Corporate Finance
FIN 206
Spring 2025
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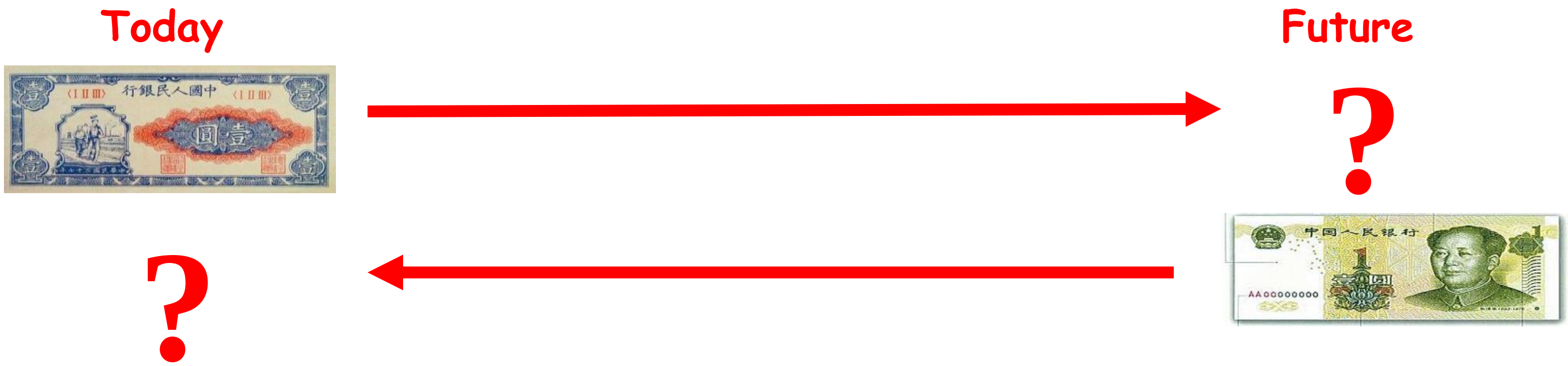
Lecture 02

Discounted Cash Flow Valuation

2.1 The Time Value of Money

- A dollar received today is worth more than a dollar received tomorrow
  - This is because a dollar received today can be invested to earn interest
  - The amount of interest earned depends on the rate of return that can be earned on the investment
- Time value of money quantifies the value of a dollar through time

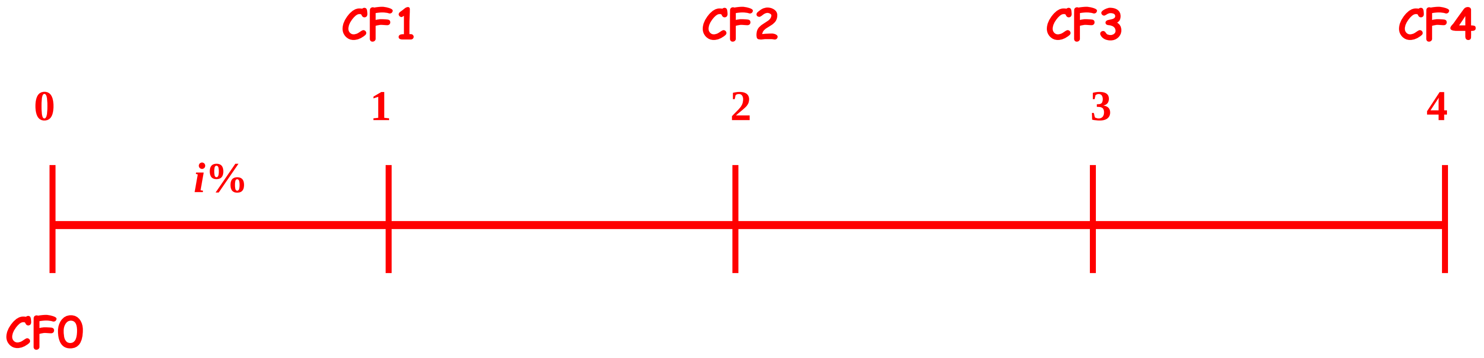


Uses of Time Value of Money

- Time Value of Money is a concept that is used in all aspects of finance including:
  - Bond valuation
  - Stock valuation
  - Accept/reject decisions for project management
  - Financial analysis of firms
  - And many others!

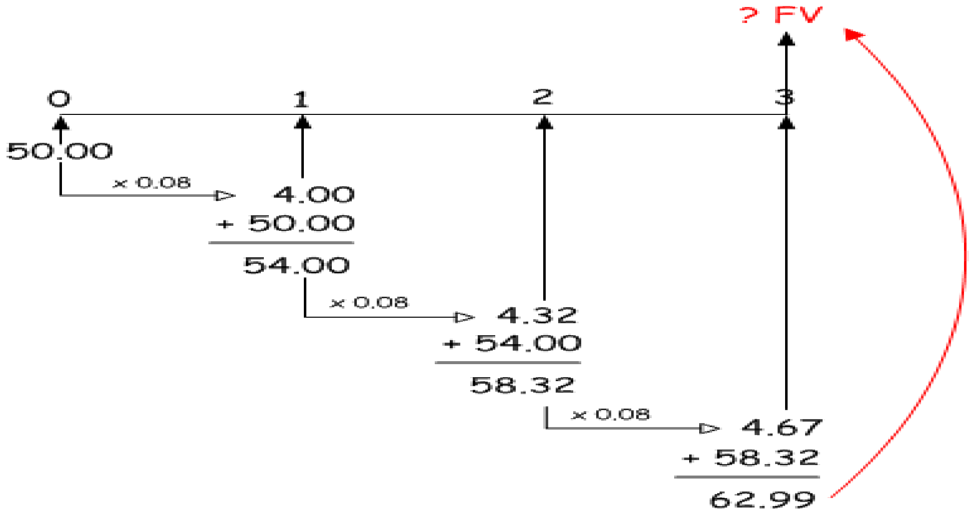
Definitions and Assumptions

- Unless otherwise stated, t=0 represents today (the decision point)
- Unless otherwise stated, cash flows occur at the end of a time interval
- Cash inflows are treated as positive amounts, while cash outflows are treated as negative amounts



Future Value

- Future value is the value in Future dollars of a today cash flow.
- Future value is higher than today, because if I had the money I would put it to work, it would earn interest. (FV=PV+INT)



Future Value

- 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 × (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.

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

n/i	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	1.01000	1.01500	1.02000	1.02500	1.03000	1.03500	1.04000	1.04500	1.05000	1.05500	1.06000	1.07000	1.08000	1.09000	1.10000	1.11000	1.12000	1.20000
2	1.02010	1.03022	1.04040	1.05063	1.06090	1.07123	1.08160	1.09203	1.10250	1.11303	1.12360	1.14490	1.16640	1.18810	1.21000	1.23210	1.25440	1.44000
3	1.03030	1.04568	1.06121	1.07689	1.09273	1.10872	1.12486	1.14117	1.15763	1.17424	1.19102	1.22504	1.25971	1.29503	1.33100	1.36763	1.40493	1.72800
4	1.04060	1.06136	1.08243	1.10381	1.12551	1.14752	1.16986	1.19252	1.21551	1.23882	1.26248	1.31080	1.36049	1.41158	1.46410	1.51807	1.57352	2.07360
5	1.05101	1.07728	1.10408	1.13141	1.15927	1.18769	1.21665	1.24618	1.27628	1.30696	1.33823	1.40255	1.46933	1.53862	1.61051	1.68506	1.76234	2.48832
6	1.06152	1.09344	1.12616	1.15969	1.19405	1.22926	1.26532	1.30226	1.34010	1.37884	1.41852	1.50073	1.58687	1.67710	1.77156	1.87041	1.97382	2.98598
7	1.07214	1.10984	1.14869	1.18869	1.22987	1.27228	1.31593	1.36086	1.40710	1.45468	1.50363	1.60578	1.71382	1.82804	1.94872	2.07616	2.21068	3.58318
8	1.08286	1.12649	1.17166	1.21840	1.26677	1.31681	1.36857	1.42210	1.47746	1.53469	1.59385	1.71819	1.85093	1.99256	2.14359	2.30454	2.47596	4.29982
9	1.09369	1.14339	1.19509	1.24886	1.30477	1.36290	1.42331	1.48610	1.55133	1.61909	1.68948	1.83846	1.99900	2.17189	2.35795	2.55804	2.77308	5.15978
10	1.10462	1.16054	1.21899	1.28008	1.34392	1.41060	1.48024	1.55297	1.62889	1.70814	1.79085	1.96715	2.15892	2.36736	2.59374	2.83942	3.10585	6.19174
11	1.11567	1.17795	1.24337	1.31209	1.38423	1.45997	1.53945	1.62285	1.71034	1.80209	1.89830	2.10485	2.33164	2.58043	2.85312	3.15176	3.47855	7.43008
12	1.12683	1.19562	1.26824	1.34489	1.42576	1.51107	1.60103	1.69588	1.79586	1.90121	2.01220	2.25219	2.51817	2.81266	3.13843	3.49845	3.89598	8.91610
13	1.13809	1.21355	1.29361	1.37851	1.46853	1.56396	1.66507	1.77220	1.88565	2.00577	2.13293	2.40985	2.71962	3.06580	3.45227	3.88328	4.36349	10.69932
14	1.14947	1.23176	1.31948	1.41297	1.51259	1.61869	1.73168	1.85194	1.97993	2.11609	2.26090	2.57853	2.93719	3.34173	3.79750	4.31044	4.88711	12.83918
15	1.16097	1.25023	1.34587	1.44830	1.55797	1.67535	1.80094	1.93528	2.07893	2.23248	2.39656	2.75903	3.17217	3.64248	4.17725	4.78459	5.47357	15.40702
16	1.17258	1.26899	1.37279	1.48451	1.60471	1.73399	1.87298	2.02237	2.18287	2.35526	2.54035	2.95216	3.42594	3.97031	4.59497	5.31089	6.13039	18.48843
17	1.18430	1.28802	1.40024	1.52162	1.65285	1.79468	1.94790	2.11338	2.29202	2.48480	2.69277	3.15882	3.70002	4.32763	5.05447	5.89509	6.86604	22.18611
18	1.19615	1.30734	1.42825	1.55966	1.70243	1.85749	2.02582	2.20848	2.40662	2.62147	2.85434	3.37993	3.99602	4.71712	5.55992	6.54355	7.68997	26.62333
19	1.20811	1.32695	1.45681	1.59865	1.75351	1.92250	2.10685	2.30786	2.52695	2.76565	3.02560	3.61653	4.31570	5.14166	6.11591	7.26334	8.61276	31.94800
20	1.22019	1.34686	1.48595	1.63862	1.80611	1.98979	2.19112	2.41171	2.65330	2.91776	3.20714	3.86968	4.66096	5.60441	6.72750	8.06231	9.64629	38.33760
21	1.23239	1.36706	1.51567	1.67958	1.86029	2.05943	2.27877	2.52024	2.78596	3.07823	3.39956	4.14056	5.03383	6.10881	7.40025	8.94917	10.80385	46.00512
25	1.28243	1.45095	1.64061	1.85394	2.09378	2.36324	2.66584	3.00543	3.38635	3.81339	4.29187	5.42743	6.84848	8.62308	10.83471	13.58546	17.00006	95.39622
30	1.34785	1.56308	1.81136	2.09757	2.42726	2.80679	3.24340	3.74532	4.32194	4.98395	5.74349	7.61226	10.06266	13.26768	17.44940	22.89230	29.95992	237.37631
40	1.48886	1.81402	2.20804	2.68506	3.26204	3.95926	4.80102	5.81636	7.03999	8.51331	10.28572	14.97446	21.72452	31.40942	45.25926	65.00087	93.05097	1469.77160

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.

$$\$9,523.81 = \$10,000/1.05$$

- 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*).
- **Present value is the value in today's dollars of a future cash flow.**

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:

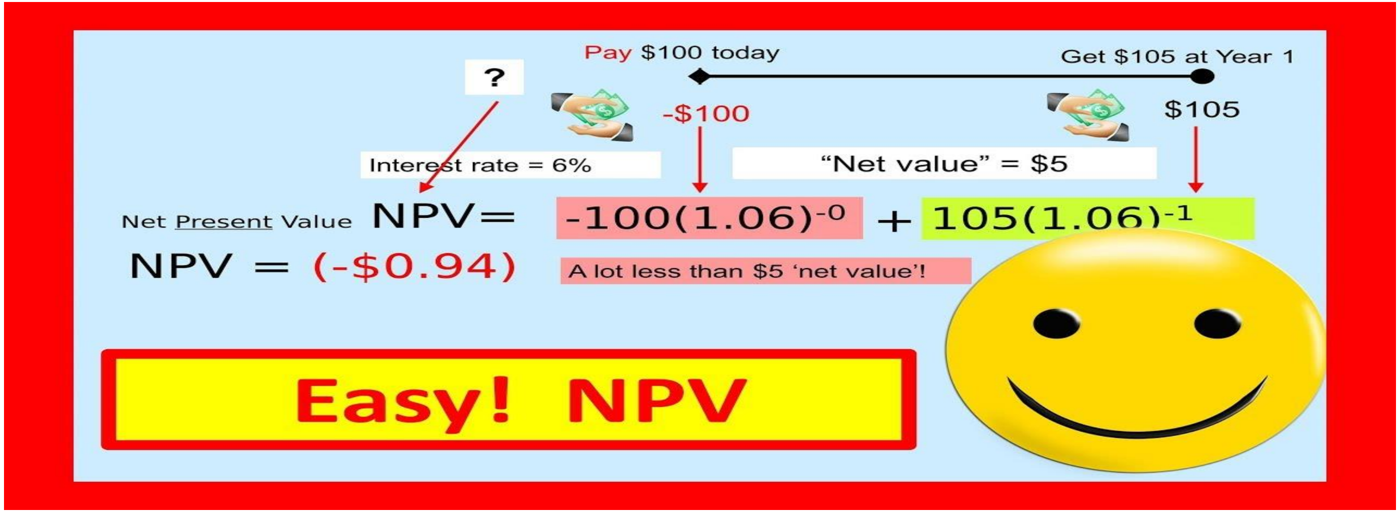
$$PV = \frac{C_1}{1 + r}$$

Where C_1 is cash flow at date 1, and

r is the appropriate interest rate.

Net Present Value

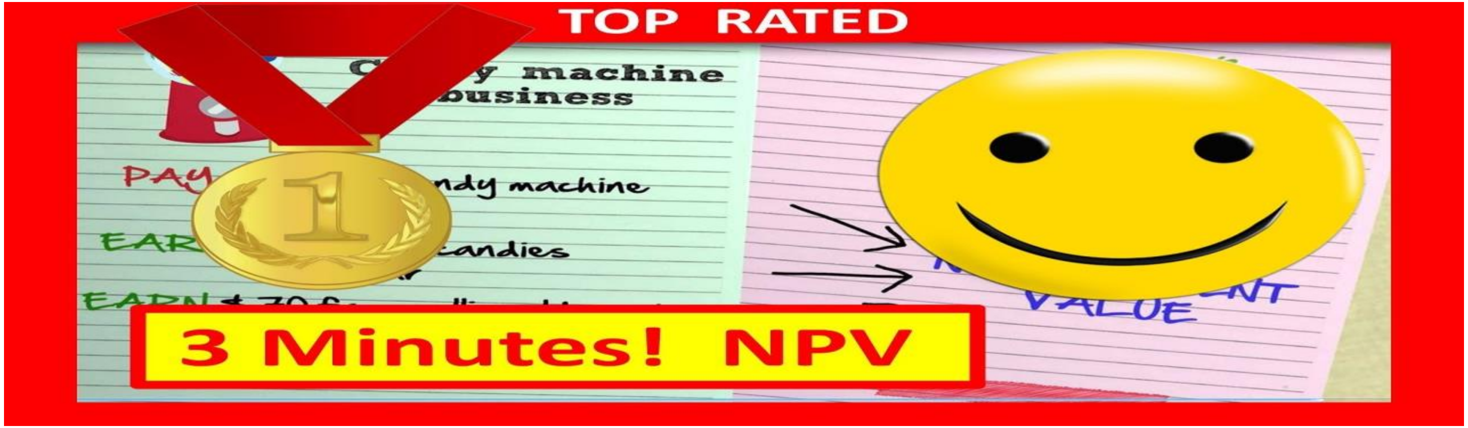
- The Net Present Value (NPV) of an investment is the present value of the expected cash flows, less the cost of the investment.
- Suppose an investment that promises to pay $10,000 in one year is offered for sale for $9,500. Your interest rate is 5%. Should you buy?



Net Present Value

$$\begin{aligned} NPV &= -\$9{,}500 + \$10{,}000/1.05 \\ &= -\$9{,}500 + \$9{,}523.81 \\ &= \$23.81 \end{aligned}$$

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 :

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

2.2 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

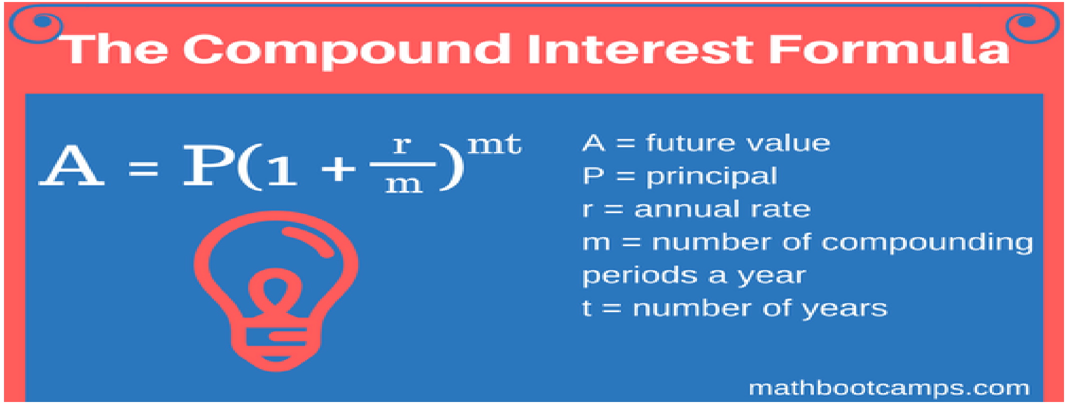
- Suppose a stock currently pays a dividend of \$1.10, which is expected to grow at 40% per year for the next five years.
- What will the dividend be in five years?
  - $FV = C_0 \times (1 + r)^T$
  - $\$5.92 = \$1.10 \times (1.40)^5$

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

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- To further illustrate the effect of compounding for long horizons, consider the case of Peter Minuit and the American Indians. In 1626, Minuit bought all of Manhattan Island for about $24 in goods and trinkets. This sounds cheap, but the Indians may have gotten the better end of the deal. To see why, suppose the Indians had sold the goods and invested the $24 at 10 percent. How much would it be worth today? About 385 years have passed since the transaction. At 10 percent, $24 will grow by quite a bit over that time. How much? The future value factor is roughly:

$$(1+r)^t = (1.1)^{385} = 8,600,000,000,000,000$$

$24X8.6…=$20,700,000,000,000,000

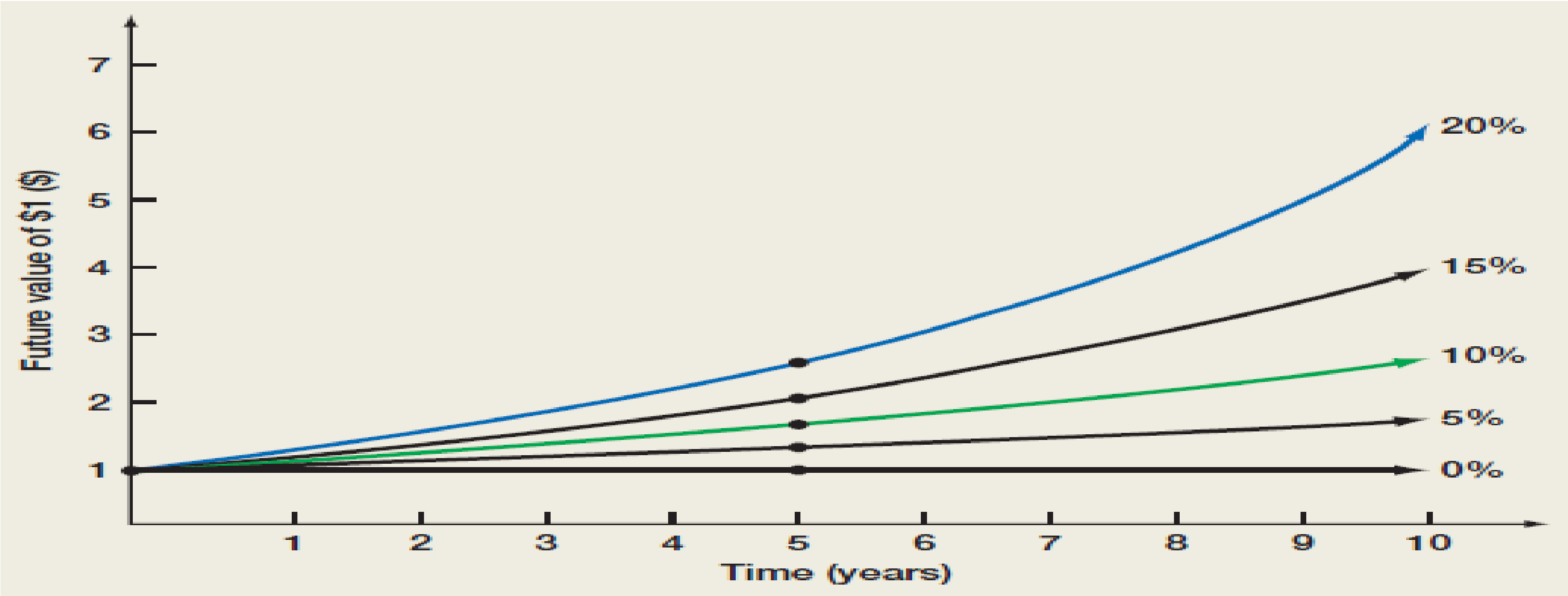
To 2020

$24X1.1^394=$48,857,000,000,000,000

To today-2022

$24X1.1^396=$ 59,116,970,000,000,000.00

Future Value and Compounding



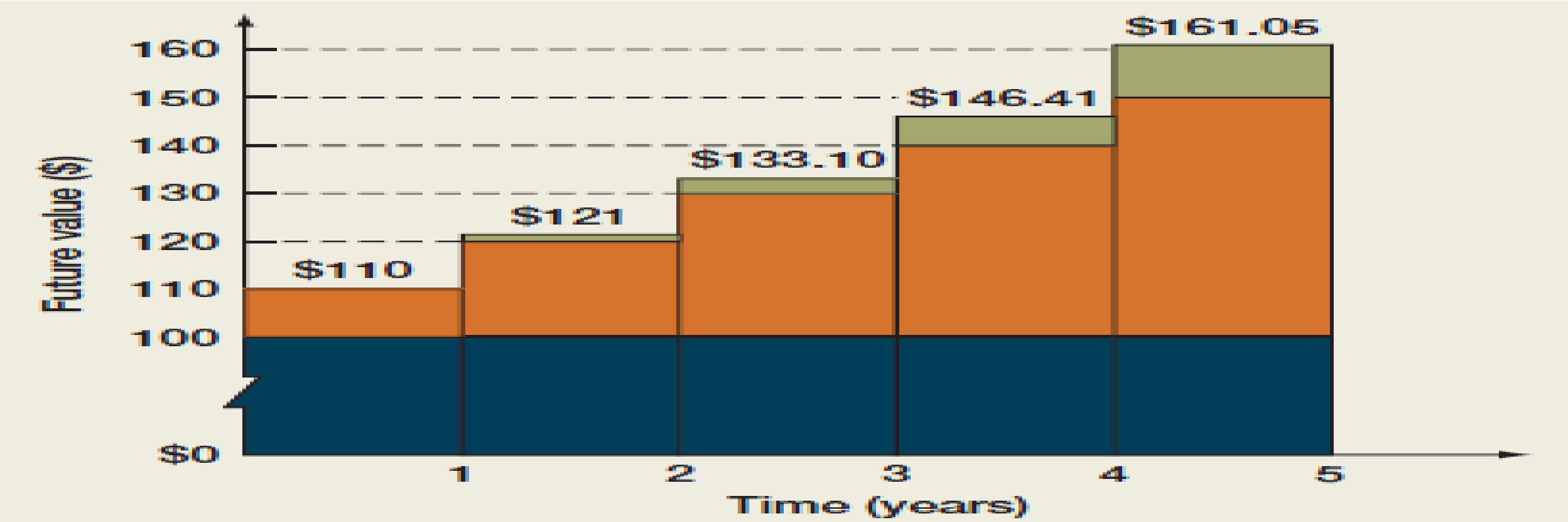
Future Value of $1 for Different Periods and Rates

Future Value and Compounding

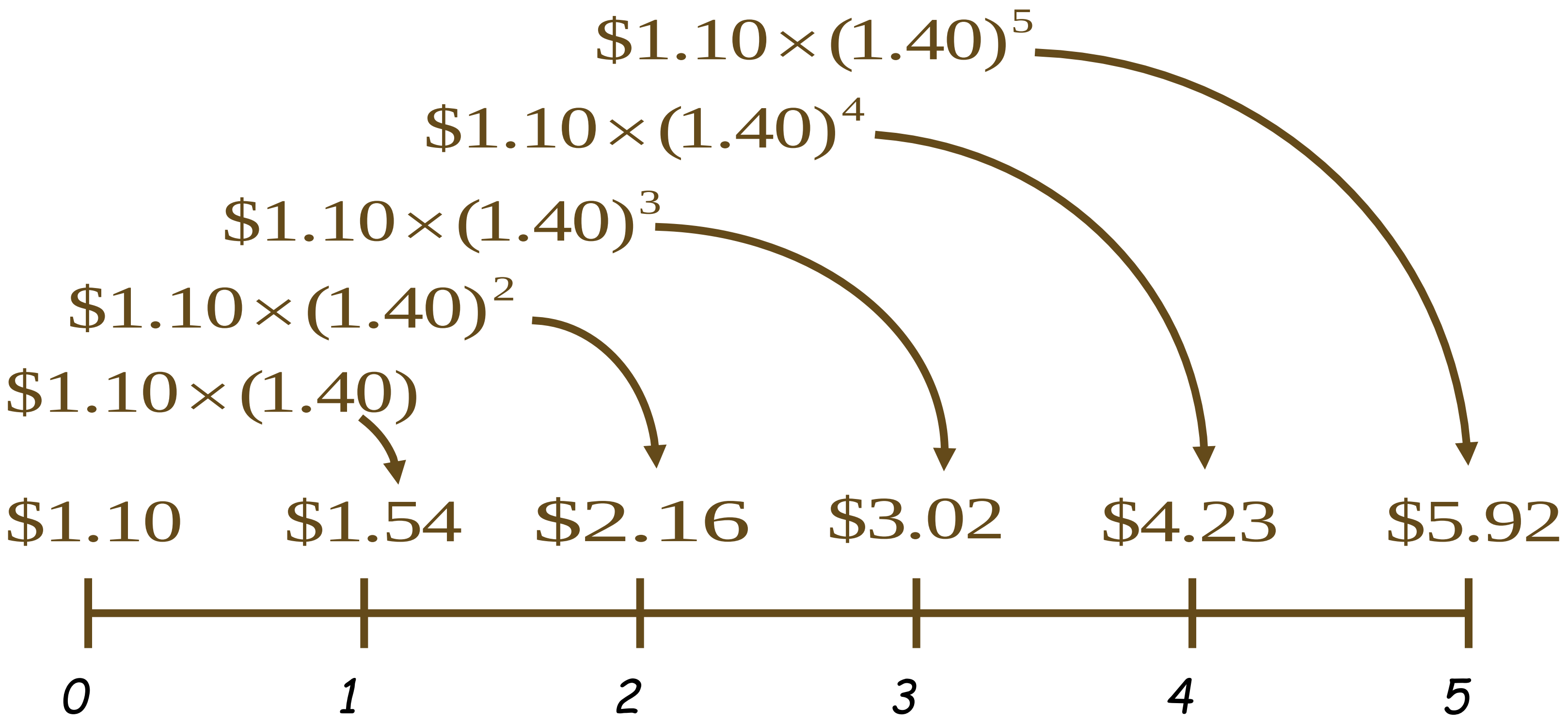
	Interest Rate			
Number of Periods	5%	10%	15%	20%
1	1.0500	1.1000	1.1500	1.2000
2	1.1025	1.2100	1.3225	1.4400
3	1.1576	1.3310	1.5209	1.7280
4	1.2155	1.4641	1.7490	2.0736
5	1.2763	1.6105	2.0114	2.4883

Future Value and Compounding

- How to explain?

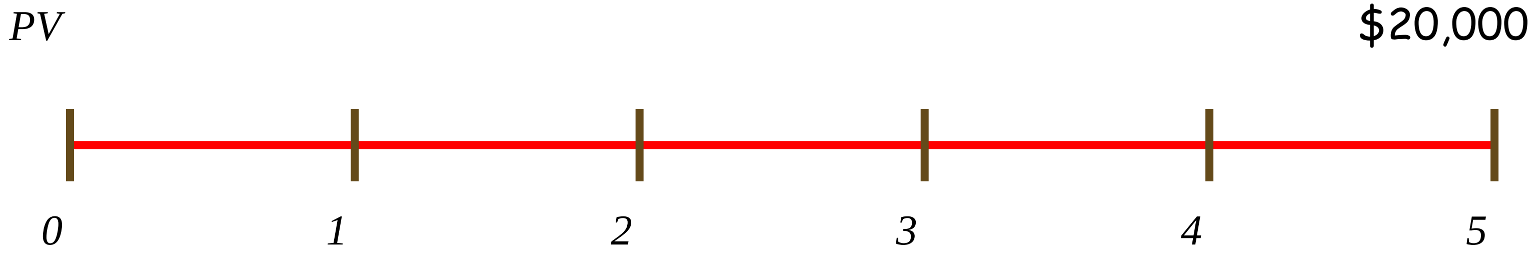


Future Value and Compounding



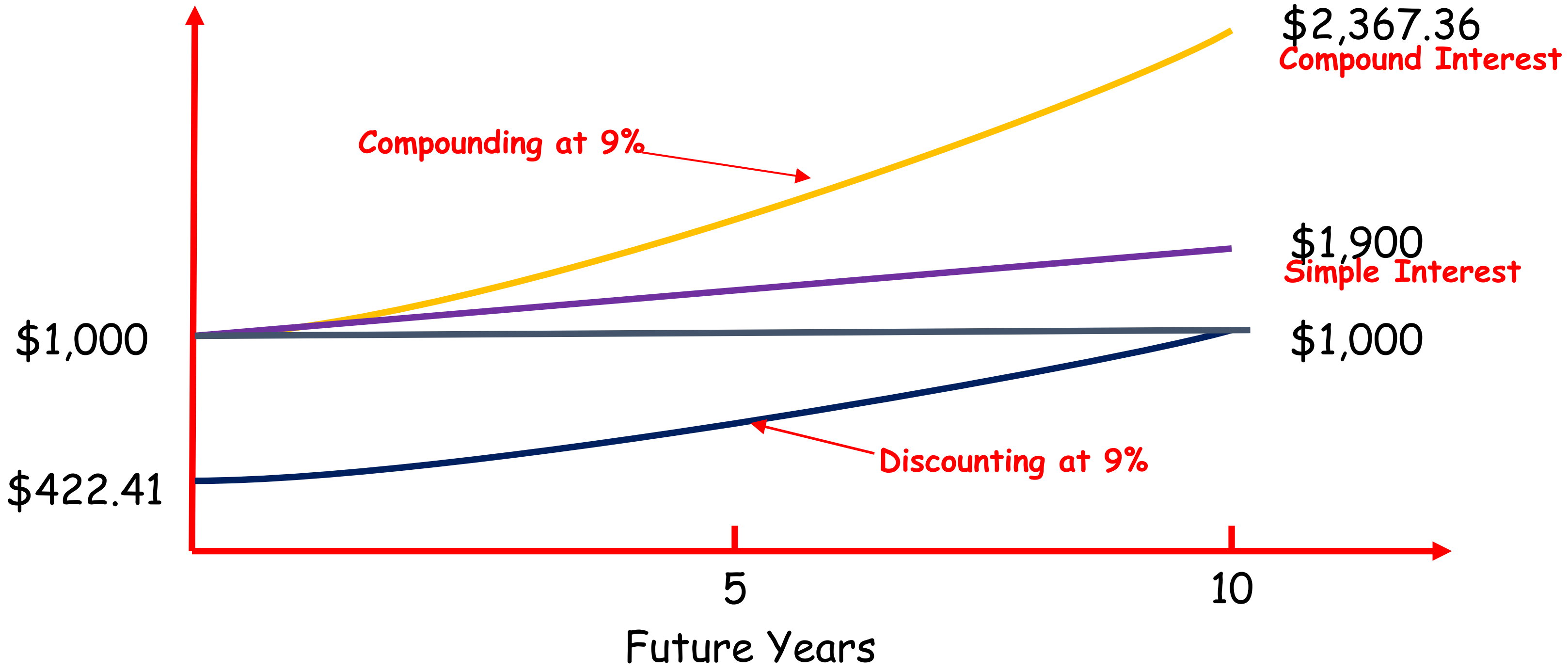
Present Value and Discounting

- 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%?



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

Compounding and Discounting



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=ln*(FV/PV)/*ln*(1+*r*)**

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

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%.

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

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

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

$$(1+r) = 10^{1/12}$$

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

Rule of Thumb

- $FV=PV(1+r)^t$
- $FV=2PV$

  $\Rightarrow 2PV=PV(1+r)^t$

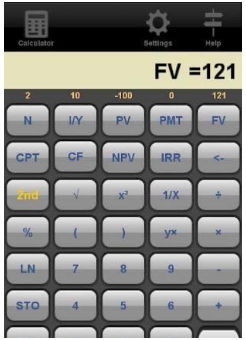
  $\Rightarrow t=\ln 2/\ln(1+r)$

r	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
$1+r$	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09
$\ln(1+r)$	0.010	0.020	0.030	0.039	0.049	0.058	0.068	0.077	0.086
$Ln(2)=0.69314$	69.661	35.003	23.450	17.673	14.207	11.896	10.245	9.006	8.043

$$FV = PV * 2^{\frac{R*T}{72}}$$

Calculator Keys

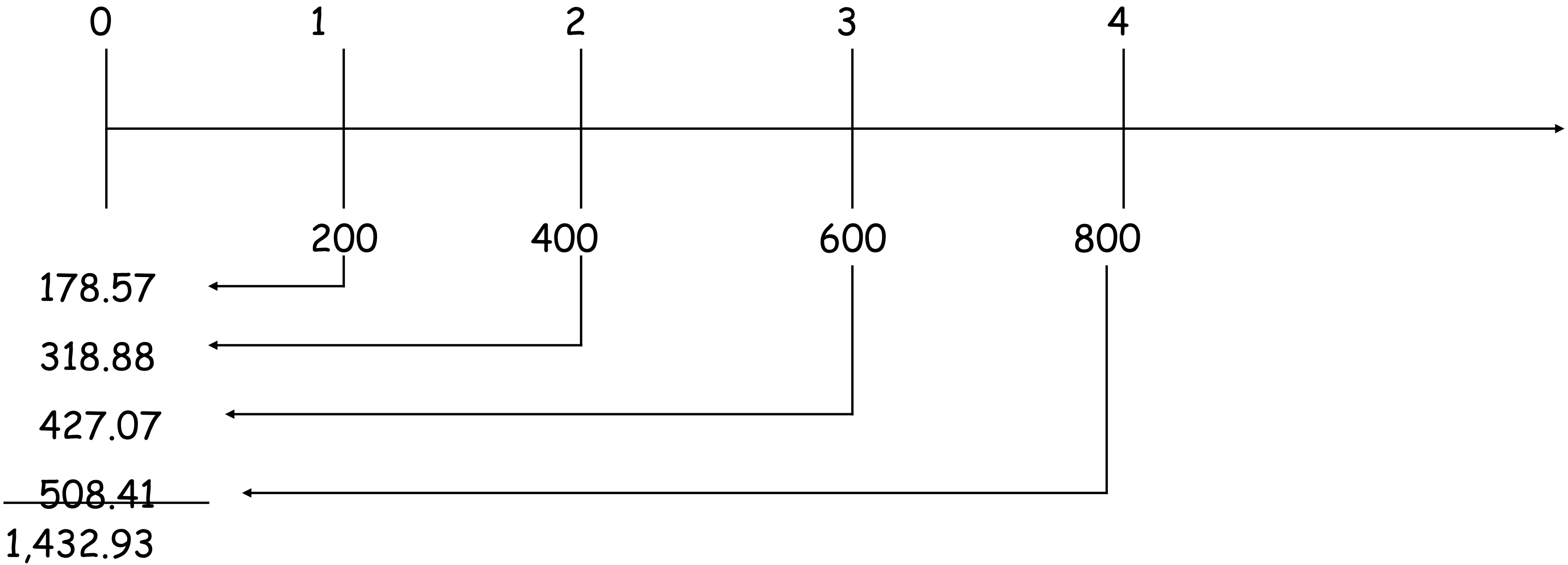
- Texas Instruments BA-II Plus
  - *FV* = future value
  - *PV* = present value
  - *I/Y* = periodic interest rate
    - *P/Y* must equal 1 for the *I/Y* to be the periodic rate
    - Interest is entered as a percent, not a decimal
  - N = number of periods
  - Remember to clear the registers (CLR TVM) after each problem
  - Other calculators are similar in format



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

Valuing "Lumpy" Cash Flows

- First, set your calculator to 1 payment per year.
- Then, use the cash flow menu:

CF0	0	CF3	600	I	12
CF1	200	F3	1	NPV	1,432.93
F1	1	CF4	800		
CF2	400	F4	1		
F2	1				

2.3 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

$$FV = \$50 \times \left(1 + \frac{.12}{2}\right)^{2\times3} = \$50 \times (1.06)^6 = \$70.93$$

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?"

$$FV = \$50 \times (1 + \frac{.12}{2})^{2\times3} = \$50 \times (1.06)^6 = \$70.93$$

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

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

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

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

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

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%.

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

EAR on a Financial Calculator

Texas Instruments BAII Plus

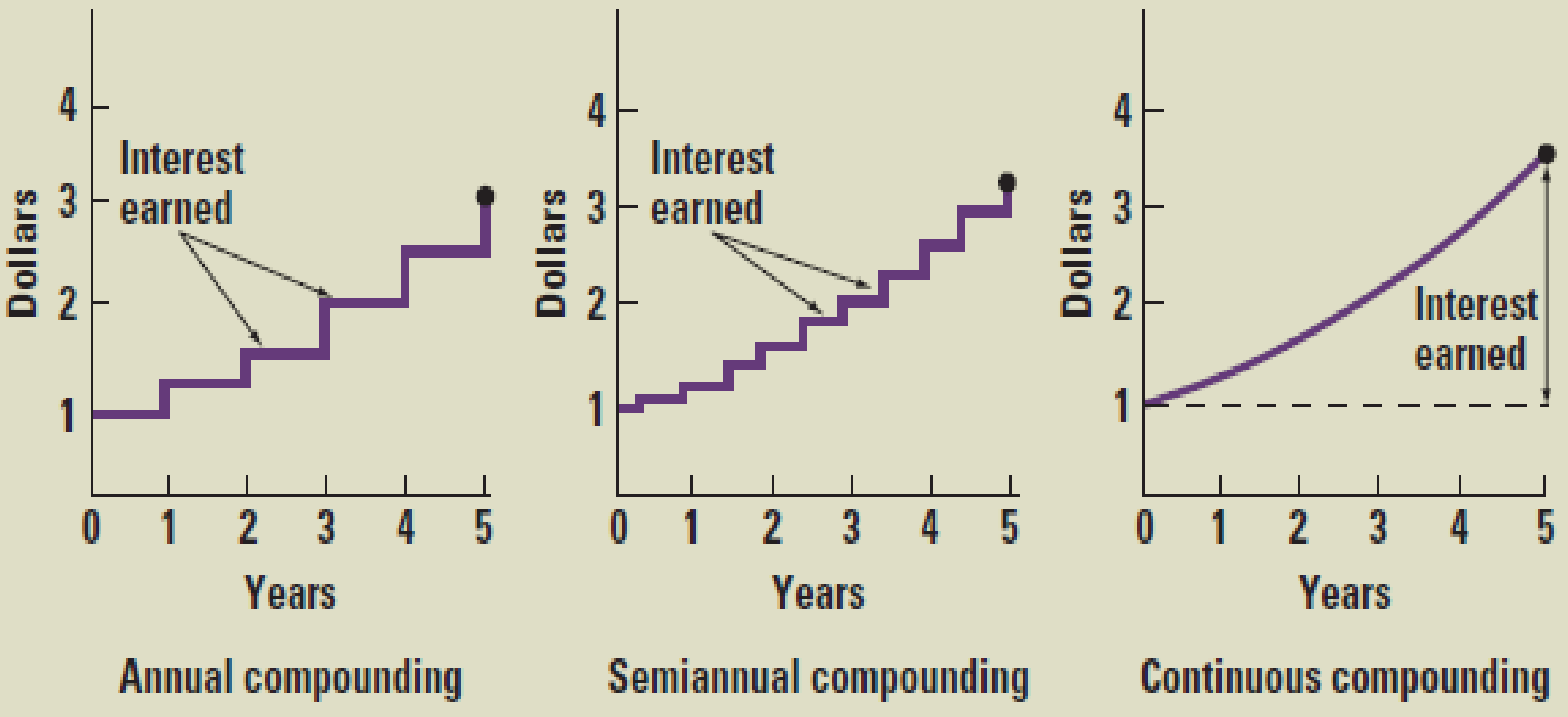
keys:	description:
[2nd] [ICONV]	Opens interest rate conversion menu
[↑] [C/Y=] 12 [ENTER]	Sets 12 payments per year
[↓][NOM=] 18 [ENTER]	Sets 18 APR.
[↓] [EFF=] [CPT]	19.56

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. ex is a key on your calculator.

Example: JD Finance

Annual, Semi-annual, and Continuous Compounding



2.4 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

- 国电电力发展股份有限公司公告称，定于12月18日发行2013年度第一期中期票据。值得注意的是，本期中票为我国债券市场首只永续中票。
- 本期中票发行金额10亿元，在发行人依照发行条款的约定赎回之前长期存续，并在发行人依据发行条款的约定赎回时到期。在本期中期票据第5个和其后每个付息日，发行人有权按面值加应付利息（包括所有递延支付的利息）赎回本期中期票据。

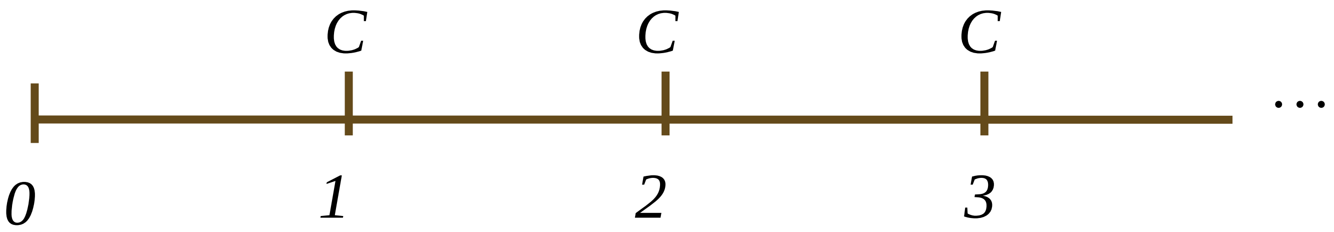
中国国电
CHINA GUODIAN
国电电力发展股份有限公司
GD POWER DEVELOPMENT CO.,LTD.

Perpetuity

- 本期中期票据采用固定利率计息；前5个计息年度内保持不变；自第6个计息年度起，每5年重置一次票面利率；前5个计息年度的票面利率为初始基准利率加上初始利差；
- 其中初始基准利率为簿记建档日前5个工作日的中债银行间固定利率国债收益率曲线中，待偿期为5年的国债收益率算术平均值；
- 初始利差为票面利率与初始基准利率之间的差值；如果发行人不行使赎回权，则从第6个计息年度开始票面利率调整为当期基准利率加上初始利差再加上300个基点，在第6个计息年度至第10个计息年度内保持不变。
- 即票面利率公式为：当期票面利率=当期基准利率+初始利差+300BPs。

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

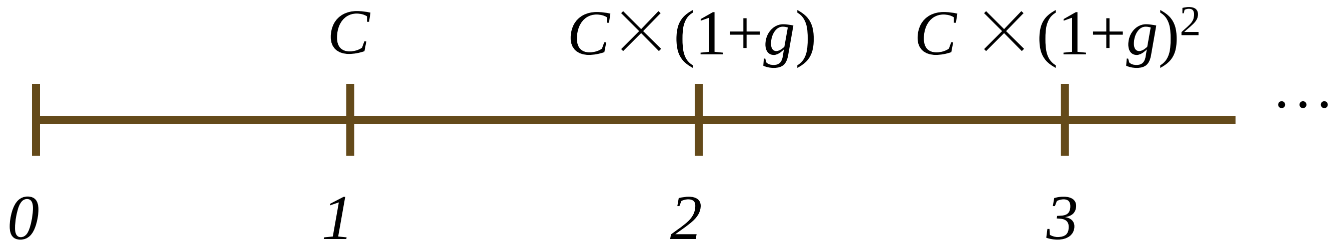
- What is the value of a British Consol that promises to pay £15 every year forever?
- The interest rate is 10-percent.

0	1	2	3	…
	£15	£15	£15	

$$PV = \frac{£15}{.10} = £150$$

Growing Perpetuity

- A growing stream of cash flows that lasts forever

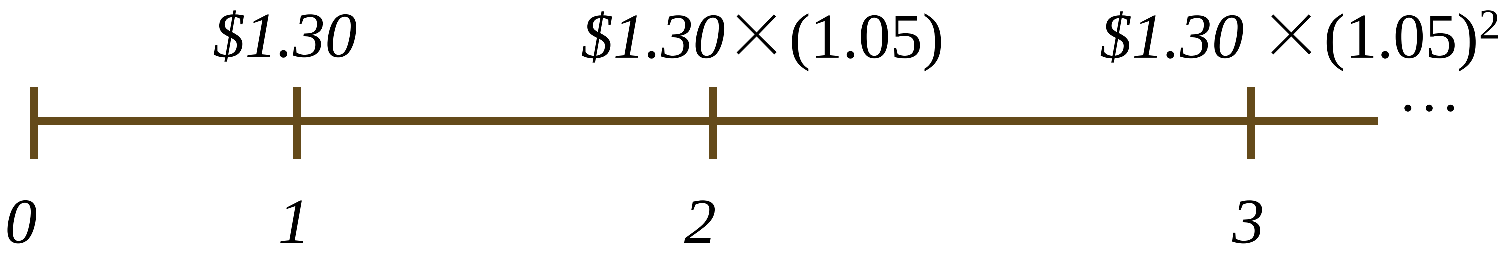


$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \frac{C \times (1+g)^2}{(1+r)^3} + \cdots$$

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

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?



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

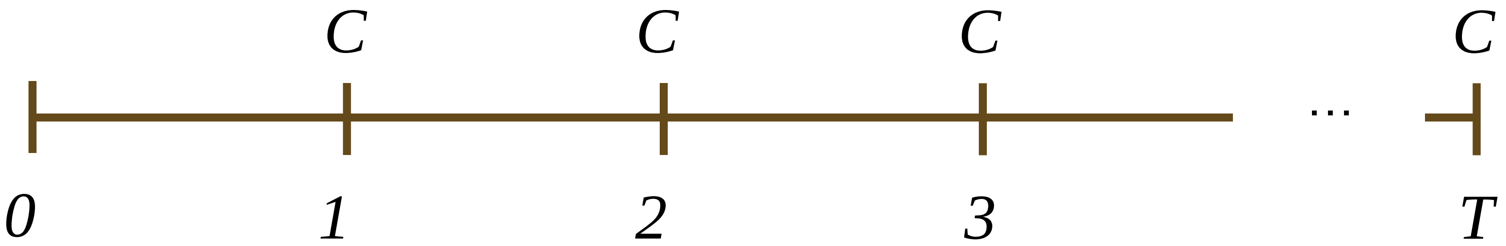
Annuity

- A constant stream of cash flows with a fixed maturity

	Now						
Date (or end of year)	0	1	2	3	T	(T + 1)	(T + 2)
Consol 1		C	C	C . . .	C	C	C . . .
Consol 2						C	C . . .
Annuity		C	C	C . . .	C		

Annuity

- A constant stream of cash flows with a fixed maturity

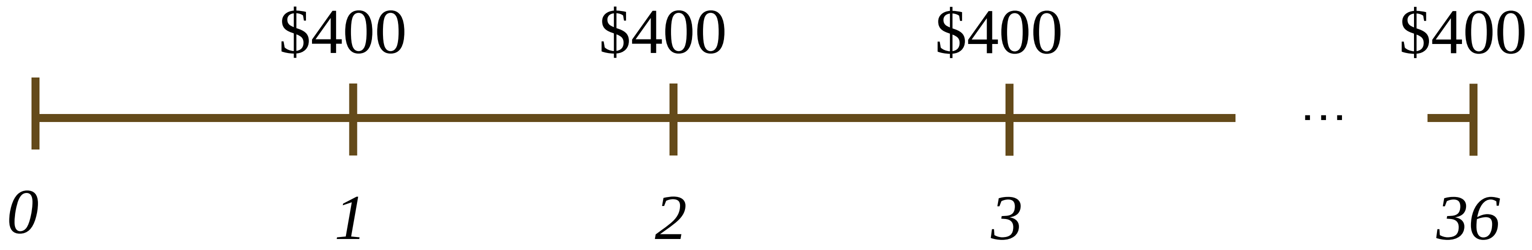


$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots \frac{C}{(1+r)^T}$$

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

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?

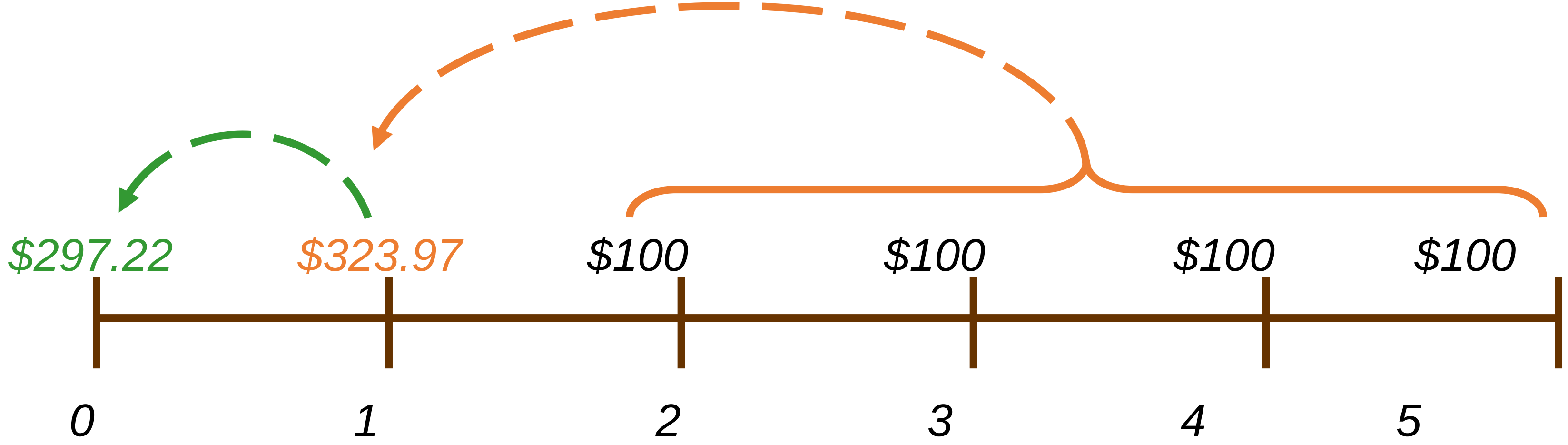


$$PV = \frac{\$400}{.07/12}\left[1-\frac{1}{(1+.07/12)^{36}}\right] = \$12,954.59$$

Annuity: Example

- 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%?

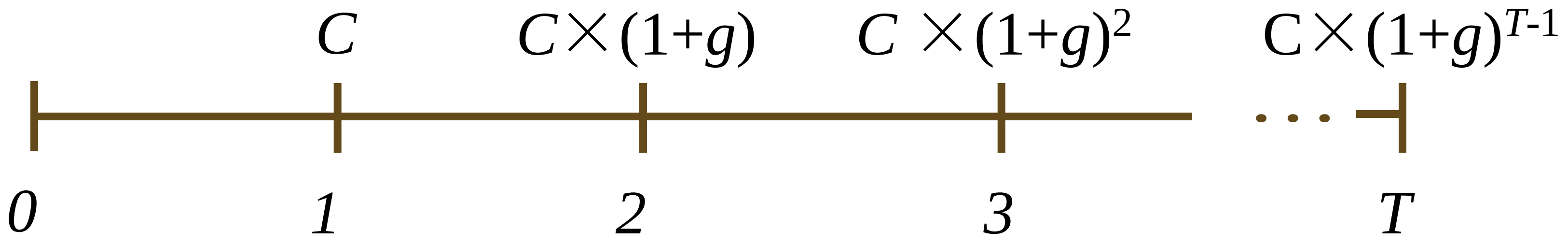
$$PV_1 = \sum_{t=1}^{4} \frac{\$100}{(1.09)^t} = \frac{\$100}{(1.09)^1} + \frac{\$100}{(1.09)^2} + \frac{\$100}{(1.09)^3} + \frac{\$100}{(1.09)^4} = \$323.97$$



$$PV_0 = \frac{\$327.97}{1.09} = \$297.22$$

Growing Annuity

- A growing stream of cash flows with a fixed maturity

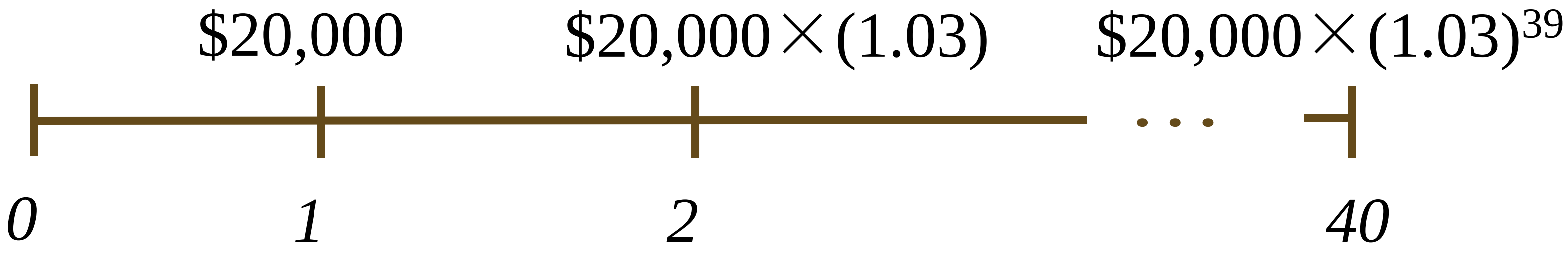


$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \cdots + \frac{C \times (1+g)^{T-1}}{(1+r)^T}$$

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

Growing Annuity: Example

- A defined-benefit retirement plan offers to pay $20,000 per year for 40 years and increase the annual payment by 3% each year. What is the present value at retirement if the discount rate is 10%?



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

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%?

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

0	1	2	3	4	5
	\$8,500	\$9,095	\$9,731.65	\$10,412.87	\$11,141.77

\$34,706.26

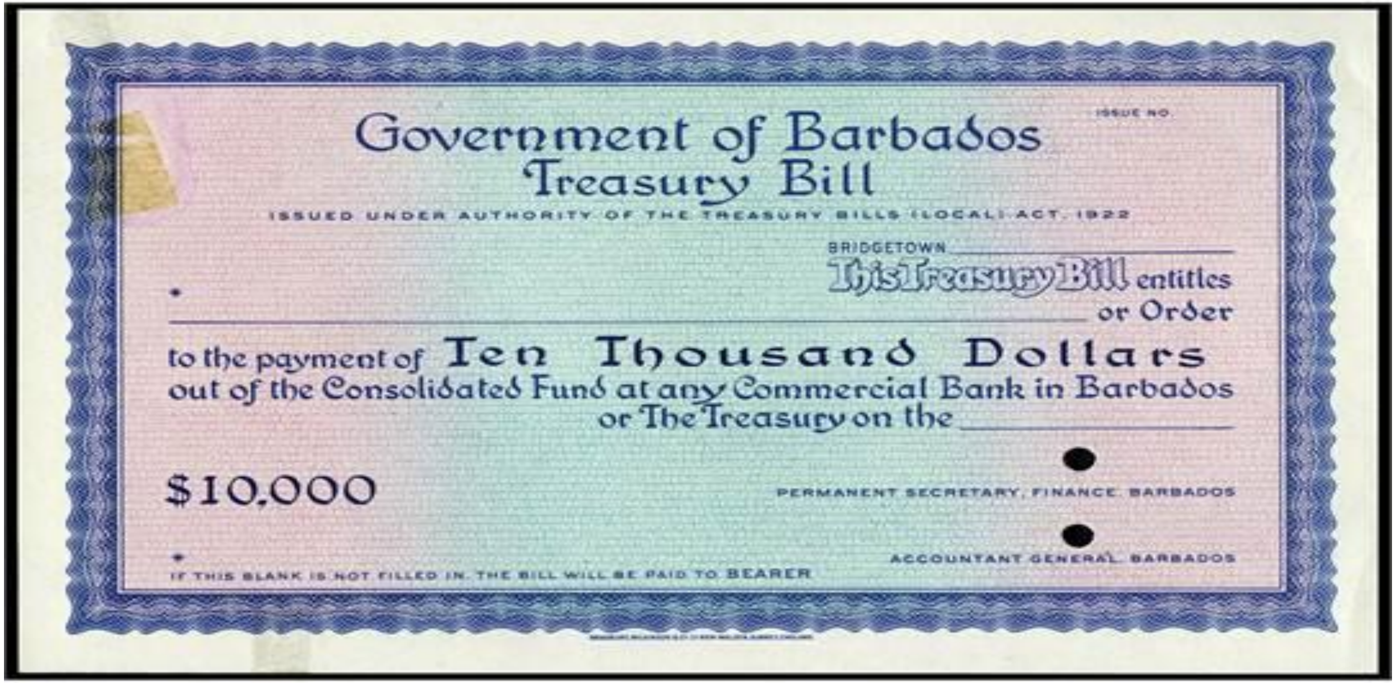
2.5 Loan Amortization

- Pure Discount Loans are the simplest form of loan. The borrower receives money today and repays a single lump sum (principal and interest) at a future time.
- Interest-Only Loans require an interest payment each period, with full principal due at maturity.
- Amortized Loans require repayment of principal over time, in addition to required interest.

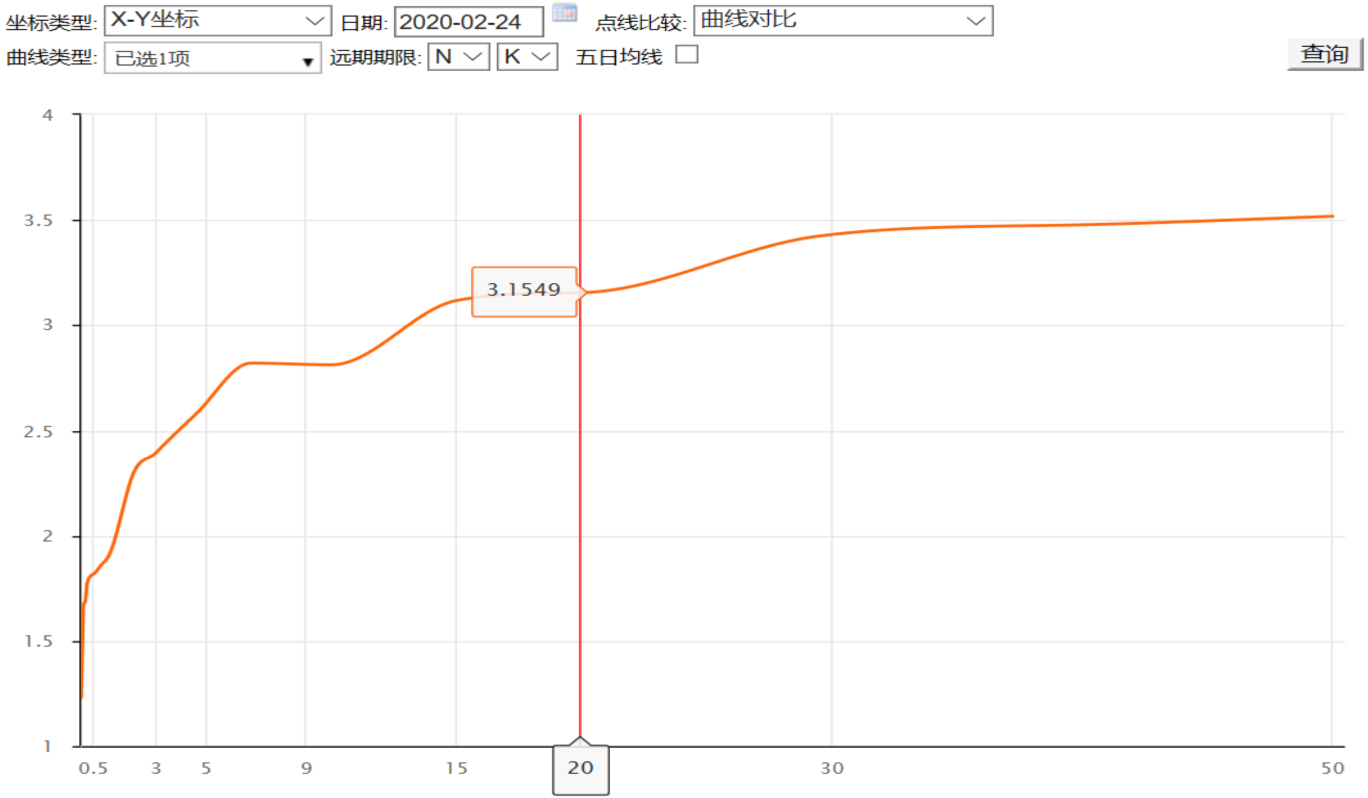
Pure Discount Loans

- Treasury bills are excellent examples of pure discount loans. The principal amount is repaid at some future date, without any periodic interest payments.
- If a T-bill promises to repay $10,000 in 12 months and the market interest rate is 7 percent, how much will the bill sell for in the market?
  - $PV = 10{,}000 / 1.07 = 9{,}345.79$

US Treasury Bill



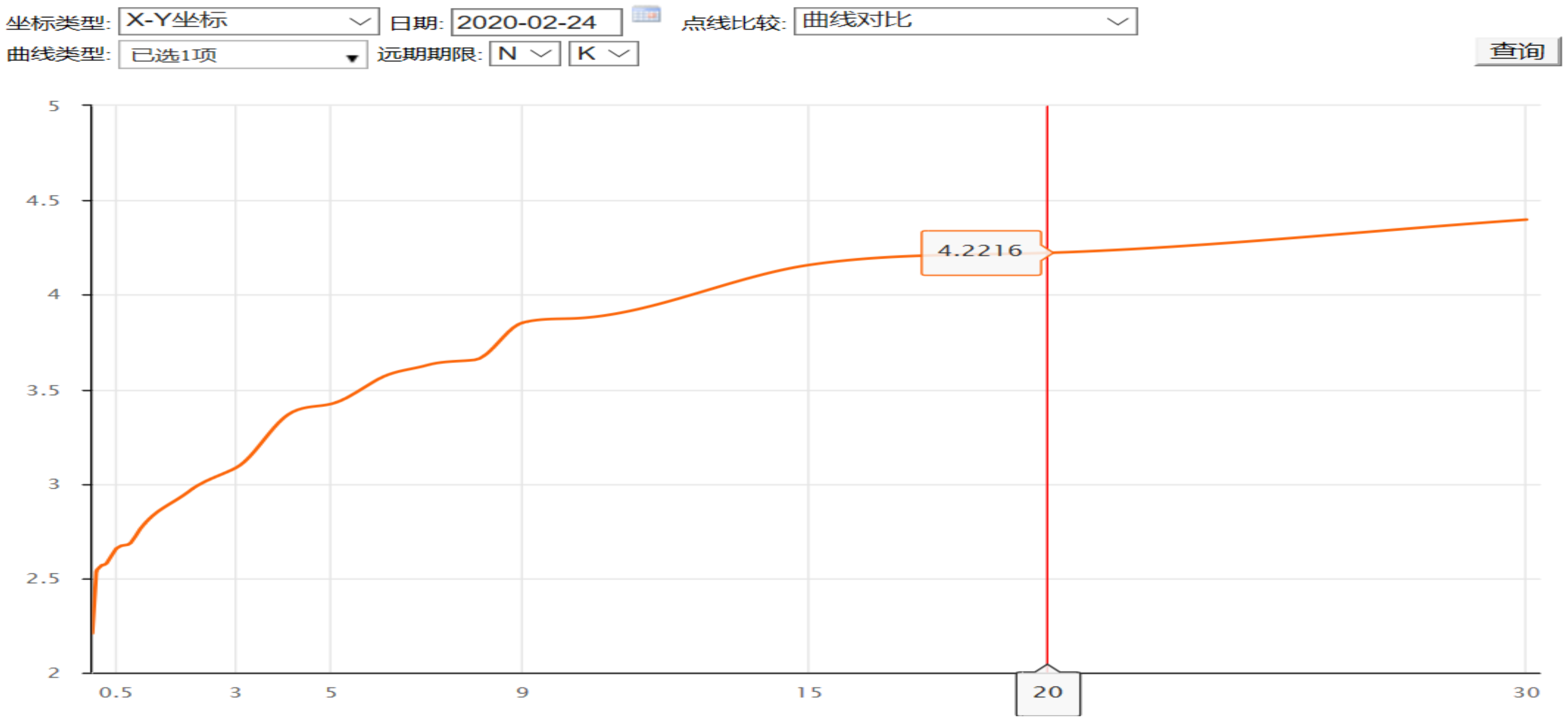
Chinese Government Bond



标准期限(年)	收益率(%)
0	1.2291
0.08	1.6626
0.17	1.6877
0.25	1.7795
0.5	1.8174
0.75	1.8535
1	1.8853
2	2.2708
3	2.3948
5	2.6311
7	2.8199
10	2.812
15	3.1175
20	3.1549
30	3.4309
40	3.4772
50	3.5177

http://yield.chinabond.com.cn/cbweb-mn/yield_main?locale=zh_CN

Chinese Urban Construction Bond-AAA



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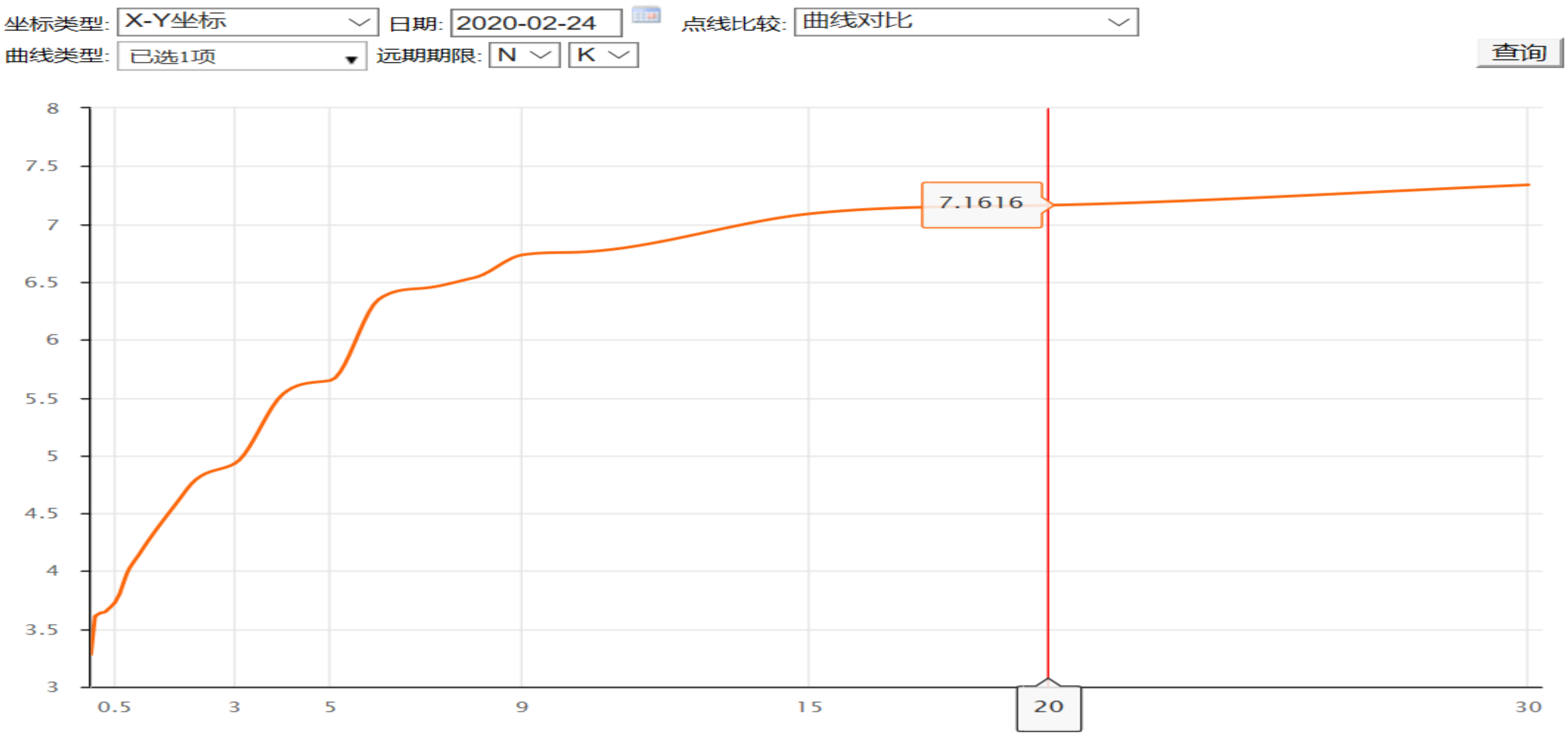
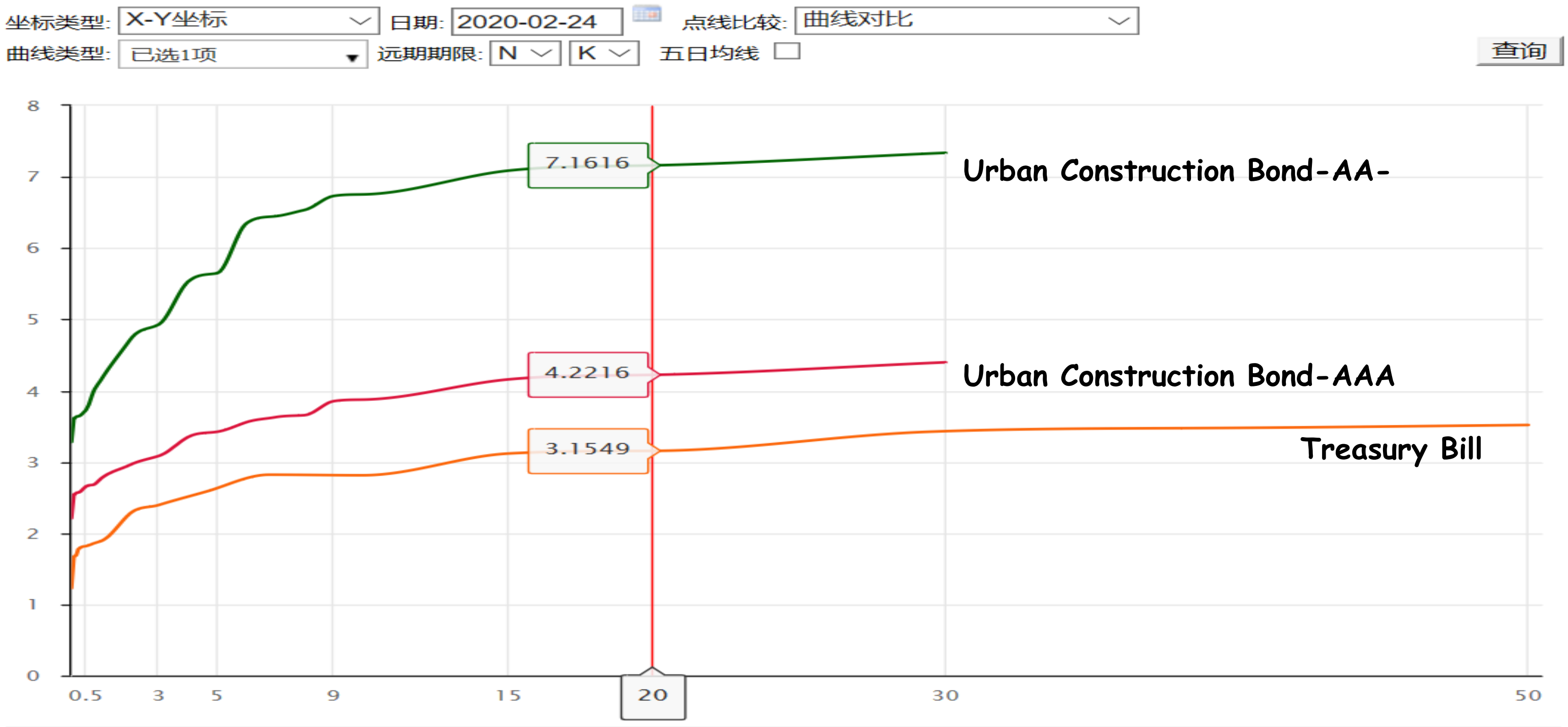
Chinese Urban Construction Bond-AA-



http://yield.chinabond.com.cn/cbweb-mn/yield_main?locale=zh_CN

Chinese Treasury Bill & Urban Construction



http://yield.chinabond.com.cn/cbweb-mn/yield_main?locale=zh_CN

Interest-Only Loan

- Consider a 5-year, interest-only loan with a 7% interest rate. The principal amount is $10,000. Interest is paid annually.
  - What would the stream of cash flows be?
    - Years 1 – 4: Interest payments of .07(10,000) = 700
    - Year 5: Interest + principal = 10,700
- This cash flow stream is similar to the cash flows on corporate bonds, and we will talk about them in greater detail later.

Amortized Loan with Fixed Principal Payment

- Consider a $50,000, 10 year loan at 8% interest. The loan agreement requires the firm to pay $5,000 in principal each year plus interest for that year.
- Click on the Excel icon to see the amortization table

Amortized Loan with Fixed Principal Payment

Year	Beginning Balance	Interest Payment	Principal Payment	Total Payment	Ending Balance
1	50000	4000	5000	9000	45000
2	45000	3600	5000	8600	40000
3	40000	3200	5000	8200	35000
4	35000	2800	5000	7800	30000
5	30000	2400	5000	7400	25000
6	25000	2000	5000	7000	20000
7	20000	1600	5000	6600	15000
8	15000	1200	5000	6200	10000
9	10000	800	5000	5800	5000
10	5000	400	5000	5400	0

Amortized Loan with Fixed Payment

- Each payment covers the interest expense plus reduces principal
- Consider a 5 year loan with annual payments. The interest rate is 9% ,and the principal amount is $5,000.
  - What is the annual payment?

Equal Principal or Equal Principal and Interest

Year	Beginning Balance	Total Payment	Interest Paid	Principal Paid	Ending Balance
1	5000	1450	450	1000	4000
2	4000	1360	360	1000	3000
3	3000	1270	270	1000	2000
4	2000	1180	280	1000	1000
5	1000	1090	90	1000	0
Totals		6350	1350	5000	

Equal Principal vs Equal Principal and Interest

Year	Beginning Balance	Total Payment	Interest Paid	Principal Paid	Ending Balance
1	5000	1285.46	450.00	835.46	4164.54
2	4164.54	1285.46	374.81	910.65	3253.88
3	3253.88	1285.46	292.85	992.61	2261.27
4	2261.27	1285.46	203.51	1081.95	1179.32
5	1179.32	1285.46	106.14	1179.32	0.00
Totals		6427.30	1427.31	5000.00	

The total interest is greater for the equal total payment case: $1,427.31 versus $1,350.

FV=5000*1.09^5=7693.12 Remember: Time value

2.6 What Is a Firm Worth?

- Conceptually, a firm should be worth the present value of the firm's cash flows.
- The tricky part is determining the size, timing, and risk of those cash flows.

Case Analysis

- 沈阳市正在考虑对学生零首付买房：2016.03.01沈阳市政府下发《沈阳市人民政府办公厅关于促进房地产市场健康发展的实施意见(试行)》,该意见提及,支持高校、中等职业学校在校生、新毕业生购房,并首付比例可以零首付。沈阳的这一房地产新政,因"大学生可零首付买房"广泛传播并引发热议。不过好景不长,公布仅半天,当晚,沈阳官方发布消息称,"零首付"暂不具备出台条件。

- 假设深圳市目前针对南方科大毕业的学生优惠零首付买房，你是买还是租呢?

Case Analysis

P/M2	7000	7000	7000	7000	7000
M2	100	100	100	100	100
PV	700000	700000	700000	700000	700000
r	0.03	0.035	0.04	0.049	0.06
Month	360	360	360	360	360
Payment/M	2,951.2	3,143.3	3,341.9	3,715.0	4,196.8

Assignment 2

- Review chapter 4 and preview chapter 8
- Exercises: Chapter 4 1-17
- Deadline:2025.03.31

Thanks!!!

SUSTech

2024.02.25

Appendix Outline

- Making Consumption Choices over Time
- Making Investment Choices
- Illustrating the Investment Decision

Making Consumption Choices Over Time

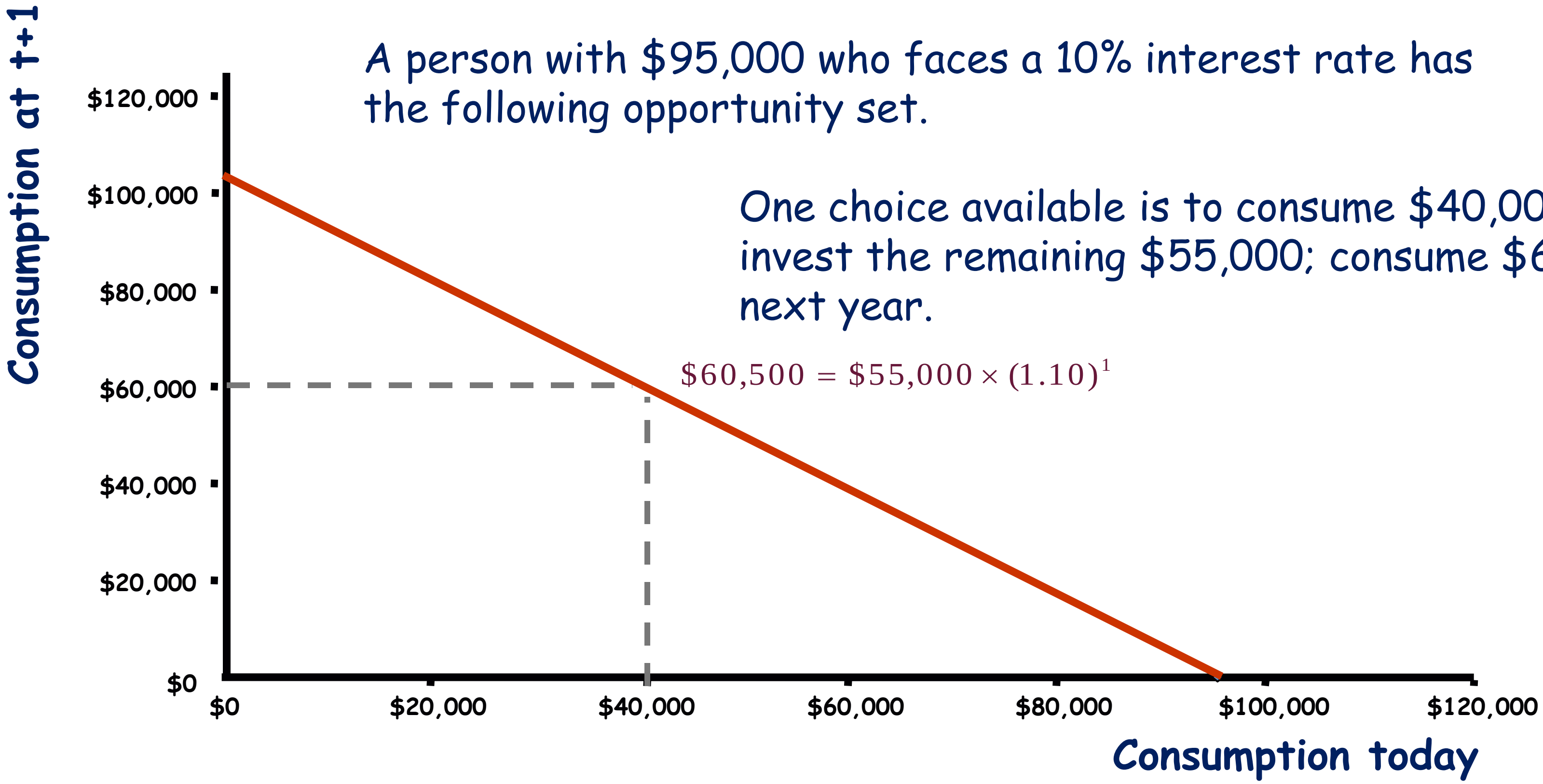
- An individual can alter his consumption across time periods through borrowing and lending.
- We can illustrate this by graphing consumption today versus consumption in the future.
- This graph will show intertemporal consumption opportunities.

Intertemporal Consumption Opportunity Set

A person with \$95,000 who faces a 10% interest rate has the following opportunity set.

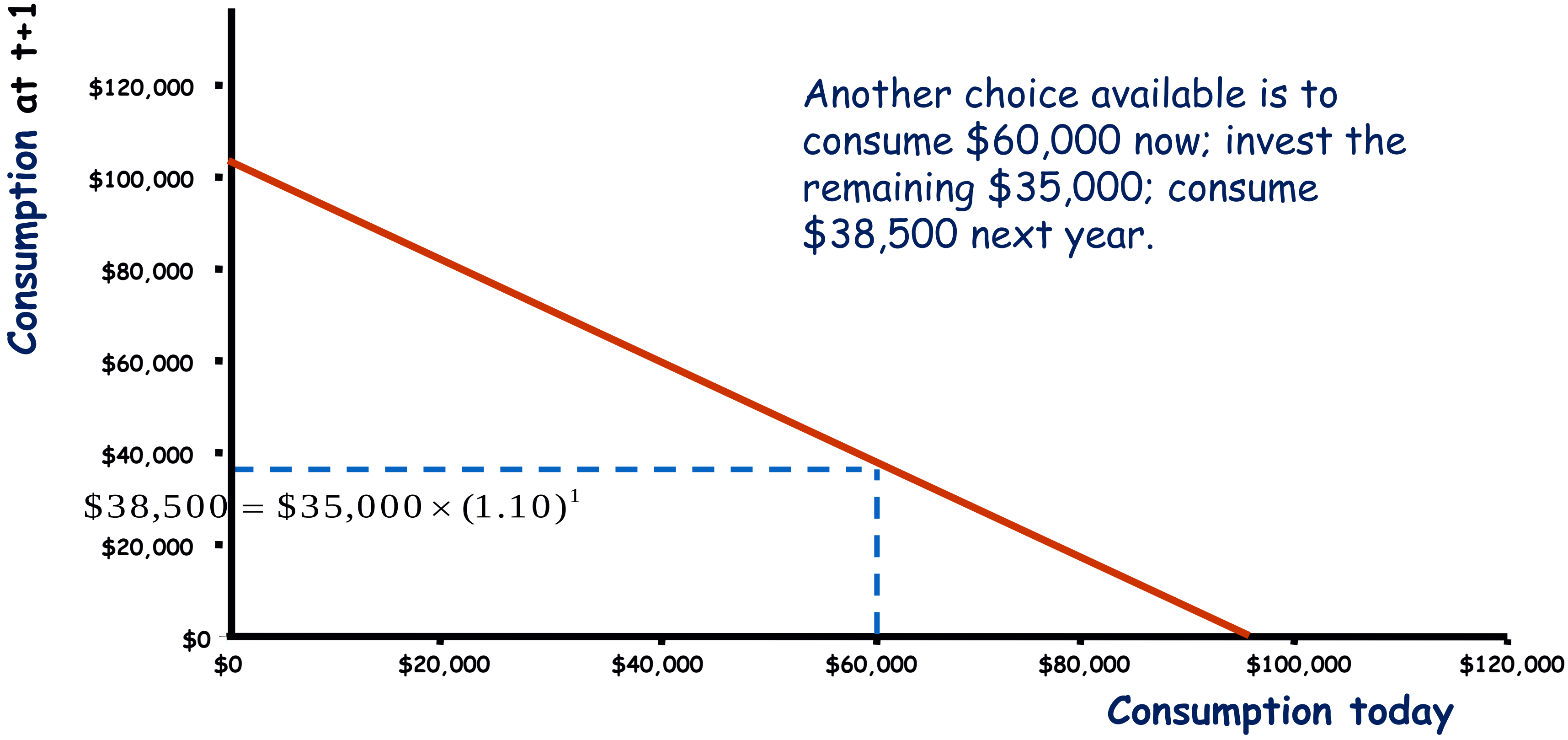
One choice available is to consume \$40,000 now; invest the remaining \$55,000; consume \$60,500 next year.

$$\$60{,}500 = \$55{,}000 \times (1.10)^1$$



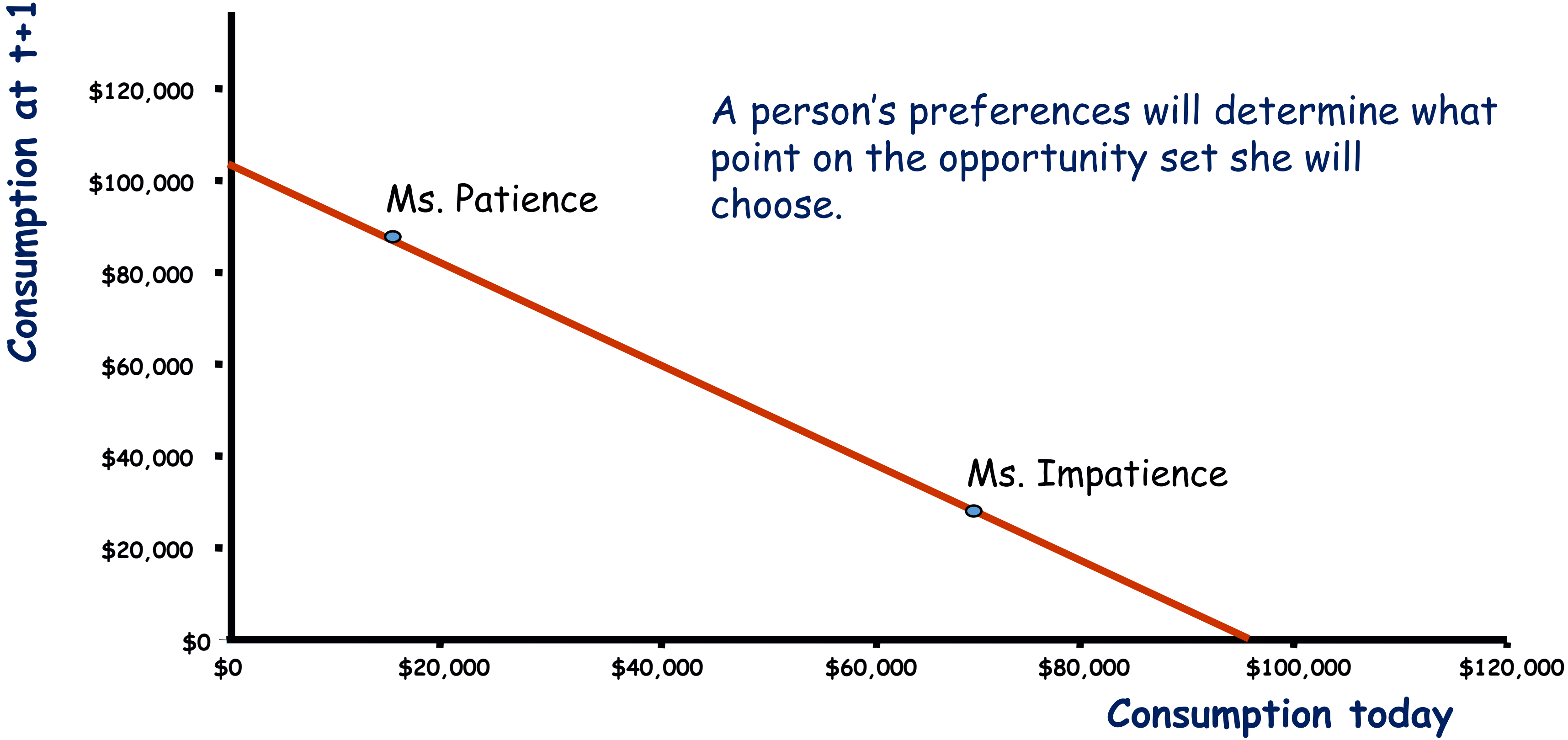
Intertemporal Consumption Opportunity Set

Another choice available is to consume $60,000 now; invest the remaining $35,000; consume $38,500 next year.



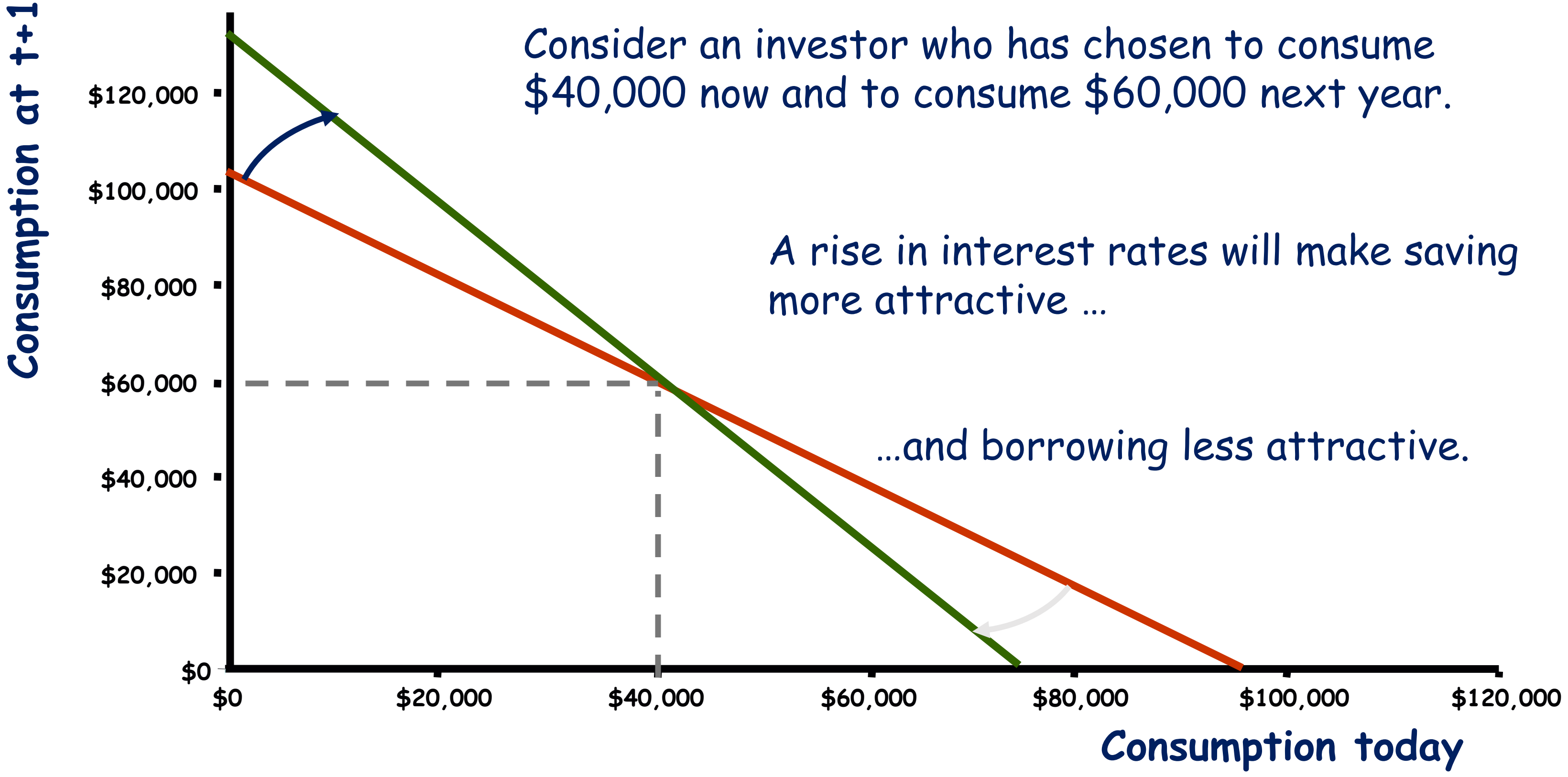
$$\$38,500 = \$35,000 \times (1.10)^1$$

Taking Advantage of Our Opportunities



A person's preferences will determine what point on the opportunity set she will choose.

Changing Our Opportunities



Consider an investor who has chosen to consume $40,000 now and to consume $60,000 next year.

A rise in interest rates will make saving more attractive …

…and borrowing less attractive.

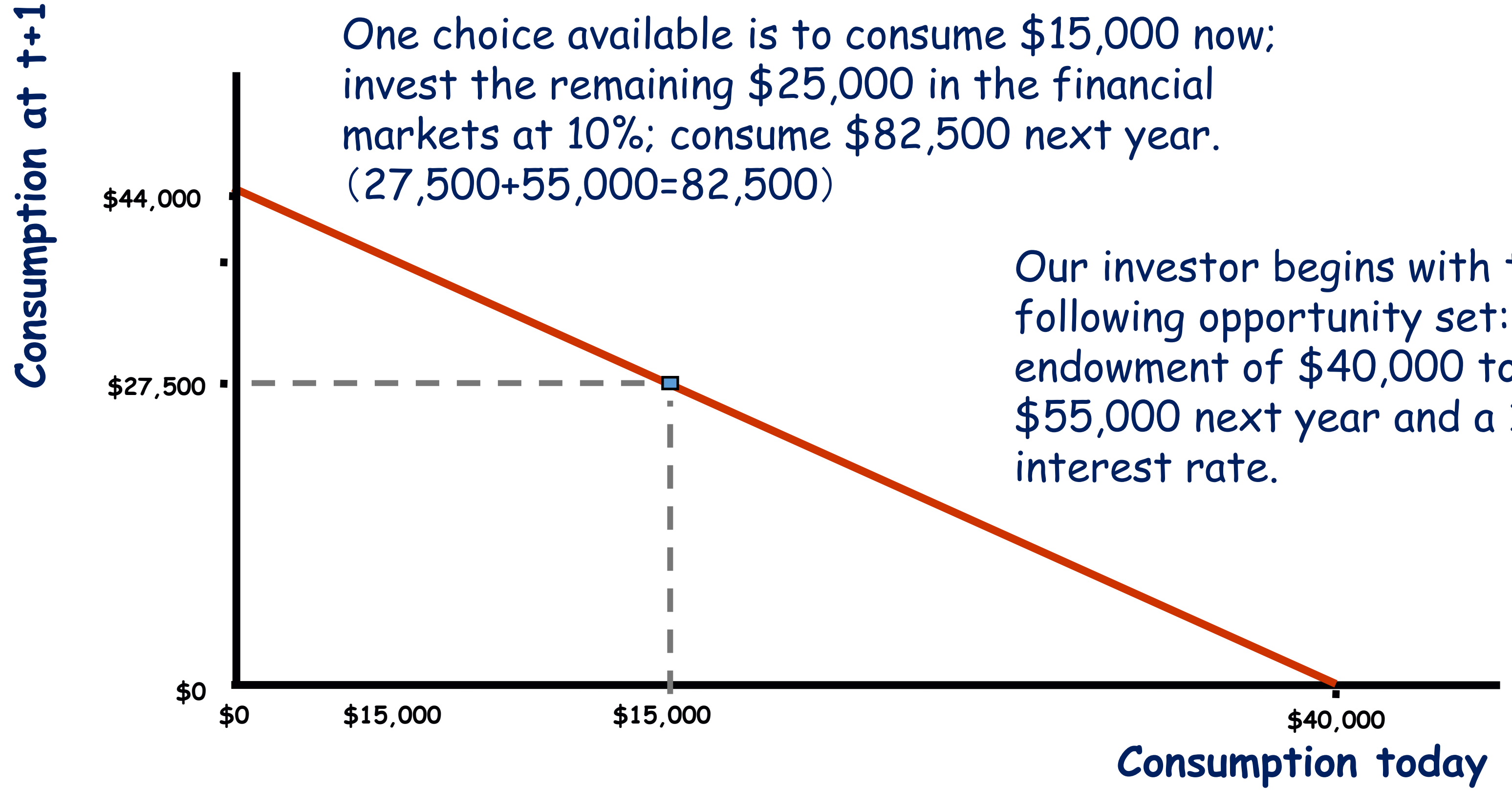
Illustrating the Investment Decision

- Consider an investor who has an initial endowment of income of \$40,000 this year and \$55,000 next year.
- Suppose that she faces a 10-percent interest rate and is offered the following investment.

Illustrating the Investment Decision

One choice available is to consume $15,000 now; invest the remaining $25,000 in the financial markets at 10%; consume $82,500 next year. (27,500+55,000=82,500)

Our investor begins with the following opportunity set: endowment of $40,000 today, $55,000 next year and a 10% interest rate.

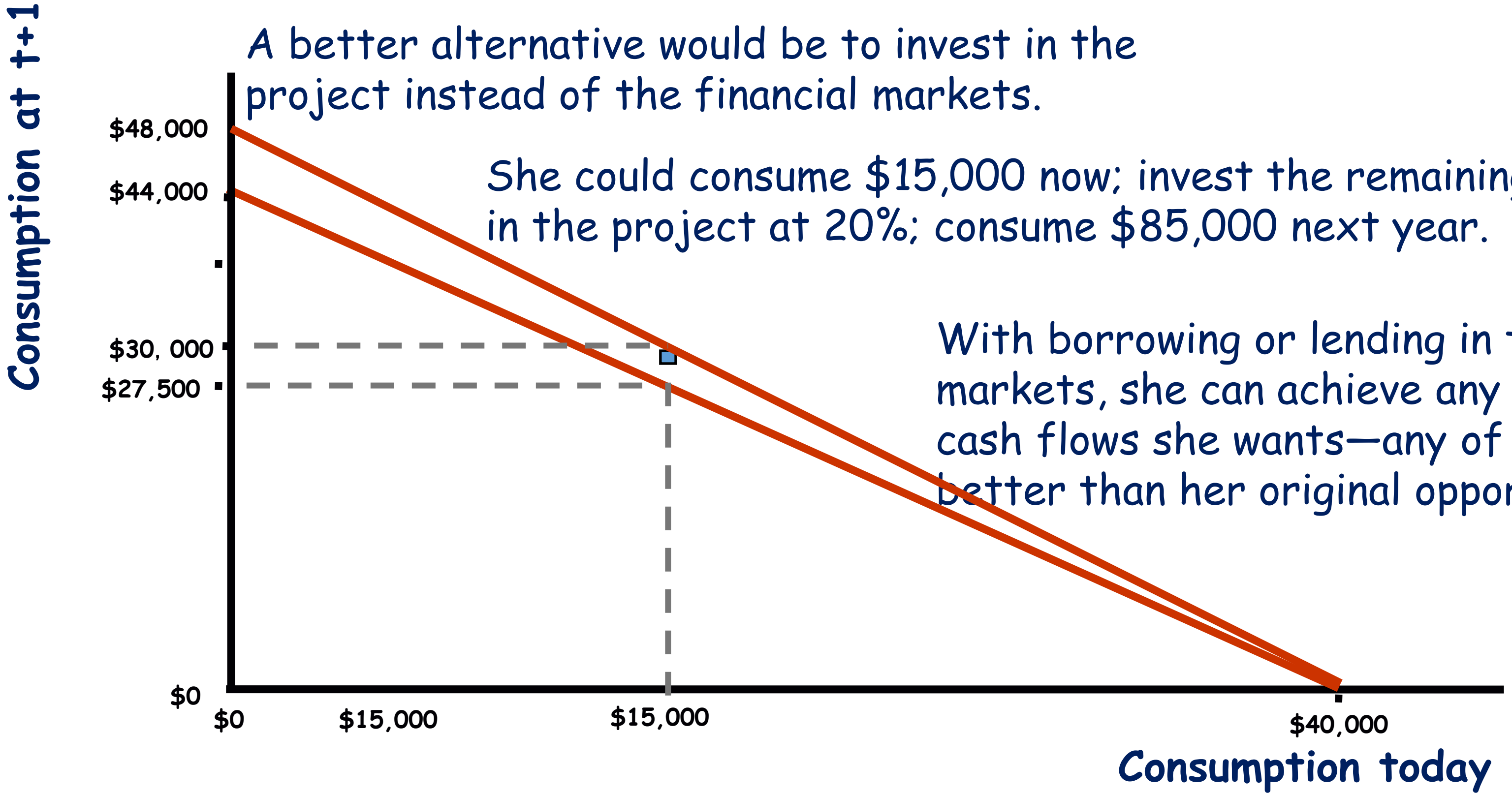


Illustrating the Investment Decision

A better alternative would be to invest in the project instead of the financial markets.

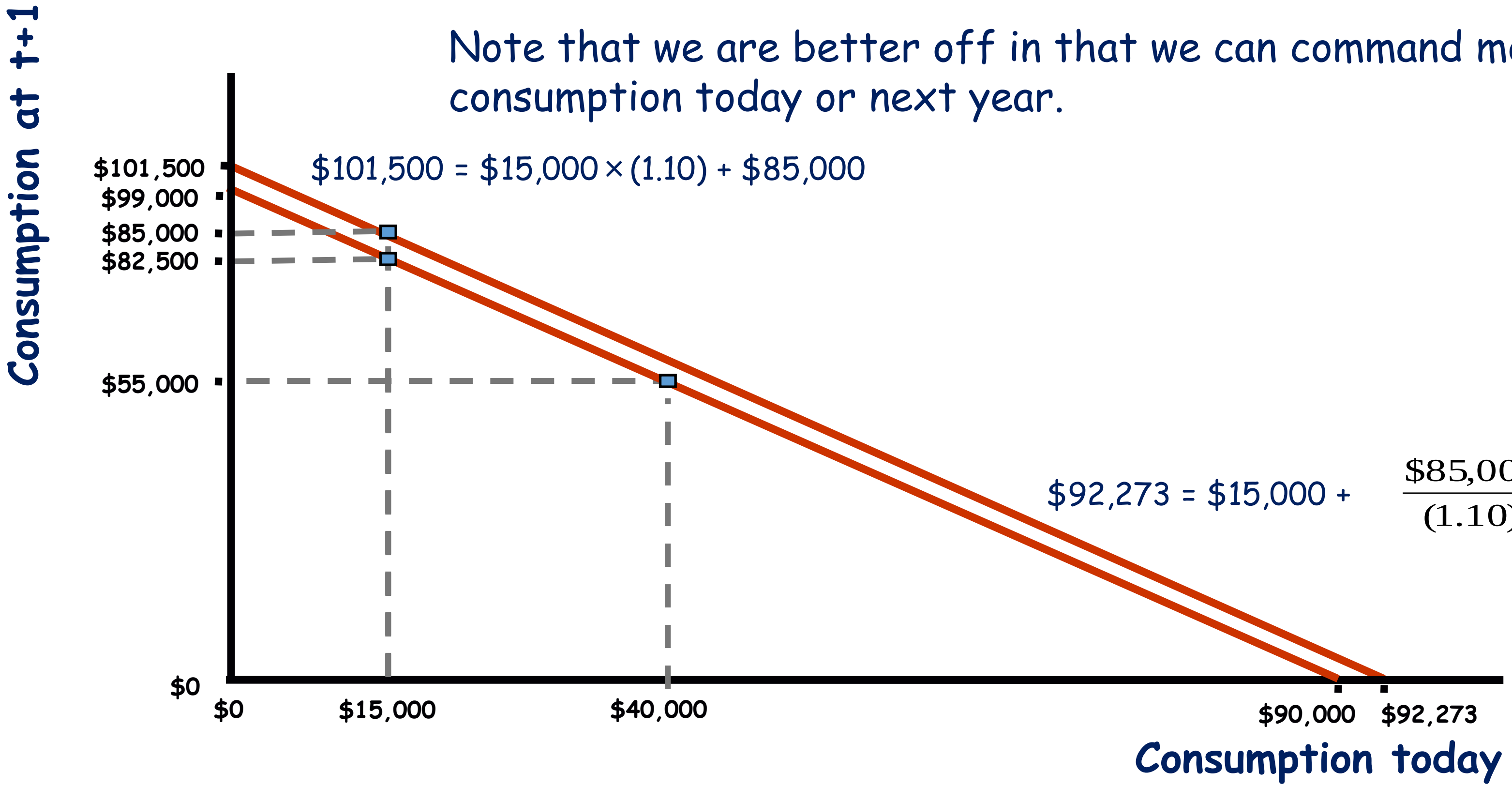
She could consume $15,000 now; invest the remaining $25,000 in the project at 20%; consume $85,000 next year.

With borrowing or lending in the financial markets, she can achieve any pattern of cash flows she wants—any of which is better than her original opportunities.



Illustrating the Investment Decision

Note that we are better off in that we can command more consumption today or next year.



$\$101{,}500 = \$15{,}000 \times (1.10) + \$85{,}000$

$$\$92{,}273 = \$15{,}000 + \frac{\$85{,}000}{(1.10)}$$

Net Present Value

- The value created by the investment opportunity increased our possible consumption.
- This opportunity, therefore, created value.
- The current value of the opportunity is the investment's NPV.

Quick Quiz

- What factors determine our consumption next year?
- How do investment opportunities create value?