9-1-2017

Criteria for Corporate Investment Decisions: Comparison of Cash Flow and Accounting Based Approaches

Tom W. Miller
Kennesaw State University

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Abstract

Cash flow based and accounting based criteria for corporate investment decisions are examined and compared. Even though one approach uses cash flows and the other approach uses accounting numbers, the values of the metrics produced, net present value and market value added, are shown to be identical. Use of net present value and market value added produce the same corporate investment decisions.

Keywords: economic value added, market value added, net present value, return on invested capital

I. Introduction

Management may use several alternative measures and decision rules when making investment decisions for a corporation (Titman and Martin (2015)). Suppose the financial manager of a company currently uses a cash flow based approach to analyze investment projects. This approach requires that the increment cash flows for a project be forecasted over the life of the project, the opportunity cost of capital incorporating both the time value of money and the appropriate risk premium be estimated and used to discount the future cash flows, and the net present value be calculated by summing the present values of all of the incremental cash flows including the initial cash flow (Copeland, Weston, Shastri (2004)). For this approach, the investment project's net present value depends on just its incremental cash flows and opportunity cost of capital. The investment project should be accepted if the net present value is not negative. If the net present value is positive, accepting the investment project will increase shareholders' wealth by an amount equal to the net present value. If the net present value is zero, accepting the investment project will maintain shareholders' wealth and provide the opportunity cost of capital. If the net present value is negative, accepting the investment project will decrease shareholders' wealth by an amount equal to the net present value (Fernandez (2002)).

When companies report to their shareholders, they provide accounting income and book values. Both top-level executives and lower-level managers of many publicly trades firms have their compensation tied to accounting income and other accounting based performance measures (Stewart (1999 and 2013)). Sometimes, financial managers use accounting numbers to calculate book rates of return that are compared to the opportunity cost of capital for investment projects. Accounting based approaches for analyzing investment projects are criticized because incremental cash flows and incremental accounting income and incremental book values are very different. Accounting numbers depend on arbitrary choices made by accountants. Book rates of return may not be good measures of an investment project's ability to create wealth for the firm's shareholders. The goodness of an investment project should not depend on arbitrary choices made by accountants. In spite of these criticisms, financial managers often use an accounting based approach employing the rate of return on invested capital, the economic value added, and the market value added to obtain useful information about whether accepting an investment project will create wealth for the firm's shareholders (Koller, Goedhart, and Wessels (2015)).

For examination and comparison of the cash flow based approach and the proposed accounting based approach, consider the financial information shown in Table I for a proposed independent investment project that involves opening a new store that has a life of five years. The opportunity cost of capital is 10 percent for this investment project.

Refer Table I

II. The Cash Flow Based Approach

The net cash flows in Table I are the increment cash flows for this project and the opportunity cost of capital is 10 percent per year. The net present value at time zero is given by

$$NPV = \sum_{t=0}^{5} \frac{NCF_t}{(1+R)^t} \tag{1}$$

where NPV is the net present value at time zero, t is the time in years, NCF_t is the net cash flow for year t, and R is the opportunity cost of capital. The future net cash flow has two components: the free cash flows for years one through five and the salvage value after taxes at time five. The net present value at time zero can be expressed as

$$NPV = \sum_{t=0}^{5} \frac{FCF_t}{(1+R)^t} + \frac{SVAT_5}{(1+R)^5} \tag{2}$$

where FCF_t is the free cash flow for year t and $SVAT_5$ is the salvage value after taxes at time five.

The numerical values in Table I indicates that

$$NPV = -545{,}000 + \frac{197{,}500}{1.1} + \frac{245{,}000}{1.1^2} - \frac{135{,}000}{1.1^3} + \frac{217{,}500}{1.1^4} + \frac{247{,}500}{1.1^5} + \frac{100{,}000}{1.1^5} = 99{,}922.88. \tag{3}$$

The present value of the free cash flows is 37,830.75 and the present value of the salvage value after taxes is 62,092.13. The net present value at time zero of 99,922.88 indicates that accepting the investment project will increase the shareholders' wealth by 99,922.88.

III. The Accounting Based Approach

The rate of return on invested capital for each year is equal to the earnings before interest and taxes for the year minus the taxes on the earnings before interest and taxes for the year divided by the invested capital at the beginning of the year.

$$ROIC_t = \frac{(1-T_c)EBIT_t}{IC_{t-1}} \tag{4}$$

where $ROIC_t$ is the rate of return on invested capital for year t, T_c is the corporate tax rate, $EBIT_t$ is the earnings before interest and taxes for year t, and IC_{t-1} is the beginning invested capital for year t. Use of the numerical values in Table I provides the numerical values shown in Table II.

Refer Table II

The information in Table II indicates that the rate of return on invested capital exceeds the opportunity cost of capital for years one, two, and three, but is negative for years four and five. Overall, the rate of return on invested capital does not indicate whether accepting this five-year investment project will create, maintain, or destroy shareholders' wealth.

For each year, the rate of return on invested capital, the opportunity cost of capital, and the beginning invested capital are used to calculate the economic value added (Grant (2003)). The economic value added for each year is equal to the spread between the rate of return on invested capital for each year and the opportunity cost of capital multiplied by the beginning invested capital for the year.

$$EVA_t = (ROIC_t - R) \cdot IC_{t-1} \quad (5)$$

where EVA_t is the economic value added for year t, $ROIC_t$ is the rate of return on invested capital for year t, R is the opportunity cost of capital, and IC_{t-1} is the beginning invested capital for year t. Use of the numerical values in Table II provides the numerical values shown in Table III.

Refer Table III

The information in Table III shows that the economic value added is positive for years one, two, and three, but is negative for years four and five. The behavior of the economic value added over time has the same pattern as the spread over time, but the economic value added includes the effect of the size of the beginning invested capital for the year. However, overall, the rate of return on invested capital does not indicate whether accepting this five-year investment project will create, maintain, or destroy shareholders' wealth.

The economic value added for each year and the opportunity cost of capital are used to calculate the market value added at time zero. The market value added at time zero is equal to the sum of present values of all of the economic values added when the opportunity cost of capital is the discount rate.

$$MVA = \sum_{t=0}^{5} \frac{EVA_t}{(1+R)^t} \quad (6)$$

where MVA is the market value added at time zero, t is the time in years, EVA_t is the economic value added for year t, and R is the opportunity cost of capital. Use of the numerical values in Table III indicates that

$$MVA = \frac{43{,}000}{1.1} + \frac{85{,}500}{1.1^2} + \frac{32{,}000}{1.1^3} - \frac{85{,}500}{1.1^4} - \frac{60{,}500}{1.1^5} = 37{,}830.75\,. \quad (7)$$

The market value added at time zero captures all of the value of the project except the salvage value after taxes at the end of the project. The present value of the salvage value after taxes is 62,092.13. The market value added at time zero plus the present value of the salvage value after taxes is 99,922.88. This indicates that accepting the investment project will increase the shareholders' wealth by 99,922.88.

IV. Comparison of the Cash Flow and Accounting Based Approaches

The net present value at time zero and the market value added at time zero plus the present value of the salvage value after taxes are identical. Use of the cash flow based approach to evaluation of an investment project and use of the proposed accounting based approach to evaluation of an investment project indicate that accepting the investment project will increase shareholders' wealth by exactly the same amount. The net present value at time zero is based on cash flows and not accounting numbers. The market value added at time zero is based on accounting numbers. Why do these two approaches yield the same result?

V. How Market Value Added and Net Present Value are Related

The net cash flow for the year is equal to the operating cash flow for the year minus the change in the net working capital and the capital spending for the year.

$$NCF_t = OCF_t - \Delta NWC_t - CS_t \tag{8}$$

where NCF_t is the net cash flow for year t, OCF_t is the operating cash flow for year t, ΔNWC_t is change in the net working capital for year t, and CS_t is capital spending for year t. For year zero, OCF_0 is zero. Capital spending for year t is the gross amount of capital spending because it includes the change in the book value of the store for year t and the depreciation for year t.

$$CS_t = \Delta BVS_t + DEP_t \tag{9}$$

where ΔBVS_t is change in the book value of the store for year t and DEP_t is depreciation for year t. For year zero, CS_0 equals the initial book value of the store plus the initial net working capital.

The net cash flow for year t is equal to the operating cash flow for year t minus the change in the net working capital for year t, the change in the book value of the store for year t, and the deprecation for year t.

$$NCF_t = OCF_t - \Delta NWC_t - \Delta BVS_t - DEP_t \tag{10}$$

The change in the net working capital for year t plus the change in the book value of the store for year t is equal to change in the invested capital for year t.

$$\Delta IC_t = \Delta NWC_t + \Delta BVS_t \tag{11}$$

where ΔIC_t is the change in the invested capital for year t. The net cash flow for year t is equal to the operating cash flow for year t minus the change in the invested capital for year t and the deprecation for year t.

$$NCF_t = OCF_t - \Delta IC_t - DEP_t \tag{12}$$

The operating cash flow for year t is equal to the earnings before interest and taxes for year t minus the taxes on earnings before interest and taxes for year t plus depreciation for year t.

$$OCF_t = (1 - T_c) \cdot EBIT_t + DEP_t \tag{13}$$

 ISSN 2229 – 6891
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Combining equations 12 and 13, shows that

$$NCF_t = (1 - T_c) \cdot EBIT_t + DEP_t - \Delta IC_t - DEP_t = (1 - T_c) \cdot EBIT_t - \Delta IC_t \quad (14)$$

The economic value added for year t is equal to the spread between the rate of return on invested capital for year t and the opportunity cost of capital multiplied by the beginning invested capital for year t.

$$EVA_t = (ROIC_t - R) \cdot IC_{t-1} \quad (15)$$

The rate of return on invested capital for year t is equal to the earnings before interest and taxes for year t minus the taxes on the earnings before interest and taxes for year t divided by the invested capital at the beginning of year t.

$$ROIC_t = \frac{(1 - T_c)EBIT_t}{IC_{t-1}} \quad (16)$$

Substituting equation 16 into equation 15 shows that

$$EVA_t = \left[\frac{(1 - T_c) \cdot EBIT_t}{IC_{t-1}} - R\right] \cdot IC_{t-1} = (1 - T_c) \cdot EBIT_t - R \cdot IC_{t-1} \quad (17)$$

Comparing equations 14 and 17 shows that both the net cash flow for year t and the economic value added for year t contain the earnings before interest and taxes for year t minus the taxes on the earnings before interest and taxes for year t. Equations 14 and 17 show that the unique terms in each equation are the change in the invested capital for year t in the equation for the net cash flow for year t and the dollar cost of capital for year t in the equation for the economic value added for year t where the dollar cost of capital is equal to the opportunity cost of capital times the beginning invested capital for year t. If the net present value at time zero and the market value added at time zero are equal, the present value at time zero of all of the changes in the invested capital for each year and the present value at time zero of all of the dollar costs of capital for each year must be equal. The present value at time zero of all of the changes in the invested capital for each year is given by

$$PV(\Delta IC) = \sum_{t=0}^{5} \frac{\Delta IC_t}{(1+R)^t} = IC_0 + \frac{IC_1 - IC_0}{1+R} + \frac{IC_2 - IC_1}{(1+R)^2} + \frac{IC_3 - IC_2}{(1+R)^3} + \frac{IC_4 - IC_3}{(1+R)^4} + \frac{IC_5 - IC_4}{(1+R)^5} \quad (18)$$

where IC_t is the invested capital at the end of year t. The present value at time zero of all of the changes in the invested capital for each year can be separated into two present values at time zero.

$$PV(IC) = \sum_{t=0}^{4} \frac{IC_t}{(1+R)^t} = IC_0 + \frac{IC_1}{1+R} + \frac{IC_2}{(1+R)^2} + \frac{IC_3}{(1+R)^3} + \frac{IC_4}{(1+R)^4} \quad (19)$$

$$PV(-IC) = -\left(\frac{1}{1+R}\right)\sum_{t=0}^{4} \frac{IC_t}{(1+R)^t} = -\left(\frac{1}{1+R}\right)\left[IC_0 + \frac{IC_1}{1+R} + \frac{IC_2}{(1+R)^2} + \frac{IC_3}{(1+R)^3} + \frac{IC_4}{(1+R)^4}\right] \quad (20)$$

For the end of year five, the invested capital is zero. Comparing equations 19 and 20 shows that

$$PV(-IC) = -\left(\frac{1}{1+R}\right)PV(IC) \tag{21}$$

The present value at time zero of all of the changes in the invested capital for each year is given by

$$PV(\Delta IC) = PV(IC) + PV(-IC) = PV(IC) - \left(\frac{1}{1+R}\right)PV(IC) = \left(\frac{R}{1+R}\right)PV(IC) \tag{22}$$

The present value at time zero of all of the dollar costs of capital for each year is given by

$$PV(R \cdot IC) = \sum_{t=1}^{5}\frac{R \cdot IC_{t-1}}{(1+R)^t} = \frac{R \cdot IC_0}{1+R} + \frac{R \cdot IC_1}{(1+R)^2} + \frac{R \cdot IC_2}{(1+R)^3} + \frac{R \cdot IC_3}{(1+R)^4} + \frac{R \cdot IC_4}{(1+R)^5} \tag{23}$$

where $R \cdot IC_{t-1}$ is the dollar cost of capital for year t. Factoring equation 23 shows that

$$PV(R \cdot IC) = \left(\frac{R}{1+R}\right)\sum_{t=0}^{4}\frac{R \cdot IC_t}{(1+R)^t} = \left(\frac{R}{1+R}\right)\left[IC_0 + \frac{IC_1}{1+R} + \frac{IC_2}{(1+R)^2} + \frac{IC_3}{(1+R)^3} + \frac{IC_4}{(1+R)^4}\right] \tag{24}$$

Comparing equations 19 and 24 shows that

$$PV(R \cdot IC) = \left(\frac{R}{1+R}\right)PV(IC) \tag{25}$$

Comparing equations 22 and 25 shows that the present value of all of the net cash flows for the investment project must always equal the present value of all of the economic values added for the investment project,

$$\sum_{t=0}^{5}\frac{NCF_t}{(1+R)^t} = \sum_{t=1}^{5}\frac{EVA_t}{(1+R)^t} \tag{26}$$

and the net present value at time zero and the market value added at time zero and must be equal.

$$NPV = MVA \tag{27}$$

VI. Summary and Conclusions

Cash flow based approaches to corporate investment decisions use increment cash flows, the opportunity cost of capital, and net present value. Accounting based approaches employ the rate of return on invested capital, the economic value added, and the market value added. Even though cash flow based approaches and accounting based approaches appear to be different, both approaches will produce the same corporate investment decisions because the values of the net present value and the market value added are always identical.

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Table I

Financial Information for an Investment Project

This table shows the forecasted yearly revenue, costs, and cash flows for a proposed independent investment project.

Time	0	1	2	3	4	5
Revenue		450,000	450,000	300,000	300,000	300,000
Expenses		200,000	150,000	100,000	100,000	100,000
Before-tax cash flow		250,000	300,000	200,000	200,000	200,000
Depreciation		100,000	100,000	100,000	250,000	250,000
Earnings before interest & taxes		150,000	200,000	100,000	-50,000	-50,000
Taxes ($T_c = 0.35$)		52,500	70,000	35,000	-17,500	-17,500
Net income		97,500	130,000	65,000	-32,500	-32,500
Net working capital	45,000	45,000	30,000	30,000	30,000	0
Book value of the store	500,000	400,000	300,000	500,000	250,000	0
Total book value	545,000	445,000	330,000	530,000	280,000	0
Earnings before interest & taxes		150,000	200,000	100,000	-50,000	-50,000
Depreciation		100,000	100,000	100,000	250,000	250,000
Taxes		52,500	70,000	35,000	-17,500	-17,500
Operating cash flow		197,500	230,000	165,000	217,500	217,500
Change in net working capital	45,000	0	-15,000	0	0	-30,000
Capital spending	500,000	0	0	300,000	0	0
Net cash flow	-545,000	197,500	245,000	-135,000	217,500	247,500

Table II
Return on Invested Capital

This table shows the results of the calculation of the rate of return on invested capital for each year from dividing the earnings before interest and taxes for the year minus the taxes on the earnings before interest and taxes for the year by the invested capital at the beginning of the year.

Time	0	1	2	3	4	5
$(1 - T_c)EBIT_t$		97,500	130,000	65,000	-32,500	-32,500
IC_{t-1}		545,000	445,000	330,000	530,000	280,000
$ROIC_t$		0.17890	0.29213	0.19697	-0.06132	-0.11607

Table III
Economic Value Added

This table shows the results of the calculation of the economic value added for each year from multiplying the spread between the rate of return on invested capital for each year and the opportunity cost of capital by the beginning invested capital for the year.

Time	0	1	2	3	4	5
ROIC – R		0.07890	0.19213	0.09697	-0.16132	-0.21607
Beginning Invested Capital		545,000	445,000	330,000	530,000	280,000
Economic Value Added		43,000	85,500	32,000	-85,500	-60,500

Author

Tom W. Miller
Professor of Finance, Department of Economics, Finance, and Quantitative Analysis, Kennesaw State University, USA, tmiller@kennesaw.edu