NET VALUE ADDED (NVA) AND SHARE VALUE APPRECIATION RATE (SVAR): IMPROVED VALUE ADDITION MEASURES FOR EVALUATION OF CAPITAL PROJECTS

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Corporate financial objective of *stockholder wealth maximization* and use of *discounted cash flow* (DCF) techniques for the evaluation of capital projects are two of the important tenets of financial management that got wider consensus among academicians. Net present value method (NPV) among the DCF measures, is considered to be the most suitable method congruent with the corporate financial objective of stockholder wealth (value) maximization.

Maximizing the difference between a corporation's market value of equity and its book value of equity capital maximizes stockholder wealth. This difference which is termed as market value added (MVA) is tied via economic value added (EVA) to the widely used DCF project evaluation technique, NPV. EVA which is the residual wealth that a firm creates from several capital projects in a given year after accounting for the opportunity cost of invested capital "is a link in the chain that begins with the NPV of an individual project and ends with the firm's MVA[1]."

This paper attempts to scrutinize the relevance of the NPV method in achieving the corporate objective of stockholder wealth maximization and suggest a superior alternative. The newly suggested alternative method is named as Net Value Added (NVA), which measures the creation of value to stockholders through corporate investment decisions.

I. CORPORATE FINANCIAL OBJECTIVE

As stated, stockholder wealth maximization[2] is the widely accepted objective of large corporations. The wealth or value is differentiated from profit on two counts[3], time and risk. Profit based criteria ignores timing of incidence of benefits and costs of investments as well as their riskiness. Recognition of time and risk would warrant use of cash flows rather than profits

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[1] Brigham E. F. & Gapenski, L.C. (1996): *Intermediate Financial Management*, 6th ed., Fortworth: The Dryden.Press.

[2] Durand David & Lutz (1952): *Cost of Debt and Equity Funds for Business: Trends and Problems of Measurement"*, Conference on Research in Business Finance, New York.

[3] Levy, Halm and Sarnat, Marshall (1978): *Capital Investment and Financial Decisions*, Prentice Hall International

in making value-maximizing investments. A value-maximizing firm manages its balanced scorecard[4] through carefully managing its growth-cycle. Such a firm takes calculated risk in its investments and converts that into sales growth leading to value maximization through effective innovation, customer and internal business perspectives[5].

Investment is a part of financial perspective in the balanced scorecard and it is an important stage in the growth-cycle of a firm[6]. Financial evaluation of investment proposals, are carried out prudently through discounted cash flow (DCF) techniques, basically through net present value (NPV) and internal rate of return (IRR), with quite a few variants of each of them. For example, profitability index (PI) and adjusted present value (APV) are variants of NPV and modified internal rate of return (MIRR) is the variant of IRR. Each variant has been an attempt to remove some weakness of the main technique. Some of them have come into being for meeting a specific problem situation. A couple of issues addressed in these attempts are: (a) the rate of appreciation in value and (b) the appropriateness of the discount rate. For example, PI was developed to give rate of appreciation in value rather the absolute value that NPV gives. APV and MIRR attempt to address the issue of appropriate discount rate.

The theoretical contributions of Tuttle and Litzenberger[7], Robert Hamada[8] and others integrating capital budgeting theory with the Sharpe[9]-Lintner[10] capital assest pricing model (CAPM) have provided insights into the relationship between costs of capital and risk. Hamada has provided the methodology to separate risk premium into two parts: business and financial risk premiums. He combined the CAPM with the Modigliani and Miller[11] after-tax model of capital structure to obtain the following expression for K_{SL}, the cost of equity to a leveraged firm.

$$K_{SL} = \text{Risk-free Rate} + \text{Business Risk Premium} + \text{Financial Risk Premium}$$
$$= K_{RF} + (K_M - K_{RF})b_U + (K_M - K_{RF})b_U(1-T)(D/S)$$

[4] Kaplan, Robert S. and Norton, David P. (1992): The Balanced Scorecard - Measures That Drive Performance, *Harvard Business Review,* January - February.

[5] Kaplan, Robert S. and Norton, David P. (1996): *Linking the Balanced Scorecard to Strategy*, California Management Review, Vol. 39, No. 1, Fall.

[6] Patel Bhavesh M. (2000): *Project Management: Strategic Financial Planning, Evaluation and Control,* Vikas Publishing House, New Delhi.

[7] Tuttle, D. L., and Litzenberger, R.H. (1968): Leverage, Diversification, and Capital Market Effects on a Risk-Adjusted Capital Budgeting Framework, *Journal of Finance*, Vol. 23, June, 427-443.

[8] Hamada, Robert S. (1969): "Portfolio Analysis, Market Equilibrium, and Corporation Finance, "*Journal of Finance*, Vol. 24, March, 13-31.

[9] Sharpe, W.F. (1964): Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, *Journal of Finance*, Vol. 19, September, 425-442.

[10] Lintner, J. (1965) The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *Review of Economics and statistics*, Vol. 47, February, 13-37.

[11] Modigliani, F. and Miller, M.H. (1958): Corporate Income Taxes and the Cost of Capital: A Correction, *American Economic Review*, Vol. 31, December, 433-443.

where: K_{RF} = risk free rate, K_M = market return, T = tax rate, D/S = debt equity ratio, and b_U is the beta coefficient of the unlevered (all equity) firm.

An inquisitive mind will search for an answer to the question what is the measure of wealth, so that one can select the right decision tool that measures wealth. What is (are) measure(s) of 'wealth'? Four different alternative measures of wealth can be found in the literature. They are as follows:

1. Net replacement/ net liquidation value of the firm
2. Gross market capitalization of the firm
3. Net market capitalization of the firm
4. Common Stock price per share

Replacement or liquidation value of the firm net of its liabilities would hardly be recognized as the lighthouse for a going-concern. At best, it can be used to approximately judge the 'fairness' of market capitalization of the firm. Even that would fail in case of judging fair capitalization of a firm dominant on knowledge-capital. Gross market capitalization can be kept aside quickly when 'stockholder wealth' is under discussion. Net market capitalization and common stock price per share would move in tandem when fresh issue of shares is not contemplated, and when two mutually exclusive projects with significant difference in capital base are not under evaluation. (In that case one may use share value appreciation rate (SVAR) explained later which is an extension of the NVA proposed in this paper.)

We consider net market capitalization as the measure of wealth in developing the theme of this paper. We focus on bringing out limitations of the NPV method and offer a superior alternative called as net value added (NVA) and its extension into share value appreciation rate (SVAR). As superiority of NPV over IRR is a proven matter, no effort is made to scrutinize IRR.

II. ISSUES ADDRESSED

This paper intends to cover the following which are the limitations of the NPV as the best value creation measure, and suggest remedial measures.

1. NPV method follows the principle of 'separation of investment decisions from financing decisions' and considers project cash flows for discounting purposes. Project cash flows belong to all types of suppliers of long-term funds. Discounted value of project's cash flows cannot be a true measure of shareholder wealth. This paper advocates deducting debt cash flows from the project cash flows to get those cash flows that belong to stockholders only.

2. Since financing is considered an issue independent of investment, the NPV method does not take into account the debt-repayment pattern. It is a prudent business practice to service the debt from the cash flows of a project for which the debt is obtained. It is essential to structure the debt, as it will have an impact on the value creation. This paper shows that the debt repayment pattern has significant impact on the value creation.

3. This paper advocates that the residual cash flows that belong to the stockholders should be classified on the basis of their end-use. They are divided into three parts, viz., (a) cash flows for maintenance of capital, (b) cash flows for servicing the equity capital and (c) surplus cash flows that create value.

4. NPV method prescribes the use of a single discount rate. APV method suggested the application of separate rate of discount depending upon the risk associated with the end-use of different parts of project cash flows. The risk implication of project is captured in the cost of funds. Note the risk associated with each part of the stockholders' cash flow appropriation is not the same. As such these three parts cannot be combined into one for the calculation of net value creation. They need to be discounted at appropriate rates depending upon the associated risk. This paper suggests meaningful rates for the discounting process

5. In calculating NPV the power of time (η) is assigned to a single discount rate, viz., the firm's weighted average cost of capital, Ka. The power of time can be assigned if the cash flow series are subject to the exponential growth over time. The single discount rate is unsuitable because a single rate conventionally applied to the calculation of NPV has at least three components in it and all of which are not subject to the exponential growth over time. One would notice that the real rate of return (r=Rf) and inflation premium (h) are subject to the time value of money while risk premium (Rp) is not. Thus the power of time (η) can be assigned to only those components of required rate of return which are related to the time value of money. This paper considers this aspect in calculating the NVA of a project.

A summary of limitations of present methods of capital project evaluation and suggested remedies in the form of NVA are given in Table 1.

Table-1: Limitations of Present Project Evaluation Methods and Prescribed Remedies

	Limitations	Remedies
1.	Project cash flows are considered, and discounted at the firm's weighted average cost of capital.	Project debt cash flows are subtracted from the project cash flows to get stockholders' cash flows, and discounted at K_e.
2.	Project debt repayment pattern is ignored.	Project debt repayment pattern is considered while deducting the debt cash flows.
3.	Only one cash flow stream is recognized.	Stockholders' cash flows are separated into three distinct classes, namely; (a) capital maintenance, (b) capital servicing, and (c) net surplus.
4.	A single cash flow per period is discounted with one single rate, Ka comprising all the components of (weighted average) cost of capital.	Each part of the stockholders' cash flows is discounted at an appropriate rate, which is specific to that cash flow only. For this purpose the cost of equity is broken down into three parts in line with the three classes of stockholders' cash flows.
5.	Power of time (η) is assigned to the single discount rate, Ka. This ignores the fact that all the components of a single discount rate may not be subject to the exponential growth over time.	Power of time is assigned to only those cash flows, which are subject to the geometric progression over time.

II. **PRESENTATION OF ISSUES**

III.

The theme of the paper is developed around a hypothetical example. All the variables that are required for addressing the issues are given in Table 2. The basic computations are also shown in the following pages before setting to arrive at the net value added (NVA). Finally, the NVA calculation is shown and its extension into share value appreciation rate (SVAR) is suggested to address some specific situations. The paper addresses the project cash flow discounting process in right perspective for attaining the best results for stockholder value maximization.

1. Example

Let us take an example of a project with five year life to demonstrate the method of net value added (NVA). The project is assumed to cost $100,000, sixty percent of which is financed by debt at an after tax interest rate of 9.73%. Variables used in the example and their assumed values are given in Table 2 and required computations are shown in Tables 3, 4 and 5.

Table 2: Variables, their Symbols and Values Used in the Example

Sacrifice value of money (real rte of return: rf)	r	2.50%
Premium for inflation	h	5.00%
Premium for degree of operating leverage (DOL)	d	2.00%
Premium for degree of financial leverage (DFL)	f	1.50%
Corporate Tax rate applicable	t	35.00%
Debt-Equity Ratio:		3:2 = 60:40
Debt repayment		at the end of project life

It should be noted that the required rate of return is expressed in real terms net to inflation and tax. Component wise break up of costs of funds are given so that the suitable parts of the cost of equity can be recognized for discounting different parts of stockholders' cash flows.

A new project may change the risk profile of a business. Even when we consider a change in the risk profile in our example project the validity of the NVA method would hold. In that case we will have to work out the marginal cost of capital (MCC) and use its break-up components as the discount rates. To avoid this unnecessary complication we assume in our example that the new project will not change the risk profile of the business. We will use, therefore, break up components of WACC for the purpose of discounting project cash flows.

1. Computations

The calculation of net value added necessitates us to look at the basic computations. The debt-servicing pattern is required for finding the stockholders' cash flows. It is given in Table 3. Cost of funds and weighted average cost of capital are shown in Table 4. If the debt is repaid at the end of the project life then cost of equity will remain constant over the project's life. It will change if debt repayment starts during the life of the project. As such we also need to calculate year-wise cost of equity. Year-wise costs of equity for different debt repayment schedules are given in Table 5.

(a) *Debt Servicing Schedule*

The servicing of debt would consume a part of the project's cash flows. It would depend on the terms and conditions contracted with the lender. In the present example we considered only alternative debt repayment schedules over time. Table 3 shows the $60,000 debt repayment starting at different years during the project life and the resultant alternative debt servicing cash flows.

Table 3: Debt Servicing Schedule ($60,000 @ 9.73% Posttax)

Year	Debt Servicing Schedule under Different Repayment Options				
	At the end of period (Interest and Principal)	$30 K Equal installments in last 2 years	$20 K Equal installments in last 3 years	$15K Equal installments in last 4 years	$12K Equal installments in 5 years
1	5,835	5,835	5,835	5,835	17,835
2	5,835	5,835	5,835	20,835	16,668
3	5,835	5,835	25,835	19,376	15,501
4	5,835	35,835	23,890	17,918	14,334
5	65,835	32,918	21,945	16,459	13,167

(b) *Component-wise Cost of Funds*

The calculation of nominal rates of each component of cost of debt as well as equity is essential for proper discounting of project cash flows. The calculation of the component-wise rates and the total rates for cost of debt and cost of equity are given below:

- Cost of Debt:

Using the conventional equation of calculating cost of debt we get the following:

$$K_d = h + \{(1+h) \times (r + d)\} \qquad \text{(Eq. 1)}$$

$$\therefore K_d = \{0.05 + 1.05 \times (0.025 + 0.02) = 9.725\%$$

Alternatively, this can also be presented thus:

$$\therefore K_d = \quad h \quad + \quad (1+h) \times r \quad + \quad (1+h) \times d$$

$\therefore K_d =$ 0.05 + 1.05×0.025 + 1.05×0.02

$\therefore K_d =$ 5% + 2.625% + 2.10% = 9.725%

The effective rate of each component of the cost of debt is calculated as below:

R_{Dh} =	Inflation premium on debt	= h		= 5.000%
R_{Dr} =	Real rate of return on debt	$= (1+h) \times r$	$= (1+0.05) \times 2.5\%$	= 2.625%
R_{Dd} =	Business risk premium (DOL)	$= (1+h) \times d$	$= (1+0.05) \times 2.0\%$	= 2.100%
			Post-tax K_d =	9.725%

- <u>Cost of Equity</u>:

The cost of equity can also be calculated in the same way.

$K_e = [h + \{(1+h) \times (r + d + f)\}] \div (1-t)$ (Eq. 2)

$\therefore K_e = [0.05 + \{1.05 \times (0.025 + 0.02 + 0.015)\}] /.65$

$\therefore K_e = 17.38\%$

This can be presented this way also:

$\therefore K_e =$ $h \div (1-t)$ + $\{(1+h) \times r\} \div (1-t)$ + $\{(1+h) \times (d+f)\} \div (1-t)$

$\therefore K_e =$ $0.05 \div 0.65$ + $(1.05 \times 0.025) \div 0.65$ + $\{1.05 \times (0.02+0.015)\}$ $\div 0.65$

$\therefore K_e =$ 7.69% + 4.04% + 5.65%

$\therefore K_d = 17.38\%$

The individual equations and calculations are shown below:

R_{Eh} =	Inflation premium on equity	$= h \div (1-t)$	$= 5.0\% \div 0.65$	7.69%

R_{Er} =	Real rate on equity	= (1+h) × r ÷ (1-t)	= (1+0.05)×2.5%÷0.65)	4.04%
R_{Ee} =	Business and Financial risk premiums (both. DOL & DFL)	= (1+h) × (d + f) ÷(1-t)	= (1+0.05)×(2.0%+1.5%) ÷0.65	5.65%
			K_e =	17.38%

Weighted average cost of capital is calculated using the following equation:

$$Ka = [(K_d \times D) + (K_e \times E)] \div [D + E] \qquad \text{(Eq. 3)}$$

Where,

d = premium for operating risk
D = debt portion of 60%
f = premium for financial risk
E = equity portion of 40%
h = inflation premium

K_d = cost of debt
K_e = cost of equity
r = real interest rate
t = tax rate
Ka = WACC

The final figures of all the costs of funds are reproduced in Table 4.

Table 4: Total and Component-wise Cost of Funds

Sources	Wt	Sacrifice value	DOL & DFL risk	Capital maintenance	Total
Post tax K_d	.60	2.63%	2.10%	5.00%	9.73%
Ke	.40	4.04%	5.65%	7.69%	17.38%
Ka=WACC	1.0	3.19%	3.52%	6.08%	12.79%

It should be noted that real (interest) rate of return compensates the sacrifice value of funds, business and financial risk premiums compensate the DOL and DFL risks, and inflation premium takes care of capital maintenance. (Wt in Table 4 refers to the weight of each capital source, viz., 60% weight for debt and 40% weight for equity.)

Conventionally project cash flows are discounted at the firm's WACC. Since we consider stockholders' cash flows, we need to discount them at the cost of equity. Cost of equity is 17.38% in this case. It is important to note that the total cost of equity comprises three components in it, as seen earlier in Table 4. We consider cost of each component separately.

(c) *Year-wise Cost of Equity*

In the conventional calculation of NPV it is assumed that the net operating income (NOI) theory of capital structure is operative. NOI theory postulates that the overall cost of funds remains constant at all the levels of debt-equity ratio. Therefore, the project cash flows are discounted at a constant rate of WACC. If we continue with that assumption it would imply that the (risk premium component) of cost of equity would change (decrease) when some portion of debt is retired. With the beginning of debt repayment any time during the life of a project the cost of equity will start declining. However, the cost of equity will not change if the debt is repaid at the end of the project. Table 5 shows the cost of equity in different years for different repayment schedules.

Table 5: Business and Financial Risk Components of Cost of Equity over the Five-Year Period with Different Debt Repayment Schedules (Based on NOI Theory of Capital Structure)

Year	Debt Repayment Options				
	At the end of period	$30 K Equal installments in last 2 years	$20 K Equal installments in last 3 years	$15 K Equal installments in last 4 years	$12 K Equal installments in 5 years
1	5.65%	5.65%	5.65%	5.65%	5.65%
2	5.65%	5.65%	5.65%	5.65%	5.23%
3	5.65%	5.65%	5.65%	5.12%	4.80%
4	5.65%	5.65%	4.94%	4.59%	4.37%
5	5.65%	4.59%	4.23%	4.05%	3.95%

Later when we consider financing together with the investment decision we will look into different repayment structures and check their effect on the stockholder value creation.

1. Calculation of Net Value Added (NVA)

Calculation of net value added is given in four steps and issues are addressed along side. They are as follows:

A. In the first step we subtract the project's debt cash flows from the project cash flows to get cash flows that belong to the stockholders.

B. In the second step we apportion the stockholders cash flows into three parts according to their end-use. They are equity servicing, capital maintenance (which consists of inflationary effect and capital recovery) and net surplus.

C. In the third step we look at the discount rate. We break down the total cost of equity in three parts. They include (a) a rate that ensures retention of capital (inflation effect), (b) expected risk-free rate and (c) expected risk (business and financial) premium.

D. In the fourth and final step we calculate NVA by discounting the stockholders' net surplus cash flows using components of risk-free rate and risk-premium. Care is taken here to avoid the problem of discounting by not assigning the power of time to the risk premium portion of the cost of equity as risk premium does not increase over time.

E. The last step is meant for those who either feel uncomfortable in handling absolute figure of NVA or evaluate mutually exclusive alternatives of different sizes of capital projects. An absolute figure of NVA is here translated into a rate of appreciation in value to give share value appreciation rate (SVAR), a logical extension of the NVA method.

The NVA calculation is more focussed on measuring the value creation in terms of net market capitalization of the firm. The design of debt instrument impacts net market capitalization in light of the project funded by it. It is not independent of it. The remaining part of the paper is devoted to solving the example following the steps outlined above.

A] <u>Calculating Stockholders' Cash Flow Stream</u>

Project cash flows are discounted at WACC adhering to the principle of separation of financing from investment decisions. As the resultant NPV does not measure wealth either in terms of net market capitalization or gross market capitalization, it loses its validity. As a first step of improvement in the calculation of net value added we find stockholders' cash flows by subtracting debt cash flow stream from the project cash flows. Then we discount them at the cost of equity. Table-6 shows this calculation of stockholders' cash flows under varying debt-repayment schedules.

Table 6: Calculation of Equity holders' Cash Flow Stream and Its Conventional IRR and NPV When Debt is Repayable at the End of Project Life

Year	Project Cash Flows	Debt Cash Flows	Equity holders' Cash Flows
0	-100,000	60,000	-40,000
1	30,000	-5,835	24,165
2	30,000	-5,835	24,165
3	30,000	-5,835	24,165

4	20,000	-5,835	14,165
5	30,000	-65,835	-35,835
DR	Ka = 12.79%	Kd = 9.73%	Ke =17.38%
NPV	-116	0	4,445
IRR	12.74%	9.73%	28.00%

Note: DR = Discount Rate.

Debt is a contractual obligation and debt cash flows are known. In Table 6 they are subtracted from the project cash flows to obtain equity holders' cash flows from the project. When discounted at the cost of equity of 17.38%, the net present value showed a totally different result than under the conventional NPV mechanism. This adequately proves the point that NPV suffers from the limitations emanating from faulty discounting procedure. By recognizing stockholders' cash flows we eliminate this weakness of NPV. The problem of assigning the power of time (exponential growth) to risk premium component of Ke in the discounting process would still persist. The proposed NVA method goes into identifying components of stockholders' cash flows as well as the components of cost of equity so that other limitations of the conventional discounting can be fully addressed.

One can observe from Table 7 the impact of debt repayment schedule on the net value of equity holders' cash flow stream when discounted at the K_e .of 17.38%. We shall consider debt-and its repayment structure in project evaluation under NVA method to enable us to tap the fullest potential of the value maximization.

Table 7: Net Discounted Values of Equity holders' Cash Flow Stream under Different Debt Repayment Patterns

Year	Cash Flow & Net Discounted Values of Equity holders' Cash Flows at Different Debt Repayment Options				
	At the end of period	$30 K Equal installments in last 2 years	$20 K Equal installments in last 3 years	$15 K Equal installments in last 4 years	$12 K Equal installments in 5 years
0	- 40,000	- 40,000	- 40,000	- 40,000	- 40,000
1	24,165	24,165	24,165	24,165	12,165
2	24,165	24,165	24,165	9,165	13,332
3	24,165	24,165	4,165	10,624	14,499
4	14,165	- 15,835	- 3,890	2,083	5,666
5	- 35,835	- 2,918	8,055	13,541	16,833
NPV	4,445	3,414	2,264	978	- 460

B] <u>Apportionment of Stockholder's Cash Flow Stream</u>

Stockholders' share of project cash flows is being appropriated according to its end-use. Three different end-uses of stockholders' cash flow can be identified as below:

(a) Equity servicing cash flows relate to meeting the expectations of (interest) returns on the funds invested.

(b) Capital maintenance cash flows relate to that portion of stockholders' cash flows earned every year and earmarked separately for avoiding erosion of capital. Inflation and capital recovery allowances are considered in determining the capital maintenance cash flows.

(c) Net surplus is the balance of stockholders' cash flow stream after subtracting the interest returns and capital maintenance cash flows referred to above. Net surplus alone can add value to the firm. Table-8 gives appropriation of stockholders' cash flow stream under different debt-repayment patterns assumed.

Table 8: Appropriation of Stockholders' Cash Flow Stream and Basic Calculations of NVA with Regular Discounting Mechanism (i.e. Power of Time Assigned to All the Returns Related Components of Cost of Equity)

Year	Project Cash Flow	Debt Cash Flow	Equity holders' Cash Flow Stream					
			Total	Appropriation of Total				
				Equity Servicing	Capital Maintenance		Net Surplus
					Inflationary Effect	Capital Recovery	
0	-100,000	60,000	-40,000			-40,000	
1	30,000	-5,835	24,165	3,877	3,077	17,211	0
2	30,000	-5,835	24,165	2,209	1,753	20,203	0
3	30,000	-5,835	24,165	251	199	2,586	21,130
4	20,000	-5,835	14,165	0	0	0	14,165
5	30,000	-65,835	-35,835	0	0	0	-35,835
DR	***12.79%***	***9.73%***	***17.38%***	***9.69%***	***7.69%***		***9.69%***
NPV	**-116**	**0**	**4,445**	**5,560**	**4,528**	**-4,528**	

IRR	12.74%	9.73%	28.00%		Zero NPV	
			PV @ constant K_e of returns only i.e. *NI theory*			3,229
			PV @ declining K_e of returns only i.e. *NOI theory*			3,229

It should be noted that the capital recovery allowance is calculated on payback basis. Stockholder's cash flow stream after meeting the (debt, equity and inflation) servicing obligations during the initial years is fully appropriated for the capital recovery. The net surplus is recognized only after the full recovery of capital is made in this process. In Table 8 we can see that by the third year the capital is fully recovered leaving for the first time a net surplus of 21,130.

C] Decomposition of Ke, Cost of Equity:

First we have to decide whether the cost of equity or marginal cost of equity should be considered. A pertinent question to examine is whether risk-premium will be the same after the announcement of a project or will it change. It will remain the same if the new project is unlikely to change the risk profile of the firm. We have assumed in the example that the proposed project will not change the risk-profile of the business. Therefore, cost of equity before and after the announcement of the project will remain the same at the 17.38 percent.

The calculations of cost of equity and its components were shown earlier under the heading 'computations'. The relevant portion of it is reproduced below:

	Sacrifice value	DOL & DFL risk	Capital maintenance		Total
$K_e =$	4.04%	+5.65%	+7.69%	=	17.38%

We will consider only the return portion (i.e. sacrifice value R_f, and risk premium R_p) of cost of equity as the capital maintenance portion will be taken into account separately in the cash flows earmarked for the purpose of recovery of capital. For those who believe in NOI theory of capital structure and assume that the risk premium of cost of equity will decline with the repayment of debt, we show in Table 9 the decomposition of cost of equity rates and variation in them with changing debt-equity structure.

Table 9: Decomposition of (Returns Portion for Rf and Rp) of Cost of Equity and Resultant Changes at Different Debt-Repayment Schedules under the NOI Theory

Year	Component-wise Cost of Equity at Different Debt Repayment Options under Assumption of NOI Theory

	At the end of the period			$30 K Equal installments in last 2 years			$20 K Equal installments in last 3 years			$15 K Equal installments in last 4 years			$12 K Equal installments in 5 years		
	R_f	R_p	R_{Ee}	R_f	R_p	R_{Ee}	R_f	R_p	R_{Ee}	R_f	R_p	R_{Ee}	R_f	R_p	R_{Ee}
0	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69
1	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69
2	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.23	9.27
3	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.65	9.69	4.04	5.12	9.16	4.04	4.80	8.84
4	4.04	5.65	9.69	4.04	5.65	9.69	4.04	4.94	8.98	4.04	4.59	8.63	4.04	4.37	8.41
5	4.04	5.65	9.69	4.04	4.59	8.63	4.04	4.23	8.27	4.04	4.05	8.09	4.04	3.95	7.99

Business risk-profile is assumed to be constant. On the other hand, financial risk of the firm may change with the changing debt-equity ratio under the NOI theory of capital structure. The debt-equity ratio may change with the retirement of debt during the course of the project. It is pertinent to raise the question whether a change in the debt-equity ratio changes the risk-premium component of the cost of equity? If it changes, does it call for using different discount rates in different years?

Those who believe in net operating income (NOI) theory of capital structure assume that WACC does not change with the change in debt-equity ratio. That means the cost of equity will change with the change in debt-equity ratio just enough to maintain the WACC. Repayment in debt will reduce the debt-equity ratio and that will in turn reduce the cost of equity. On the other hand, those who support the net income (NI) theory of capital structure assume that the cost of debt and cost of equity are not sensitive to the debt-equity ratio. This theory implies that the WACC will decline with the increase in debt-equity ratio and vice-a-versa.

Many academics agree with the practicing managers' argument that traditional theory of capital structure is more relevant. There exists an ideal debt-equity level for a firm under given circumstances. There exists a narrow range of capital structure in which the WACC will be the lowest. It is also true those firms that establish the ideal debt-equity ratio will also maintain their ideal debt levels unless circumstances warrant a change. Therefore, repayment of a particular debt may have no bearing on the WACC, or on the cost of equity. They may remain constant for the firm.

We have noted the effects of changing capital structure on Ka and Ke under the NOI and NI theories and assumptions. Going by NOI theory we calculated the year-wise cost of equity, and we also took constant equity position irrespective of debt repayment patterns to conform to the NI and traditional theories.

D] Discounting for the Calculation of NVA

Now we can calculate net value addition. This involves the application of discounting mechanism. And the question is how do we discount the net surplus cash flow of stockholders.

Conventionally, we multiply the cash flows with the relevant discount rate to obtain their present value. Equation 4 is traditionally used for the purpose of discounting.

$$\frac{1}{(1+r)^n} \qquad \text{(Eq. 4)}$$

The *r* in this function is total cost of equity funds in our case. Power of time assigned to the function (1+r) in the process of discounting needs to be scrutinized. The *r* in equation 4 has got three parts in it, namely, (a) maintenance of the original capital,
(b) returns required by the stockholders and (c) net surplus towards the value creation. They are R_{Eh}, R_{Er} and R_{Ee} respectively. Therefore, equation 4 can be re-written as follows:

$$\frac{1}{\{1+(R_{Eh}+R_{Er}+R_{Ee})\}^n} \qquad \text{(Eq. 5)}$$

Of the three parts, the first component is eliminated because it is related to the capital maintenance cash flow. Therefore, we will use equation 6 instead of equation 5.

$$\frac{1}{\{1+(R_{Er}+R_{Ee})\}^n} \qquad \text{(Eq. 6)}$$

Shall we apply power of time to both of the remaining components? Risk-free interest rate, gross to inflation and tax, is a function of time. That makes only R_{Er}, which should carry the power of time. But, risk-premium (R_{Ee}) covering business and financial risk is not a function of time and power of time is not assigned to it. We should modify the equation 6 to the one given in equation 7 adopting the proper mechanism of discounting.

$$\frac{1}{(1+R_{Er})^n \times (1+R_{Ee})} \qquad \text{(Eq. 7)}$$

Where, R_{Er} = risk-free return gross to the inflation and tax expected by the stockholders

R_{Ee} = risk premium net to inflation and tax

Present value of 3,229 shown in Table 8 is based on the application of equation 6, where net surplus is discounted at 9.69 percent. It comprised of both risk-free return and risk-premium. That gave us erroneous results. Applying equation 7 we replace Table 8 with Table 10. It shows the NVAs according to the proper choice of rate and mechanism of discounting under the assumptions of constant as well as changing risk-premiums.

Table 10: Calculation of NVA at Appropriate Discount Rate and with Proper Discounting mechanism (i.e. Power of Time Applied to only Returns Related Components of Cost of Equity: Equation 7)

Year	Equity holders' Cash Flows					
	Total	Appropriation of Total				
		Equity Servicing	Capital Maintenance	Capital Recovery	Net Surplus	Value Addition
0	-40,000			-40,000		
1	24,165	3,877	3,077	17,211	0	0
2	24,165	2,209	1,753	20,203	0	0
3	24,165	251	199	2,586	21,130	17,759
4	14,165	0	0	0	14,165	11,443
5	-35,835	0	0	0	-35,835	-27,829
DR	***17.38%***	***9.69%***	***7.69%***	***7.69%***	***9.69%***	***9.69%***
NPV	4,445	5,560	4,528	-4,528	3,229	
IRR	28.00%		Zero NPV			
	NVA @ constant returns portion of K_e (*NI theory*)					1,377
	NVA @ declining returns portion of K_e (*NOI theory*)					1,377

As per the conventional NPV method of evaluation this investment proposal will be rejected because of negative NPV ($–116, see Table 8, column 2 on page 12). As can be seen in the last column of Table 10, it actually will create positive net value of $ 1,377. The NVA is the same under both the assumptions of NOI as well as NI, as we assumed that the debt is repaid at the end of the project life. We can see from Table-11 that when debt repayment pattern is different, the assumption about the behavior of risk-premium with changing debt-equity ratio will impact the NVA. Assume constant risk-premium is advisable if the firm is unlikely to change its firm-wide debt-equity ratio with repayment of project-specific debt.

E] Debt Structuring and Value Creation

Can the debt repayment structure have an impact on the value creation? According to the general theory of financial management value can be created through (a) the acquisition of funds at the minimum cost and (b) investment in highest paying options. The third aspect cannot be overlooked in reality. A low cost debt can be structured better to suit a project for which debt is contemplated. Synergic effect between the project cash flows and structured debt servicing cash flows can further enhance the value of a firm. There are many elements in debt structuring.

We establish our point by touching upon only one of them. We selected only the timing of repayment of debt to demonstrate the impact of debt structuring on value creation exercise. Table-11 gives the summary of NVAs of the project considered in the example at different debt repayment terms.

Table 11: NVAs with Different Debt Repayment Terms (Using Conventional as well as Suggested Discounting Mechanism)

	Debt Repayment Options				
	At the end of period	$30K Equal installments in last 2 years	$20K Equal installments in last 3 years	$15K Equal installments in last 4 years	$12K Equal installments in 5 years
Panel A] With Power Assigned to All Returns Components of Cost of Equity (Equation 6)					
NVA @constant K_e of returns only (NI Theory)	3,229	3,235	3,241	1,373	-708
NVA @declining K_e of returns only (NOI Theory)	3,229	3,143	3,512	1,478	-708
Panel B] With Power Assigned to Only Those Returns Components of Cost of Equity that are subject to Geometrical Progression with Time (Using Equation 7)					
NVA @constant K_e of returns only (*NI Theory*)	1,377	2,701	4,062	1,693	-708
NVA @declining K_e of returns only (*NOI Theory*)	1,377	2,678	4,126	1,719	-708

Panel A of Table 11 is given only to show that equation 6 gives different results. Panel B of Table 11 gives NVA figures based on the application of equation 7, where discounting mechanism is devoid of limitations discussed earlier. If firm-wide debt-equity ratio is unlikely to change with the repayment of debt, the decision-maker must read NVA at constant K_e given in panel B of Table 11. If the firm-wide debt-equity ratio is expected to change with the debt repayment then the decision-maker must refer to the NVA at declining K_e in panel B of Table 11.

It is quite obvious from panel B of Table 11 that the company should take debt and repay it equally over the three annual installments starting from the end of third year. Other terms in the debt instruments can also have bearing on the value creation. The funding and investment can not be separated at the application level. Thus, the method of calculation of net value added is comprehensive and meaningful.

F] Extending NVA into Share Value Appreciation Rate (SVAR)

The absolute figure of NVA may have to be transformed into a share value appreciation rate (SVAR) if either (a) a decision-maker is more comfortable in handling a rate rather than an absolute number, or (b) mutually exclusive alternative projects of significant difference in size are under consideration and issue of equity shares is not planned for funding them. Methods of calculating SVAR to meet different situations and applicable decision-rules are described below:

(a) *Accept-reject situation where equity shares are not issued*: In this case,

SVAR = NVA ÷ net market value before announcement of project

Select project if SVAR is positive. NVA and SVAR based choice will be the same.

(b) *Accept reject situation where equity shares are issued*: In this case,

SVAR = NVA ÷ [net market value before announcement of project + (No. of new shares issued after the announcement of project x Stock issue price)]

Select project if SVAR is positive. NVA and SVAR based choice will be the same.

(c) *Mutually exclusive projects where equity shares are not issued*: In this case calculate SVAR as in (a) above for all mutually exclusive projects.

Select project with highest SVAR. Ranking of projects both on NVA and SVAR will be the same.

(d) *Mutually exclusive projects where equity shares are issued*: In this case, calculate SVAR as in (b) above for all mutually exclusive projects. (Number of shares issued will be different for different projects, depending upon their sizes.)

Select a project with highest SVAR. In this case rankings based on NVA and SVAR may be different. Highest NVA project may not be on the top of the list prepared in the descending order of SVAR and vice-a-versa. Stockholders may prefer the firm to select a project with highest SVAR.

Thus, SVAR is a useful technique when number of outstanding shares would be different depending upon the project selected from among the mutually exclusive ones. In this case two measures of wealth, namely, net market capitalization and equity share price, may not move in tandem. Value creation per share may be dearer to the stockholders rather than the net market capitalization of the firm.

SUMMARY

Stockholder wealth (value) maximization is the well-accepted corporate financial objective. Corporate decision tools must align with the corporate objective. The term 'wealth' recognizes the time value of money and also the risk-taking in decision-making by the firm.

Among different measures of wealth net market capitalization of firm and common stock price are better measures. These two give same results as long as new shares are not issued for funding a project, or new shares are issued at market price.

Present methods for evaluation of capital projects fail to meet the stockholder wealth maximization criteria. Net present value method also suffers from limitations. Net value added (NVA) and its further extension into the share value appreciation rate (SVAR) are suggested in this paper.

NVA can be calculated by going through the following four steps:

First, debt-related cash flows are subtracted from the project cash flows to get stockholders' cash flows. The stockholders' cash flows are then apportioned into three components; namely, (a) equity servicing cash flows, (b) capital-maintenance cash flows and (c) net surplus cash flows.

The net surplus cash flows of the stockholders are discounted at the expected rate of return. The expected rate of return should be exclusive of that portion, which is meant for maintenance of capital. It should be excluded because capital-maintenance cash flow stream is already separated. Therefore, only risk-free rate and risk-premium should be considered in discounting the net surplus cash flow stream. Only risk-free portion of interest, i.e., the required rate of return should be assigned the power of time and risk-premium should be considered without the power of time (exponential growth). This gives us a proper discounting mechanism without defects.

The discounted value of net surplus cash flow stream so obtained is the net value added (NVA). NVA shows the value added in the net market capitalization of the firm. Accept project if NVA is positive.

An extension of NVA into the share value appreciation rate (SVAR) may become necessary especially if mutually exclusive projects of different size are under evaluation and they are to be fully or partially funded with a fresh issue of equity shares. SVAR is the expression of NVA in terms of percentage appreciation in the price of one share of the firm's common stock.

NVA and its variant SVAR, thus eliminate limitations of presently available discounted cash flow techniques. The former are more focussed on the corporate financial objective of stockholders' wealth (value) maximization. They truly measure the amount of value added by a project. They can also guide the management in tailoring the debt instruments for the maximum value creation. NVA and SVAR methods are theoretically superior and pragmatically sound than the NPV technique.

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