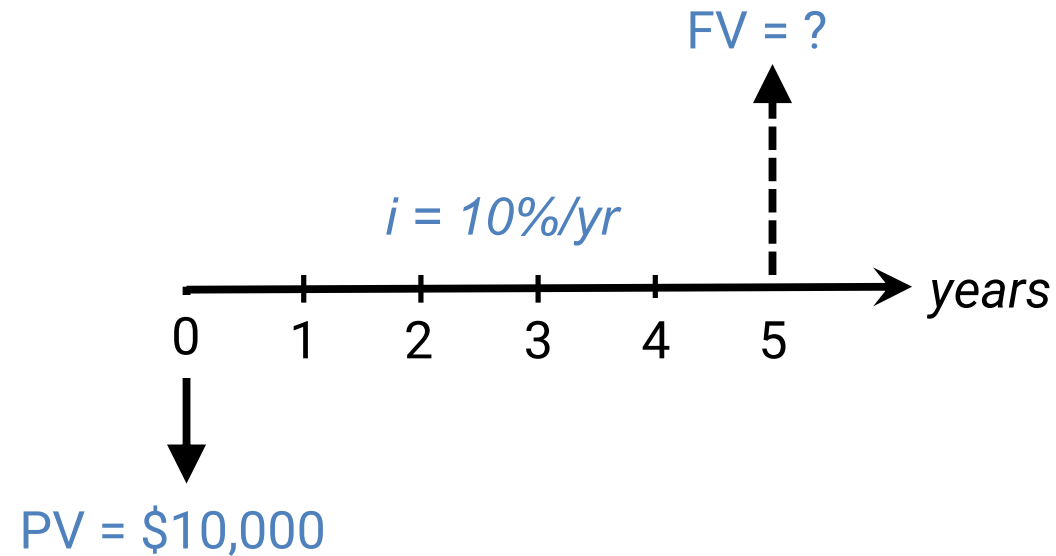Spreadsheets to the Rescue!

Single Payment Cash Flows

What is the future value of a $10,000 investment that returns 10% per year for 5 years?

FV = ?

i = 10%/yr

0   1   2   3   4   5   years

PV = $10,000

$$FV = PV\,(1 + i)^N$$

Future Value Calculation…

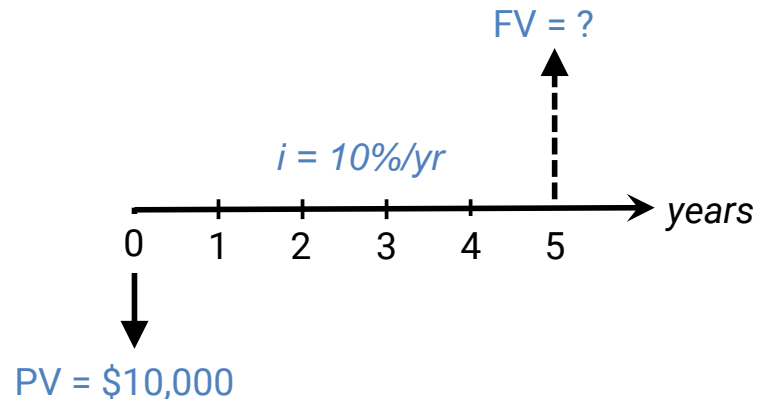What is the future value of a $10,000 investment that returns 10% per year for 5 years?

There are several ways of solving these kinds of problems:

1. The Engineering Calculator Approach

   $FV = PV (1+i)^N$

   $FV = \$10,000 (1+0.10)^5$

   FV = $16,105

2. The Financial Calculator Approach

   PV = $10,000

   N = 5

   i = 10%

   FV = $16,105

FV = ?

i = 10%/yr

0   1   2   3   4   5   years

PV = $10,000

3. The Spreadsheet Approach

Excel has pre-defined functions that do all of this for you.

Time for some Excel…

Excel, a Microsoft product, is very useful for our financial calculations. It is also commonly used in business. Therefore, our examples will come from Excel worksheets.

Google Sheets and Apple's Numbers are very similar. In many cases the function protocols in Sheets and Numbers are identical to those in Excel.

Much of the rest of the course requires access to some sort of spreadsheet software.
While the examples shown will be in Excel, use whatever you have available!

FV Function in Excel…

FV: determines the future value of an investment based on the interest rate, number of periods, multiple, uniform payments, and the present value of the investment.

Format: FV(rate, nper, pmt, pv, type).

rate: The interest rate per period.

nper: The number of payment periods.

pmt: The dollar value of the series payment at each period; cash outflows are represented by negative values, cash inflows by positive values.

pv: The present value or also the initial investment.

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1.

FV Function in Excel…

FV: determines the future value of an investment based on the interest rate, number of periods, multiple, uniform payments, and the present value of the investment.

Format: FV(rate, nper, pmt, pv, type). *(this determines our "FV")*

rate: The interest rate per period. *(this is our "i")*

nper: The number of payment periods. *(this is our "N")*

pmt: The dollar value of the series payment at each period; cash outflows are represented by negative values, cash inflows by positive values. *(this is our "A")*

pv: The present value or also the initial investment. *(this is our "PV")*

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1. *(we'll assume the default "0" for now)*

FV Function in Excel…

FV: determines the future value of an investment based on the interest rate, number of periods, multiple, uniform payments, and the present value of the investment.

Format: FV(rate, nper, pmt, pv, type) *(this determines our "FV")*

Cash outflows (cash you pay out) are represented as negative numbers.

Cash inflows (cash you receive) is represented by positive numbers.

Excel is very consistent with the cash flow diagram!

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1.   *(we'll assume the default "0" for now)*

Future Value using Excel…

Example. What is the future value of a $10,000 investment that returns 10% per year for 5 years?

	A	B	C	D	E
1	**TVM with Excel**				
2	**Future Value Calculations**				
3					
4	PV =	-$10,000	*this is our initial investment at time = 0*		
5	PMT =	$0	*this is our A, at the end of each period*		
6	RATE =	10.00%	*this is our i*		
7	NPER =	5	*this is our N*		
8					
9	FV =	$16,105	*FV(rate, nper, pmt, pv, type)*		
10			*=FV(B6,B7,B5,B4)*		
11			*=FV(0.10, 5, 0, -10000)*		

Note: excel gets the signs right – consistent with the cash flow diagram!

Single Payment Present Value

What is the Present Value, PV, of an investment if you know the Future Value, FV?

$$PV = FV / (1+i)^N$$

Future Value, FV

time

0   1   2   3   //   N-1   N
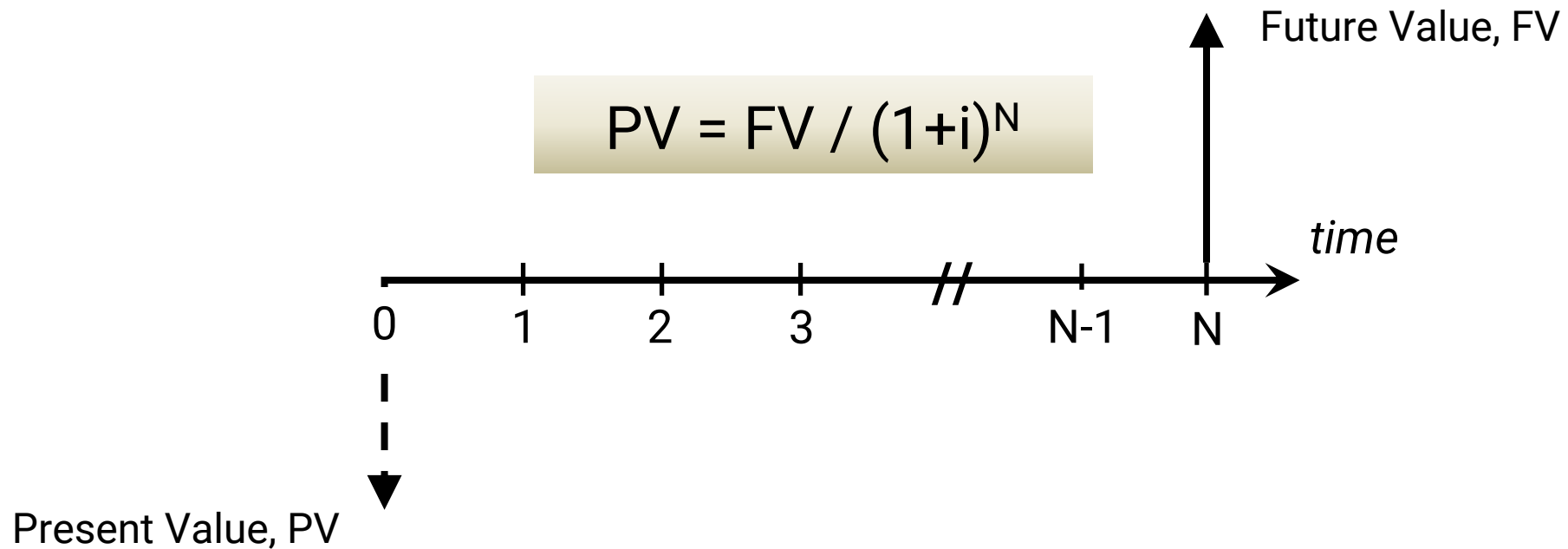
Present Value, PV

Use Excel's PV function!

PV Function in Excel...

PV: determines the present value of an investment based on the interest rate, number of periods, multiple, uniform payments, and the future value.

Format: PV(rate, nper, pmt, fv, type)

rate: The interest rate per period.

nper: The number of payment periods.

pmt: The dollar value of the series payment at each period; cash outflows are represented by negative values, cash inflows by positive values.

fv: The future value of the investment.

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1.

PV Function in Excel…

PV: determines the present value of an investment based on the interest rate, number of periods, multiple, uniform payments, and the future value.

Format: PV(rate, nper, pmt, fv, type). *(this determines our "PV")*

rate: The interest rate per period. *(this is our "i")*

nper: The number of payment periods. *(this is our "N")*

pmt: The dollar value of the series payment at each period; cash outflows are represented by negative values, cash inflows by positive values. *(this is our "A")*

fv: The future value of the investment. *(this is our "FV")*

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1. *(we'll assume the default "0" for now)*

Present Value using Excel...

Example: FV = $10,000. What is PV assuming 5 years and 10% interest?

	A	B	C	D	E	F
1	**TVM with Excel**					
2	**Present Value Calculations**					
3						
4	FV =	$10,000	*this is the value of our investment at time = N*			
5	PMT =	$0	*this is our A, at the end of each period*			
6	RATE =	10%	*this is our i*			
7	NPER =	5	*this is our N*			
8						
9	PV =	-$6,209	*PV(rate, nper, pmt, fv, type)*			
10			*=PV(B6,B7,B5,B4)*			
11			*=PV(0.10, 5, 0, 10000)*			

The Rate Function in Excel…

RATE: determines the interest rate per period for an investment based on the periodic payments, the present and future values, and the number of periods.

Format: RATE(nper, pmt, pv, fv, type, guess)

nper: The number of payment periods.

pmt: The dollar value of the series payment at each period; cash outflows are represented by negative values, cash inflows by positive values.

pv: The present value or also the initial investment.

fv: The future value of the investment.

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1.

guess: To make the calculation go faster, enter in an approximate number for the interest rate. (However, this isn't usually necessary.)

The Rate Function in Excel...

Example: FV = $10,000, PV = -$6,209.21. What is the interest rate, i, assuming N= 5 years?

	A	B	C	D	E	F
1	**TVM with Excel**					
2	**Rate Calculations**					
3						
4	PV =	-$6,209.21	*this is our initial investment at time = 0*			
5	FV =	$10,000.00	*this is the value of our investment at time = N*			
6	PMT =	$0	*this is our A, at the end of each period*			
7	NPER =	5	*this is our N*			
8						
9	RATE =	10.00%	*RATE(nper, pmt, pv, fv, type, guess)*			
10			*=RATE(B7,B6,B4, B5)*			
11			*=RATE(5, 0, -6209.21, 10000, 0)*			

The NPER Function in Excel…

NPER: determines the number of periods in an investment based on the interest rate per period, the periodic payments, and the present and future values.

Format: NPER(rate, pmt, pv, fv, type)

rate: The interest rate per period.

pmt: The dollar value of the series payment at each period; cash outflows are represented by negative values, cash inflows by positive values.

pv: The present value or also the initial investment.

fv: The future value of the investment.

type: This describes the type of series payments: If the payment comes at the end of period (Ordinary Annuities), this value is the default, 0. If the payment comes at the beginning of the period (Annuities Due), the number is 1.

The NPER Function in Excel...

Example: FV = $10,000, PV = -$6,209.21. What is the # of periods given a 10% interest rate?

	A	B	C	D	E	F
1	**TVM with Excel**					
2	**# of Period Calculations**					
3						
4	PV =	-$6,209.21	*this is our initial investment at time = 0*			
5	FV =	$10,000.00	*this is the value of our investment at time = N*			
6	PMT =	$0	*this is our A, at the end of each period*			
7	RATE =	10%	*this is our i*			
8						
9	NPER =	5.00	*NPER(rate, pmt, pv, fv, type)*			
10			*=NPER(B7, B6, B4, B5)*			
11			*=NPER(.10, 0, -6209.21, 10000, 0)*			

Summary So Far...

- Single Payment Cash Flows:

    - Single Payment, Compound Amount: $FV = PV (1+i)^N$

    - Single Payment, Present Value: $PV = FV / (1+i)^N$

- Using Excel, you can quickly calculate:

    - FV: using the FV function

    - PV: using the PV function

    - i: using the RATE function

    - N: using the NPER function

Next Time…

Annuities and the Power of Excel

Credits & References

Slide 1: Accounting or Financial Management Software Program on Laptop Screen in Office Desk, by Menara Grafis, Adobe Stock (432160164.jpeg).

Slide 4, 17: Digital format file icon. flat draw creative modification icon with initial name. vector illustration. Green icon. By Calibro44, Adobe Stock (473865302.jpeg).

Slide 18: Accounting or Financial Management Software Program on Laptop Screen in Office Desk by Menara Grafis, Adobe Stock (432160164.jpeg).