CORPORATE FINANCE

F. MICHAUX

2020

GENERAL AGENDA

- Introduction to Financial Management

- Valuation and Discounted Cash Flow Method

Introduction to Financial Management

F. MICHAUX

2020

RESPONSIBILITIES OF THE FINANCIAL MANAGER

DECISIONS IN ANY BUSINESS

- WHAT LONG-TERM INVESTMENTS SHOULD YOU ACCEPT?
  - CAPITAL BUDGETING DECISION

- WHERE WILL YOU GET THE MONEY TO PAY FOR YOUR INVESTMENTS?
  - FINANCING DECISION

CAPITAL BUDGETING

- FINANCIAL MANAGER ATTEMPTS TO ENSURE THAT :

THE PRESENT VALUE

(OR THE VALUE TODAY)

OF THE CASH FLOWS

GENERATED BY THE ASSET

IS GREATER THAN THE COST OF THE ASSET

VALUE OF CASH FLOWS FROM PROJECT AFFECTED BY:

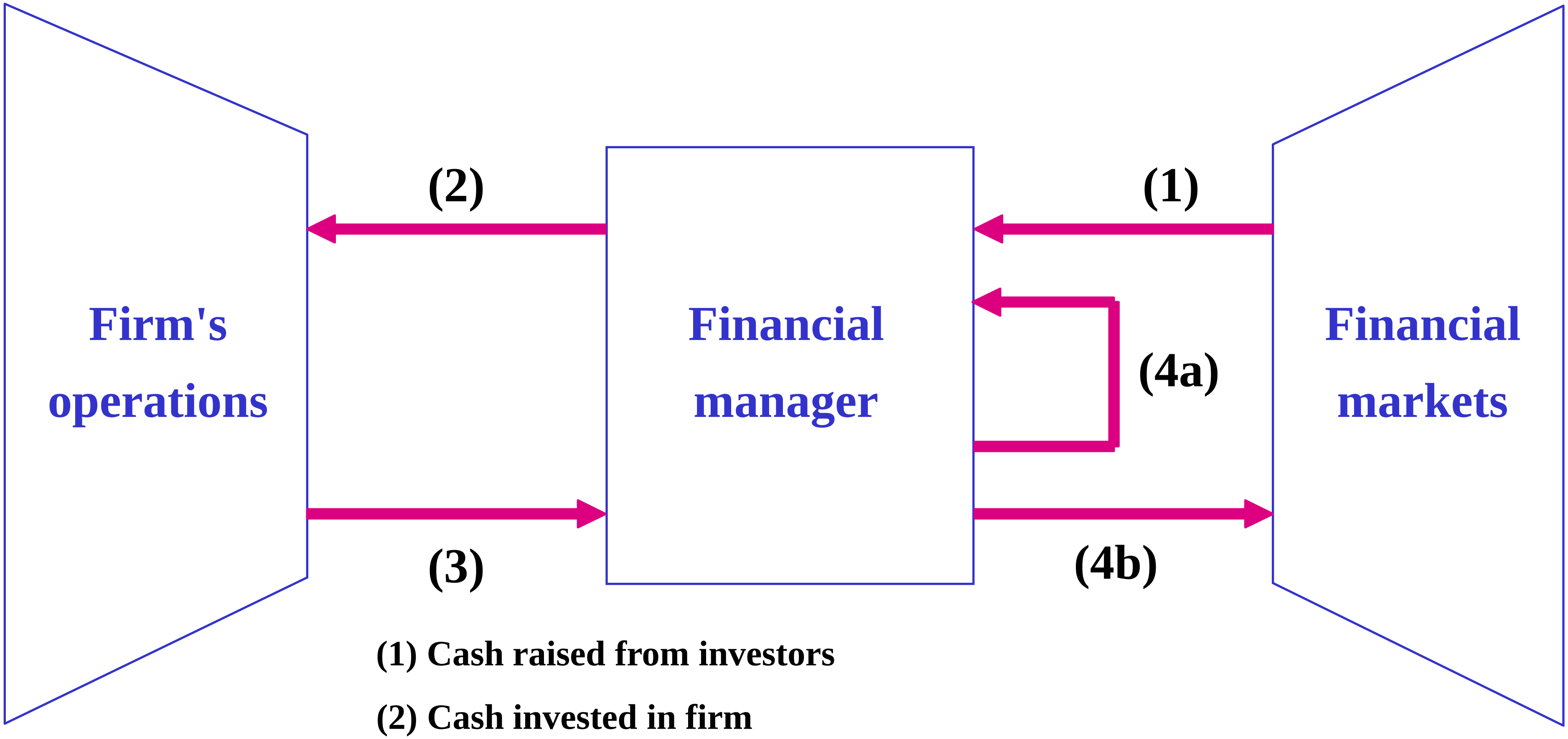
- **AMOUNT**
- **TIMING**
- **RISKINESS**

FINANCIAL MANAGER STANDS BETWEEN:

- CASH FLOWS GENERATED BY THE REAL ASSETS OF THE FIRM, AND

- INVESTORS, HOLDING FINANCIAL ASSETS
  - EQUITY, RECEIVING SHARE OF PROFITS
  - DEBT, RECEIVING SET PAYMENTS

FLOW OF CASH BETWEEN FINANCIAL MARKETS AND FIRM'S OPERATIONS



(1) Cash raised from investors

(2) Cash invested in firm

(3) Cash generated by operations

(4a) Cash reinvested

(4b) Cash returned to investors

VALUATION AND DISCOUNTED CASH FLOW METHOD

TIME VALUE OF MONEY

- **BASIC PROBLEM FACED BY FINANCIAL MANAGER IS**

  HOW TO VALUE FUTURE CASH FLOWS?

I HAVE TO SPEND MONEY <u>TODAY</u> TO BUILD A PLANT WHICH WILL GENERATE CASH FLOWS <u>IN THE FUTURE</u>

A DOLLAR TODAY
IS WORTH MORE
THAN A DOLLAR IN THE FUTURE

- **IF I HAD THE DOLLAR TODAY**
  I COULD INVEST IT
  EARN INTEREST DURING THE YEAR

SO THAT I'D HAVE MORE THAN A DOLLAR IN A YEAR'S TIME

INVESTING FOR ONE PERIOD

- I INVEST $100 TODAY AT r = .1 PER YEAR
- AT END OF YEAR, I RECEIVE $110 (FV)

$$FV=100(1+r)$$

PRESENT VALUE

- **Present Value = PV**

- **PV = Discount Factor X C_1**

PRESENT VALUE

$$\boxed{PV = DF \times C_t = \frac{C_t}{1+r_t}}$$

Replacing "1" with "t" allows the formula to be used for cash flows that exist at any point in time.

PRESENT VALUE

- **Discount Factor = DF = PV of $1**

$$\boxed{DF = \frac{1}{(1+r)^t}}$$

Discount Factors can be used to compute the present value of any cash flow.

PRESENT VALUES EXAMPLE: SAVING FOR A NEW COMPUTER

- **You will need \$3,000 in a year's time to buy a computer**
  - **You can earn interest at 8% per year**
  - **How much do you need to set aside now?**

- **PV OF \$3,000 = 3,000/1.08 = 3,000 x .926 = \$2,777.77**
  - **.926 is the 1-YEAR DISCOUNT FACTOR**

at the end of 1 year

- **\$2,777.77 grows to 2,777.77 x 1.08 = \$3,000**

CALCULATING DISCOUNTED CASH FLOWS

- $$\frac{1}{(1+r)}$$ OFTEN CALLED DISCOUNT FACTOR

- ***r*** **DISCOUNT RATE**

  HURDLE RATE

  OPPORTUNITY COST OF CAPITAL

WE HAVE ASSUMED THAT FUTURE CASH FLOWS ARE KNOWN WITH CERTAINTY

- IF FUTURE CASH FLOWS ARE NOT CERTAIN
  - USE EXPECTED FUTURE CASH FLOWS
- USE HIGHER DISCOUNT RATE
  - EXPECTED RATE OF RETURN ON OTHER INVESTMENTS OF COMPARABLE RISK WHICH IS NOT AVAILABLE TO US BECAUSE WE INVESTED IN THE PROJECT
- SAFE DOLLAR IS WORTH MORE THAN A RISKY DOLLAR

INTERREST RATE DOES NOT HAVE TO BE FOR A YEAR

- **INTEREST RATE *per period* WHERE THE PERIOD IS ALWAYS SPECIFIED**

- **THE EQUATION**

$$FV=PV(1+r)$$

GIVES THE FV *at the end of the period,* WHEN I INVEST P AT AN INTEREST RATE OF r PER PERIOD

EXAMPLE

- r =.02 PER QUARTER

  P=$100

  HOW MUCH DO I HAVE AT THE END OF THE QUARTER?

- $FV=PV(1+r)=100 \times 1.02=102$

TWO RULES
FOR ACCEPTING OR REJECTING PROJECTS

- 1. INVEST IN PROJECTS WITH POSITIVE NPV

- 2. INVEST IN PROJECTS OFFERING RETURN GREATER THAN OPPORTUNITY COST OF CAPITAL

VALUING AN OFFICE BUILDING

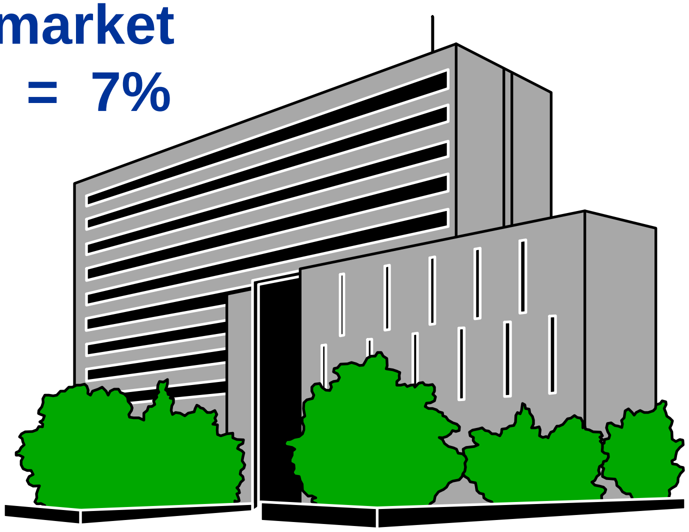
STEP 1: FORECAST CASH FLOWS

Cost of building, C_0 = 350

Sale price in Year 1, C_1 = 400

STEP 2: ESTIMATE OPPORTUNITY COST OF CAPITAL

If equally risky investments in the capital market offer a return of 7%, then cost of capital, *r* = 7%



STEP 3: Discount future cash flows

$$PV = \frac{C_1}{1 + r} = \frac{400}{1.07} = 374$$

STEP 4: Accept project if PV of payoff exceeds investment

NPV = -350 + 374 = +24

ONE-PERIOD PROJECT: RETURN UNCERTAIN

INVEST $1,000 NOW.
RECEIVE EXPECTED UNCERTAIN CASH FLOW AFTER 1 YEAR, WHOSE EXPECTED VALUE IS $1,300

INVESTORS CAN BUY EQUALLY RISKY SECURITIES WITH 35% EXPECTED RETURN.

DECISION:

1. DON'T INVEST BECAUSE 30% PROJECT RETURN IS LESS THAN 35% OPPORTUNITY COST.

2. DON'T INVEST BECAUSE NET PRESENT VALUE IS NEGATIVE.

$$\text{NET PRESENT VALUE} = \frac{1,300}{1.35} - 1,000 = 963 - 1,000 = -37$$

VALUE OF FIRM
WILL FALL BY $37
IF WE ACCEPT THE PROJECT

RATE OF RETURN RULE

- $$\text{RETURN} = \frac{\text{PROFIT}}{\text{INVESTMENT}} = \frac{400 - 350}{350} = 14.3\%$$

- **ACCEPT PROJECT BECAUSE RATE OF RETURN IS GREATER THAN THE OPPORTUNITY COST OF CAPITAL, 7%**

POSSIBLE GOALS OF FINANCIAL MANAGERS

1. MAXIMIZE PROFITS
2. REDUCE RISK
3. MAXIMIZE SALES
4. MAXIMIZE MARKET SHARE
5. MAINTAIN STEADY EARNINGS GROWTH
6. MINIMIZE COSTS

STEADY : Stable

PROFIT MAXIMIZATION

- **NOT PRECISE**
  - **PROFITS THIS YEAR OR LONG RUN?**
  - **WHAT LONG RUN?**
- **WHAT IS TRADEOFF (compromis) BETWEEN CURRENT AND FUTURE PROFITS?**
- **WHAT PROFITS, EPS OR CASH FLOW? WHAT EPS?**

CONFLICT BETWEEN MAXIMIZING PROFIT AND REDUCING RISK

- WE NEED A GOAL THAT ENCOMPASSES BOTH OBJECTIVES
- MAXIMIZE NET PRESENT VALUE

INVESTING FOR MORE THAN ONE PERIOD

- I INVEST P=$100 FOR 2 YEARS AT *r* =.1 PER YEAR.

- AT END OF YEAR 1, I HAVE FV_1=100X1.1=110 IN MY ACCOUNT, WHICH IS MY BEGINNING PRINCIPAL FOR YEAR 2.

- AT THE END OF YEAR 2, I WILL HAVE

  $FV_2 = FV_1(1+r)$
  $= P(1+r)(1+r)$
  $= P(1+r)^2$
  $= 121$

- I WILL EARN $10 INTEREST IN YEAR 1,
  $11 INTEREST IN YEAR 2,

  ALTHOUGH *r* = .1 IN BOTH YEARS.

- WHY?

FUTURE VALUE OF \$121 HAS FOUR PARTS

$$FV_2=P(1+r)^2=P+2rP+Pr^2$$

- $P=100$
  - RETURN OF PRINCIPAL
- $2rP=20$
  - SIMPLE INTEREST ON PRINCIPAL FOR 2 YEARS AT 10% PER YEAR
- $Pr^2=1$
  - INTEREST EARNED IN YEAR 2 ON \$10 INTEREST PAID IN YEAR 1
- AMOUNT OF SIMPLE INTEREST CONSTANT EACH YEAR
- AMOUNT OF COMPOUND INTEREST INCREASES EACH YEAR

FV OF PRINCIPAL, P,

AT END OF n YEARS IS

$$FV_n = PV(1+R)^n$$

COMPOUND INTEREST

INTEREST EARNED ON PRINCIPAL AND REINVESTED INTEREST OF PRIOR PERIODS

SIMPLE INTEREST

INTEREST EARNED ON THE

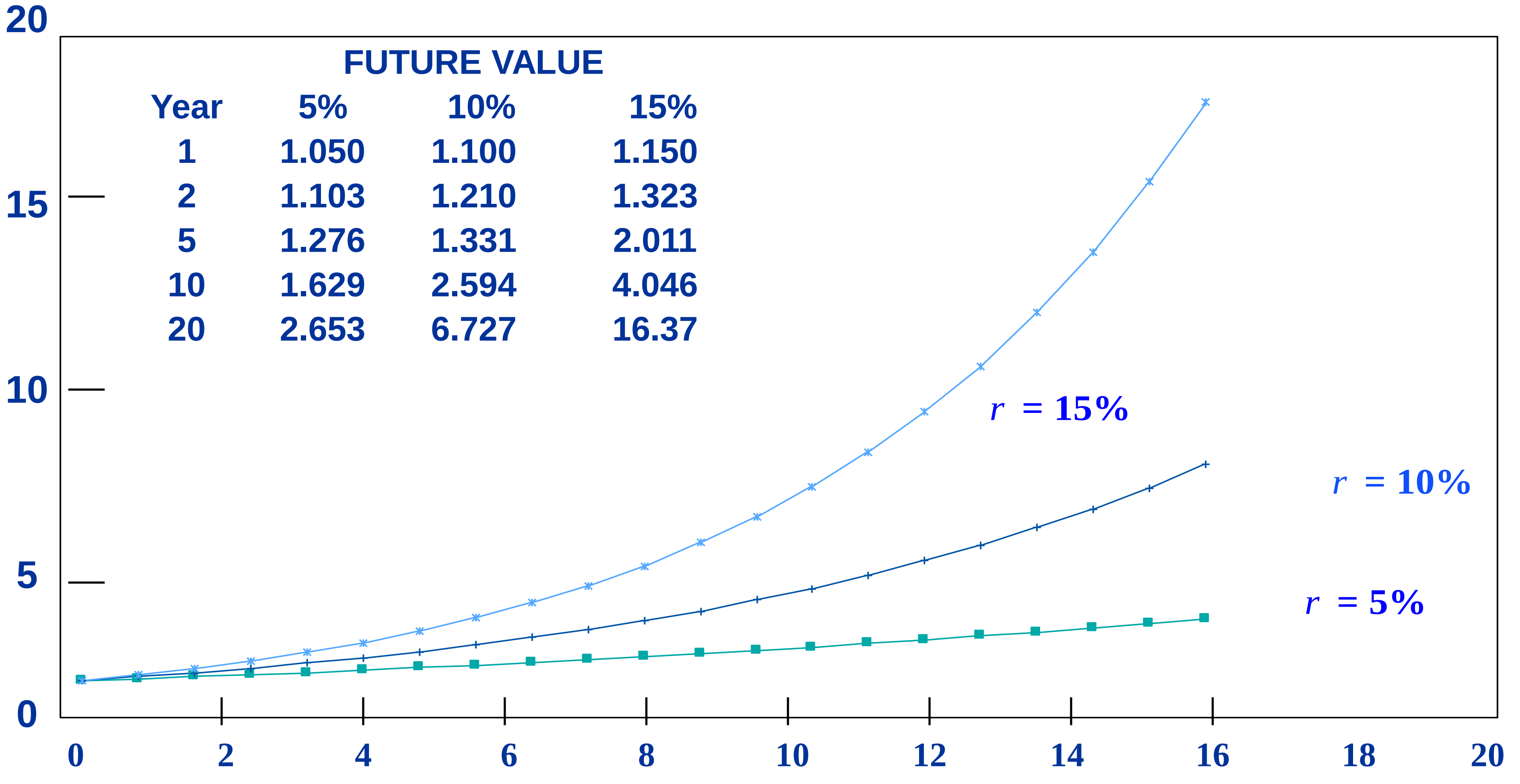
ORIGINAL PRINCIPAL ONLY

Compound Interest

i Periods per year	ii Interest per period	iii APR (i x ii)	iv Value after one year	v Annually compounded interest rate
1	6%	6%	1.06	6.000%
2	3	6	$1.03^{2} = 1.0609$	6.090
4	1.5	6	$1.015^{4} = 1.06136$	6.136
12	.5	6	$1.005^{12} = 1.06168$	6.168
52	.1154	6	$1.001154^{52} = 1.06180$	6.180
365	.0164	6	$1.000164^{365} = 1.06183$	6.183

FUTURE VALUE

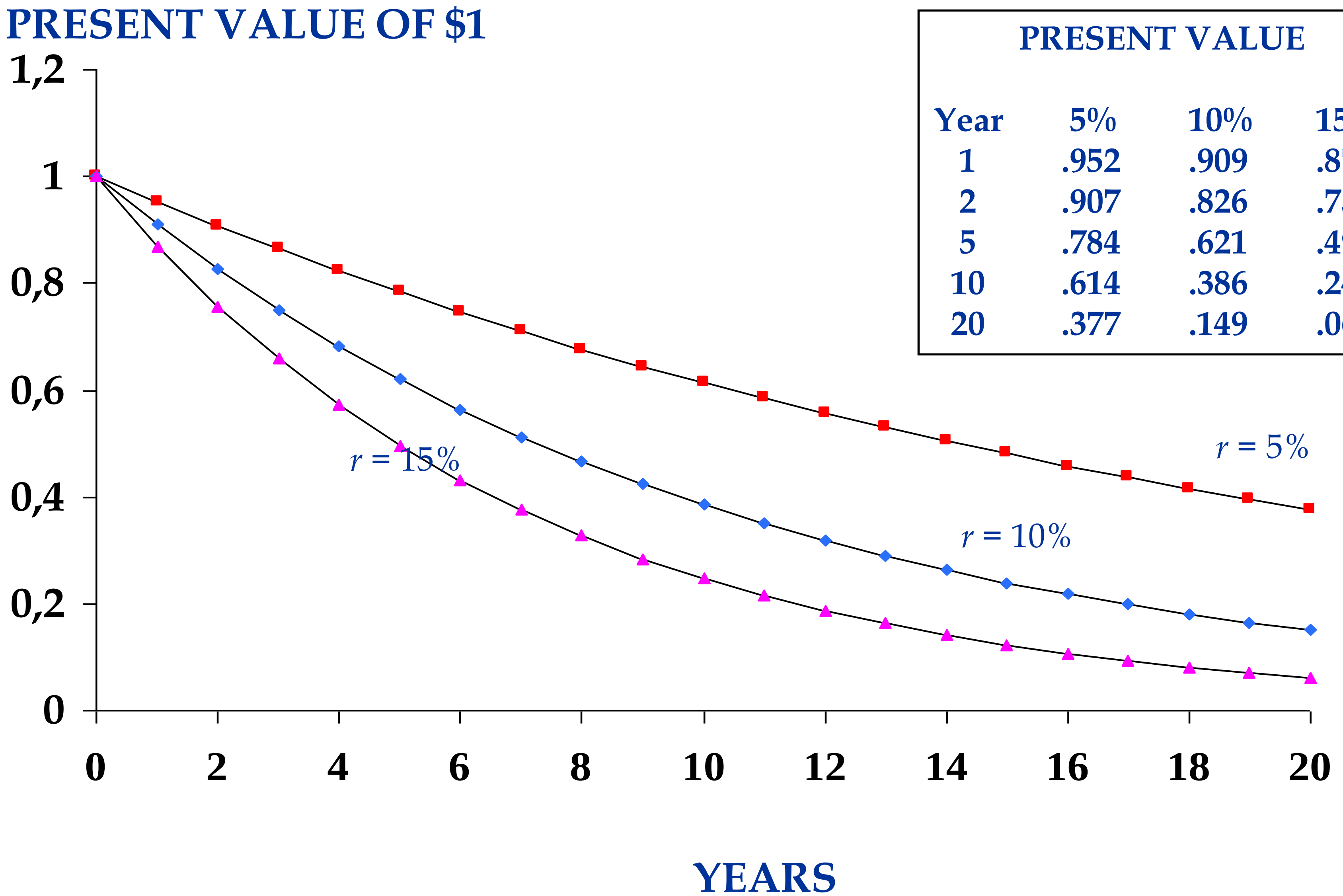
FUTURE VALUE OF $1



FUTURE VALUE

Year	5%	10%	15%
1	1.050	1.100	1.150
2	1.103	1.210	1.323
5	1.276	1.331	2.011
10	1.629	2.594	4.046
20	2.653	6.727	16.37

PRESENT VALUE



PRESENT VALUE

Year	5%	10%	15%
1	.952	.909	.870
2	.907	.826	.756
5	.784	.621	.497
10	.614	.386	.247
20	.377	.149	.061

FUTURE VALUE

- COMPOUND PRINCIPAL AMOUNT FORWARD INTO THE FUTURE

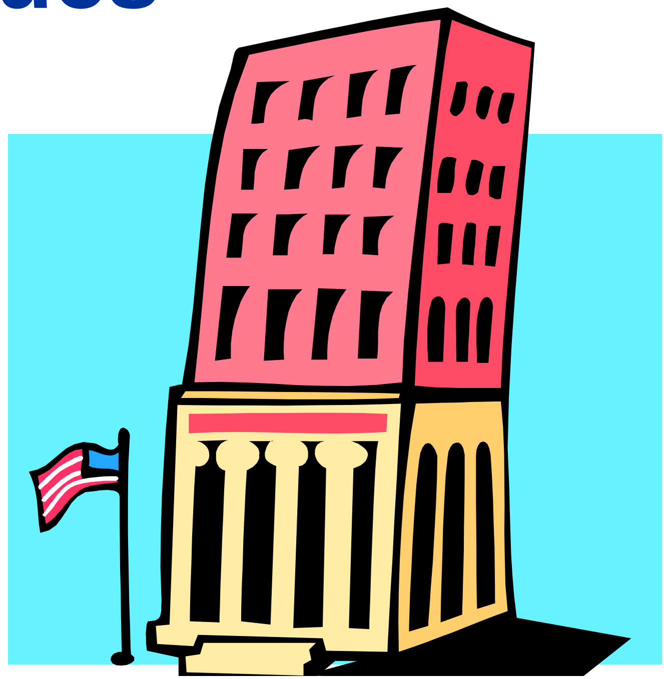
PRESENT VALUE

- DISCOUNT A FUTURE VALUE BACK TO THE PRESENT

$$PV_0 = \frac{FV_t}{(1+r)^t}$$

BASIC RELATIONSHIP BETWEEN PV AND FV

Present Values



Example

Assume that the cash flows from the construction and sale of an office building is as follows. Given a 7% required rate of return, create a present value worksheet and show the net present value.

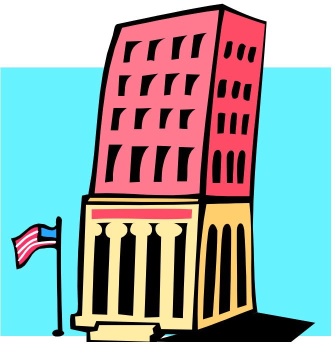
Year 0	Year 1	Year 2
$-150{,}000$	$-100{,}000$	$+300{,}000$

Present Values

Example - continued

Assume that the cash flows from the construction and sale of an office building is as follows. Given a 7% required rate of return, create a present value worksheet and show the net present value.

Period	Discount Factor	Cash Flow	Present Value
0	1.0	$-150{,}000$	$-150{,}000$
1	$\frac{1}{1.07} = .935$	$-100{,}000$	$-93{,}500$
2	$\frac{1}{(1.07)^2} = .873$	$+300{,}000$	$+261{,}900$
		$NPV = Total =$	$\$18{,}400$



$$PV_0 = C_0 + \frac{C_1}{(1+r_1)} + \frac{C_2}{(1+r_2)^2} + \ldots\ldots + \frac{C_t}{(1+r_t)^t}$$

DISCOUNTED CASH FLOW (DCF) EQUATION

$$NPV = \sum \frac{C_t}{(1 + r_t)^t}$$

NET PRESENT VALUE OF A PROJECT
WHERE THE SUMMATION IS OVER ALL THE CASH FLOWS
GENERATED BY THE PROJECT,

INCLUDING INITIAL NEGATIVE CASH FLOWS AT THE START OF THE PROJECT, C_0 ETC.

EXAMPLE

- $C_0 = -500, \; C_1 = +400, \; C_2 = +400$
- $r_1 = r_2 = .12$
- $$NPV = -500 + \frac{400}{1.12} + \frac{400}{(1.12)^2}$$
- $= -500 + 400\,(.893) + 400\,(.794)$
- $= -500 + 357.20 + 318.80 = +176$

$$\mathrm{PV} = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \ldots\ldots + \frac{C}{(1+r)^n}$$

$$= \frac{C}{(1+r)}\left(\frac{1-\dfrac{1}{(1+r)^n}}{1-\dfrac{1}{(1+r)}}\right)$$

$$= C\left(\frac{1-\dfrac{1}{(1+r)^n}}{r}\right)$$

PERPETUITIES

CASH FLOWS LAST FOREVER

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

$$= \frac{C}{r}$$ AS n GETS VERY LARGE

ALTERNATIVE WAY TO VALUE A PERPETUITY

IF I LEAVE AN AMOUNT OF MONEY, P, IN THE BANK,

I CAN EARN ANNUAL INTEREST OF $C = r$P FOREVER

$$\mathrm{P} = \frac{C}{r}$$

VALUING PERPETUITIES

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

- **EXAMPLE:**

SUPPOSE YOU WANT TO ENDOW A CHAIR AT YOUR OLD UNIVERSITY, WHICH WILL PROVIDE $100,000 EACH YEAR FOREVER. THE INTEREST RATE IS 10%

$$PV = \frac{\$100{,}000}{.10} = \$1{,}000{,}000$$

- **A DONATION OF $1,000,000 WILL PROVIDE AN ANNUAL INCOME OF .10 X $1,000,000 = $100,000 FOREVER.**

GROWING PERPETUITIES

$$\mathrm{PV} = \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \frac{C_4}{(1+r)^4} + \ldots\ldots\ldots$$

$$= \frac{C_1}{(1+r)} + \frac{C_1(1+g)}{(1+r)^2} + \frac{C_1(1+g)^2}{(1+r)^3} + \ldots.$$

$$= \frac{C_1}{(1+r)} \frac{1}{1-\frac{(1+g)}{(1+r)}} = \frac{C_1}{(1+r)-(1+g)}$$

$$\boxed{= \frac{C_1}{r-g}}$$

GROWING PERPETUITIES

SUPPOSE YOU WISH TO ENDOW A CHAIR AT YOUR OLD UNIVERSITY WHICH WILL PROVIDE $100,000 PER YEAR GROWING AT 4% PER YEAR TO TAKE INTO ACCOUNT INFLATION. THE INTEREST RATE IS 10% PER YEAR.

$$PV = \frac{C_1}{r - g} = \frac{100,000}{.10 - .04} = \$1,666,667$$

$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \ldots\ldots + \frac{C}{(1+r)^n}$$

$$= C\left(\frac{1 - \frac{1}{(1+r)^n}}{r}\right)$$

FOUR VARIABLES, PV, *r*, n, *C*

IF WE KNOW ANY THREE, SOLVE FOR THE FOURTH

PRICE AN ANNUITY AS EQUAL TO THE DIFFERENCE BETWEEN TWO PERPETUITIES

Asset	*Year of payment* 1 2 . . t+1 . .	*Present Value*
Perpetuity (first payment year 1)	→	$\frac{C}{r}$
Perpetuity (first payment year t + 1)	→	$\left(\frac{C}{r}\right)\frac{1}{(1+r)^t}$
Annuity from year 1 to year t	→	$\frac{C}{r} - \left(\frac{C}{r}\right)\frac{1}{(1+r)^t}$

CALCULATING PV WHEN I KNOW *C*, *r*, N OR HOW MUCH AM I PAYING FOR MY CAR?

EXAMPLE:

- I BUY A CAR WITH THREE END-OF-YEAR PAYMENTS OF $4,000
- THE INTEREST RATE IS 10% A YEAR

$$PV = \$4{,}000 \quad x \left[\frac{1}{.10} - \frac{1}{.10(1.10)^3} \right] = \$4{,}000 \text{ x } 2.487 = \$9{,}947.41$$

ANNUITY TABLE			
NUMBER OF YEARS	INTEREST RATE		
	5%	8%	10%
1	.952	.926	.909
2	1.859	1.783	1.736
3	2.723	2.577	2.487
5	4.329	3.993	3.791
10	7.722	6.710	6.145

LOANS

- EXAMPLE: AMORTIZATION SCHEDULE FOR 5-YEAR , $5,000 LOAN, 9% INTEREST RATE, ANNUAL PAYMENTS IN ARREARS.

- SOLVE FOR PMT AS ORDINARY ANNUITY PMT=$1,285.46

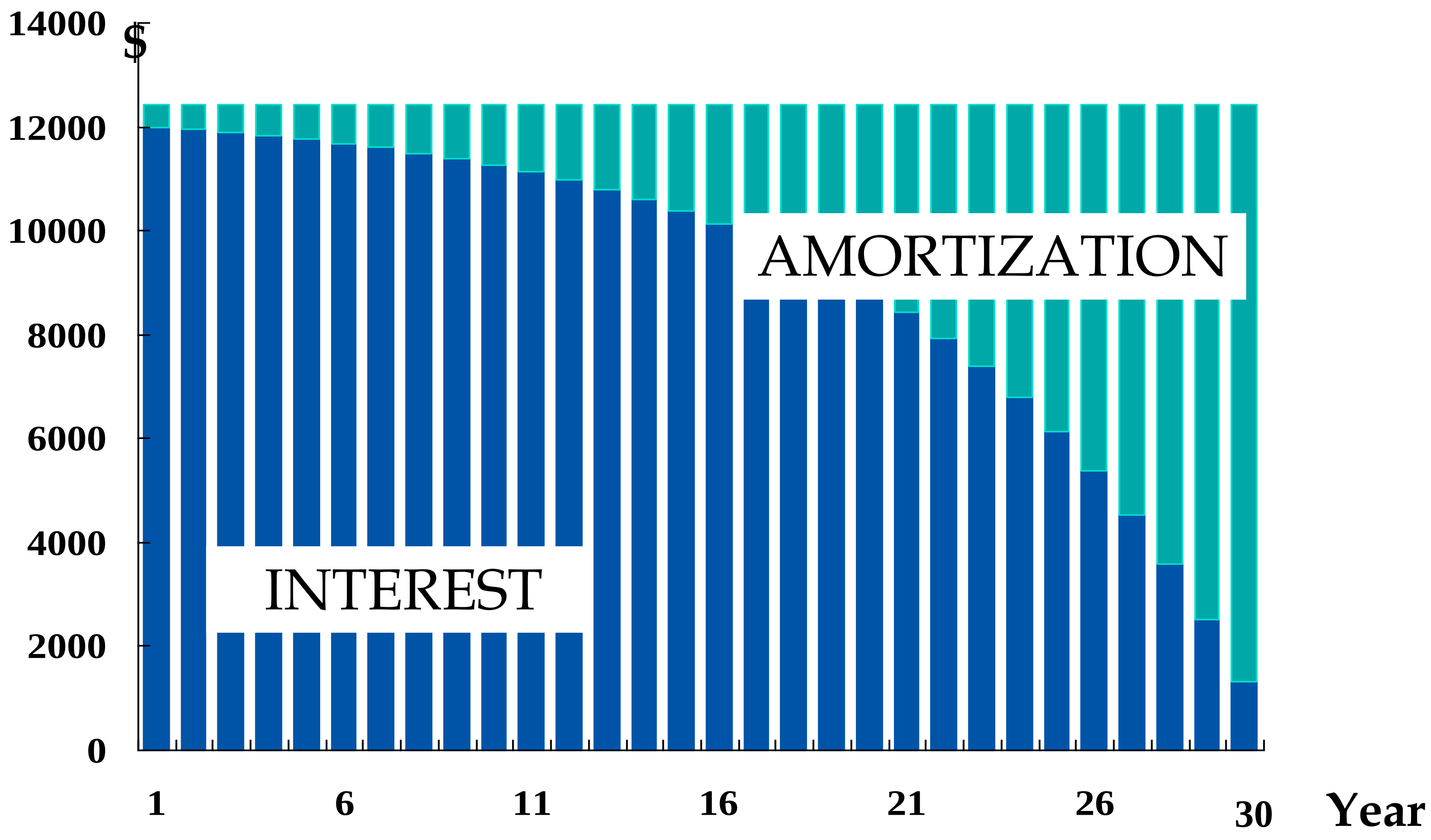
$$PMT = \$5,000 \,/ \left[\frac{1}{.09} - \frac{1}{.09(1.09)^5} \right] \qquad \$5,000 \,/\, 3.889 = \$1,285.46$$

- WE KNOW THE TOTAL PAYMENT, WE CALCULATE THE INTEREST DUE IN EACH PERIOD AND BACK CALCULATE THE AMORTIZATION OF PRINCIPAL

AMORTIZATION SCHEDULE

YEAR	BEGINNING ....BALANCE	TOTAL PAYMENT	INTEREST PAID	PRINCIPAL PAID	ENDING BALANCE
1	5,000	1,285.46	450.00	835.46	4,164.54
2	4,165	1,285.46	374.81	910.65	3,253.88
3	3,254	1,285.46	292.85	992.61	2,261.27
4	2,261	1,285.46	203.51	1,081.95	1,179.32
5	1,179	1,285.46	106.14	1,179.32	0

INTEREST DECLINES EACH PERIOD
AMORTIZATION OF PRINCIPAL INCREASES OVER TIME



AMORTIZING LOAN

F. MICHAUX

2020

GENERAL RESULT

$$\textbf{EAR} = \left(1+\frac{r}{m}\right)^{m} - 1$$

r IS THE QUOTED ANNUAL RATE,

COMPOUNDED m TIMES PER YEAR

EAR

EQUIVALENT **A**NNUALLY COMPOUNDED **R**ATE

ANNUAL PERCENTAGE RATE (APR)

- **EXAMPLE: CAR LOAN CHARGES INTEREST**
  AT 1% PER MONTH
  APR OF 12% PER YEAR *BUT*
  EAR=$(1+.01)^{12}-1=12.6825\%$ PER YEAR
  THIS IS THE RATE YOU ACTUALLY PAY

6% INTEREST RATE

COMPOUNDING FREQUENCY		EAR	APR
YEAR	1	6.000%	6.000%
QUARTER	4	6.136%	6.000%
MONTH	12	6.168%	6.000%
DAY	365	6.183%	6.000%
MINUTE	525,600	6.184%	6.000%
CONTINUOUSLY	-	6.184%	6.000%

GENERAL RESULT

$$\text{EAR} = \left(1 + \frac{r}{m}\right)^{m} - 1$$

$$= e^{r} - 1$$ AS m INCREASES WITHOUT LIMIT

$1 INVESTED CONTINUOUSLY

AT AN INTEREST RATE *r* FOR t YEARS BECOMES $e^{rt} - 1$

10% PER YEAR CONTINUOUSLY COMPOUNDED

$$EAR = e^{.1} - 1$$
$$= 10.51709\%$$

NOMINAL AND REAL RATES OF INTEREST

- NOMINAL CASH FLOW FROM BANK IS \$1,100
  IF INFLATION IS 6% OVER THE YEAR, REAL CASH FLOW IS

$$\frac{\$1,100}{1.06} = \$1,037.74$$

- REAL CASH FLOW =

$$\frac{\text{NOMINAL CASH FLOW}}{(1 + \text{AVERAGE INFLATION RATE})^{t}}$$

NOMINAL AND REAL RATES OF INTEREST

- **20-YEAR**
  - **$1,000 INVESTMENT**
  - **10% PER YEAR INTEREST RATE**
  - **EXPECTED AVERAGE FUTURE INFLATION 6% / YEAR**
- **FUTURE NOMINAL CASH FLOW**

$$= \$1{,}000 \times 1.1^{20}$$

$$= \$6{,}727.50$$

- **FUTURE REAL CASH FLOW**

$$= \frac{\$6{,}727.50}{1.06^{20}}$$

$$= \$2{,}097.67$$

NOMINAL RATE OF RETURN 10%

REAL RATE OF RETURN

$$\frac{1.1}{1.06} - 1 = 3.774\%$$

FISHER EQUATION

$(1+ r_{nominal}) = (1+ r_{real})$(1+EXPECTED INFLATION RATE)

$= 1 + r_{real}$ + EXPECTED INFLATION RATE
$+ r_{real}$ (EXPECTED INFLATION RATE)

APPROXIMATELY,
$r_{nominal} = r_{real}$ +EXPECTED INFLATION RATE