Modeling Compound Growth in Excel Part 1

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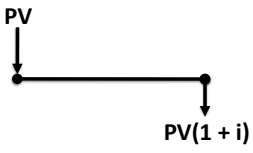
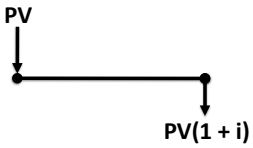
Exchange

- Want to borrow some money?
  - You'll have to pay it back!
  - You'll have to give me something extra for depriving me of the possession of my resource.
    - Usually expressed as a percentage of the amount borrowed --- the **interest rate**

Borrow PV for 1 Day at interest rate i

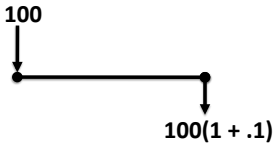


Borrow PV for 1 Day at interest rate i



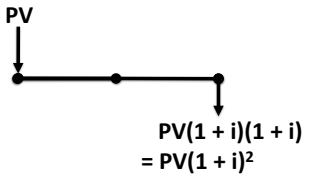
The Future Value $FV_1 = PV(1 + i)$

Example: 100 at 10%



FV = 100(1 + .1)
= 110

Two Periods



$FV_2 = PV(1 + i)(1 + i)$
$= FV_1(1 + i)$

n Periods – the Basic Formula

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

n Periods – the Basic Formula

$$FV_{nper} = PV(1 + rate)^{nper}$$

Future Value in Excel

FV(rate, nper, pmt, PV, type)

Future Value in Excel

FV(rate, nper, pmt, PV, type)

Negative for Outflow Positive for Inflow

FV(10%,2,,-100)
= 121

Negative for Outflow Positive for Inflow

FV(10%,2,,100)
= (-121)

Example

Problem : Aunt Alice gave you a gift of $2000 on your birthday. How much is it now that you are 21 if it grew at 5% per year?

Answer:

Example

Problem : Aunt Alice gave you a gift of $2000 on your birthday. How much is it now that you are 21 if it grew at 5% per year?

Answer:

$= 2000 * (1 + .05)^{21}$

= FV(5%, 21, , -2000)

= $5,571.93

Example

Problem : You buy a ladybug colony with 200 ladybugs. If their population doubles every year, how many lady bugs will you have in 6 months?

Answer:

Example

Problem : You buy a ladybug colony with 200 ladybugs. If their population doubles every year, how many lady bugs will you have in 6 months?

Answer:

$= 200 * (1 + 1)^{1/2}$

= FV(1, 1/2, , -200)

= 282.84

Example

Problem : You buy a ladybug colony with 200 ladybugs. If their population doubles every year, how many new lady bugs will you have in 5 days? Round to the nearest integer.

Answer:

Example

Problem : You buy a ladybug colony with 200 ladybugs. If their population doubles every year, how many new lady bugs will you have in 5 days? Round to the nearest integer.

Answer:

= ROUND(200 * (1 + 1)^(5/365) – 200),0)

= 2

Example

Problem : Aunt Alice gave you a gift of $2000 on your birthday. How much is it now that you are 21 if it grew at 5% per year compounded by the minute?

Answer:

Example

Problem : Aunt Alice gave you a gift of $2000 on your birthday. How much is it now that you are 21 if it grew at 5% per year compounded by the minute?

Answer:

= FV(5%/(365*24*60),21*365*24*60,,-2000)

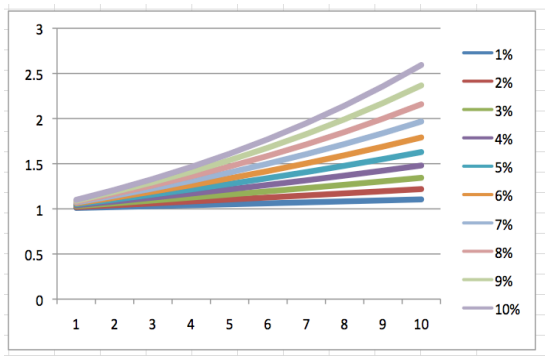
= $5,715.30 NB: > FV(5%, 21,, - 2000)

Compounding Factor

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

Table of Compounding Factors

	A	B	C	D	E	F	G	H	I	J	K	L
1	Robert Muller											
2	CS 021 Computers in Management											
3												
4	Compounding Factors											
5												
6			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7		**1%**	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.105
8		**2%**	1.02	1.04	1.06	1.08	1.1	1.13	1.15	1.17	1.2	1.219
9		**3%**	1.03	1.06	1.09	1.13	1.16	1.19	1.23	1.27	1.3	1.344
10		**4%**	1.04	1.08	1.12	1.17	1.22	1.27	1.32	1.37	1.42	1.48
11		**5%**	1.05	1.1	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.629
12		**6%**	1.06	1.12	1.19	1.26	1.34	1.42	1.5	1.59	1.69	1.791
13		**7%**	1.07	1.14	1.23	1.31	1.4	1.5	1.61	1.72	1.84	1.967
14		**8%**	1.08	1.17	1.26	1.36	1.47	1.59	1.71	1.85	2	2.159
15		**9%**	1.09	1.19	1.3	1.41	1.54	1.68	1.83	1.99	2.17	2.367
16		**10%**	1.1	1.21	1.33	1.46	1.61	1.77	1.95	2.14	2.36	2.594
17												



Solving for PV, rate and nper

$$FV = PV(1 + rate)^{nper}$$

Solving for PV

$$FV = PV(1 + rate)^{nper}$$

$$PV = FV[1/(1 + rate)^{nper}]$$

Discount Factor

$$PV = FV[1/(1 + rate)^{nper}]$$

Properties of the Discount Factor

$$1/(1 + rate)^{nper}$$

Example

Problem : Your parents plan to give your newborn daughter a gift that will grow to $100,000 when she starts college. How much will they have to stash away if they earn 5% per year?

Answer:

Present Value in Excel

PV(rate, nper, pmt, FV, type)

Example

Problem : Your parents plan to give your newborn daughter a gift that will grow to $100,000 when she starts college. How much will they have to stash away if they earn 5% per year?

Answer:

= 100000 * (1 / (1 + .05)^18)
= PV(5%, 18, , -100000)
= $41,552

Example

Problem : Your neighbor made $1,000,000 on risky investments in mortgage backed securities. How much would this have been in 1956 dollars, assuming a 5% annual growth rate?

Answer:

Example

Problem : Your neighbor made $1,000,000 on risky investments in mortgage backed securities. How much would this have been in 1956 dollars, assuming a 5% annual growth rate?

Answer:

= 1000000*(1 / (1 + .05)^(2009 – 1956))
= PV(5%, 2009 – 1956, , -1000000)
= $75,330