Indian Institute of Science

Design of Photovoltaic Systems

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NPTEL Online Certification Course

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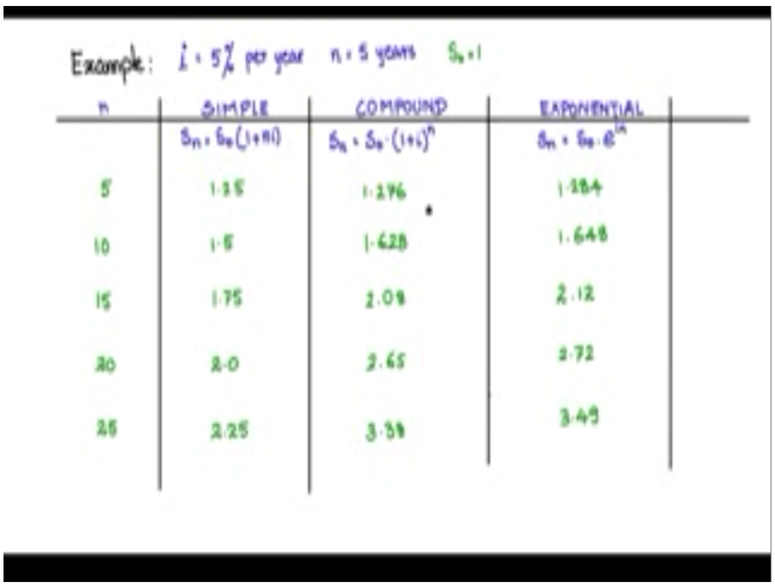

Example: $i = 5\%$ per year $n = 5$ years $S_0 = 1$

n	SIMPLE $S_n = S_0(1+ni)$	COMPOUND $S_n = S_0 \cdot (1+i)^n$	EXPONENTIAL $S_n = S_0 \cdot e^{in}$
5	1.25	1.276	1.284
10	1.5	1.628	1.648
15	1.75	2.08	2.12
20	2.0	2.65	2.72
25	2.25	3.38	3.49

Let us put some numbers and make a simple comparison of the three growth profiles. Let us take I=5% per year and n = 5 years, and let me make a tabular column N, the simple interest model, the compound interest model here and the exponential growth model in the last column. Let me use SN=S01+ni for the simple interest SN=S0 ($1+i^n$) for the compound, SN=S0e^{in} for the exponential.

You can take S0=1 without loss of generality because S0 is appearing here as a factor every in fact you can normalize SN/S0 to see what is the growth profile that comes. So let us take SN 5 years and if you calculate you will see that it is 1.25, 25 in five years you have 25% more, 1.276, 1.284. So exponential model gives you the largest interest. Now in 10 years you will see this is going in a linear fashion 1.5, 1.628, 1.648in 15 years.

This is 1.75, 2.0, 2.12, the exponential model is increasing faster and much more, and in 20 years this is going linear fashion to 2.65, 2,72, in 25 years 2.25, 3.38, 3,5. So like this you will see that you can plot the curves the exponential will give you the largest interest rate, the compound model gives you in between and the lowest interest rate is by the simple interest formula.

So this is just to give you an idea with the numbers a comparative understanding of the three growth profiles. Most popular used mostly by the banks would be the compound interest formula and the discrete compounding formula.

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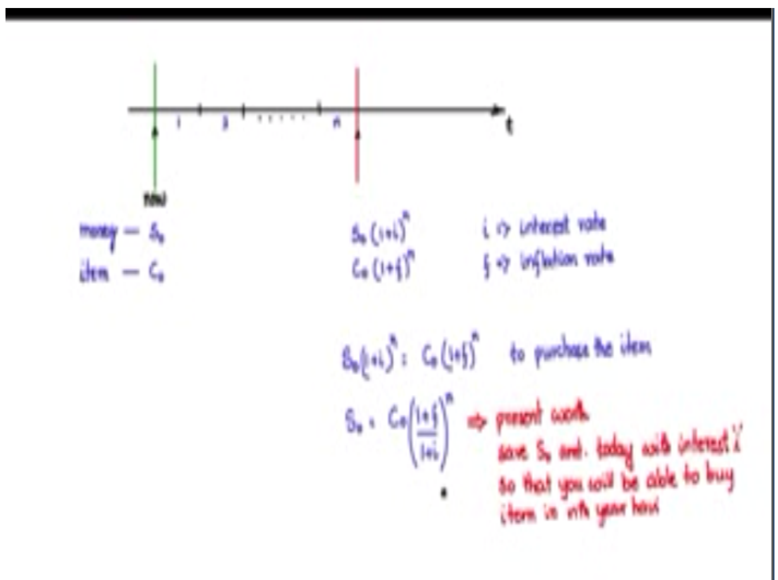

Let us further consolidate our understanding of the growth profiles. Now let us say this is the present time, this is now and along the time line let me put the equi-space ticks and this red line here is a future time of interest. So if you say these intervals, interval one, interval two, interval n this will be at the end of the n^{th} interval. Let us consider the two aspects one is money and another is the value of the item.

The value of the money at the start of now that is start of this time evolution now easier start, the value of the item is, let us say C0 now after n years the value of the money would have become $S0(1+I^n)$ and the value of the item would have become $C0(1+F^n)$ this F is nothing but inflation rate. So the value of money has grown because of I which is the interest rate and the value of the item has grown because of the F that is the inflation rate.

Let us take for example S0 and C0 of same. So today now you are able to buy this item with money S0, because the value C0 and value S0 are same. If the interest rate and the inflation rate had been same, then $S0(1I^n)$ $C0(1+F^n)$ would have been same, so even in future and after the n^{th} interval or 3n years you are money whatever escalated money would have bought the escalated value of the item.

Now suppose I and F are not same if the interest rate is more than the inflation rate, then the value of the item would not have increased as much as the value of the money. So you will be able to purchase this item and still be leftover with some money. On the other hand if the interest rate had been lower than the inflation rate after n years the value of the item would have would be higher than the value of the money.

So you will not be able to purchase the item with this even with this escalated money value. So let us say that we are able to purchase after n years with this money this item. So we will equate it $S0(1+I^n) = C0(1+F^n)$, so to purchase the item we need to equate this. Now S0 would be $C0(1+F^n)$ or I can write $1+F//1+I^n$. So what this means is that this is the present worth of an item what it means is that S0 is the present world.

Now let us say that you want to purchase an item after n years the item has an inflation rate of F and the money has an interest rate of I, then you need to save S0 amount of money today, so that after n years you will be able to purchase this particular item which is today costing C0. So say S0 amount today with interest I, so that you will be able to purchase the item in the n^{th} year having inflation S.

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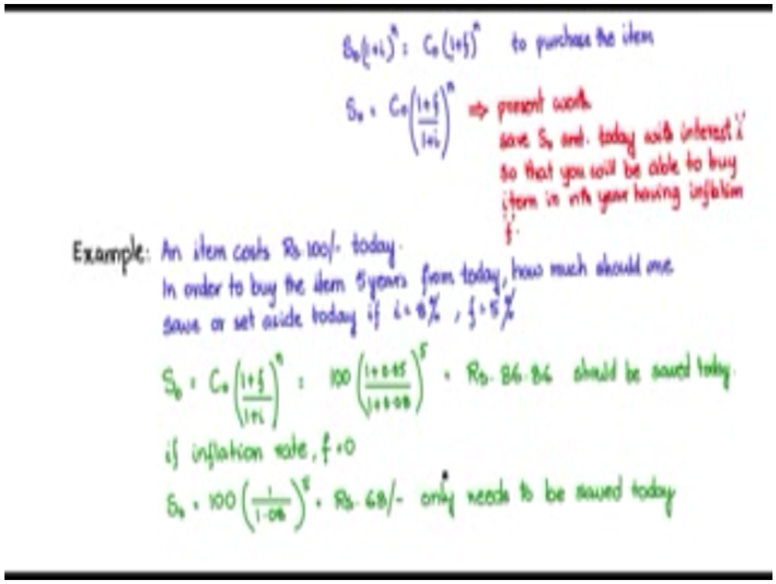

Let me take a simple example let us say an item costs through this 100 today, and in order to buy the item five years from today how much should one sale or set aside today if I is 8% interest rate is 8 percent and inflation rate is 5%. So if you use S0=C0 the $1+F/1+I^n$ $100(1+0.5/1+0.08)^5$ you will get rupees 86.86, what it means is that I should say 86.86 rupees today, so that five years from now I can buy that product which costs 100 rupees today.

If inflation are not there if inflation rate were 0 F=0, then for the same problem you will see that rupees 68 only needs to be saved today which for an item it costs 100 today, so that you may buy it after five years.