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Analysis of the Use of Discounted Cash Flow Technique of Appraisal under a Changing Discounted Rate and Cash Flow Condition

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Abstract— *Discounted cash flow analysis is a valuation technique which assists the investor in determining the viability of a proposed investment by estimating the present value of the expected future cash flows using a discount rate. The conventional approach has been the use of fixed discount rate which from the analyses carried out tends to overestimate the asset value. The use of changing discount rate was found to be more efficient in obtaining more reliable present value of the projected investment cash flows. The credibility of the varying discount rate was essentially due to its ability to take into consideration the impacts of tax risk, market risk, liquidity risk and political risk on the overall investment performances which are prevalent in most economies. To this end, a new discounted cash flow analysis model was derived: NPV = 1/ (1 + (r $\pm$x))^n to introduce the varying discount rate factor which is recommended for long term investments (above five years) and in volatile economies.*

Key words— *Discounted cash flow analysis, fixed discount rate, changing discount rate, investment risks.*

I. INTRODUCTION

Discounted cash flow (DCF) analysis is a method of valuation used in estimating the worth of an investment based on its expected future in and out cash flows. The discounted cash flow gives a summary of the adjusted cash flow that reflects the time value of money; hence, discounted cash flow analysis can be said to be an application of the time value of money concept for the future cash flow. The outcome of the process explains better the conception that money to be received or paid in the future has less value today, than an equal amount received or paid today.

The use of the model has widely gain acceptance among investment appraisers, hence, Perrakis (1991) acknowledged discounted cash flow (DCF) method to be the mostly used fundamental method in business valuation. It assists the investor in determining the viability of a proposed investment by estimating the present value of the expected future cash flows using a discount rate. Discounted cash flow analysis offers investors a platform on which possible investment opportunities are compared with the view to determine the most viable option thereby guiding the investor's decision in making choice. Vo and Marks (2018) described discounted cash flow analysis as a financial modelling method that encourages an investor in determining if making a big purchase is a good long-term investment by analysing how one can spend on the investment right now towards getting the desired return in the future.

The investment analyst based on his professional competence projects future cash flow streams expected of the investment within its life span and discounts it at chosen discount rate as to determine the present value of the investment. Generally, it is a practice that the investment with larger option of surplus cash flow net present value will be recommended as the better option. The outcome of discounted cash flow (DCF) model depends on two inputs namely the estimated future cash flow and the discount rate (weighted average cost of capital). According to Bohlin, Copeland and Ross (as cited in Arumuga, 2007) how to calculate the discount rate are the major concern of some scientific reports as well as the topic of large discussions in financial text. Where the discounting period between now and the future cash payments increases, the present value decreases. Similarly, as the discount rate (interest rate) in the present calculations increases, the present value decreases. This was affirmed in the work of Udo (2003) where he indicated that different target discount rate produces different net present value and concluded that the higher target returns produce lower net present value.

The discount rate used in the determining the present value of investment future cash flow streams is equivalent to the interest rate of the capital invested. To ensure high level of accuracy in any investment discounted cash flow analysis, the need to correctly project the future cash flow streams and to determine the appropriate discount rate cannot be over-emphasized. The appropriateness of any discount rate lies essentially on the type of investment. Considering the peculiarity of different investment vehicles, while investing in standard assets, for example 'Treasury bonds', the risk-free rate of return in a given economy is often used as the discount rate. On the other hand, if an assessment of the viability of a potential business investment/project is to be carried out, it is advisable that the Weighted Average Cost of Capital (WACC) should be used as the discount rate. The Weighted Average Cost of Capital refers to the average cost the company pays for capital from borrowing or selling equity under any of the conditions, the net present value of all cash flow should be positive to select the investment/project.

In discounted cash flow analysis, it is argued that the discount rate selected is an average rate based on future uncertainty and investment criteria. According to standard financial theory, long-term investments require a higher rate of return than short term financial investment. Long term investment ties up investors fund longer period of time and

exposes investors to longer term of fluctuations in the interest rate and greater risk. A greater rate of return would be required to compensate for this risk; hence higher discount rates are used for investments that are viewed to be risky, while low discount rates are used for investments that are considered less risky. For the risky investments, the use of higher rates is considered as a means of hedging against risk. Generally, single discount rate for the study period is often used, this has been considered to represent an average risk return of the project being reviewed. The quest to be more accurate in the estimation of the investment value by reflecting the increasing investment risk associated with passing time, many questions have been raised by appraisers on the credibility of using fixed discount rate in cash flow analysis.

Observations have shown that the early years of most business investment are faced with less risk; while the risk tends to increase with time particularly for long term investments. Therefore, to account for risks that vary with time, varying discount rates become inevitable, hence the proposal to adoption of time-varying discount rate particularly in developing/under-developed economies that do experience unstable economic conditions. This would therefore help to take care of impacts of market risks, inflations and fluctuating exchange rates.

Aim and Objective

The aim of the study is to carry out analysis of the application of changing discount rates in cash flow analysis of investment assets with the view to determine the justification of the application of time-varying rates. The objective of the study is to develop discounted cash flow analysis model with time-varying discount rate factor.

Review of Related Literature

Ogbuefi (2011) indicated that discount cash flow analysis technique, as a time-adjusted technique takes care of the effects of time on the value of money by putting into consideration the extrinsic factors of the uncertainty of future returns and the effect of inflation. He further illustrated that discounted cash flow technique introduced the concept of present value in order to reduce to manageable proportion the time dimensions involved in the investment project analysis.

Ogunba (2013) is his study opined that risk-adjusted discount rate adjust for risk by increasing the discount rate/capitalization rate adopted in appraisal, depending on the perceived volatility or risk of the project relative to the risk – free rate of return. This he said is based on the principle of having to compensate for additional risk taken with higher return. Ogunba further illustrated that the amount by which the target rate is raised to take account of the risk of the project is known as the risk-adjusted discount rate.

Liu and Mei. (1994) in their study adopted a model that held cash flows artificially constant, allowing only the return expectations to vary through time according to the forecasts of the Vector Auto Regression (VAR) model applied to the historical data. Finally, the returns were held artificially constant with only the forecasted cash flows allowed to vary through time according to the VAR model forecast. They noticed that the model with constant cash flows but variable returns tracks very closely the unrestricted model (which, in turn, closely tracks the actual historical market values). In contrast, the present value model with the returns held

constant (similar to the traditional present value approach) does not track closely at all to the other series. Their findings confirm that when we remove the variability in the return expectations, were move almost all of the volatility from the present value. The study further suggests that accounting for time-variability in returns is quite important in real estate market valuation.

Ang and liu (2002), in their study found that using constant discount rates can produce large mis-valuation, which in portfolio data are mostly driven at short horizons by market premium and at long horizon by time-variation in risk-free rates factor loadings. To them, practical valuation is accomplished with an analytic term structure of discount rates, with different discount rates applied to expected cash flows at different horizons. Karl, Jonas and Madeleine (2002) in their study alluded to the position of Ang and Liu by stating that discount rate should change with time as interest rates, inflation, and other factors affecting the environment the company operates in, are changing. Therefore, the assumption that it will remain the same for the entire forecasting period is not realistic.

According to Ogunba (2013), to advise on the purchase of a property or mortgage value based on non-risk adjustment past market trends is increasingly becoming inadequate for sophisticated clients. This he said ignores the possibility of capital value change due to changes in rental income, growth rate, yield forecast etc.

Baun and Crosby (1988) further emphasized on the need to advise clients on impacts of investment risks on capital values. This according to Baun and Crosby has made risk-return analysis major focus of modern investment analysis.

Enever (1981) and Baun et. al (1988) pointed out that it is important to incorporate risk adjustment model in asset valuation in United Kingdom particularly for institutions or big companies wishing to invest huge capital on long time basis. The inclusion of quantitative risk analysis in investment asset valuation is adjudged relevant because of the cloud of uncertainty that usually besiege future investment performances.

Deducting from the foregoing contributions, it shows that while undertaking cash flow analysis of long term investment assets, particularly those that are highly vulnerable to risk, time-varying discount rate should be adopted to account for the related risks.

II. METHODOLOGY

Historical data on rental and capital values of six number three-bedroom flats on three floors in Owerri CBD were obtained (2008 – 2017) from practicing Estate Surveying and Valuation firms in Owerri, Nigeria. The data were analysed to obtain the current returns (which is measured as the periodic income in relation to the beginning price of the investment) and total returns (is estimated by the addition of the current return and the capital return). The capital return is determined by dividing the price appreciation (or depreciation) with the

initial price of the asset. The average return obtained over the analysis period was used in the cash flow analysis. The net present value (NPV) arrived at by using a fixed mean return of the block of flats over the study period was compared with the NPV obtained by periodically adjusting the mean return used as discount rate.

III. Result and Findings

To illustrate the effects of using fixed discount rate in the valuation of investment asset, analysis of the data generated from practicing estate surveying and valuation firms in Owerri on six number Three Bedroom Flats on Three Floors in Owerri CBD was carried out. The analysis was done in two phases: the first phase was done by using fixed discount rate of 10%, while the second phase was done by varying the discount rate at three year interval (at 10, 11, 12 and 13%) as shown in Table 1 and 2.

Discounted Cash Flow Analysis of six number Three Bedroom Flats on Three Floors in Owerri CBD at Fixed Discount Rate

Year	Cash inflow(#)	Cash outflow(#)	Discounted rate 10%	Discounted Cash inflow(#)	Discounted Cash outflow(#)
0	-	48,000,000.00	1.00	-	48,000,000.00
1	1,500,000.00	300,000.00	0.909	1,363,500.00	272,700.00
2	1,500,000.00	300,000.00	0.826	1,239,000.00	247,800.00
3	1,500,000.00	300,000.00	0.751	1,126,500.00	225,300.00
4	1,920,000.00	384,000.00	0.683	1,311,360.00	262,272.00
5	1,920,000.00	460,800.00	0.621	1,192,320.00	286,156.80
6	1,920,000.00	460,800.00	0.564	1,082,880.00	259,891.20
7	2,100,000.00	525,000.00	0.513	1,077,300.00	269,325.00
8	2,100,000.00	525,000.00	0.467	980,700.00	245,175.00
9	2,100,000.00	525,000.00	0.424	890,400.00	222,600
10	81, 000,000.00	4,050,000.00	0.386	31,266,000.00	1,563,300.00
		Discounted cash flows total		+41,529,960.00	-51,854,520.00

NPV = # -10,324,560.00

Discounted Cash Flow Analysis of six number Three Bedroom Flats on Three Floors in Owerri CBD at Varying Discount Rate

Year	Cash inflow	Cash outflow	Varying Discount rate 10% - 13%	Discounted Cash inflow	Discounted Cash outflow
0	-	48,000,000.00	@10% 1.00	-	48,000,000.00
1	1,500,000.00	300,000.00	0.909	1,363,500.00	272,700.00
2	1,500,000.00	300,000.00	0.826	1,239,000.00	247,800.00
3	1,500,000.00	300,000.00	0.751	1,126,500.00	225,300.00
4	1,920,000.00	384,000.00	@11% 0.659	1,265,280.00	253,056.00
5	1,920,000.00	460,800.00	0.593	1,138,560.00	273,254.40
6	1,920,000.00	460,800.00	0.535	1,027,200.00	246,528.00
7	2,100,000.00	525,000.00	@12% 0.452	949,200.00	237,300.00
8	2,100,000.00	525,000.00	0.404	848,400.00	212,100.00
9	2,100,000.00	525,000.00	0.361	758,100.00	189,525.00
10	81, 000,000.00	4,050,000.00	@13% 0.295	23,895,000.00	1,194,750.00
		Discounted cash flows total		+33,610,740.00	-51,352,313.40

NPV = #-17,741,573.40

The results show that at a fixed discount rate of 10% as shown in table 1, the investment asset gave negative NPV of#-10,324,560.00illustrating that at the discount rate of 10% the investor would yet require #10,324,560.00to recoup the capital invested. However, varying the discount rate at a given interval as shown in Table 2 gave much higher income deficit NPV = #-17,741,573.40 compared to the outcome of Table 1 cash flow analysis.

A critical examination of the investment performances at different discount rate shows that using a fixed discount rate in investment analysis tends to overestimate the investment value as a single discount rate cannot reflect the variability of any economy and market conditions. It is therefore expedient to vary the discount rate in investment asset valuation, particularly where it may take fairly long time to recoup capital invested. This will help the appraiser to capture basic periodic economic changes in any given economy.

The rate at which the discount rate can be varied should be based on the vulnerability of the investment to different market risk factors and the stability level of the local economy. In undertaking risk adjustment analysis, it is observed that the vulnerability level of most investment is high with market risk, Tax risk, liquidity risk and political risk. Hence, the ability of the appraiser to determine the impacts of these risk factors is paramount to achieving reliable investment values.

To further justify the rationale for the application of varying discount rate in the valuation of investment assets, the impacts of the following risks: tax risk, market risk, liquidity risk and political risk on the overall investment performances were decisively analyzed.

Tax risk: Taxation poses risk to investors when the taxing authority changes tax laws that will affect an investment negatively. Higher taxes on investment income reduce real returns and can lower the prices of investments in the secondary markets (Yu, 1986; John, 2008 & INVL, 2015).

In most developing/undeveloped economies, where taxes are major sources of government revenue, taxes levied on incomes are often reviewed upwards with time; particularly as the need to raise more funds arises. Different tax regimes

affect the investors' assets net returns at different magnitude over the life span of an investment. Assessment of the present value of investment by the application of discounted cash flow analysis model with fixed discount rate without varying the discount rate in order to capture the effects of changes in tax regimes would result to over-estimation of the valuation outcome.

In investment cycle, it is accepted norm to go for higher rate of return for a more risky investment scenario; therefore, to cushion the probable impacts of different tax regimes on investments over an investment life time, it is logical to review upwards with time the discount rate for the cash flow analysis of the prospective investments to compensate for the variability of the tax risk impacts.

Market risk

Any market conditions that can negatively impact on investment returns constitute market risk. Although market risk affects most investments, some investments are affected more than others depending on its price volatility, in relation to an index of similar investments. Market risk is generally dependent on economic conditions, such as inflation, consumer sentiment, or credit availability (Ken, 2020 & Motilal, 2020).

Drawing from the impacts of market risks on investment returns, to efficiently contain the effects of assets price volatility, investment analysts should vary the discount rate in their discount cash flow analysis to reflect market realities. To appropriately predict the required discount rates, good understanding of the historical investment performances in relation to the changing market/economic conditions is critical.

Liquidity risk, it is the risk that an investment cannot be sold quickly for a reasonable price. Real estate, for instance, is an illiquid investment because it takes considerable time to sell unless it is sold below market value (INVL, 2015). Owe to the possibility of encountering liquidity risk at the disposal of most industrial properties, particularly real estate assets at the point of decommissioning, it is logical to make provision for a higher discount rate to take care of liquidity risk when appraising the viability of the investment using discounted cash flow analysis technique.

Political risk is increasingly becoming noticeable in investment market. This often takes place when a change in government comes with policy change and step down in the previous administration policies (Motilal, 2020 & Hemant, 2020). This should always be anticipated in investment asset appraisal particularly in developing economies. In efforts to stabilize the economies of most developing countries, such countries often embark on economic policies that will drive down the prices of any securities issued by companies located in their territories, such as increasing taxes, discouraging foreign investment, or in extreme cases, nationalizing the companies without proper compensation. These however, increase the risk of actualizing the expected returns. Therefore, varying the investment returns by reviewing upwards the expected returns in long term investments becomes expedient in countries where political risk is most expected,

To align with the possibility of encountering the preceding scenarios in the life time of any investment, it is advisable to make provision for periodical review of the discount rate employed in determining the present value of any investment using discounted cash flow analysis technique. Sequel to the above assertion, a modification of the discounted cash flow technique model is recommended. This is adopted to incorporate into the existing net present value (NPV) formula $(1/1+ r)^n$, 'x' element that would account for the 'Changing Discount Rate' factor which can vary at any degree depending on the prevailing investment market condition and the general economy of investment host country.

The new formula propounded by the authors to incorporate the 'Changing Discount Rate' in the net present value formula used when discounted cash flow appraisal technique is employed in appraising investment asset value is:

$NPV = 1/ (1 + (r \pm x))^n$

Where:

NPV = net present value

r= rate of return (equivalent to the interest rate of the capital invested)

$x = 1, 2, 3...\infty$

n = the discounted period

IV. Conclusion

Cash flow analysis technique helps in determining the present value of an investment by discounting at a determined rate the anticipated cash flows over the life span of an investment. The outcome of the analysis is compared to the initial/present capital outlay of the investment with the view to determine its viability.

The use of fixed discount rate is observed to be inefficient as it tends to overestimate the investment present value. Therefore, to reflect the realities of investment returns variability orchestrated by changes in the economic and political situations of different countries, the researchers strongly opine that discounting rates should be varied over time, pending on the life span of the investment. The application of varying discount rate is observed to be significant in curbing the effects of most unavoidable investment risks that are bound to reduce the present value of an investment.

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