DISCOUNTING METHODS

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ABOUT APTA CONSULTING

APTA provides Financial modelling, Petroleum Economics evaluation & analysis, and Excel training for business modelling and data analysis to range of clients. Our clients range from blue chip to small enterprises and individuals. Our clients have access to high quality, cost effective modelling support delivered by team of experts around the world.

APTA FINANCIAL MODELLING TEAM

APTA's dedicated financial modeling team is led by Santosh Singh. Santosh has more than 12 years of industry experience. With a technical background in drilling engineering and further qualification in Finance and Economics, he has worked in a number of major technical and commercial functions and gained extensive experience in economics evaluation, business development and commercial agreements.

Santosh's commercial valuation and analysis experience covers Africa, Asia, and Eurasia to name a few. He has a proven ability in the fiscal regime modelling, investment analysis, and providing high quality support to management for the strategic investment decisions.

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DISCOUNTING METHODS

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By now it should be clear to you that discounting is nothing but converting the future cash flow into present. This process is called discounting the cash flow. The interest rate used for discounting is called *Discount Rate.*

When we discount or compound a cash flow there is an implicit assumption about the cash flow timing. Normally one would assume that compounding period (or discounting period) would be once a year. In such situation we assume we have an initial amount as of today and we receive (or pay) an interest on it at the end of one year. We assume the cash flow to occur *at the end of the year.* SO if we have \$100 today we compound it for 1 year at an interest rate applicable to that sum of money.
If the applicable interest rate is 10%, we compound it to \$100 x $(1+ 10\%)^{1}$ = \$110.

So if we have an amount at the end of a year from now, say \$110, we would bring it to today's value by discounting it for 1 full year at 10%, \$100 = \$110 / $(1 + 10\%)^{1.}$

Now assume that the interest is paid biannual, at the same 10% (10% being annual rate of interest). In this case \$100 will grow to not \$110, but slightly more. The formula is \$100 x $(1 + 10\%/2)^{2}$. The compounding period is now 2 not 1 and in each compounding period the interest rate is now 5% (10%/2). The general formula for more frequent compounding is given below:

$$(1 + r) = \left(1 + \frac{i}{m}\right)^{m}$$

R = effective annual interest rate
I = nominal annual interest rate
M = no of compounding period

So when we have to discount a cash flow it is critical for us to understand which cash flow we are discounting. Are we discounting the cash flow that occurs at the end period, or the cash flow that occurs in the beginning of the period? Sometime cash flows are assumed to occur in the middle of the year. We present below general formulas for some generic discounting assumptions.

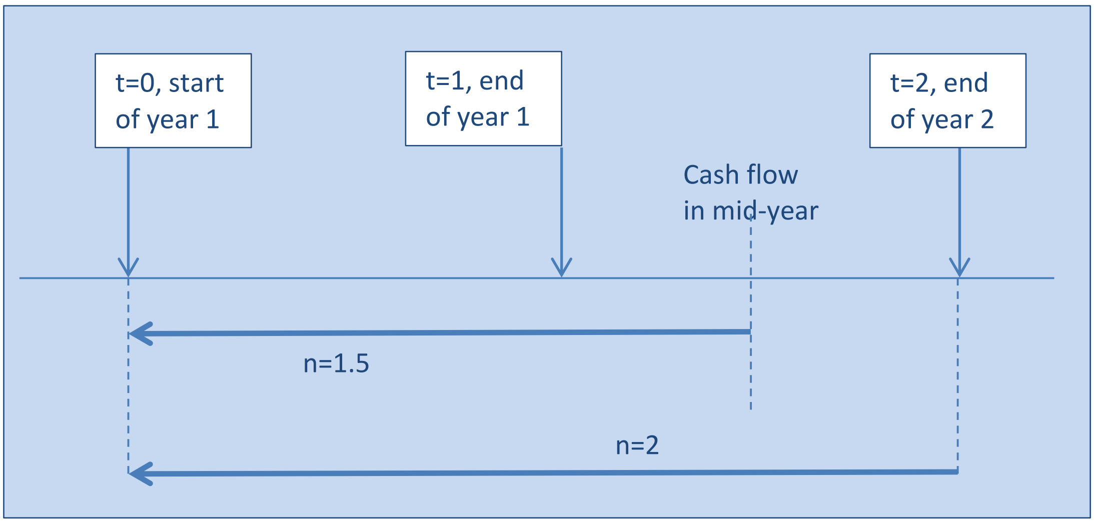
$$End\ of\ year\ discount\ factor\ in\ year\ n = \frac{1}{(1+i)^n}$$

i = discount rate

$$Mid\ Year\ discount\ factor\ in\ year\ n = \frac{1}{(1+i)^{n-.5}}$$

i = discount rate

At first glance the formula for the mid-year discounting may seem weird. But it's actually easy to explain. Say we are in year 2. The year 2 cash flow has occurred in the middle of year 2. So the total period that we need it to be brought back is not 2 years. It's actually 1.5 years (= 2 - .5). The 2^{nd} year cash flow did not occurred at 24^{th} month, it occurred at 12 (one full year) + 6 (half year) = 18 months (1.5 years) from the beginning period. May be drawing a time line makes it more apparent.



There can be some other possible assumptions about the timing of the cash flows. One such assumption is cash flows occur monthly throughout the year. Or in an extreme case there can be an assumption of continuous compounding (and therefore continuous discounting) where we assume that the cash flows keep occurring continuously throughout the year. We present here only the formula of discount factor for such situation. Due to mathematical complexity, we won't be discussing their derivation here.

$$Monthly\ \ discount\ factor\ in\ year\ n =$$

$$(\frac{i}{12})/\{(1+i)^{\left(n+\frac{1}{12}\right)} - \ (1+i)^{n}$$

i = discount rate

However our advice would be to instead of using this complex looking formula, just change the model periodicity to monthly and discount normally using an equivalent monthly interest rate or discount rate.

$$Continious\ \ discount\ factor\ in\ year\ n =$$

$$i/\{(1+i)n\ x\ \log_{e}(1+i)$$

i = discount rate

In practice continuous compounding is hardly used in Oil and Gas upstream sector for discounting. We presented this just to make you aware of these methods. Their practical utility in petroleum economics is next to none.