

PART
One

**Technical Supplement—
Supplements to Chapters
of *Cost of Capital:
Applications and
Examples*, 4th ed.**

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CHAPTER 1

Alternative Net Cash Flow Definitions—Supplement to Chapter 3

Introduction
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INTRODUCTION

As we discussed in Chapter 3 of *Cost of Capital: Applications and Examples*, 4th ed., we are estimating net cash flows. In that chapter we began by presenting formulations of net cash flow, which we revisit here. In later chapters we further presented other net cash flow definitions. We thought it would be useful to summarize them here.

EQUITY CASH FLOW METHOD

In the equity cash flow method, the value of equity equals present value net cash to equity. The net cash flow to equity (NCF_e) is defined as (repeating Formula 3.1 of *Cost of Capital: Applications and Examples*, 4th ed.):

(Formula 1.1)

- Net income to common equity (after income taxes)
- Plus: Noncash charges (e.g., depreciation, amortization, deferred revenues, and deferred income taxes)
- Minus: Capital expenditures (amount necessary to support projected revenues and expenses)
- Minus: Additions to net working capital (amount necessary to support projected revenues)
- Minus: Dividends on preferred equity capital

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Plus: Cash from increases in the preferred equity or debt components of the capital structure (amount necessary to support projected revenues)

Minus: Repayments of any debt components or retirement of any preferred components of the capital structure

Equals: Net cash flow to common equity capital

In the cash flow to equity method, earnings (after interest expense and after income taxes) are adjusted for various items to produce net cash flow, including:

- Noncash expenses that are subtracted from revenues but do not affect cash flow, including depreciation, amortization, depletion allowance, and in some cases changes in deferred taxes.
- Amounts necessary to augment net working capital as levels of production increase. Net working capital does not include the current portion of long-term debt, any other permanent invested capital financing of a short-term nature, or increases in cash above the level necessary to sustain the business.
- Amounts invested in plant, property, and equipment to establish or maintain productive capacity in line with increases or decreases in revenues.
- Reflection of amounts to cover scheduled repayments of debt principal or additions to debt principal.
- Because we are only including amounts of investment in net working capital and capital expenditures needed for the projected revenues and expenses included in the projected net cash flows to be discounted, we can term these sustainable net cash flows.
- Net cash flow to equity is also called *free cash flow to equity* (FCF_e).

INVESTED CAPITAL METHOD

In valuing the entire *invested capital* of a business or project by discounting or capitalizing expected cash flows, *net cash flow to invested capital* or *net cash flow to the firm* (NCF_f in our notation system) is defined as (repeating Formula 3.2 of *Cost of Capital: Applications and Examples, 4th ed.*):

(Formula 1.2)

Net income to common equity (after income taxes)

Plus: Noncash charges (e.g., depreciation, amortization, deferred revenues, and deferred income taxes)

Minus: Capital expenditures (amount necessary to support projected revenues and expenses)

Minus: Additions to net working capital (amount necessary to support projected revenues)

Plus: Interest expense (net of the tax deduction resulting from interest as a tax-deductible expense)

Plus: Dividends on preferred equity capital

Equals: Net cash flow to invested capital

The amounts of capital expenditures and additions to net working capital are consistent with the projections of revenues and expenses and the amounts defined earlier (in the net cash flow to common equity capital).

In other words, NCF_f adds back interest (tax-affected because interest is a tax-deductible expense) because invested capital includes the debt on which the interest is paid. Interest is the payment to the debt component of the invested capital. It also adds back dividends on preferred stock for the same reason (i.e., invested capital includes the preferred capital on which the dividends are paid).

Net cash flow to invested capital is also called free cash flow to the firm (FCF_f).

An alternative formula for net cash flow to invested capital is:

(Formula 1.3)

Earnings before interest and income taxes
 Minus: Incomes taxes on EBIT at effective income tax rate (equals earnings before interest, after-tax)
 Plus: Noncash charges (e.g., depreciation, amortization, deferred revenues, and deferred income taxes)
 Minus: Capital expenditures (amount necessary to support projected revenues and expenses)
 Minus: Additions to net working capital (amount necessary to support projected revenues)
 Equals: Net cash flow to overall invested capital

The earnings (before interest expense and after income tax) are adjusted for various items to produce net cash flow, including:

- Noncash expenses that are subtracted from revenues but do not affect cash flow, including depreciation, amortization, depletion allowance, and in some cases changes in deferred taxes.
- Amounts necessary to augment net working capital as levels of production increase. Net working capital does not include current portion of long-term debt, any other permanent invested capital financing of a short-term nature, or increases in cash above the level necessary to sustain the business.
- Amounts invested in plant, property, and equipment to establish or maintain productive capacity in line with increases or decreases in revenues.

Debt is not subtracted or added in the invested capital model because it is deducted at the conclusion of the process to derive the value of equity.

CAPITAL CASH FLOW METHOD

An alternative definition of *net cash flow to invested capital* is *capital cash flow*. In this formulation the net cash flows include the income tax benefits of the interest expense on debt capital. The literature and practitioners refer to the

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formulation of the weighted average cost of capital (WACC) in Formula 18.3 of *Cost of Capital: Applications and Examples*, 4th ed. as an after-tax WACC and the formulation in Formula 18.10 as the pretax WACC. For clarity we will use the term pre-interest-tax-shield WACC. The basic formula for computing the pre-interest-tax-shield WACC for an entity with three capital structure components (repeating Formula 18.10 of *Cost of Capital: Applications and Examples*, 4th ed.) is:

(Formula 1.4)

$$WACC_{(pt)} = (k_e \times W_e) + (k_p \times W_p) + (k_{d(pt)} \times W_d)$$

where: $WACC_{(pt)}$ = Weighted average cost of capital, pre-interest-tax-shield

k_e = Cost of common equity capital

W_e = Percentage of common equity in the capital structure, at market value

k_p = Cost of preferred equity

W_p = Percentage of preferred equity in the capital structure, at market value

$k_{d(pt)}$ = Cost of debt without adjusting for the interest tax shield

W_d = Percentage of debt in the capital structure, at market value

The pre-interest-tax-shield WACC capital is applied to *capital cash flows* (NCF_c), which include the tax savings from interest tax deductions on debt capital in the cash flows (repeating Formula 18.11):

(Formula 1.5)

Net income to common equity (after income taxes)

Plus: Noncash charges (e.g., depreciation, amortization, deferred revenues, and deferred income taxes)

Minus: Capital expenditures (amount necessary to support projected revenues and expenses)

Minus: Additions to net working capital (amount necessary to support projected revenues)

Plus: Interest expense

Plus: Dividends on preferred equity capital

Equals: Net capital cash flow

or

(Formula 1.6)

(repeating Formula 18.12)

Net cash flow to invested capital

+ Tax deductions resulting from interest as a tax deductible expense

= Net capital cash flows

In using the NCF_c methodology, the proper formulas for unlevering and relevering are the Practitioners' Method formulas. The formula for unlevering beta is

Formula 11.7 of *Cost of Capital: Applications and Examples*, 4th ed. and the proper formula for levering beta is Formula 11.8.

ADJUSTED PRESENT VALUE METHOD

In the adjusted present value method, the value of equity equals the present value of equity cash flows, as if the business were financed solely with equity capital plus the present value of the expected benefits to equity from financing part of the business capital with debt (the present value of the tax shield). The net cash flow to unlevered equity (NCF_{ue}) is defined as:

(Formula 1.7)

Earnings before interest and income taxes
 Minus: Incomes taxes on earnings before interest and tax (EBIT) at effective income tax rate (equals earnings before interest, after-tax)
 Plus: Noncash charges (e.g., depreciation, amortization, deferred revenues, and deferred income taxes)
 Minus: Capital expenditures (amount necessary to support projected revenues and expenses)
 Minus: Additions to net working capital (amount necessary to support projected revenues)
 Minus: Preferred dividends, if any
 Equals: Net cash flow to unlevered business enterprise

As in the cash flow to equity method, earnings (before interest expense, after income tax) are adjusted for various items to produce net cash flow, including:

- Noncash expenses that are subtracted from revenues but do not affect cash flow, including depreciation, amortization, depletion allowance, and in some cases changes in deferred taxes.
- Amounts necessary to augment net working capital as levels of production increase. Net working capital does not include current portion of long-term debt, any other permanent invested capital financing of a short-term nature, or increases in cash above the level necessary to sustain the business.
- Amounts invested in plant, property, and equipment to establish or maintain productive capacity in line with increases or decreases in revenues.

Debt is not subtracted or added in the adjusted present value method because the present value of the net benefits and costs of debt are added to the present value of the cash flows to unlevered business enterprise (i.e., the value to equity assuming there is no debt). The net cash flows of the unlevered business enterprise are discounted at the unlevered cost of equity capital, k_{eu} , which is calculated using Formula 1.8 (assuming we are basing our discount rate with capital asset pricing model [CAPM]) (repeating Formula 18.14 of *Cost of Capital: Applications and Examples*, 4th ed.):

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(Formula 1.8)

$$k_{eu} = R_f + B_U(RP_m) + RP_s \pm RP_u$$

where: k_{eu} = Cost of unlevered equity capital
 R_f = Rate of return available on a risk-free security as of the valuation date
 B_U = Unlevered beta (i.e., financial risk removed)
 RP_m = General equity risk premium for the market
 RP_s = Risk premium for small size with effect of financial risk, if any, removed
 RP_u = Risk premium attributable to the specific company risk factors (u stands for unique or unsystematic risk) without regards to financial risk of debt financing

Although the various measures of economic income differ in format, they all are composed of similar elements and require comparable estimates of their future components: sales, operating expenses, noncash charges, investments in fixed assets (capital expenditures), and investments in net working capital.

RESIDUAL INCOME METHOD

Residual income is the return on common equity (expressed in dollars) in excess of the cost of equity capital, as is shown in (repeating Formula 3.4 of *Cost of Capital: Applications and Examples, 4th ed.*):

(Formula 1.9)

$$RI_{e,n} = NCI_{e,n} - [BV_{n-1} \times k_e]$$

where: $RI_{e,n}$ = Residual income for common equity capital
 $NCI_{e,n}$ = Net comprehensive income to common equity; if there are preferred dividends, they would have to be subtracted
 BV_{n-1} = Book value of net assets
 k_e = Cost of equity capital

Residual income to total capital is based on *clean-surplus* accounting statement (repeating Formula 3.5):

(Formula 1.10)

$$NOA_n = NOA_{n-1} + NCI_{f,n} - D_{f,n}$$

where: NOA = Net operating assets = Total capital of the business
 $NCI_{f,n}$ = Net comprehensive income to the firm, which includes income terms reported directly in the equity account rather than in the income statement
 $D_{f,n}$ = Distributions to total capital, net of new issues of debt or equity capital = $NCI_{f,n} - [NOA_n - NOA_{n-1}]$

Residual income is the return on total capital (expressed in dollars) in excess of the overall cost of capital (WACC) as is shown in (repeating Formula 3.6):

(Formula 1.11)

$$RI_{f,n} = NCI_{f,n} - [NOA_{n-1} \times WACC]$$

where: $RI_{f,n}$ = Residual income for total capital
 $NCI_{f,n}$ = Net comprehensive income to total capital
 NOA = Net operating assets
 $WACC$ = Overall cost of capital

Formula 1.11 is the formula typically used for the Economic Value Added (EVA) method.

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