (80% of sales)	1,000
Taxable income	$ 250
Taxes (34%)	85
Net income	$ 165

Another Financial Planning Example - continued

ROSENGARTEN CORPORATION
Balance Sheet

Assets	$	Percentage of Sales	Liabilities and Owners' Equity	$	Percentage of Sales
Current assets			Current liabilities		
Cash	$ 160	16%	Accounts payable	$ 300	30%
Accounts receivable	440	44	Notes payable	100	n/a
Inventory	600	60	Total	$ 400	n/a
Total	$1,200	120	Long-term debt	$ 800	n/a
Fixed assets			Owners' equity		
Net plant and equipment	$1,800	180	Common stock and paid-in surplus	$ 800	n/a
			Retained earnings	1,000	n/a
			Total	$1,800	n/a
Total assets	$3,000	300%	Total liabilities and owners' equity	$3,000	n/a

Another Financial Planning Example – continued
1st step in balancing the Balance Sheet

ROSENGARTEN CORPORATION
Partial Pro Forma Balance Sheet

Assets	Next Year	Change from Current Year	Liabilities and Owners' Equity	Next Year	Change from Current Year
Current assets			Current liabilities		
Cash	$ 200	$ 40	Accounts payable	$ 375	$ 75
Accounts receivable	550	110	Notes payable	100	0
Inventory	750	150	Total	$ 475	$ 75
Total	$1,500	$300	Long-term debt	$ 800	$ 0
Fixed assets			Owners' equity		
Net plant and equipment	$2,250	$450	Common stock and paid-in surplus	$ 800	$ 0
			Retained earnings	1,110	110
			Total	$1,910	$110
Total assets	$3,750	$750	Total liabilities and owners' equity	$3,185	$185
			External financing needed	$ 565	$565

Another Financial Planning Example – continued

Bal. Sheet balanced – assumption: NWC stays the same

ROSENGARTEN CORPORATION
Pro Forma Balance Sheet

Assets			Liabilities and Owners' Equity		
	Next Year	Change from Current Year		Next Year	Change from Current Year
Current assets			Current liabilities		
Cash	$ 200	$ 40	Accounts payable	$ 375	$ 75
Accounts receivable	550	110	Notes payable	325	225
Inventory	750	150	Total	$ 700	$300
Total	$1,500	$300	Long-term debt	$1,140	$340
Fixed assets			Owners' equity		
Net plant and equipment	$2,250	$450	Common stock and paid-in surplus	$ 800	$ 0
			Retained earnings	1,110	110
			Total	$1,910	$110
Total assets	$3,750	$750	Total liabilities and owners' equity	$3,750	$750

Percent of Sales and EFN

- External Financing Needed (EFN) can also be calculated as:

$$\left(\frac{\text{Assets}}{\text{Sales}}\right)\times\Delta\text{Sales}-\frac{\text{Spon Liab}}{\text{Sales}}\times\Delta\text{Sales}-(PM\times\text{Projected Sales})\times(1-d)$$

$$=(3\times250)-(0.3\times250)-(0.13\times1250\times0.667)$$

$$=\$565$$

3.5 External Financing and Growth

- At low growth levels, internal financing (retained earnings) may exceed the required investment in assets.
- As the growth rate increases, the internal financing will not be enough, and the firm will have to go to the capital markets for financing.
- Examining the relationship between growth and external financing required is a useful tool in financial planning.

HOFFMAN COMPANY
Income Statement and Balance Sheet

Income Statement

Sales		$500
Costs		400
Taxable income		$100
Taxes (34%)		34
Net income		$ 66
Dividends	$22	
Addition to retained earnings	44	

Balance Sheet

Assets	$	Percentage of Sales	Liabilities and Owners' Equity	$	Percentage of Sales
Current assets	$200	40%	Total debt	$250	n/a
Net fixed assets	300	60	Owners' equity	250	n/a
Total assets	$500	100%	Total liabilities and owners' equity	$500	n/a

HOFFMAN COMPANY
Pro Forma Income Statement and Balance Sheet

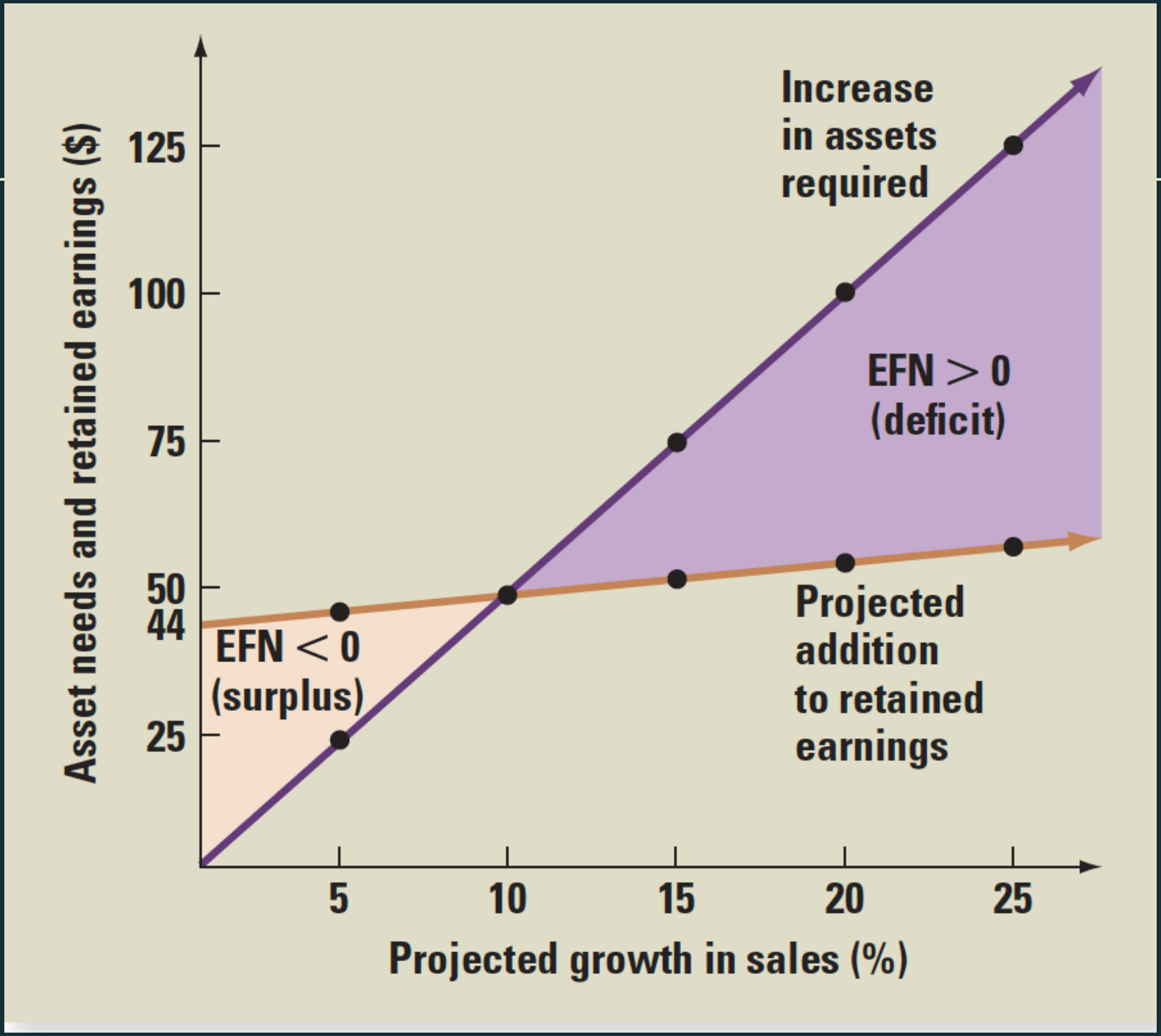
Income Statement

Sales (projected)		$600.0
Costs (80% of sales)		480.0
Taxable income		$120.0
Taxes (34%)		40.8
Net income		$ 79.2
Dividends	$26.4	
Addition to retained earnings	52.8	

Balance Sheet

Assets	$	Percentage of Sales	Liabilities and Owners' Equity	$	Percentage of Sales
Current assets	$240.0	40%	Total debt	$250.0	n/a
Net fixed assets	360.0	60	Owners' equity	302.8	n/a
Total assets	$600.0	100%	Total liabilities and owners' equity	$552.8	n/a
			External financing needed	$ 47.2	n/a

Projected Sales Growth	Increase in Assets Required	Addition to Retained Earnings	External Financing Needed, EFN	Projected Debt–Equity Ratio
0%	$ 0	$44.0	−$44.0	.70
5	25	46.2	−21.2	.77
10	50	48.4	1.6	.84
15	75	50.6	24.4	.91
20	100	52.8	47.2	.98
25	125	55.0	70.0	1.05


Increase
in assets
required
EFN > 0
(deficit)
EFN < 0
(surplus)
Projected
addition
to retained
earnings
Asset needs and retained earnings ($)
125
100
75
50
44
25
5
10
15
20
25
Projected growth in sales (%)

The Internal Growth Rate

- The internal growth rate tells us how much the firm can grow assets using retained earnings as the only source of financing.
- Using the information from the Hoffman Co.
  - ROA = 66 / 500 = .132
  - b = 44/ 66 = .667

$$\text{Internal Growth Rate} = \frac{\text{ROA} \times \text{b}}{1 - \text{ROA} \times \text{b}}$$

$$= \frac{.132 \times .667}{1 - .132 \times .667} = .0965$$

$$= 9.65\%$$

The Sustainable Growth Rate

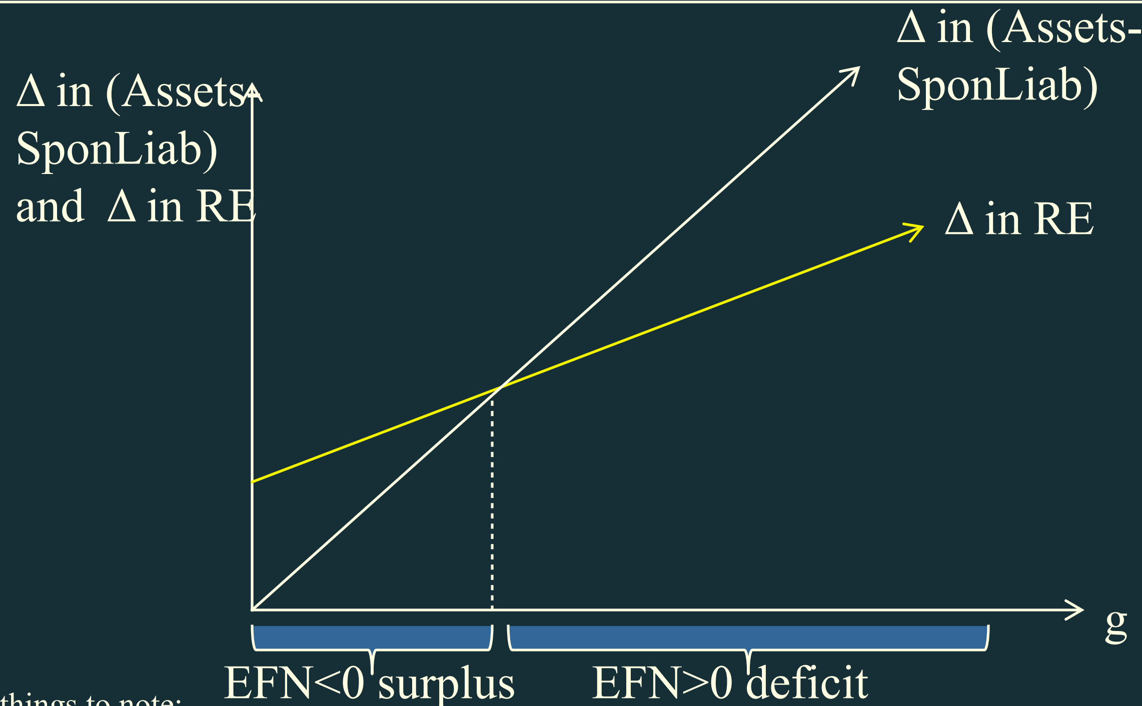
- The sustainable growth rate tells us how much the firm can grow by using internally generated funds and issuing debt to maintain a constant debt ratio.
- Using the Hoffman Co.
  - ROE = 66 / 250 = .264
  - b = .667

$$\text{Sustainable Growth Rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b}$$

$$= \frac{.264 \times .667}{1 - .264 \times .667} = .214$$

$$= 21.4\%$$

Relationship between growth rate and EFN



Two things to note:

1. Note that Δ in (Assets-SponLiab) starts at the origin. If the company does not grow (g=0%) there is no need to increase assets or change spontaneous liabilities. (Per year, sales will take place as before, existing assets will be used and depreciation amount, which is taken off as cost, can be used to replace the depreciating asset. Δ in RE starts at a positive value. Note that if the company does not grow, it will still have revenue, albeit as before. Hence, if company had positive profit and kept some of it as RE, without any growth, the same amount of revenue and Δ in RE will be obtained.
2. There is a differential in the slopes of two lines which allows a unique intersection and the existence of IGR. The Slope of the white line is equal to Δ in Assets-SponLiab per percentage growth rate. The slope of the yellow line is equal to Δ in RE per percentage growth rate. Since assets are expected to be used over time, it is reasonable to expect the sales to be smaller and profit and addition to RE even smaller than assets.

Determinants of Growth

- Profit margin – operating efficiency
- Total asset turnover – asset use efficiency
- Financial leverage – choice of optimal debt ratio
- Dividend policy – choice of how much to pay to shareholders versus reinvesting in the firm

3.6 Some Caveats

- Financial planning models do not indicate which financial polices are the best.
- Models are simplifications of reality, and the world can change in unexpected ways.
- Without some sort of plan, the firm may find itself adrift in a sea of change without a rudder for guidance.

Quick Quiz

- What is the purpose of financial planning?
- What are the major decision areas involved in developing a plan?
- What is the percentage of sales approach?
- What is the internal growth rate?
- What is the sustainable growth rate?
- What are the major determinants of growth?

Chapter 4

Discounted Cash Flow Valuation

McGraw-Hill/Irwin

Key Concepts and Skills

- Be able to compute the future value and/or present value of a single cash flow or series of cash flows
- Be able to compute the return on an investment
- Be able to use spreadsheet to solve time value problems
- Understand perpetuities and annuities

Chapter Outline

4.1 Valuation: The One-Period Case

4.2 The Multiperiod Case

4.3 Compounding Periods

4.4 Simplifications

4.1 The One-Period Case

- If you were to invest \$10,000 at 5-percent interest for one year, your investment would grow to \$10,500.

\$500 would be interest (\$10,000 × .05)

\$10,000 is the principal repayment (\$10,000 × 1)

\$10,500 is the total due. It can be calculated as:

$$\$10{,}500 = \$10{,}000 \times (1.05)$$

- The total amount due at the end of the investment is call the *Future Value* (*FV*).

Future Value

- In the one-period case, the formula for *FV* can be written as:

$$FV = C_0 \times (1 + r)$$

Where C_0 is cash flow today (time zero), and r is the appropriate interest rate.

Present Value

- If you were to be promised \$10,000 due in one year when interest rates are 5-percent, your investment would be worth \$9,523.81 in today's dollars.

$$\$9{,}523.81 = \frac{\$10{,}000}{1.05}$$

The amount that a borrower would need to set aside today to be able to meet the promised payment of \$10,000 in one year is called the *Present Value* (*PV*).

Note that $\$10{,}000 = \$9{,}523.81 \times (1.05)$.

Present Value

- In the one-period case, the formula for *PV* can be written as:

$$PV = \frac{C_1}{1+r}$$

Where C_1 is cash flow at date 1, and

r is the appropriate interest rate.

Net Present Value

- The Net Present Value (*NPV*) of an investment is the present value of the expected cash flows, less the cost of the investment.
- Suppose an investment that promises to pay \$10,000 in one year is offered for sale for \$9,500. Your interest rate is 5%. Should you buy?

Net Present Value

$$NPV = -\$9{,}500 + \frac{\$10{,}000}{1.05}$$

$$NPV = -\$9{,}500 + \$9{,}523.81$$

$$NPV = \$23.81$$

The present value of the cash inflow is greater than the cost. In other words, the Net Present Value is positive, so the investment should be purchased.

Net Present Value

In the one-period case, the formula for *NPV* can be written as:

$$NPV = -Cost + PV$$

If we had *not* undertaken the positive *NPV* project considered on the last slide, and instead invested our \$9,500 elsewhere at 5 percent, our *FV* would be less than the \$10,000 the investment promised, and we would be worse off in *FV* terms :

$$\$9{,}500 \times (1.05) = \$9{,}975 < \$10{,}000$$

4.2 The Multiperiod Case

- The general formula for the future value of an investment over many periods can be written as:

$$FV = C_0 \times (1 + r)^T$$

Where

C_0 is cash flow at date 0,

r is the appropriate interest rate, and

T is the number of periods over which the cash is invested.

Future Value

- Suppose a stock currently pays a dividend of \$1.10, which is expected to grow at 40% per year for the next five years.
- What will the dividend be in five years?

$$FV = C_0 \times (1 + r)^T$$

$$\$5.92 = \$1.10 \times (1.40)^5$$

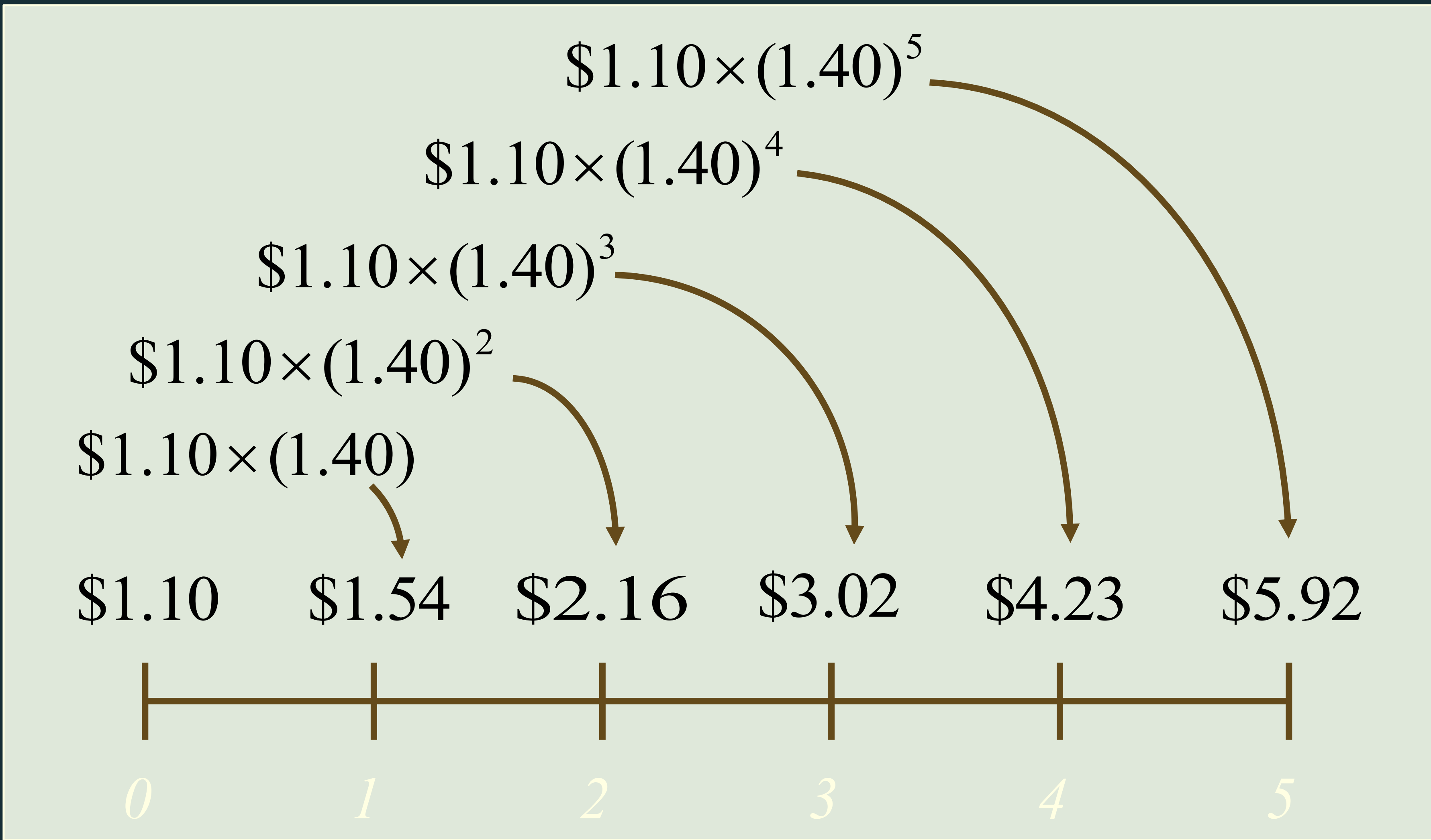
Future Value and Compounding

- Notice that the dividend in year five, \$5.92, is considerably higher than the sum of the original dividend plus five increases of 40-percent on the original \$1.10 dividend:

$$\$5.92 > \$1.10 + 5 \times [\$1.10 \times .40] = \$3.30$$

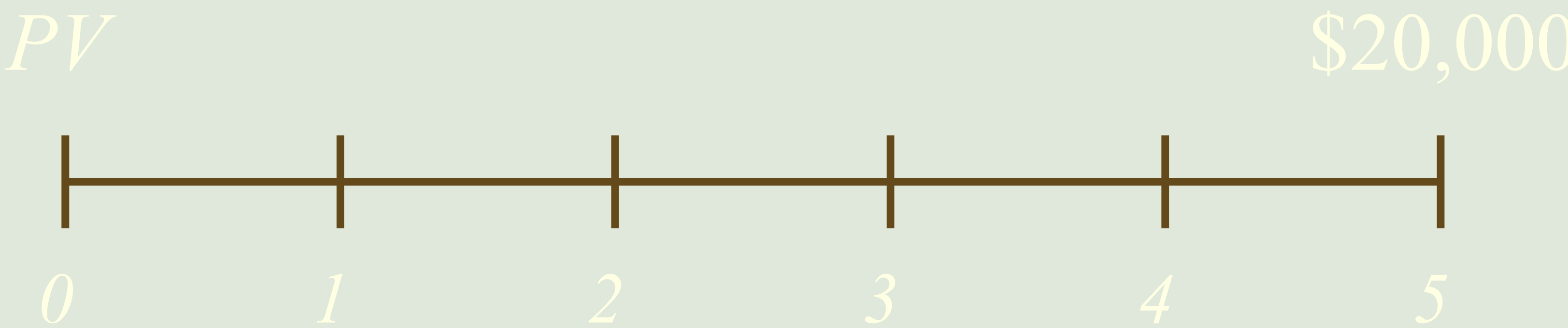
This is due to *compounding*.

Future Value and Compounding



Present Value and Discounting

- How much would an investor have to set aside today in order to have $20,000 five years from now if the current rate is 15%?



$$\$9,943.53 = \frac{\$20,000}{(1.15)^5}$$

4.5 Finding the Number of Periods

If we deposit $5,000 today in an account paying 10%, how long does it take to grow to $10,000?

$$FV = C_0 \times (1 + r)^T \qquad \$10{,}000 = \$5{,}000 \times (1.10)^T$$

$$(1.10)^T = \frac{\$10{,}000}{\$5{,}000} = 2$$

$$\ln(1.10)^T = \ln(2)$$

$$T = \frac{\ln(2)}{\ln(1.10)} = \frac{0.6931}{0.0953} = 7.27 \text{ years}$$

What Rate Is Enough?

Assume the total cost of a college education will be \$50,000 when your child enters college in 12 years. You have \$5,000 to invest today. What rate of interest must you earn on your investment to cover the cost of your child's education? About 21.15%.

$$FV = C_0 \times (1 + r)^T \qquad \$50,000 = \$5,000 \times (1 + r)^{12}$$

$$(1 + r)^{12} = \frac{\$50,000}{\$5,000} = 10 \qquad (1 + r) = 10^{1/12}$$

$$r = 10^{1/12} - 1 = 1.2115 - 1 = .2115$$

Using the tables:

Table 1 Future Value of $1
$FV = \$1\ (1 + i)^n$

n/i	1.0%	1.5%	2.0%	2.5%
1	1.01000	1.01500	1.02000	1.02500
2	1.02010	1.03022	1.04040	1.05063
3	1.03030	1.04568	1.06121	1.07689
4	1.04060	1.06136	1.08243	1.10381
5	1.05101	1.07728	1.10408	1.13141

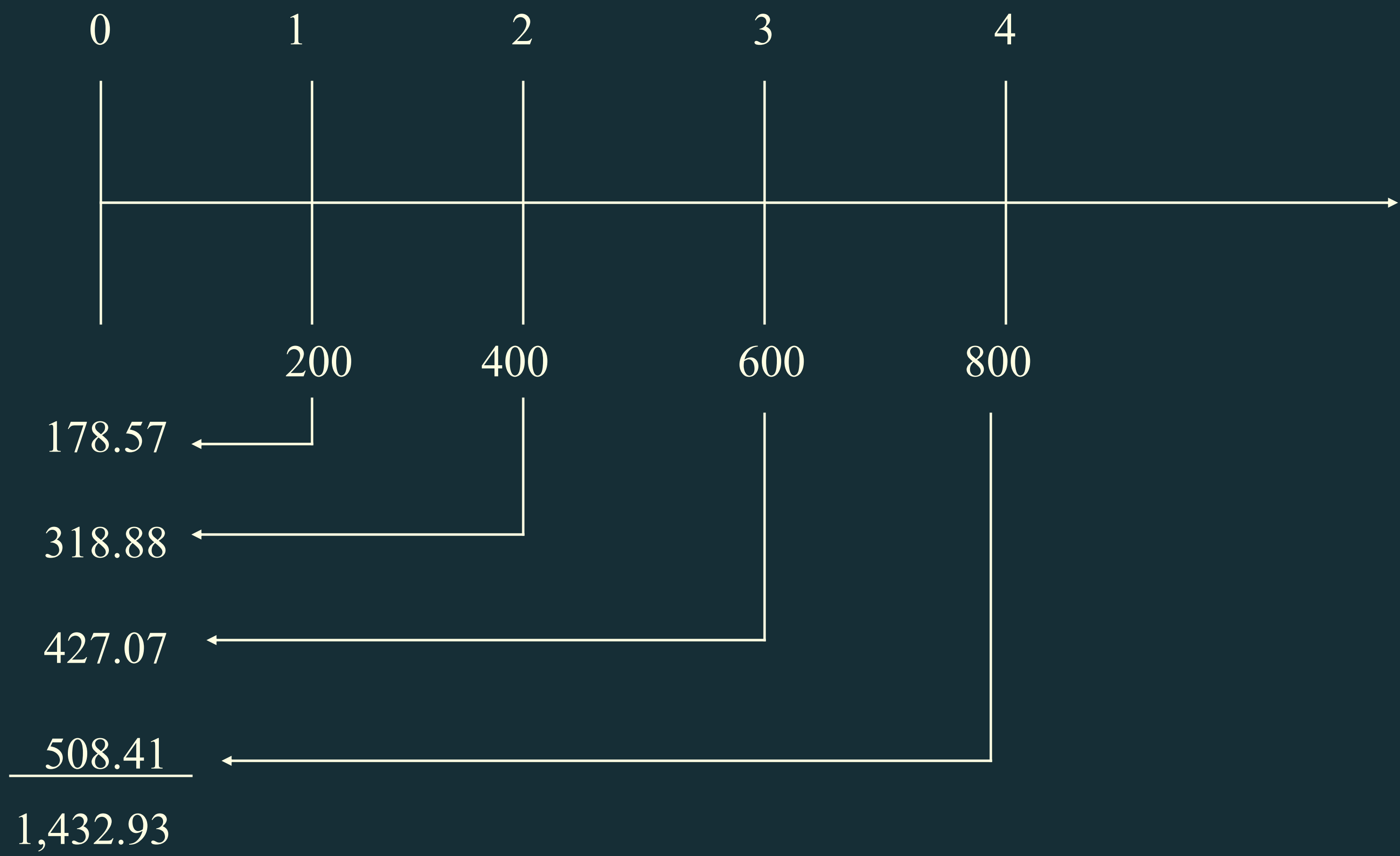
Table 2 Present Value of $1
$$PV = \frac{\$1}{(1 + i)^n}$$

n/i	1.0%	1.5%	2.0%	2.5%
1	0.99010	0.98522	0.98039	0.97561
2	0.98030	0.97066	0.96117	0.95181
3	0.97059	0.95632	0.94232	0.92860
4	0.96098	0.94218	0.92385	0.90595
5	0.95147	0.92826	0.90573	0.88385

Multiple Cash Flows

- Consider an investment that pays \$200 one year from now, with cash flows increasing by \$200 per year through year 4. If the interest rate is 12%, what is the present value of this stream of cash flows?
- If the issuer offers this investment for \$1,500, should you purchase it?

Multiple Cash Flows



Present Value < Cost → Do Not Purchase

4.3 Compounding Periods

Compounding an investment m times a year for T years provides for future value of wealth:

$$FV = C_0 \times \left(1 + \frac{r}{m}\right)^{m \times T}$$

Compounding Periods

- For example, if you invest \$50 for 3 years at 12% compounded semi-annually, your investment will grow to

$$FV = \$50 \times \left(1 + \frac{.12}{2}\right)^{2\times 3} = \$50 \times (1.06)^6 = \$70.93$$

Effective Annual Rates of Interest

A reasonable question to ask in the above example is "what is the effective *annual* rate of interest on that investment?"

$$FV = \$50 \times (1 + \frac{.12}{2})^{2\times 3} = \$50 \times (1.06)^6 = \$70.93$$

The Effective Annual Rate (EAR) of interest is the annual rate that would give us the same end-of-investment wealth after 3 years:

$$\$50 \times (1 + EAR)^3 = \$70.93$$

Effective Annual Rates of Interest

$$FV = \$50 \times (1 + EAR)^3 = \$70.93$$

$$(1 + EAR)^3 = \frac{\$70.93}{\$50}$$

$$EAR = \left(\frac{\$70.93}{\$50} \right)^{1/3} - 1 = .1236$$

So, investing at 12.36% compounded annually is the same as investing at 12% compounded semi-annually.

Effective Annual Rates of Interest

- Find the Effective Annual Rate (EAR) of an 18% APR loan that is compounded monthly.
- What we have is a loan with a monthly interest rate rate of 1½%.
- This is equivalent to a loan with an annual interest rate of 19.56%.

$$\left(1+\frac{r}{m}\right)^{m}=\left(1+\frac{.18}{12}\right)^{12}=(1.015)^{12}=1.1956$$

Continuous Compounding

- The general formula for the future value of an investment compounded continuously over many periods can be written as:

$$FV = C_0 \times e^{rT}$$

Where

C_0 is cash flow at date 0,

r is the stated annual interest rate,

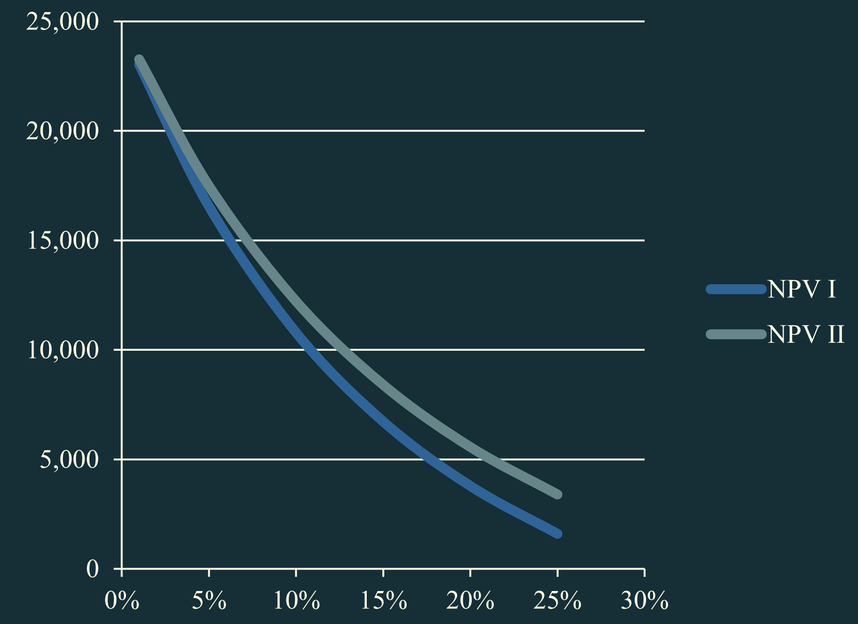
T is the number of years, and

e is a transcendental number approximately equal to 2.718. e^x is a key on your calculator.

Effect of Interest Rate on Tail Heavy Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10
Cash Flow I	-10,000	3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	4,000	4,000
Cash Flow II	-10,000	4,000	4,000	4,000	4,000	4,000	3,000	3,000	3,000	3,000	3,000

Rate	NPV I	NPV II
1%	23,032	23,267
5%	16,557	17,495
10%	10,787	12,224
15%	6,723	8,408
20%	3,779	5,568
25%	1,593	3,401



Quick Quiz

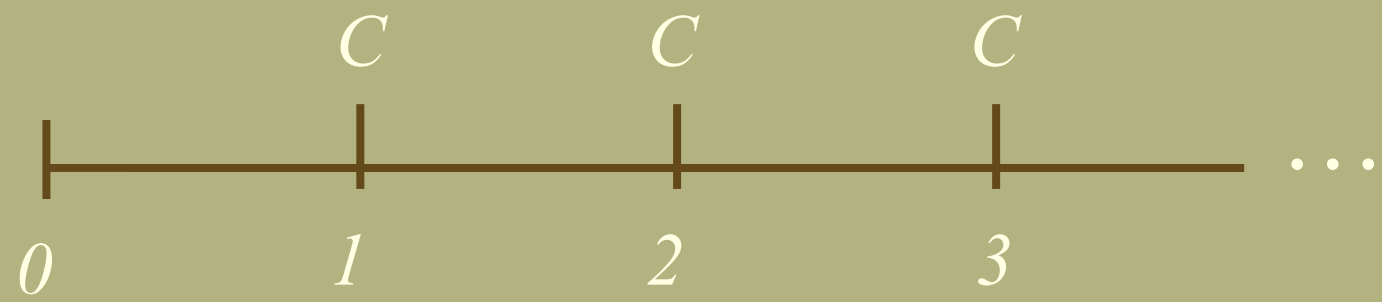
- How is the future value of a single cash flow computed?
- How is the present value of a series of cash flows computed.
- What is the Net Present Value of an investment?
- What is an EAR, and how is it computed?

4.4 Simplifications

- Perpetuity
  - A constant stream of cash flows that lasts forever
- Growing perpetuity
  - A stream of cash flows that grows at a constant rate forever
- Annuity
  - A stream of constant cash flows that lasts for a fixed number of periods
- Growing annuity
  - A stream of cash flows that grows at a constant rate for a fixed number of periods

Perpetuity

A constant stream of cash flows that lasts forever



$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots$$

$$PV = \frac{C}{r}$$

Perpetuity: Example

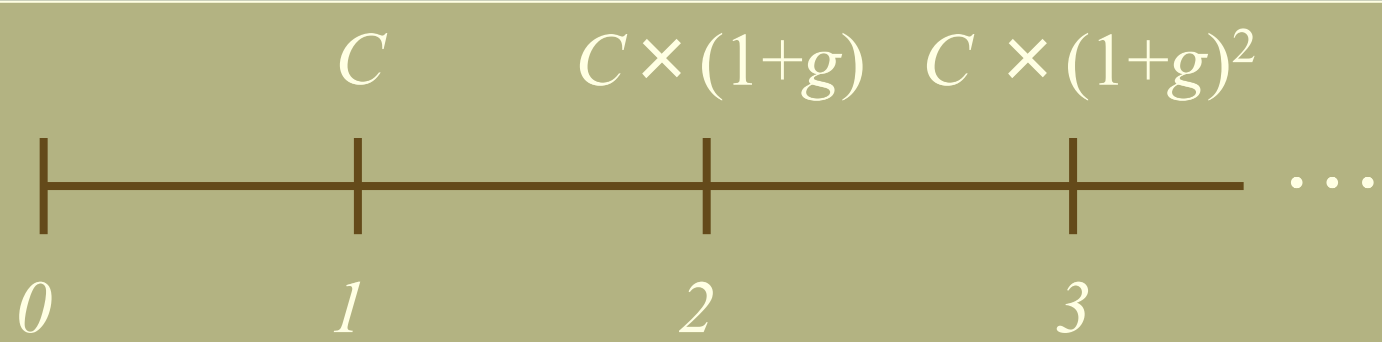
What is the value of an asset that promises to pay $15 every year for ever?

The interest rate is 10-percent.

$$PV = \frac{\$15}{.10} = \$150$$

Growing Perpetuity

A growing stream of cash flows that lasts forever



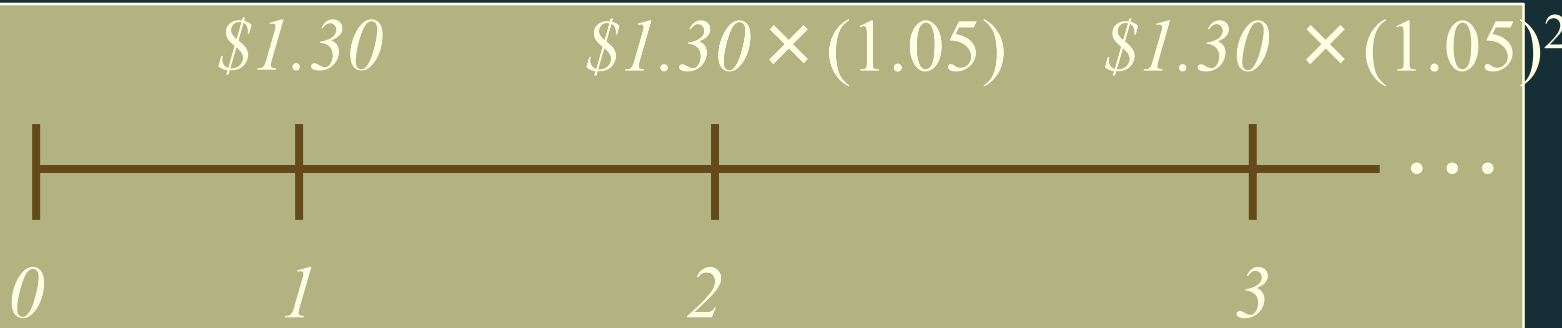
$$PV = \frac{C}{(1+r)} + \frac{C\times(1+g)}{(1+r)^2} + \frac{C\times(1+g)^2}{(1+r)^3} + \cdots$$

$$PV = \frac{C}{r-g}$$

Growing Perpetuity: Example

The expected dividend next year is \$1.30, and dividends are expected to grow at 5% forever.

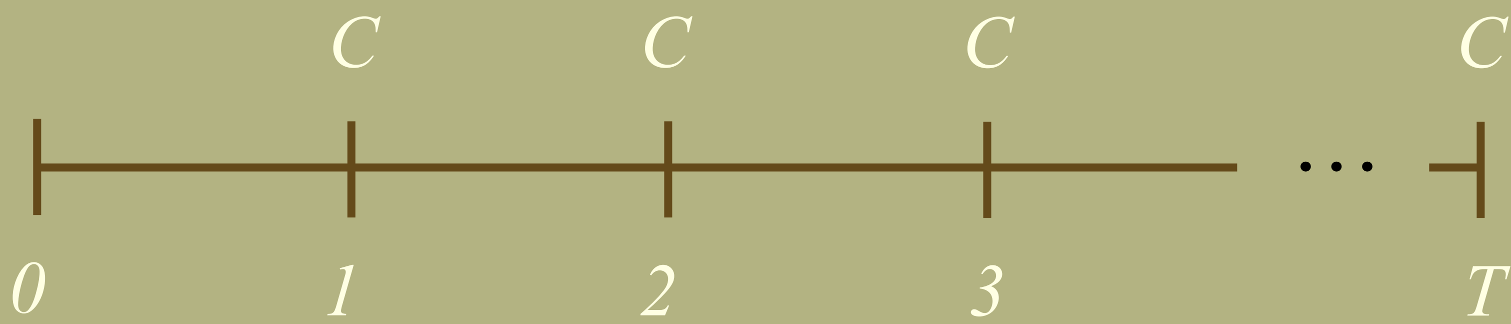
If the discount rate is 10%, what is the value of this promised dividend stream?



$$PV = \frac{\$1.30}{.10 - .05} = \$26.00$$

Annuity

A constant stream of cash flows with a fixed maturity

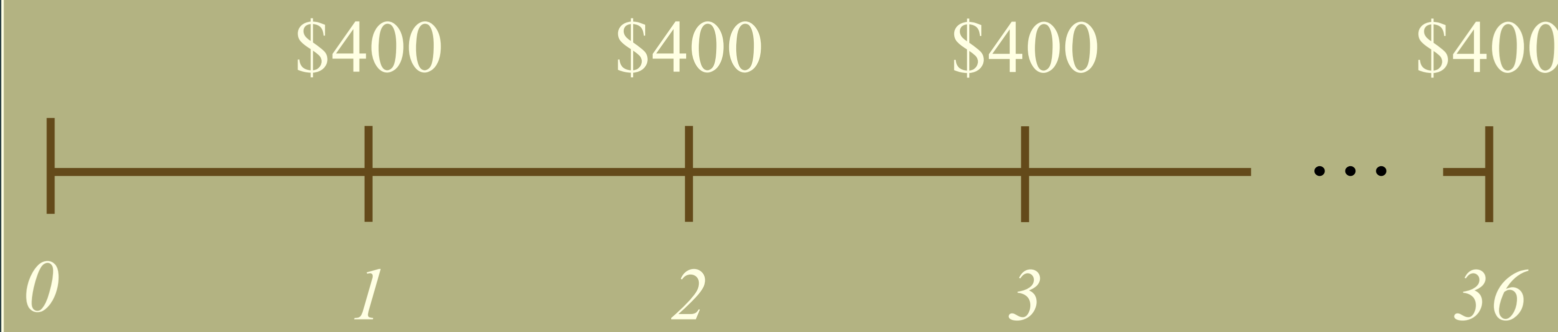


$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots \frac{C}{(1+r)^T}$$

$$PV = \frac{C}{r}\left[1 - \frac{1}{(1+r)^T}\right]$$

Annuity: Example

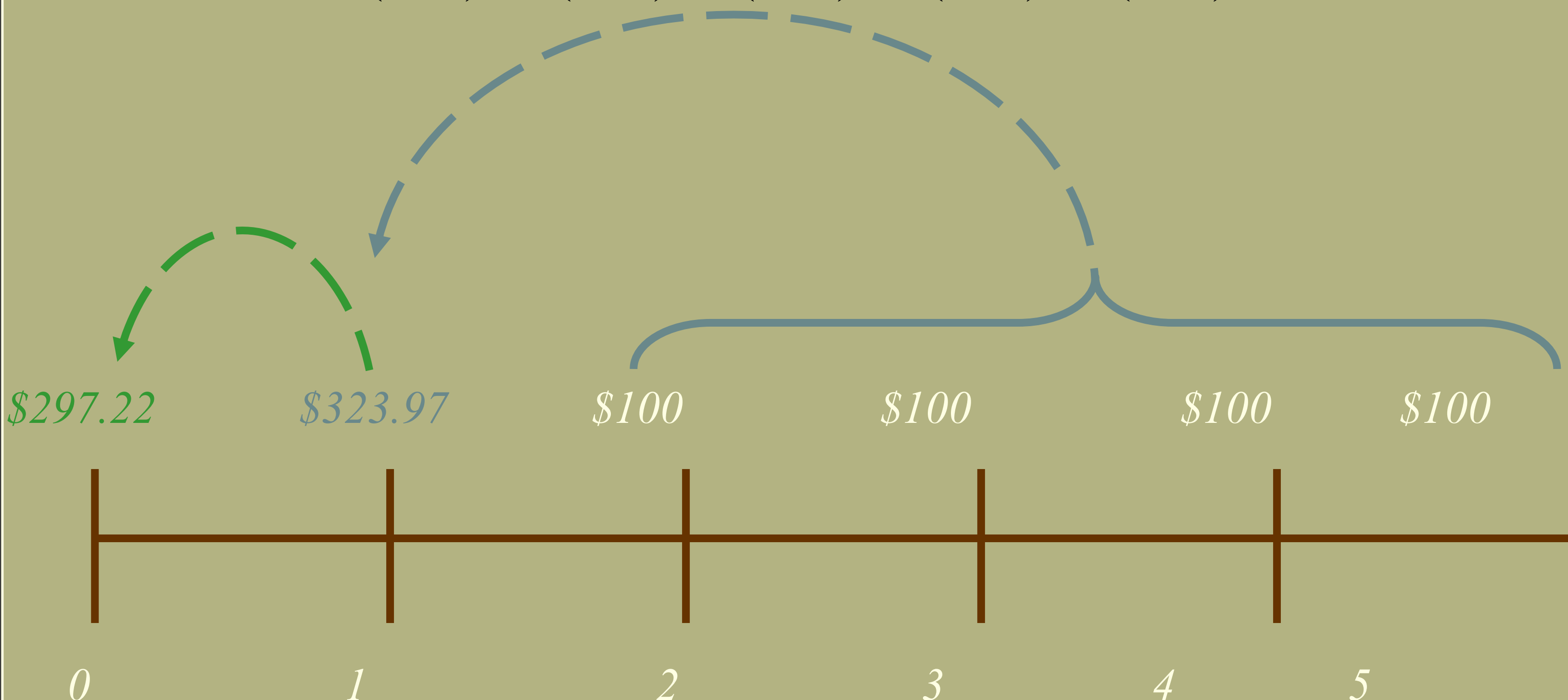
If you can afford a \$400 monthly car payment, how much car can you afford if interest rates are 7% on 36-month loans?



$$PV = \frac{\$400}{.07/12}\left[1 - \frac{1}{(1+.07/12)^{36}}\right] = \$12,954.59$$

What is the present value of a four-year annuity of \$100 per year that makes its first payment two years from today if the discount rate is 9%?

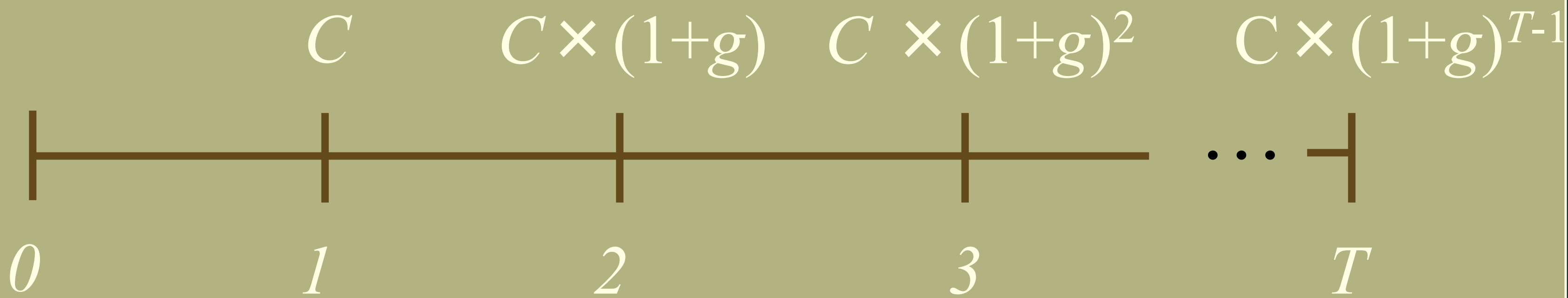
$$PV_1 = \sum_{t=1}^{4} \frac{\$100}{(1.09)^t} = \frac{\$100}{(1.09)^1} + \frac{\$100}{(1.09)^2} + \frac{\$100}{(1.09)^3} + \frac{\$100}{(1.09)^4} = \$323.97$$



$$PV_o = \frac{\$323.97}{1.09} = \$297.22$$

Growing Annuity

A growing stream of cash flows with a fixed maturity



$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \cdots + \frac{C \times (1+g)^{T-1}}{(1+r)^T}$$

$$PV = \frac{C}{r-g}\left[1 - \left(\frac{1+g}{(1+r)}\right)^T\right]$$

Growing Annuity: Example

An asset offers to pay $20,000 per year for 40 years and increase the annual payment by 3% each year beginning a year from today. What is the present of this asset today if the discount rate is 10%?

$\$20{,}000 \quad \$20{,}000 \times (1.03) \quad \$20{,}000 \times (1.03)^{39}$

0   1   2   …   40

$$PV = \frac{\$20{,}000}{.10 - .03}\left[1 - \left(\frac{1.03}{1.10}\right)^{40}\right] = \$265{,}121.57$$

Growing Annuity: Example

You are evaluating an income generating property. Net rent is received at the end of each year. The first year's rent is expected to be \$8,500, and rent is expected to increase 7% each year. What is the present value of the estimated income stream over the first 5 years if the discount rate is 12%?

$$\$8{,}500 \times (1.07) = \quad \$8{,}500 \times (1.07)^2 = \quad \$8{,}500 \times (1.07)^3 = \quad \$8{,}500 \times (1.07)^4 =$$

\$8,500 \$9,095 \$9,731.65 \$10,412.87 \$11,141.77

0 1 2 3 4 5

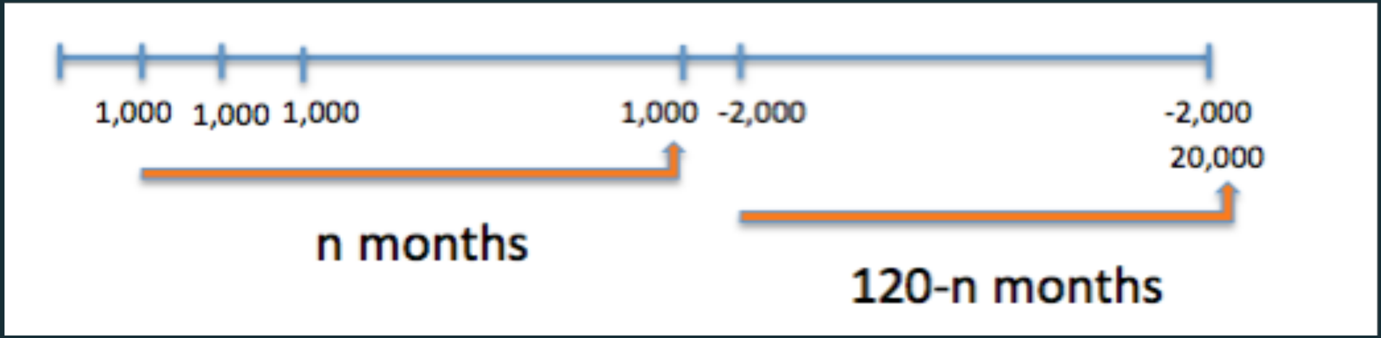
\$34,706.26

Annuity Formula Application

Boeing would like to create a fund to fulfill future battery problem obligations.

Beginning a month from today, Boeing will start to invest $1,000 each month.
At some point, it will stop investing and start withdrawing $2,000 per month and still have $20,000 in this fund right after its withdrawal 10 years from now.

When can Boeing start withdrawing money if APR is 12% and compounding is done monthly?



Example

Question: You are offered \$20,000 in 4 years at the cost of \$X today. At most how much should be X for this offer to be attractive if you know you can make 5% in the coming two years and 8% thereafter.

Example

Invest \$10,000 and get \$11,000 in one year. What is your return?

$10{,}000\ (1+r) = 11{,}000$

Invest \$10,000 and get \$3,000 every 3 months in the coming year. What is your return per quarter? What is your effective return per year?

Quarterly return approx. 7.71%

Effective Annual Rate: $EAR = (1+0.0771)^4 - 1 = 34.6\%$