INFLATION & ESCALATION

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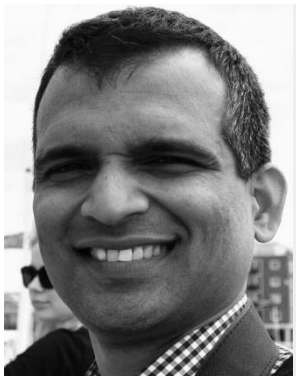
ABOUT APTA CONSULTING

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 OIL & GAS TEAM

APTA's dedicated Oil & Gas modeling team is led by Santosh Singh. Santosh has more than 10 years of Oil and Gas 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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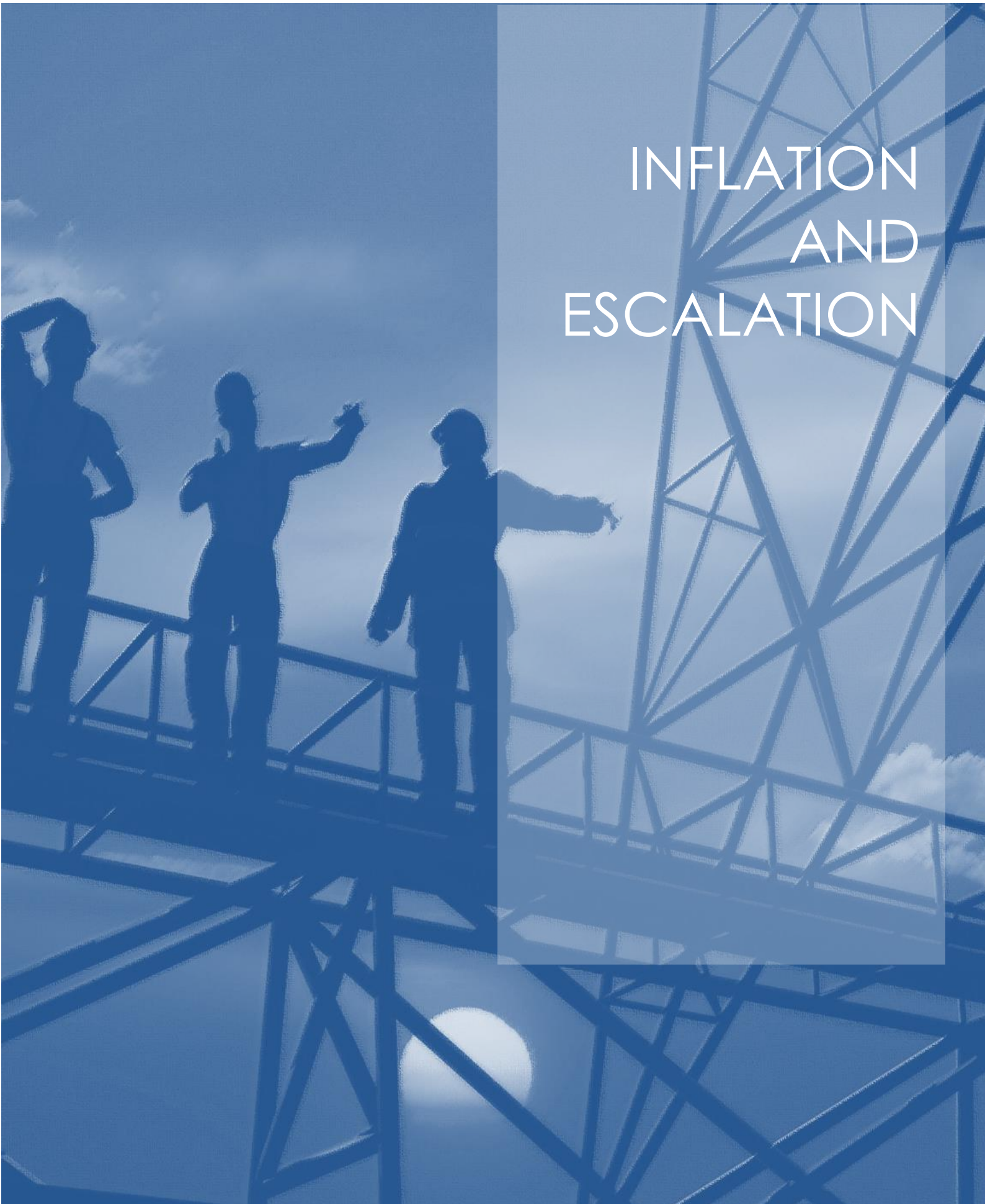

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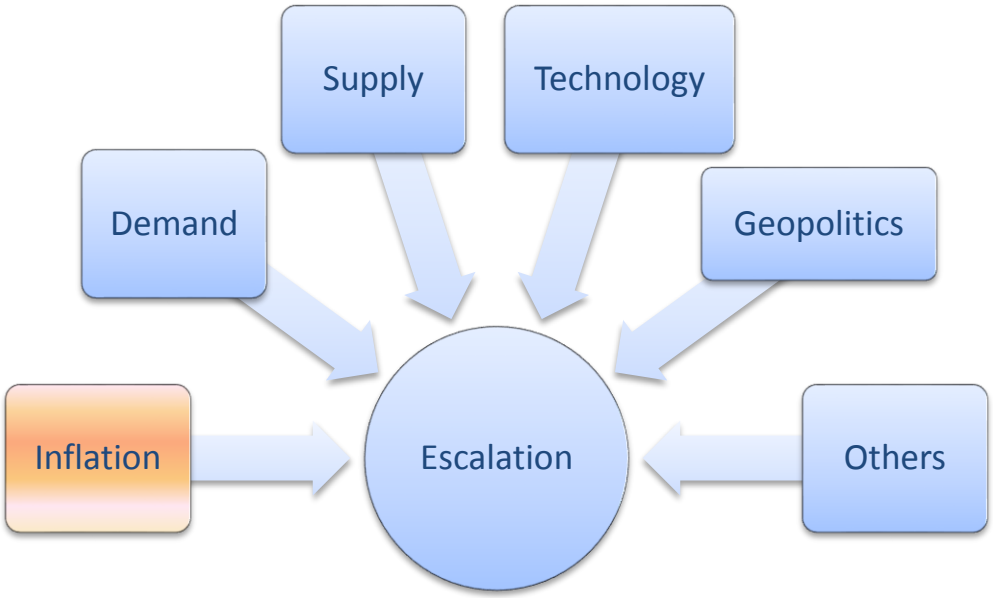
Let's say your monthly expense on living cost like food, utility bills, phone bills, entertainment, commuting etc. was $1,000 last year. But this year, you had to pay $1,040 on your living cost. You are still consuming the same amount of food, commuting the same distance with same frequency, your usage of utility and phones haven't changed at all. So why you had to pay $40 extra this year?

You are spending more on the same amount of goods and services that you used to consume last year. This means $1,000 has lost some of its value. This loss in purchasing power of the money is due to inflation. Inflation means a general increase in the price level in the economy. ***Inflation is the average price rise in an economy.*** For e.g. when we say inflation rate is 2% it means it cost 2% more now to buy the same basket of goods and service as last reference period (which could be annual, monthly, quarterly etc.)

Many analyst use inflation and escalation interchangeably. But inflation is not the same as escalation. They are different. One is the cause and the other is the effect. Let me clarify that. Escalation is the price rise of a ***specific*** commodity, goods or service. Mind the word specific. You can say the price of petrol has escalated, the price of beer has escalated, and the price of electricity has escalated.

You can keep going recounting hundreds of ***specific*** item whose prices may have gone up (or sometime down). And the price rise for these items will go up or down by different amount. When you want to express the average total price increase of all goods then you use the term inflation. And you would say inflation has gone up (or down, in which case it is called deflation) say by 3%. That ***does not mean*** all goods and service price has risen by 3%. Some of them may have risen by 10%, 15% or may have fallen by 5%.



Let's show you a specific example. When the crude price crashed in the later part of the 2014 by more than 50%. Not all the prices fell by the same percentage. Rig rates fell drastically. But home prices in and around London did not crash. In fact they were still growing by about 10%!

Most often you will observe that when a project is sanctioned the estimated cost of say laying the pipe line would be $ X million. By the time the project is finished, the actual cost of laying the pipeline would have gone up to $ 2X than the original estimate. Therefore, inflation would have gone up by 100% in the same period. I hope you get the drift. There is a distinct difference between inflation and escalation. Yet most analysts either fail to see this distinction or simply ignore it for the sake of simplicity in calculations.

This rise in the price of a specific good can be due to various factors, such as inflation, demand growth, supply shortage, technological changes, political, and environmental issues etc. it could be just one factor or a combination of factors.

Most investment projects especially in the upstream Oil and Gas industry gave a life span of more than a decade; may go up to 50 years! When projects cost estimation is done, it's done based on "how much will it cost today". But when the time comes to pay for those expense in future, the actual cost would have gone up (very rarely will it go down, but can go down). Thus evaluating projects economics without incorporating the rising costs would not be a reflection of true economic profitability. When we have to evaluate such long lived projects we must then incorporate the effect of escalation (and thus inflation) on the project economics. Not only cost but revenue will also be

affected due to escalation (but positively)

One way we can handle the inflation/escalation issue to ***analyze the project economics using the actual revenue and costs that are supposed to be incurred at the future date***. One can call this the nominal term economics. There are various terms used in the industry such as "Money of the Day", "Nominal", "Inflated", "Escalated", "Outturn" etc. Basically they all refer to same thing.

So what is "Nominal" money? To understand that we need to understand "Real" money. "Real" money is referred to hypothetical money whose purchasing power is same as the current purchasing power of the money (of the same currency) and its purchasing power is not going to change in future. That is it will always retain its same value as of today. For example a $100 today is the "real" money as of today. Next year due to an inflation rate of 5% todays $100 (real money) will be same as next year's $105 (nominal money). "Real" money is also termed as "Constant" money or "Deflated" money.

A "Nominal" value is expressed in MOD and has the effect of inflations and other factors influencing the price rise/fall in built into it. The "Real" value on the other hand has the inflationary impact removed from it. It shows you how the money in future will actually be to buy in today's term.

Now coming back to analyzing the economics of investment projects, another way to analyze the economics is by using "Real" or "Constant" money. The way to do it is discount the inflated money at a discount rate equal to inflation rate at the reference date. See relationship between real and nominal money in the formula above.

Will there be a difference in the conclusion of the economic analysis if we apply "Real" money valuation or "Nominal" money valuation?

We would say, no. Please understand that economist try to evaluate the projects by comparing with alternate proposal which will create maximum value. If a certain project maximizes the value in "Nominal" terms, then it should maximize the value in real terms also among the rest of the alternatives. So neither method is superior over the other.

The only thing to be wary of when analyzing two or more projects is that one has to be consistent with the method of analysis. Once cannot use "Nominal" basis for one and "real" term basis for another project indicator. Either both are in "Nominal" or both are in "Real" terms. But never mixed up.

However for a multination company who has to evaluate projects in multiple countries, it's slightly complex. The issue with the MNCs is as follows:

An economic evaluation is based on DCF (discounted cash flows) method. Discount rate used is based on the cost of capital, which in turn is affected by inflation rate of the individual country. A country with high inflation will have high cost of capital and thus high discount rate. A country with low inflation will have low cost of capital and thus low discount rate. When MNCs have projects spread over multiple countries, each project will be discounted at different discount rate. The comparison between the projects is then impossible.

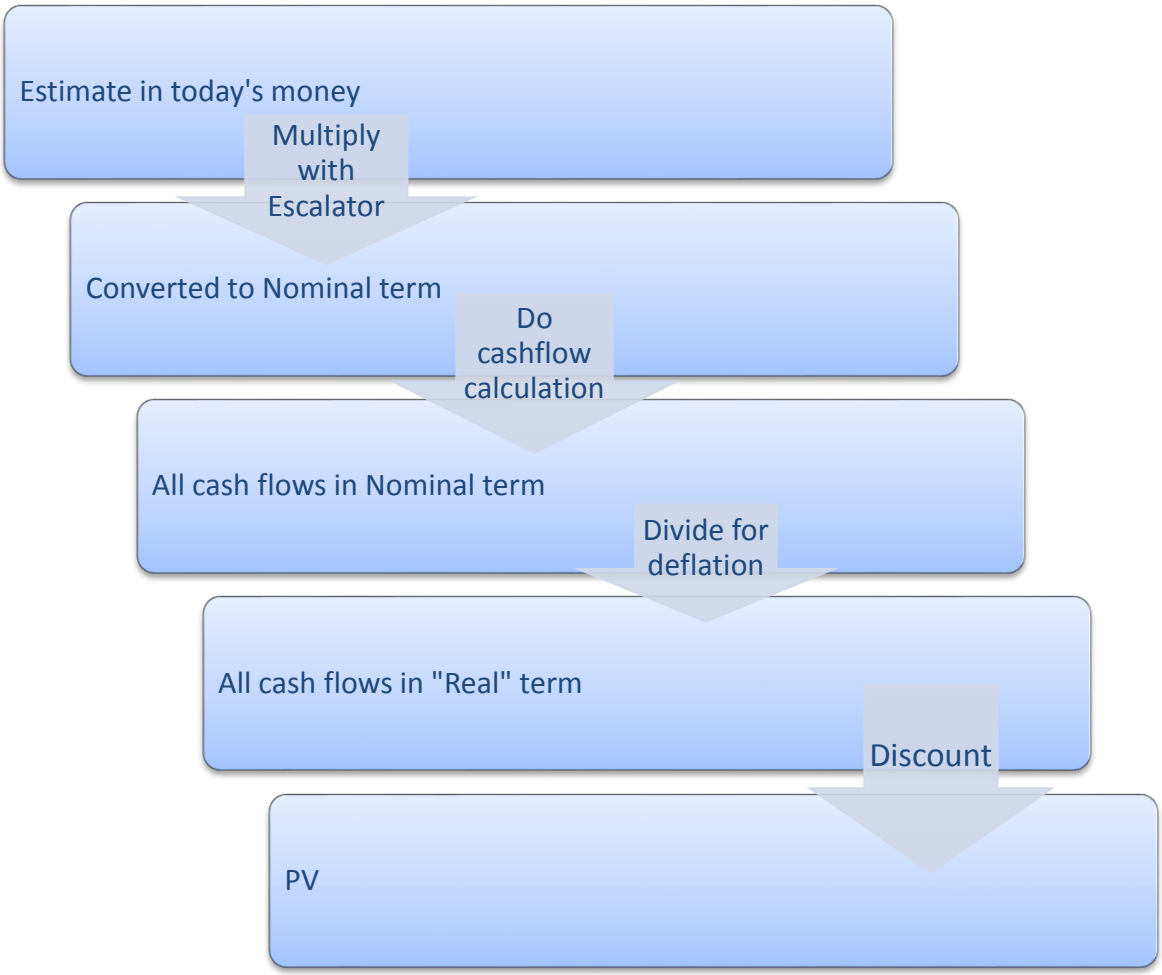
One solution then is to construct cash flows first in "Real" terms. Then convert them into local "Nominal" currency of the country, using appropriate inflation factor and exchange rate. Then do the calculation and taxation in local currency. After all calculation (which will be in Nominal local currency term) convert the final after tax cash flows into "Real" term US $. This way all the projects are in real term US $. Now we can do the analysis using economic indicator based on US $. This makes sure all projects are on the same page.

Another reason of converting "Nominal" cash flows into "Real" cash flows is that nominal money will have different purchasing power in different years/period. So to ensure comparability, it's better to first convert all cash flows to same purchasing power value, i.e. in "Real" terms.

PROJECT EVALUATION PROCESS

To start with the first step is to estimate the costs (Opex and Capex) of the proposed investments. At this point one would look at the current market prices for different goods and services and develop the values of Opex and Capex as if all those expense were going to be incurred today, the reference period of the project (normally what it would cost at the time the estimate is made) - this money is called Estimate Date Money (EDM) or Base Year Cost (BYC).

For example let's say the field development plan for a shallow water offshore field in Nigeria has 50 wells to be drilled in next five years. 'Today' the reference date, it costs $25 million to drill one well in the shallow offshore region using a Jack-up rig. The plan has 10 wells to be drilled each year for next five years. So in today's money (todays money is our "Real" term or RT money) the plan has $1,250 million (50 x $25 million) as drilling Capex in "Real" terms.



The next step in the process is to convert “Real” term drilling Capex into “Nominal” money or “Money of the Day”. This is because our estimate is based on ‘todays’ money. As time passes by, due to various factors, inflation being one of them, these 50 wells will cost more than what it cost today to drill them.

To convert our “Real” term drilling estimate into “Nominal” or “MOD” cash flow these estimate has to be escalated to incorporate the expected inflation and any other factor that may cause these cost to go up (or down) on the specific item. Individual items may not increase in price at the same rate as predicted by the inflation rate which is based on general price index of the economy. That’s why we need to incorporate effects of individual item on top of inflation rate.

Many analysts use just a constant inflation rate to escalate the cost and prices. That may depend on the individual company take on the economy. But it’s absolutely necessary to have a constant inflation rate for all periods. Inflation rate may go up or down and may even go negative (during recession). It is up to the company’s corporate policy to decide on the right inflation rate to use.

Similarly different cost items like drilling a well, laying pipeline, building offshore platforms and subsea installation may not increase in cost at the same rate. They can have different escalation rates among themselves as well as across time period.

For example, when the oil price goes up, demand for drilling rigs goes upward too. This leads to sharp increase in the rig rate. Construction activity will also pick up and will put pressure on fabrication yards. Rate increase in all these will go up and probably higher than the rate of inflation but in each a different higher rate.

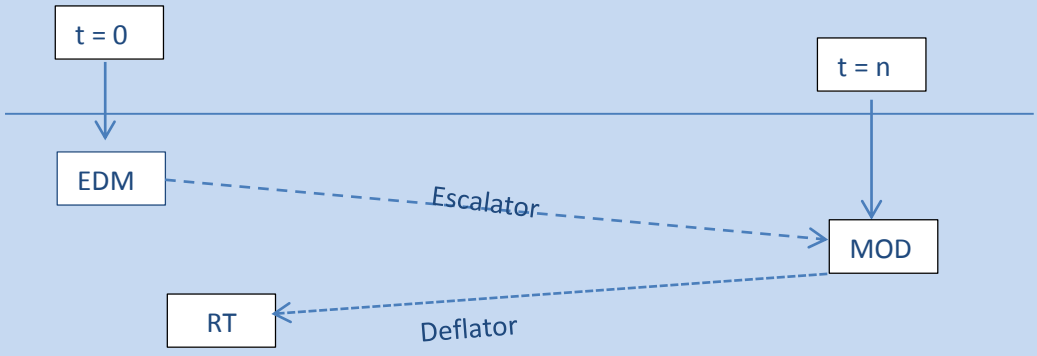
MOD = EDM x Escalator

Escalator = General price index * Market factor

General price index is a measure of inflation

RT = MOD x Deflator

Deflator = Index in reference period/Index in future period



Did you notice that in the diagram above, EDM and RT are not shown in the same period "t=0". "t=0" is the base date or the reference date for EDM. When we roll back MOD to RT using a discount factor called deflator, you would expect the MOD to be rolled back to EDM when converted back into RT. But EDM and RT money many not necessarily be the same.

There are two reasons for this mismatch. First EDM may not be deflated back to same reference date/base date as EDM. Secondly when EDM is escalated to MOD, it is multiplied by a factor which has effect of inflation and other market factors. But when MOD is deflated back, it's not deflated back by same escalation factor (though you would assume and expect so). It's deflated by a factor which is dependent on general inflation index. Simply put the time line do not match and deflator is not the inverse of escalator (only if the market factors equal zero, in that case escalator and deflator will

be inverse of each other)

Let's recap the key points one last time. We start from EDM, and then escalate it to MOD. After converting the EDM to MOD we do the tax and NCF calculation in MOD. From this point we have two choices. Either performs all economic indicators calculation and compare in MOD term or convert the MOD NCF back to RT and then calculate economic indicators for comparison with other projects indicators.

Both choice is mathematically valid and will end up with the same decision conclusion. However one reason why people prefer to convert MOD cash flow back to RT is as follows.

MOD cash flow may look attractive but when seen in the light of inflation, that cash flow would have lost some of its purchasing power. Thus to account for that loss in purchasing power, MOD cash flow are turned into today's money or RT money on the reference date/base date as EDM. Secondly when EDM is escalated to MOD, it is multiplied by a factor which has effect of inflation and other market factors. But when MOD is deflated back, it's not deflated back by same escalation factor (though you would assume and expect so). It's deflated by a factor which is dependent on general inflation index. Deflator is not the inverse of escalator (only if the market factors equal zero, in that case escalator and deflator will be inverse of each other).

Let's do an exercise to see the theory in action! The table below shows the inputs for a project cash flow. We have assumed different escalation rate for Capex (10% escalation year on year) and Opex (8% escalation year on year).

The Oil price is forecasted at flat $60 in today's term. We assume the long term price to go up by 5% each year. Average inflation is assumed to be 3 % overall. Point to note is even though, Capex is forecasted to increase in cost by 10%, Opex by 8% and Oil price itself by 5%, the general price index or inflation goes up only 3% year on year. This is because inflation or general price level in the economy is determined not just by crude oil price and Capex and Opex, but many other items (some of which may go up or down).

Capex, Opex and Oil price is forecasted based on today's estimate (EDM, or estimate day money).

We start with all inputs in the table (pale yellow section). Next we calculate the escalation factors for each category of inputs for all periods.

Price escalation factor in period t = $(1 + \text{Price Escalation \%})^{t}$

Price in MOD terms in period t = Price in period in EDM x Price escalation factor of period

Revenue in MOD terms in period t = Production in period x Price in MOD in period t

Opex escalation factor in period t = $(1 + \text{Opex Escalation \%})^{t}$

Opex in MOD terms in period t = Opex in period in EDM x Opex escalation factor of period

Capex escalation factor in period t = $(1 + \text{Capex Escalation \%})^{t}$

Capex in MOD terms in period t = Capex in period in EDM x Capex escalation factor of period

Pre Tax cash flow (Pre Tax CF) is simply = Revenue – Opex – Capex, all in MOD terms. Taxable profit = Revenue - Opex – Depreciation – any losses of previous period. Depreciation and Tax both are based on MOD Revenue, Opex and Capex. We have assumed 5 years straight line depreciation for Capex. Depreciation to start from production start and any pre-production cost is capitalized and depreciated. Assumed tax rate is 30%. We did not assume any royalty. Calculated tax is also in MOD terms.

Next we calculate net cash flow (NCF in MOD terms). To convert NCF – MOD into real term (NCF-RT) we use deflation factor. Deflation factor = $1 /(1+\text{Inflation rate})^{t}$.

NCF in Real Term = NCF in MOD terms x Deflation Factor.

		Year	1	2	3	4	5	6	7	8	9	10
Capex - EDM	MM$	500	100	200	200							
Opex - EDM	MM$	350				50	50	50	50	50	50	50
Production	MMBbl	53				10	10	9	9	8	5	2
Price - EDM	$/Bbl		60	60	60	60	60	60	60	60	60	60
Price Escalator	%		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Price Escalation	5%		1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.63
Capex Escalation	10%		1.10	1.21	1.33	1.46	1.61	1.77	1.95	2.14	2.36	2.59
Opex Escalation	8%		1.08	1.17	1.26	1.36	1.47	1.59	1.71	1.85	2.00	2.16
Inflation	3%		1.03	1.06	1.09	1.13	1.16	1.19	1.23	1.27	1.30	1.34
Production	MMBbl	53	0	0	0	10	10	9	9	8	5	2
Price - MOD	$/Bbl	82	63	66	69	73	77	80	84	89	93	98
Revenue - MOD	MM$	4349	0	0	0	729	766	724	760	709	465	195
Capex - MOD	MM$	618	110	242	266	0	0	0	0	0	0	0
Opex - MOD	MM$	607	0	0	0	68	73	79	86	93	100	108
Pre Tax CF - MOD	MM$	3123	-110	-242	-266	661	692	644	674	617	365	88
Production Start	Flag		0	0	0	1	1	1	1	1	1	1
To Depreciate	MM$	618				618						
Depreciation	MM$	618	0	0	0	124	124	124	124	124	0	0
Taxable Profit - MOD	MM$	3123	0	0	0	538	569	521	551	493	365	88
Tax - MOD	MM$	937	0	0	0	161	171	156	165	148	110	26
NCF - MOD	MM$	2186	-110	-242	-266	500	522	488	509	469	256	61
Deflator	Fraction		0.97	0.94	0.92	0.89	0.86	0.84	0.81	0.79	0.77	0.74
NCF - RT	MM$	1750	-107	-228	-244	444	450	409	414	370	196	46

IMPACT OF INFLATION ON CASH FLOWS

The cash flow calculated with and without inflation/escalation will differ when compared in MOD terms. They will not differ however if they are compared in RT terms once the tax impact of depreciation allowance passed by. The difference in RT cash flow arises due to the difference in the timing of the Capex spend and the tax benefit through the depreciation. The tax relief loses purchasing power due to delayed claim. If Capex was allowed to be expensed instead of depreciated, escalation and deflation would cancel out each other (provided market factor in the escalation =1).

Some fiscal regime like UK allowed oil companies to 'uplift' their Capex for tax purpose by certain % to compensate them for loss in purchasing power of the delayed tax relief on account of depreciation.

A second difference arises in the IRR. It will be higher for MOD cash flow than IRR cash flows. When inflation is present the effect of inflation on the RROR (real ROR) is to seriously reduce the attractiveness of the project (10% inflation reduces the RROR from 10% to only 1 %).

MULTIPLE CURRENCIES

Most of the upstream E&P Companies operate in more than one country. They may be headquarter in country X, while their field operations might be going on in country Y and Z and many more, depending on the size of the company.

For such companies, evaluating project economics and making comparison between projects of various countries having their own currencies, exchange rate and inflation rate, makes the comparison quite difficult. It is therefore desirable that the final cash flow and indicators are based in the same currency and same MOD or RT terms.

It will also be driven by company's presentation and function currency which would be dictated by the accounting rules that the company follows. As a generic guideline we are presenting here what some of the big companies do in such situation.

All cash flow elements should be calculated in the MOD currency in which the transaction occurred. Then they should then be converted into the MOD of local currency using actual or forecasted exchange rate. After this MOD of the local currency is converted into the MOD of the parent company's currency where it is based. Next the MOD parent company's currency is presented into RT parent company's currency.