Closed-Loop Corporate Finance and Valuation:

A Structural Framework Linking Operating Capital, Return, Cash Flow, Risk, and Value With Scenario-Based Computational Evidence and Institutional Decision Protocols

BY

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CAIRO, EGYPT

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The underlying twenty-eight-sheet Excel models, their formulas, cell references, linked-sheet dependency structure, hidden implementation logic, and executable mechanics constitute protected author know-how. This book discloses the economic definitions, general identities, selected numerical results, and static evidence necessary for academic evaluation while preserving the confidential computational engine.

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Preface

Corporate finance is often taught and practised as a collection of separate tools. Financial statements describe the past, ratios describe performance, cash-flow models project the future, the cost of capital prices risk, and valuation methods convert forecasts into an estimate. Each tool may be individually correct while the total analysis remains structurally inconsistent.

This book takes a different position. It treats the company as one closed financial organism. Productive capital enters the operating system, is transformed into after-tax operating income, is absorbed by reinvestment and financing claims, becomes distributable cash, and reappears as the closing state inherited by the next period. Value is accepted only when this complete sequence is coherent across capital, return, income, cash, claims, time, and risk.

The argument is built from two distinct but complementary author papers. The first establishes valuation as economic proof rather than permissive estimation. The second reconstructs the route from operating capital and ROIC to equity outcomes and introduces the author-defined Weighted Average Cost of Equity, WACE, as an ex post diagnostic of the burden absorbed by equity. The computational evidence comes from the author-controlled Excel models and selected static images, not from the narrative alone.

The objective is not to replace DCF, EVA, FCFF, FCFE, ROIC, WACC, ROE, IRR, or financialstatement analysis. It is to define the conditions under which these methods describe the same company. When theoretically equivalent routes converge, the result gains structural credibility. When they diverge, the difference is treated as evidence of a boundary, timing, classification, claim, reinvestment, or discount-rate problem that must be resolved before a decision is approved.

About the Author

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With over two decades of senior banking and corporate experience, Hany brings a unique blend of practical expertise and theoretical insight to the field of corporate finance.

Professional Experience

- Head of Treasury and Investment Sector (21 years) – Faisal Islamic Bank of Egypt, Cairo
- Board Member (18 years) – Ibn Sina Pharma
- Advisor to the Board of Directors (current) – Ibn Sina Pharma
- Board Member – Takaful Insurance Company

Research Focus

- Closed-loop valuation & operating capital
- Return on Invested Capital (ROIC)
- Economic Value Added (EVA) & Discounted Cash Flow (DCF)
- Weighted Average Cost of Equity (WACE)
- Structural consistency in corporate finance & valuation systems
- EVA/DCF Integration, Free Cash Flow, Capital Structure, and Residual Income

Hany's work focuses on developing integrated, recursive frameworks that bridge traditional finance theory with real-world financial system dynamics. This book represents the culmination of his extensive research and professional experience in corporate finance.

Executive Abstract

This book develops a closed-loop framework for corporate finance and valuation in which operating capital, return, income, cash flow, financing claims, risk, and value are treated as mutually constrained elements of one recursive system. The company is modelled as a financial organism whose opening capital state generates operating surplus, whose reinvestment determines cash conversion, whose financing structure allocates claims, and whose closing state becomes the productive opening condition of the next period.

The first governing principle is capital preservation. Capital committed to the company is not itself value created; it is a claim that must be recognised and carried forward before incremental surplus is valued. The second principle is numerator–denominator consistency: ROIC, WACC, EVA, and reinvestment must refer to the same operating-capital boundary. The third principle is multi-path closure: independent constructions of NOPLAT, net income, FCFF, FCFE, economic profit, enterprise value, equity value, and claim-specific returns must reconcile under matched definitions and timing.

The framework interprets ROIC as the generator of operating surplus rather than a standalone ratio. Operating-capital WACC prices the productive state ex ante. The author-defined WACE records the ex post burden absorbed by equity and is used as a diagnostic rather than a market discount rate. Net income becomes the fixed point at which the operating, financing, and equity-absorption paths converge. The model remains analytically informative under negative operating equity, where conventional ROE interpretation becomes unstable.

The Scenario C fixed-hurdle evidence provides a principal closure demonstration. The periodic EVA equality is controlled for the explicit years and T+1 using the beginning-capital convention. The stable incremental-return assumption used in continuing-value mechanics remains a distinct long-run input and is not substituted into the periodic EVA schedule. Pershare output is excluded until the share-count scale is independently certified.

The book translates this architecture into institutional protocols for boards, credit committees, investors, risk functions, management teams, auditors, model validators, and researchers. Mechanical closure does not prove that assumptions are realistic. It removes avoidable inconsistency so that professional judgement can focus on the remaining economic questions: the durability of margins, incremental return, reinvestment feasibility, financing resilience, terminal concentration, execution risk, and management quality.

Reader's Guide

Part I defines the company as a closed financial organism and establishes capital preservation, the productive boundary, and the time-ordered role of the financial statements. Part II develops return formation and the transmission from ROIC through operating-capital WACC to the author-defined WACE and net income. Part III converts operating surplus into cash and allocates that cash across financing claims. Part IV treats valuation as economic proof and closes DCF, economic profit, capital preservation, continuing value, and claimspecific returns. Part V presents the protected computational evidence architecture. Part VI converts the framework into risk, governance, capital-allocation, credit, project, and investment protocols.

The reader should distinguish mechanical closure from economic truth. A model can reconcile perfectly while relying on implausible sales, margins, reinvestment, stable ROIC, growth, or discount rates. Closure establishes that the arithmetic describes one internally consistent company. Economic challenge determines whether that company is plausible, resilient, financeable, and worthy of capital.

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CHAPTER 1

The Company as a Closed Financial Organism

Academic proposition

A company is best understood as a closed financial organism: a recursive system in which productive capital generates operating surplus, reinvestment and financing allocate that surplus, cash validates its durability, and the closing state becomes the next period's opening condition.

1.1 Why the Company Must Be Read as One Organism

A company does not experience its balance sheet, income statement, cash-flow statement, financing structure, and valuation as separate realities. Those documents and calculations are human representations of one continuous economic process. The company begins a period with a defined capital state, uses that state to conduct operations, produces an after-tax operating result, reinvests or distributes cash, services contractual claims, and enters the next period with a changed state.

The organism metaphor is analytical rather than biological. It emphasises interdependence. A change in working capital affects cash and financing. A new debt facility changes interest, tax shields, equity exposure, and refinancing risk. Capital expenditure changes the productive state, depreciation, future capacity, and continuing value. A terminal-growth assumption changes implied reinvestment and the amount of capital required to support the forecast. No important variable remains local.

Conventional analysis often breaks this continuity into administrative compartments. Profitability is discussed without capital intensity, leverage without the operating engine that services it, cash flow without the reinvestment that created the next state, and valuation without proving consistency among equivalent routes. The closed-loop framework restores the company as the unit of analysis.

1.2 The Living Loop: State, Transformation, Distribution, and Renewal

The company's financial life can be organised into four linked functions. State records what is committed at the beginning of the period. Transformation records what operations produce from that commitment. Distribution records how the result is absorbed by reinvestment, debt, tax, minority claims, and equity. Renewal records the closing capital and claim configuration that becomes the next opening state.

$$\text{Opening State}_t \rightarrow \text{Operating Transformation}_t \rightarrow \text{Cash and Claim Distribution}_t \rightarrow \text{Closing State}_t$$

$$\text{Closing State}_t = \text{Opening State}_{t+1}$$

This recursion turns time into a control. Receivables created in one period become collection obligations in the next. Debt raised today becomes interest and maturity pressure tomorrow. Retained earnings change the equity state. Capital expenditure becomes future productive capacity and depreciation. A forecast that ignores these transitions may produce a valuation, but it does not describe a functioning company.

1.3 From Open Valuation Models to a Closed Financial System

An open valuation model permits assumptions to travel forward without forcing them to confront the rest of the system. Growth may be inserted without sufficient reinvestment. A discount rate may be applied to a capital base different from the one used in ROIC. FCFF and FCFE may be prepared independently. Terminal value may absorb unresolved inconsistencies. The model still produces a number because the architecture does not refuse.

A closed financial system operates differently. Every important conclusion is constrained by another representation of the same economics. Operating capital must reconcile from assets and financing

claims. NOPLAT must reconcile with the operating statement. Economic profit must agree through the spread route and the capital-charge route. FCFF must close through net-investment and gross-investment constructions. Equity cash flow must be consistent with financing movement. DCF and economic-profit valuation must converge under matched assumptions.

Closed-loop rule
A valuation result is not accepted merely because one method produces it. The result must survive independent reconstruction through the other economic representations of the same company.

1.4 Capital Preservation as the Boundary of Economic Life

Capital committed to the company is not automatically value created. It is a prior claim. Treating the recovery of invested capital as new value confuses the starting condition with the economic surplus generated after that condition has been preserved.

The preservation principle does not mean that book amounts are economically perfect or that equity can never be impaired. It means that the analytical system must state explicitly what capital is being carried, consumed, released, written down, or recovered. Only after the capital state has been recognised can incremental surplus be identified.

This distinction prevents circularity. If equity is discounted directly to derive equity value while also serving as the capital input, the capital base becomes both cause and conclusion. In the closed-loop architecture, operating and equity states are defined first; future surplus and cash are then valued relative to those states.

1.5 Economic Profit as the Admission Test for Value

Accounting profit records a residual under accounting rules. It does not by itself determine whether the company compensated the capital required to generate that residual. Economic profit imposes the missing charge.

$$\text{Economic Profit}_t = \text{NOPLAT}_t - \text{Required Return}_t \times \text{Beginning Operating Capital}_t$$

$$\text{Economic Profit}_t = (\text{ROIC}_t - \text{WACC}_t) \times \text{Beginning Operating Capital}_t$$

The two forms must be equal when the numerator, capital base, timing, and required-return convention are consistent. Economic profit is therefore both a value-creation measure and a model-control identity. Positive accounting income accompanied by negative economic profit indicates that capital is being consumed more expensively than the operating system compensates it.

In this book, economic profit is an admission test, not a guarantee. Positive economic profit permits the possibility of value; it does not validate every growth, persistence, terminal, or risk assumption. The future surplus must still be converted into sustainable cash and discounted under a coherent claim structure.

1.6 Cash Conversion as the Circulatory Test

Accrual income can rise while the company's financial circulation weakens. Receivable growth, inventory accumulation, supplier compression, capital expenditure, acquisition spending, debt service, and distribution can absorb cash faster than operating income creates it. The cash test asks whether the operating result survives the requirements of the next capital state.

$$\text{FCFF}_t = \text{NOPLAT}_t - \text{Net Investment}_t$$

Free cash flow to the firm measures operating distributable capacity before financing claims. It is not the amount that belongs to common equity. The transition to FCFE requires explicit recognition of after-

tax interest, debt issuance, debt repayment, and other senior claims. This distinction prevents debt-financed distributions from being mistaken for operating strength.

The correct objective is not to maximise current cash at all costs. Underinvestment can temporarily raise FCFF while damaging future capacity. Reinvestment is justified when the incremental return on the added productive state exceeds the required return and when the financing path remains resilient.

1.7 Time as the Organism's Financial Memory

Time gives the company memory. Each period inherits the effects of earlier pricing, investment, collection, financing, and distribution decisions. Annual closure therefore matters more than a single terminal equality. A forecast should explain how every period remains internally financeable and how the closing state supports the next operating result.

Terminal value is not exempt from this discipline. It must be the continuation of the same relationships among growth, reinvestment, operating return, cost of capital, and claims. A terminal formula that requires less capital than the growth assumption implies, or assumes a stable return unsupported by the closing operating state, breaks the organism at the point where most of the reported value may reside.

The model's T+1 periodic-EVA test and its stable terminal mechanics are therefore kept conceptually separate. T+1 extends the periodic beginning-capital identity. Stable incremental return governs the reinvestment required by long-run growth. Substituting the long-run return into the periodic EVA schedule would collapse two different analytical questions into one.

1.8 Institutional Meaning and Limits of the Organism Metaphor

For boards and management, the closed organism identifies where a decision enters the system and which later obligations it creates. For banks, it links the operating engine to debt service rather than starting with collateral or a coverage ratio in isolation. For investors, it distinguishes operating quality from leverage amplification and then separates enterprise quality from the price of the residual claim. For auditors and validators, it converts unexplained differences into investigation points.

The metaphor has limits. Companies are legal, contractual, strategic, and behavioural institutions, not biological entities. Mechanical closure cannot prove competitive advantage, governance integrity, market capacity, regulatory stability, or management competence. It ensures that these judgements are applied to a coherent financial record rather than to disconnected calculations.

1.9 Integrative Reading of the Closed Organism

The company is one recursive financial system. Productive capital defines the opening state. ROIC transforms that state into NOPLAT. Economic profit tests whether the return compensated capital. Reinvestment converts current operations into the next state. FCFF tests operating cash conversion. Financing claims determine FCFE and equity exposure. Valuation closes the future sequence, while annual and terminal reconciliations test whether all representations describe the same company.

The next chapter defines the productive state more rigorously. Before return, cash flow, or value can be interpreted, the system must distinguish operating capital from non-operating resources, preserve the relevant capital claim, and reconcile the state from both the asset and financing perspectives.

CHAPTER 2

Capital Preservation and the Productive State

Academic proposition
The closed loop begins with a protected and consistently defined capital state. Capital is the productive base from which return is generated and the prior claim that must be recognised before incremental value is accepted.

2.1 Capital Is a Claim Before It Is a Source of Value

Capital performs two roles that must not be confused. Operationally, it is the resource base that enables production, sales, service delivery, working-capital support, and long-duration capacity. Financially, it represents claims held by equity investors, lenders, minority interests, and other capital providers. The first role explains performance. The second explains entitlement and risk.

A company can increase assets and accounting profit without creating value if the additional capital earns less than its opportunity cost. Conversely, releasing unproductive capital can improve value even when reported revenue or assets decline. The governing question is not whether the company became larger, but whether the productive state was preserved and transformed at an adequate return.

2.2 Operating Capital as the Primary State Variable

Operating capital is the capital committed to the company's core operating engine. It excludes resources that do not generate the NOPLAT used in the return calculation, such as surplus cash, unrelated investments, and separately valued non-operating assets. The exact boundary depends on the business model, but the matching principle is universal: the income included in the numerator must be generated by the capital included in the denominator.

$$\text{Operating Invested Capital} = \text{Operating Assets} - \text{Non-Interest-Bearing Operating Liabilities}$$

The productive state normally includes operating working capital, net productive fixed assets, and other assets required for operations. Trade payables and accrued operating liabilities reduce the capital supplied by investors because they arise spontaneously from the operating cycle. Interest-bearing debt is not deducted as an operating liability; it belongs to the financing description of the same state.

2.3 Defining the Productive Boundary

Boundary decisions should be made before the analyst observes the resulting ROIC or value. Selecting classifications after seeing the answer creates model discretion. A controlled boundary policy addresses minimum operating cash, surplus securities, goodwill, acquired intangibles, leases, pension obligations, provisions, supplier finance, minority interests, and assets held for sale.

Goodwill illustrates why more than one return view may be legitimate. A goodwill-inclusive return evaluates the full acquisition price committed by investors. A return excluding goodwill may evaluate the productivity of identifiable operating assets under current management. Both can be useful if clearly labelled. They become misleading when the denominator changes silently across ROIC, EVA, reinvestment, and valuation.

The same discipline applies to intangible investment. Capitalising selected research, software, data, customer acquisition, or organisational expenditure increases the productive state and requires a

consistent amortisation adjustment to NOPLAT. Adjusting only the denominator or only the numerator violates closure.

2.4 Equity as a Preserved Capital Identity

Equity is not treated as a valuation output invented at the end of the model. It is a residual claim with an opening state, period income, distributions, new issuance, repurchases, and other recognised changes. The equity roll-forward must be visible before market value is introduced.

$$\text{Closing Equity}_t = \text{Opening Equity}_t + \text{Net Income}_t - \text{Distributions}_t + \text{Net Equity Issuance}_t + \text{Other Recognised Changes}_t$$

Preserving the equity identity does not imply that book equity equals market value. It prevents the valuation from reclassifying capital recovery as surplus. Market value is then explained as the value of the residual claim after operating value, non-operating resources, debt, and other senior claims are reconciled.

2.5 Why Discounting the Capital Base Creates Circularity

Discounting the opening equity balance as if it were a future cash flow makes the capital base both an input to and an output from valuation. The result can hide whether the model has recovered invested capital or created surplus above it. The closed-loop system instead values future operating cash or future economic profit and then reconciles the resulting enterprise and equity claims.

This separation is especially important in residual-income and economic-profit valuation. Opening capital is recognised at the valuation date. The present value calculation applies to future surplus after the required return, not to the already existing capital claim. When timing and clean-surplus conditions are consistent, this route converges with DCF.

2.6 The Two-Sided Reconciliation of Resources and Claims

The capital state should be reconstructed independently from two sides. The operating-asset route begins with productive assets net of spontaneous operating liabilities and adds nonoperating resources. The financing route begins with equity, interest-bearing debt, minority interests, provisions treated as financing claims, and other senior obligations. Both descriptions must reach the same total investor-funded state.

$$\text{Operating Capital} + \text{Net Non-Operating Assets} = \text{Equity} + \text{Debt} + \text{Other Investor Claims}$$

A zero difference is not a cosmetic balance-sheet check. It confirms that the productive boundary has not lost or duplicated a resource or claim. A non-zero difference may indicate inconsistent treatment of cash, leases, supplier finance, goodwill, provisions, taxes, minority interests, or timing. Return and valuation should not proceed until the difference is explained.

2.7 Negative Operating Equity as a Structural Condition

Operating equity can become negative after non-operating assets and senior financing claims are separated from total book equity. This does not necessarily mean that total accounting equity is negative. It means that the common-equity portion attributed to the productive operating state is compressed or inverted under the selected boundary.

The condition is economically important because conventional ROE becomes unstable when the denominator is small or negative. It can also reveal that debt, operating liabilities, or other claims finance more than the identified operating assets while equity supports non-operating resources elsewhere in the company. The response is not to suppress the result. It is to disclose the boundary, reconcile the claims, and examine operating cash and financing resilience.

The author-defined WACE measure is introduced later as an ex post diagnostic of equity absorption under these conditions. It must not be confused with an expected market cost of equity or used as a discount rate.

2.8 Timing: Opening, Average, and Closing Capital

NOPLAT is generated over a period while capital is observed at points in time. The timing convention must therefore reflect the economic process. Beginning capital is appropriate when the opening state is treated as the base available to generate the annual operating result and reinvestment is recognised through the period. Average capital may be informative when additions are made gradually and contribute materially to the current period. Closing capital primarily describes the state transferred to the next period.

No convention should be selected because it produces the most favourable ROIC. The controlling route must be stated in advance, and alternative denominators should be presented as sensitivity or diagnostic views. The Scenario C periodic EVA closure uses the beginning-capital convention, including T+1.

2.9 Boundary-Control Protocol

1. Define the operating-income numerator before classifying the capital denominator.
2. Identify minimum operating cash separately from surplus financial assets.
3. Reconcile operating capital from the asset and financing perspectives.
4. State the treatment of goodwill, acquired intangibles, leases, provisions, minority interests, and supplier finance.
5. Select the controlling timing convention before calculating ROIC or EVA.
6. Trace every boundary decision through reinvestment, FCFF, WACC, enterprise value, and the enterprise-to-equity bridge.
7. Record alternative return views as labelled diagnostics, not as competing primary answers.

2.10 Capital-State Closure

Operating capital is the primary productive state variable of the closed-loop system. It must be reconstructed from economic function rather than copied from one published subtotal. Equity and debt describe how the wider state is financed; they do not replace the operating boundary. Capital preservation prevents recovery from being mislabelled as value, while twosided reconciliation and timing control prevent denominator choices from contaminating return, cash flow, and valuation.

The next chapter reads the financial statements as the anatomical record of this state. The balance sheet records the opening and closing configuration, the income statement records transformation, and the cash-flow statement records circulation, reinvestment, and claim allocation.

CHAPTER 3

Financial Statements as the Anatomical Record of the Loop

Academic proposition
The financial statements are not independent reports. They are time-ordered records of one capital system: the balance sheet records state, the income statement records transformation, and the cash-flow statement records circulation, reinvestment, financing, and renewal.

3.1 The Balance Sheet as a State Record

The opening balance sheet records the resources and claims inherited from prior decisions. Receivables preserve the consequences of earlier sales, inventory preserves procurement and production choices, fixed assets preserve investment history, debt preserves financing decisions, and retained earnings preserve the accumulated residual allocated to equity.

A closed-loop reading separates operating assets, spontaneous operating liabilities, nonoperating assets, and financing claims. This reclassification converts the accounting balance sheet into an analytical state record that can support ROIC, EVA, reinvestment, FCFF, and the enterprise-to-equity bridge.

3.2 The Income Statement as a Transformation Record

The income statement records the period transformation of operating activity into revenue, operating profit, tax, financing cost, and net income. The closed-loop framework separates operating performance from financing structure so that the return on the productive state can be observed before contractual claims are allocated.

NOPLAT performs this separating function. It is the after-tax operating result before the actual debt and equity structure determines the residual. It is not interchangeable with net income, because net income belongs to the common-equity claim after financing and nonoperating effects.

3.3 The Cash-Flow Statement as a Circulation Record

The cash-flow statement shows whether accrual transformation became financial circulation. It records collection, inventory and payable movements, taxes, capital expenditure, borrowing, repayment, dividends, and other changes in claims. A company can report strong operating profit while circulation fails because the operating state consumes cash faster than it releases it.

The closed-loop analysis does not treat the cash-flow statement as a separate end product. It reconciles cash movement with the change in operating capital, the debt roll-forward, the equity roll-forward, and the next balance-sheet state.

3.4 Direct Construction of NOPLAT

NOPLAT should be constructed directly from the operating statement using an operating EBIT measure and a tax charge aligned with that operating profit. Non-operating income, financing costs, exceptional items, and taxes associated with excluded items belong in the reconciliation rather than in the core operating numerator.

$$\text{NOPLAT}_t = \text{Operating EBIT}_t - \text{Operating Taxes on EBIT}_t$$

The direct construction preserves causal visibility. The reviewer can attribute changes to sales, price, volume, mix, operating cost, depreciation, and tax rather than accepting a single output. It also establishes the numerator that must be matched with operating invested capital.

3.5 The Reconciliation from NOPLAT to Net Income

Net income is reached after operating surplus is reduced or increased by financing and nonoperating effects. A simplified bridge deducts after-tax interest from NOPLAT and incorporates other non-operating income, exceptional claims, minority interests, and preferred claims where applicable.

$$\text{Net Income}_t = \text{NOPLAT}_t - \text{After-Tax Interest}_t + \text{Net Non-Operating Effects}_t - \text{Other Senior Claims}_t$$

The bridge should be explicit because it explains whether equity outcomes arise from operating productivity, financing cost, non-operating assets, tax treatment, or exceptional items. Without this separation, high ROE or rising net income can be mistaken for operating improvement.

3.6 Debt, Interest, and the Tax-Shield Layer

Debt affects the company through both cash claims and tax consequences. Interest reduces the residual available to equity, while deductibility may create a tax shield. Principal movement changes FCFE but not FCFF. Refinancing changes maturity risk even when currentperiod income is unaffected.

The debt layer must therefore reconcile balance, cost, tax, cash, and timing. Interest should be matched with the debt base and period; debt issuance and repayment should reconcile the opening and closing balances; and the tax shield should not be counted both in WACC and again as a separate value unless the valuation architecture explicitly separates it.

3.7 Net Income as a Fixed Point of the System

The second controlling paper treats net income as a fixed point: the same residual should emerge whether the analysis begins with operating capital and ROIC, with NOPLAT and financing deductions, or with the equity-absorption layer. This does not mean that accounting rules disappear. It means that the final residual must be explainable by the operating and financing structure.

$$\text{ROIC}_t \times \text{Operating Capital}_t - \text{After-Tax Financing Cost}_t = \text{Net Income}_t$$

$$\text{Author-Defined WACE\_OE},t \times \text{Operating Equity}_t = \text{Net Income}_t$$

These equalities are diagnostic, not a licence to redefine established cost-of-equity theory. The author-defined WACE is an ex post structural measure. Its role is to test how realised operating and financing outcomes were absorbed by the selected equity state, especially when conventional ROE is unstable.

3.8 The Closing Balance Sheet as the Next Opening State

The closing balance sheet completes the period loop. Operating capital should reconcile with the opening state plus net investment. Debt should reconcile with borrowing and repayment. Equity should reconcile with net income, distributions, new issuance, repurchases, and other recognised changes. The closing state then becomes the next opening state.

$$\text{Closing Operating Capital}_t = \text{Opening Operating Capital}_t + \text{Net Investment}_t$$

This identity is central to growth analysis. Growth is not merely a change in revenue. It is a change in the productive state. The value of growth depends on the return generated by the additional capital and the cash required to finance it.

3.9 Financial Radiology and Early Structural Signals

Financial radiology reads the statements for causal signals before the final valuation changes. Rising receivables and inventory may reveal cash absorption before FCFF deteriorates. Increasing debt and

falling interest coverage may reveal refinancing dependence before equity value declines. Rising net income accompanied by falling ROIC may reveal capitalheavy growth. A declining reinvestment burden may indicate efficiency, asset maturity, disposal, or underinvestment; the financial statements alone do not decide which interpretation is correct, but they identify the question.

The purpose is to locate where change first entered the organism. A model that waits for enterprise value to fall has detected the symptom too late. The linked statements make the earlier state and transformation changes visible.

3.10 Statement-System Closure

The financial statements form one time-ordered anatomical record. The balance sheet defines the state, the income statement records transformation, the cash-flow statement records circulation and claim allocation, and the closing balance sheet records renewal. NOPLAT isolates the operating result. The bridge to net income identifies financing and non-operating absorption. Net investment carries the productive state forward.

With the state and statements defined, the next chapter examines the coefficient that converts operating capital into after-tax operating surplus: ROIC.

CHAPTER 4

ROIC as the Generator of Operating Surplus

Academic proposition

ROIC is the transformation coefficient that connects the productive operating state to NOPLAT. Its meaning depends on a controlled capital boundary, a stated timing convention, and explicit separation from financing and non-operating effects.

4.1 Why ROIC Is More Than a Descriptive Ratio

ROIC is often used as a comparative ratio: one company or year is judged superior because the percentage is higher. The closed-loop framework gives it a deeper role. ROIC is the measured transformation of a defined beginning operating-capital state into after-tax operating income.

$$ROIC_t = NOPLAT_t \div \text{Beginning Operating Capital}_t$$

$$NOPLAT_t = ROIC_t \times \text{Beginning Operating Capital}_t$$

The rearranged identity is not merely algebraic. It anchors the operating-income result to the state that produced it. A change in NOPLAT can therefore be attributed to the scale of the capital base, the return earned on that base, or both.

4.2 Operating Surplus Generation

ROIC generates operating surplus before financing claims. When ROIC exceeds operatingcapital WACC, the company produces positive economic profit. When it falls below the hurdle, accounting profit may remain positive while economic value is destroyed. This sequencing prevents leverage or non-operating income from being mistaken for operating strength.

The surplus must then travel through the system. Reinvestment absorbs part of NOPLAT to establish the next state. Debt and other senior claims allocate cash. The residual reaches equity. ROIC is therefore the starting point of a distribution process rather than the final performance conclusion.

4.3 Margin and Capital Turnover as Causal Drivers

ROIC can be decomposed into operating margin and capital turnover. Margin explains how much after-tax operating profit is generated from sales. Turnover explains how much sales volume is generated from the productive capital state. The same ROIC can therefore arise from very different business models and risk profiles.

$$ROIC = \text{NOPLAT Margin} \times \text{Sales-to-Operating-Capital Turnover}$$

A high-margin, capital-intensive business and a low-margin, high-turnover business may report the same ROIC but respond differently to price pressure, volume shocks, maintenance investment, and working-capital stress. The decomposition is diagnostic; the controlling value test remains the spread over the required return and the cash needed to preserve the state.

4.4 Existing ROIC and Incremental ROIC

Existing ROIC describes the return on the current capital base. It does not prove that new investment creates value. Growth quality depends on the return earned on the additional capital required to produce additional NOPLAT.

$$\text{Incremental ROIC} = \text{Change in NOPLAT} \div \text{Change in Operating Capital}$$

A company with exceptionally high historical ROIC can destroy value by investing new capital below the hurdle. A company with a moderate existing return can create value if the next investment earns a

stronger spread. Board and project decisions should therefore focus on incremental economics rather than average corporate reputation.

4.5 ROIC under Negative Operating Equity

Negative operating equity does not invalidate ROIC because the ROIC denominator is operating invested capital, not the sign of the equity portion attributed to operations. The productive assets can generate NOPLAT even when the claim structure is inverted or heavily financed by debt and operating liabilities.

The condition changes the transmission to equity. ROE may become unstable or reverse sign, while author-defined WACE_OE becomes a diagnostic of the burden absorbed by operating equity and WACE_OC records the same net-income contribution on operating capital. The analysis should therefore preserve the operating-capital view and then explain the financing and equity bridge rather than forcing a positive equity denominator.

4.6 From ROIC to NOPLAT and the Financing Residual

Once NOPLAT is generated, the financing structure determines the residual available to equity. A simplified structural bridge is:

$$\text{ROIC}_t \times \text{Operating Capital}_t - \text{Interest}_t(1 - \text{Tax Rate}_t) = \text{Net Income}_t$$

The complete company may require adjustments for non-operating income, preferred claims, minority interests, and other items. The principle remains: net income should be explainable as the residual produced after the operating surplus and the financing layer have been reconciled.

4.7 The 2005 Stress Case as a Structural Test

The author-controlled model uses the initial 2005 condition as a demanding test because operating equity is negative under the selected boundary. A permissive model could normalise the denominator or ignore the condition. The closed-loop approach retains it and asks whether the operating, financing, and equity paths still reach the same net-income result.

The year is treated as a computational validation case rather than a general empirical claim. The publication evidence should disclose sufficient high-level amounts and reconciliations to demonstrate closure while withholding cell references, hidden formulas, linked-sheet architecture, and executable mechanics.

4.8 ROIC Control Evidence and Interpretation Limits

A ROIC schedule should state the operating-capital boundary, the timing convention, the treatment of goodwill and non-operating assets, and the source of NOPLAT. Alternative beginning, average, and goodwill-inclusive returns can be reported when they answer distinct questions. They are not interchangeable outputs from which the analyst may select the most attractive percentage.

High ROIC does not prove competitive durability, accounting quality, or low risk. It may reflect temporary margins, underinvestment, a small denominator, acquisition accounting, or working-capital release. The closed-loop system uses reinvestment, cash conversion, economic profit, scenario resilience, and multi-period closure to challenge the operating return.

4.9 Return-Formation Closure

ROIC transforms the operating-capital state into NOPLAT. It is meaningful only when the productive boundary and timing convention are controlled. Margin and turnover explain its drivers, incremental ROIC tests growth, economic profit tests the spread over the hurdle, and the financing bridge explains how the operating result reaches net income and equity. The next chapter prices the productive state by aligning WACC with the same operating capital denominator used in ROIC.

CHAPTER 5

Pricing the Productive State: Operating-Capital WACC

Academic proposition
The required return must price the same productive capital state that ROIC transforms into NOPLAT. Operating-capital WACC is therefore an ex ante hurdle applied to a matched operating denominator, not a universal rate imposed on every asset and claim in the company.

5.1 The Denominator-Matching Problem in Conventional WACC

ROIC is usually computed on an operating-capital base, while conventional WACC is often assembled from total debt and total equity and then applied without testing whether those financing amounts support the same operating assets. Surplus cash, non-operating investments, acquisition balances, and other claims can enter the weights even though their returns are absent from NOPLAT. The result is a dimensional mismatch disguised as a familiar formula.

The problem is not that total-company WACC is always unusable. It is that a comparison between ROIC and WACC has economic meaning only when both refer to the same riskbearing capital boundary. The analyst must either align the capital bases or disclose why the mismatch is acceptable for the stated decision.

5.2 Operating Debt and Operating Equity

The productive state can be described from the financing side as the combination of debt and equity claims assigned to operations. These are analytical allocations rather than new legal instruments. Operating debt represents the interest-bearing claims supporting the operating state. Operating equity is the residual portion after the operating boundary, non-operating resources, and other claims have been reconciled.

$$\text{Operating Capital}_t = \text{Operating Debt}_t + \text{Operating Equity}_t$$

The identity can remain valid even when operating equity is negative. A negative residual does not eliminate the operating assets or their financing. It signals that the selected operating state is more than fully supported by debt, operating liabilities, or other claims after nonoperating allocations are recognised.

5.3 The Operating-Capital Cost Equation

Operating-capital WACC weights the after-tax cost of operating debt and the ex ante required return on the equity portion by their shares of the operating state. The purpose is to price the capital exposed to the operating return, not to create a new market-pricing model.

$$\text{WACC}^{op}_t = (\text{Operating Debt}_t \div \text{Operating Capital}_t) \times r\_d,_t(1 - \text{Tax Rate}_t) + (\text{Operating Equity}_t \div \text{Operating Capital}_t) \times r\_e,_t$$

The expected equity return in this equation remains an ex ante required return estimated using an appropriate market or institutional method. It is not the author-defined WACE, which is an ex post diagnostic introduced in the next chapter. Mixing the two would make the hurdle depend on the realised residual it is intended to test.

5.4 Tax Shields and Claim-Specific Pricing

Interest deductibility can reduce the after-tax cost of debt, but the tax shield belongs to a specific debt and tax regime. The model should match the tax rate, interest base, timing, and availability of taxable income. A nominal tax rate cannot be applied automatically when losses, limitations, withholding, or jurisdictional differences prevent the shield from being realised.

The tax shield must also be located once. When after-tax debt cost is embedded in WACC, the enterprise DCF already reflects the financing tax effect through the hurdle. Adding a separate tax-shield value without changing the cash-flow architecture can double count the same benefit. A separate adjusted-present-value treatment is legitimate only when the claim and discounting paths are reconstructed consistently.

5.5 Fixed and Floating Hurdle Regimes

A floating WACC allows the hurdle to change with leverage, market inputs, and the evolving claim structure. It may be economically responsive, but it can obscure attribution because operating improvement and discount-rate movement occur simultaneously. A fixed WACC holds the hurdle constant so that changes in ROIC, capital scale, economic profit, and cash conversion can be observed without a moving opportunity-cost threshold.

The Scenario C workbook uses a fixed WACC of approximately 17.6754% as a controlled analytical benchmark. The fixed rate is not a claim that risk never changes. It is an experimental control that isolates the operating and capital effects within the stated scenario.

Interpretation rule

A fixed WACC is a control condition; a floating WACC is a risk-responsive condition. Neither should be selected after observing which one produces the preferred value.

5.6 Why WACC Is an Ex Ante Operating Threshold

WACC answers a forward-looking question: what minimum return must the productive state earn to compensate the capital providers bearing its risk? It is therefore applied before the period result is known and before the residual is allocated to equity. Economic profit measures the realised spread over this threshold.

$$\text{Economic Profit}_t = (\text{ROIC}_t - \text{WACC}^{op}_t) \times \text{Beginning Operating Capital}_t$$

The hurdle should not be reverse engineered to make EVA equal a desired number. It should be approved from identifiable market, business-risk, leverage, tax, and claim assumptions and then frozen for the relevant scenario. Changes require a documented reason and a full downstream impact test.

5.7 Required-Return Governance

1. State the operating-capital boundary to which the hurdle applies.
2. Identify the debt, equity, tax, and risk inputs and their valuation date.
3. Distinguish fixed-control scenarios from floating-risk scenarios.
4. Prohibit the use of the author-defined WACE as a discount rate.
5. Test the effect of leverage on both debt cost and the required equity return.
6. Record every override and rerun EVA, DCF, continuing value, and claim-bridge checks.

5.8 Hurdle-Rate Closure

Operating-capital WACC prices the productive state on the same denominator used by ROIC. This alignment gives the ROIC–WACC spread a clear economic meaning and permits economic profit to

operate as both a value-creation measure and a control identity. Fixed and floating regimes answer different analytical questions and must be labelled explicitly.

The next chapter examines the residual equity-absorption layer and the author-defined WACE diagnostic that emerges after the operating return and financing structure have produced the realised equity result.

CHAPTER 6

WACE and the Equity Burden

Academic proposition

The author-defined Weighted Average Cost of Equity, WACE, is an ex post structural diagnostic of the return or burden absorbed by the selected operating-equity state. It is not an expected market return, not a substitute for CAPM, and not a valuation discount rate.

6.1 The Missing Equity-Absorption Layer

Corporate-finance analysis usually begins with an ex ante cost of equity and ends with reported ROE. The intervening transmission from operating surplus through financing claims to the equity residual is often left implicit. The author-defined WACE construct is intended to make this absorption layer visible.

ROIC generates NOPLAT on the operating-capital state. After-tax financing costs and nonoperating effects determine net income. The selected operating-equity state absorbs that residual. In this chapter, WACE_OE denotes the realised ratio between net income and operating equity; WACE_OC is reserved for the same net-income contribution expressed on the operating-capital base.

6.2 Author-Defined WACE_OE as an Ex Post Structural Measure

$$\text{WACE\_OE},t = \text{Net Income}_t \div \text{Operating Equity}_t$$

$$\text{Net Income}_t = \text{WACE\_OE},t \times \text{Operating Equity}_t$$

The definition is intentionally descriptive of realised structure. It records what the selected equity state absorbed after operations and financing were resolved. It does not estimate what investors required before the period, and it does not claim that book equity is a market-value weighting base.

Because the measure is author-defined and not an established market-pricing concept, the manuscript uses the term with an explicit qualifier and a strict misuse control. Its scientific role is to close and diagnose the operating-to-equity pathway, particularly under unusual capital conditions.

6.3 WACE, ROE, and the Need for Conceptual Separation

When WACE_OE is calculated as net income divided by a positive and stable operating-equity base, its arithmetic can resemble ROE. The concepts should nevertheless be separated. Conventional ROE is based on reported equity. Author-defined WACE_OE is tied to the operating-equity attribution selected within the closed-loop model, while WACE_OC expresses the weighted contribution on operating capital. Both are ex post diagnostics and neither is a market-required return.

The distinction becomes material when total equity and operating equity differ, when nonoperating assets are significant, or when the operating-equity denominator is negative. Calling every such ratio ROE would conceal the boundary decision that gives the result its meaning.

6.4 WACE_OE under Negative Operating Equity

The 2005 operating-equity condition is negative under the model's selected boundary. Conventional performance interpretation becomes unstable because a positive residual divided by a negative denominator produces a negative percentage. The sign does not imply that the operating system generated no income; it reveals an inverted claim configuration.

Under this condition, author-defined WACE_OE should be read as a structural signal. It identifies the magnitude and direction of residual absorption relative to the selected operating-equity state. WACE_OC then records the weighted contribution on operating capital. The surrounding evidence—

operating capital, debt, non-operating assets, cash flow, and claim reconciliation—must accompany both ratios.

6.5 WACE versus CAPM and Implied Cost of Equity

CAPM and related factor models estimate an expected return required by investors for market risk. Implied cost-of-equity models infer a forward-looking discount rate from market price and forecast cash flows. Author-defined WACE_OE answers a different question: what realised residual was absorbed by operating equity after the company's operating and financing outcomes occurred? WACE_OC answers the linked question on the operating-capital coordinate.

The measures may be compared diagnostically, but they are not substitutes. Persistent tension between an ex ante required return and an ex post absorption result may motivate investigation of operating performance, leverage, capital allocation, or accounting boundaries. It does not authorise the analyst to replace the market hurdle with WACE_OE or WACE_OC.

6.6 The ROIC–WACC–WACE_OE Closure Bridge

The closed-loop bridge connects operating return, capital pricing, financing claims, and equity absorption. In a simplified form, the same net income is obtained after the operating surplus is reduced by the after-tax financing layer and is then reproduced by author-defined WACE_OE applied to operating equity. The identical amount is also reproduced by WACE_OC applied to operating capital.

$$\text{ROIC}_t \times \text{Operating Capital}_t - \text{After-Tax Financing Cost}_t + \text{Net Non-Operating Effects}_t = \text{WACE\_OE},t \times \text{Operating Equity}_t = \text{WACE\_OC},t \times \text{Operating Capital}_t$$

The complete model contains more detailed claim and adjustment layers. The governing principle is not the simplified formula itself but the absence of an unexplained residual. Every amount generated by operations must be reinvested, paid to a claimant, retained, or attributed to the closing state.

6.7 Governance Interpretation and Misuse Controls

1. Always label WACE as an author-defined ex post structural measure.
2. State the exact operating-equity denominator and its sign.
3. Do not describe WACE as the expected market cost of equity.
4. Do not use WACE as a DCF or residual-income discount rate.
5. Present WACE beside ROIC, WACC, debt cost, non-operating effects, and net income.
6. Escalate large changes to determine whether they arise from operations, financing, or denominator compression.

6.8 Equity-Burden Closure

Author-defined WACE is a denominator-qualified family of ex post equity-absorption measures. WACE_OE is the raw operating-equity rate NI/OE; WACE_OC is its weighted contribution NI/OC. Their value lies in boundary transparency and structural reconciliation, not in replacing established asset-pricing methods. Under negative operating equity,
WACE_OE becomes a warning and attribution device rather than a conventional performance percentage.

The next chapter treats net income as the fixed point at which the operating-capital, financing-deduction, and operating-equity paths must converge.

CHAPTER 7

Net Income as the Fixed Point between Operations and Equity

Academic proposition
Net income is not accepted as an isolated accounting output. It must be reproducible as the residual of operating surplus, financing and non-operating claims, and the selected equity-absorption state.

7.1 Why Net Income Must Be Reconstructed

Reported net income is essential, but it does not by itself explain why the residual arose. The same number can result from powerful operations, low financing cost, non-operating income, asset sales, tax effects, leverage, or temporary adjustments. Reconstruction turns the reported residual into a causal result.

The closed-loop model uses independent routes because one route can be internally consistent yet economically misclassified. Agreement among routes provides stronger evidence that operating income, financing claims, and the equity state have been mapped coherently.

7.2 The Operating-Capital Path

$$\text{NOPLAT}_t = \text{ROIC}_t \times \text{Beginning Operating Capital}_t$$

The operating-capital path begins with the productive state and the return earned on that state. It produces NOPLAT before the actual financing structure is allowed to affect the result.
This path isolates operating productivity and creates the starting surplus for claim allocation.

7.3 The Financing-Deduction Path

$$\text{Net Income}_t = \text{NOPLAT}_t - \text{After-Tax Interest}_t + \text{Net Non-Operating Effects}_t - \text{Other Senior Claims}_t$$

The financing-deduction path explains how the operating surplus becomes the commonequity residual. Interest and the tax shield should be matched to the debt base. Non-operating income should be connected to the corresponding excluded assets. Minority, preferred, and other senior claims should be identified rather than absorbed into an unexplained plug.

7.4 The Operating-Equity Absorption Path

$$\text{Net Income}_t = \text{Author-Defined WACE\_OE,t} \times \text{Operating Equity}_t$$

The operating-equity path reproduces the same residual from the claim-absorption perspective. The product is a closure identity under the author's definition, not an independent market valuation. Its usefulness depends on a documented operating-equity boundary and exact agreement with the net-income target.

7.5 Multi-Path Convergence to One Net-Income Result

The author-controlled model reports the following operating-capital/equity bridge across the explicit years. The operating-equity return applied to operating invested capital reproduces the net-income sequence while the equity-to-operating-capital relationship changes materially.

Computational Record 7.1 — Operating-Capital and Equity-Absorption Bridge

Year	Operating Capital	Operating-Equity Return	Net Income	Total Equity / Operating Capital
2005	6,756	72.3444%	4,887.59	91.8591%
2006	9,804	74.5283%	7,306.75	97.9660%
2007	14,098	60.8435%	8,577.71	100.2294%
2008	17,286	55.6440%	9,618.63	105.4787%
2009	19,134	59.8427%	11,450.31	108.1984%

Source: author-controlled twenty-eight-sheet Excel model, operating-capital/equity focus schedule. Amounts follow the model's stated units. No cell references or executable logic are disclosed.

The table should not be read as proof that one percentage is a market cost of equity. It demonstrates that the residual can be reproduced from a controlled capital-and-equity attribution schedule and that the relationship between total equity and operating capital changes through time.

7.6 What Divergence Reveals

A difference among the paths may arise from inconsistent tax treatment, missing nonoperating income, the wrong debt movement, a changed capital boundary, an average-versusbeginning timing mismatch, a sign error, or a unit difference. The model should identify the first failed equality rather than place the residual in a catch-all adjustment.

The refusal principle is important. When a material residual cannot be explained, the analyst should not average the routes or select the most favourable one. Approval is suspended until the statement, capital, financing, and equity maps are restored.

7.7 Net-Income Convergence

Net income is the fixed point linking the operating and equity layers. ROIC and operating capital generate NOPLAT; financing and non-operating claims produce the residual; the operating-equity attribution reproduces that residual. Convergence does not change accounting net income. It explains and audits it.

Fixed-point auditing must preserve the distinction between a monetary outcome and the ratios used to represent it. Net income is the accepted monetary residual. The operatingcapital route, the operating-equity route, and the reported-equity route are admissible only when each route reconstructs that same amount from a clearly defined denominator. A percentage is therefore not accepted because it looks plausible or resembles a familiar market metric. It is accepted because its multiplication by the stated capital base reproduces the same net-income amount without a plug.

The audit proceeds in four stages. First, the reviewer certifies the net-income numerator and traces it to NOPLAT, after-tax financing cost, non-operating effects, and any senior claims. Second, each capital denominator is defined independently and dated consistently: operating invested capital, operating equity, and total reported equity are not interchangeable. Third, signs and weights are tested, especially when operating equity is negative. A large negative raw return on a negative operating-equity base can coexist with a positive weighted contribution, but only when the multiplication route closes exactly. Fourth, the monetary products are compared. Operating capital multiplied by the equity-attributable return on operating capital, operating equity multiplied by the raw operating-equity return, and total equity multiplied by ROE must all converge on the certified net income.

This protocol converts denominator geometry into an error-detection system. A failed route points to a specific class of defect: a missing financing item, a duplicated non-operating adjustment, an inconsistent tax convention, a wrong opening or average capital base, a sign reversal, or a timing mismatch. No route is privileged merely because it produces a conventional-looking percentage. The accepted conclusion is the one supported
simultaneously by accounting reconciliation, capital-boundary consistency, and amount-level closure. The denominator-qualified WACE architecture remains an ex post structural diagnostic within this protocol; neither WACE_OE nor WACE_OC is an expected market return or valuation discount rate.

CHAPTER 8

Economic Profit and the Legitimacy of Value

Academic proposition

Economic profit is the monetary expression of the spread between operating return and the required return on the matched beginning operating-capital state. Equality between its two constructions is a primary closed-loop control.

8.1 Accounting Profit Is Not a Capital Test

Accounting profit can be positive while the company fails to compensate the capital required to generate it. A large asset base, acquisition premium, working-capital burden, or riskadjusted opportunity cost may make a profitable business economically unproductive. Economic profit exposes this difference by charging the productive state for the hurdle it must earn.

8.2 Economic Profit through Two Equivalent Routes

$$\text{Economic Profit}_t = (\text{ROIC}_t - \text{WACC}^{op}_t) \times \text{Beginning Operating Capital}_t$$

$$\text{Economic Profit}_t = \text{NOPLAT}_t - \text{WACC}^{op}_t \times \text{Beginning Operating Capital}_t$$

The spread route begins with the percentage excess return and converts it into an amount.
The capital-charge route begins with NOPLAT and deducts the required monetary return. Their equality verifies that ROIC, NOPLAT, capital, timing, and WACC refer to the same economic object.

8.3 EVA as an Admission Test Rather Than a Stand-Alone Metric

Positive economic profit admits the possibility that value has been created. Negative economic profit denies that conclusion even when sales, accounting earnings, or distributions rise. The test is necessary but not sufficient. The future surplus must be durable, convertible into cash, financeable, and valued without terminal contradiction.

Economic profit should therefore be read together with net investment, FCFF, leverage, and the continuing-value assumptions. A company can create substantial current EVA while creating fragility through excessive reinvestment or debt. Conversely, current cash can look strong because the company is underinvesting in the state required to preserve future EVA.

8.4 Positive Spread, Capital Scale, and Value Quality

Economic profit can increase even while ROIC declines if the company applies a still-positive spread to a much larger capital base. The amount of value creation rises, but the quality and resilience of that value may weaken. The reviewer should distinguish return improvement from scale expansion.

Computational Record 8.1 — Scenario C Explicit-Period Economic Profit under Fixed WACC

Year	Beginning Operating Capital	ROIC	Fixed WACC	Economic Profit
2005	6,756	93.2592%	17.6754%	5,106.44
2006	9,804	90.9501%	17.6754%	7,183.86
2007	14,098	74.2851%	17.6754%	7,980.84
2008	17,286	66.9075%	17.6754%	8,510.27
2009	19,134	71.3981%	17.6754%	10,279.31

Source: author-controlled Scenario C fixed-WACC workbook. Explicit-period values are reproduced at high level. The T+1 periodic calculation continues the same beginning-capital identity and is read directly from the workbook's ROIC and Economic Profit schedules.

The explicit-period record shows that operating capital nearly triples while ROIC moderates and then partially recovers. Economic profit nevertheless rises because the spread remains strongly positive. The correct conclusion is not simply that performance improved. The analyst must test the incremental return on the added capital, the cash required to finance it, and the durability of the spread at scale.

8.5 Durability of Economic Profit

One-period EVA can be driven by temporary margins, delayed maintenance, working-capital release, favourable tax, or an artificially low hurdle. Durability requires annual closure and a credible path from the closing capital state to future NOPLAT, reinvestment, and cash. The terminal period must continue the same logic rather than replace it with an unsupported stable-state assumption.

The model's T+1 periodic-EVA test is therefore a separate control from the stable incrementalreturn input used to derive long-run reinvestment. The periodic test extends the explicit operating-capital identity. The stable input addresses the economics of growth beyond the forecast. They should agree conceptually without being substituted mechanically.

8.6 Value-Legitimacy Closure

Economic profit converts the ROIC–WACC spread into the monetary surplus earned after compensating the productive capital state. Its two forms must agree. Rising EVA may reflect better return, more value-creating capital, a lower hurdle, or a combination of these effects; attribution is essential.

The next chapter converts NOPLAT and economic surplus into operating cash by tracing the reinvestment that carries the company from one productive state to the next.

CHAPTER 9

Reinvestment and the Transition to Free Cash Flow

Academic proposition. Free cash flow is not a separately chosen valuation input. It is the cash consequence of the operating result after the investment required to carry the productive state from one period to the next has been recognised. NOPLAT measures the after-tax operating surplus generated during the period; net investment measures the amount retained in the operating system; FCFF is the residual distributable capacity available to all capital providers. The three quantities must therefore be derived from one state-transition identity rather than assembled from unrelated schedules.

9.1 Reinvestment as the State-Transition Mechanism

A company survives from period to period because part of the current operating result is retained in productive resources. Receivables are financed until collected, inventory is acquired before sale, productive assets are maintained or expanded, and intangible capability is developed. These commitments are not external to the valuation model. They explain how the closing operating state is created.

$$\textit{Ending Operating Capital}_t = \textit{Beginning Operating Capital}_t + \textit{Net Investment}_t$$

The identity gives reinvestment a precise role. Beginning operating capital is the state inherited from the previous period. Net investment is the transition applied during the current period. Ending operating capital is the state transferred to the next period. Because the closing state of period t becomes the opening state of period t+1, reinvestment links performance, cash conversion, and future earning capacity in one recursive chain.

$$\textit{Beginning Operating Capital}_{t+1} = \textit{Ending Operating Capital}_t$$

A valuation that forecasts income without constructing this transition leaves the productive system incomplete. It may assume revenue growth, margin improvement, or terminal expansion while failing to identify the receivables, inventory, capacity, technology, or other operating capital required to support those outcomes. Closed-loop analysis does not permit growth to appear without its capital consequence.

9.2 Net Investment and Gross Investment

Net investment is the increase in the operating-capital state after recognising depreciation and other operating consumption already reflected in the financial statements. Gross investment records the full addition to productive resources before deducting depreciation or amortisation. The distinction matters because depreciation is both an accounting expense within operating profit and a non-cash charge that approximates part of the capital consumed during the period.

$$\textit{Net Investment}_t = \textit{Ending Operating Capital}_t - \textit{Beginning Operating Capital}_t$$

$$\textit{Gross Investment}_t = \textit{Net Investment}_t + \textit{Operating Depreciation and Amortisation}_t$$

These equations provide two independent routes from operating income to cash. The first begins with NOPLAT and deducts the increase in the operating state. The second adds back non-cash operating charges and deducts the full gross investment. Under consistent boundaries, signs, and timing, the routes must agree.

The gross-investment route is especially useful as a diagnostic. A difference between the two constructions can identify omitted working-capital movements, inconsistent depreciation treatment, non-cash acquisitions, asset disposals, lease reclassification, goodwill movements, or a silent change in the productive boundary. A plug is not an acceptable remedy; the difference must be traced to its economic source.

9.3 The Two FCFF Identities

$$FCFF_t = NOPLAT_t - Net\ Investment_t$$

$$FCFF_t = NOPLAT_t + Operating\ Depreciation\ and\ Amortisation_t - Gross\ Investment_t$$

The first identity states the economic relationship compactly: the company generates an operating surplus and retains part of it to enlarge or preserve the productive state. The second identity exposes the cash mechanics: non-cash operating charges are restored and the cash committed to working capital, fixed assets, and other operating resources is deducted.

FCFF is therefore neither accounting profit nor cash on the balance sheet. It is the cash generated by operations after the investment required by the operating plan, before the allocation of that cash among debt, equity, and other financing claims. It measures distributable capacity at the enterprise level, not the amount automatically belonging to common shareholders.

The identities also show why FCFF can rise while NOPLAT grows slowly, or fall while NOPLAT increases. A release of working capital or a temporary reduction in capital expenditure can raise current FCFF. Conversely, value-creating expansion can depress current FCFF because the company is committing cash to investments whose incremental return exceeds the required return. Cash conversion must therefore be interpreted together with the quality and purpose of reinvestment.

9.4 Maintenance, Expansion, and Capital Release

Not all reinvestment has the same economic meaning. Maintenance investment preserves existing productive capacity. Expansion investment enlarges capacity or capability. Capital release reduces the operating state through collection, inventory rationalisation, disposal, outsourcing, or the withdrawal of resources from activities no longer justified by their return. Each category has different implications for current cash and future value.

Reinvestment form	Economic purpose	Cash-flow effect	Primary interpretive risk
Maintenance investment	Preserve current capacity and operating reliability	Reduces current FCFF but protects future NOPLAT	Underinvestment temporarily inflates cash and later weakens the operating state
Expansion investment	Create additional capacity, products, markets, or capability	Reduces current FCFF; creates value only if incremental ROIC exceeds the hurdle	Growth can enlarge sales and profit while destroying value
Working-capital investment	Support sales, production, and collection cycles	Absorbs cash before the related operating result is collected	Receivable or inventory growth may conceal weakening conversion
Capital release	Remove idle or inefficient operating resources	Raises current FCFF and may improve ROIC	A one-off release is not recurring operating cash generation

The classification cannot be inferred from the sign of net investment alone. Low or negative net investment may represent efficiency and disciplined capital release, but it may also reflect deferred

maintenance, capacity exhaustion, or the liquidation of the operating base. High investment may represent valuable expansion or uncontrolled capital intensity. The decision test is the expected incremental return and the credibility of the future operating state.

9.5 Scenario C: The Explicit-Period Cash-Conversion Record

The fixed-hurdle Scenario C evidence provides a five-period demonstration of the income-tocash transition. Beginning operating capital rises from 6,756 to 19,134 across the explicit period. NOPLAT rises from approximately 6,300.59 to 13,661.31. Net investment is highest in the early expansion years and then declines. FCFF consequently accelerates from approximately 3,252.59 to 12,001.31.

Metric	2005	2006	2007	2008	2009
Beginning operating capital	6,756	9,804	14,098	17,286	19,134
NOPLAT	6,300.59	8,916.75	10,472.71	11,565.63	13,661.31
Net investment	3,048	4,294	3,188	1,848	1,660
FCFF	3,252.59	4,622.75	7,284.71	9,717.63	12,001.31
FCFF / NOPLAT	51.62%	51.85%	69.56%	84.02%	87.85%

Computational Record 9.1 — Scenario C NOPLAT, Net Investment, and FCFF

Source: author-controlled Scenario C fixed-WACC workbook. Values follow the workbook's stated units and are presented as highlevel evidence; the executable formulas, cell addresses, and linked-sheet architecture remain protected.

The sequence should not be interpreted as a simple story of continuous improvement. The cash-conversion ratio rises sharply because net investment falls relative to NOPLAT. The analyst must determine whether this reflects maturation of the early investment programme, improved working-capital control, increased asset utilisation, or emerging underinvestment.

The same numbers can support different economic conclusions unless the underlying operating drivers are investigated.

The record also explains why NOPLAT and FCFF must be reported together. NOPLAT more than doubles, but FCFF increases by substantially more because the investment burden moderates. A decision based only on the final cash amount would miss the capital path that produced it. A decision based only on profit would miss the strengthening cash conversion. The closed-loop reading preserves both.

9.6 Cash-Conversion Quality

Cash-conversion quality concerns the source, durability, and economic consequence of the cash residual. A high FCFF-to-NOPLAT ratio is favourable when it reflects efficient workingcapital management, mature productive assets, disciplined maintenance, and a limited need for low-return expansion. The same ratio is unfavourable when it reflects supplier stretch, receivable sales, inventory depletion, deferred maintenance, asset disposals, or the exhaustion of investment opportunities.

$$Cash\text{-}Conversion\ Ratio_t = FCFF_t \div NOPLAT_t$$

The ratio is a diagnostic, not a target to be maximised. A company with abundant high-return opportunities should rationally reinvest more and report a lower current conversion ratio. A company with weak incremental returns should release capital rather than preserve a highinvestment growth narrative. The governing test is whether retained cash is expected to earn more than the required return and whether distributed cash is genuinely surplus to the productive system.

Longitudinal review is essential. A sudden improvement in conversion should be traced through receivable days, inventory days, supplier terms, capital expenditure, depreciation, asset disposals, acquisition payments, lease movements, and non-cash investment. The investigation should locate the first point at which the cash improvement entered the system rather than attributing the result vaguely to management efficiency.

9.7 Growth, Reinvestment, and Incremental Return

Growth is not an independent valuation input. It is produced by reinvestment and the return earned on the additional productive state. In a stable economic condition, the relation can be expressed as follows:

$$\textit{Growth Rate} = \textit{Reinvestment Rate} \times \textit{Return on Incremental Operating Capital}$$

$$\textit{Reinvestment Rate} = \textit{Growth Rate} \div \textit{Return on Incremental Operating Capital}$$

These identities prevent a terminal model from combining a high growth rate with negligible reinvestment or a low incremental return. They also prevent the analyst from applying historical ROIC automatically to new capital. Existing operations may possess scarcity advantages, fully depreciated assets, favourable working-capital terms, or legacy margins that cannot be reproduced by expansion. The return on the next unit of capital is the relevant growth variable.

In the Scenario C stable-state evidence, 7% growth and a stable incremental return of approximately 57.61% imply a reinvestment rate of approximately 12.1511%. The remaining approximately 87.8489% of stable-period NOPLAT is available as FCFF. This stable incremental-return assumption belongs to the continuing-value mechanism. It must not be substituted into the separate T+1 periodic-EVA calculation, which follows the beginningcapital formula and the fixed Scenario C hurdle.

9.8 The Reinvestment Decision Gate

Management should not approve reinvestment merely because the company has cash, because sales are growing, or because the project increases accounting earnings. The proposal must demonstrate the additional operating capital, the expected incremental NOPLAT, the timing of cash absorption and recovery, the incremental ROIC, the capital charge, and the downside funding requirement.

Gate	Proceed when	Reject, redesign, or defer when
Productive need	The operating constraint or opportunity is explicitly identified	The proposal is a general growth narrative without an operating mechanism
Capital completeness	Working capital, fixed assets, implementation cost, maintenance, and contingencies are included	Material capital needs are deferred to later forecasts or hidden in terminal value
Incremental return	Incremental ROIC exceeds the riskconsistent hurdle in credible cases	The project relies on average corporate ROIC or earnings accretion
Cash resilience	Peak funding, debt service, and covenant effects remain feasible in downside conditions	The project creates a liquidity break before the operating return is realised
Closure	Capital roll-forward, NOPLAT, FCFF, and valuation routes reconcile	An unexplained residual, plug, or unit/timing mismatch remains

The decision gate separates value-creating reinvestment from capital accumulation. It also makes a later post-investment review possible. Actual capital committed, NOPLAT generated, cash conversion, and

incremental economic profit can be compared with the approved case. Management quality is then evaluated through realised capital outcomes rather than through the original narrative.

9.9 Reinvestment and Cash-Flow Closure

Reinvestment closes the transition from operating performance to enterprise cash. The required control sequence is:

Opening Operating Capital → NOPLAT → Net Investment → FCFF → Closing Operating Capital

The closing capital state must equal the next opening state. Net investment must reconcile with the change in that state. FCFF must close through both the net-investment and grossinvestment routes. The economic interpretation of investment must then be challenged separately: whether it preserves capability, expands value-creating capacity, releases inefficient capital, or masks underinvestment.

Mechanical closure does not prove that the investment plan is wise. It proves that the cash consequence is correctly traced. Economic judgment remains necessary to assess incremental return, competitive durability, execution risk, financing feasibility, and the credibility of the future state. The distinction between mechanical proof and economic judgment is central to the institutional use of the framework.

9.10 Chapter Synthesis

NOPLAT records the after-tax operating surplus generated by the productive state. Net investment records the portion retained to preserve or change that state. FCFF is the residual cash available to all capital providers after this transition. The identities are inseparable: an income forecast without reinvestment is incomplete, a cash forecast without a capital rollforward is ungrounded, and a growth forecast without incremental return is economically permissive.

Scenario C demonstrates the relationship across five explicit periods. NOPLAT rises, the investment burden moderates, and FCFF conversion strengthens. The result is analytically favourable only after the declining investment requirement is explained and the future productive state is shown to remain credible. The next chapter allocates enterprise cash among financing claims and derives the cash residual attributable to common equity.

CHAPTER 10

Financing Claims, FCFE, and the Distribution of Cash

Academic proposition. Enterprise cash and equity cash represent different claims on the same operating system. FCFF is generated before financing allocation; FCFE is the residual after the timing and cost of debt claims have been recognised. Borrowing can change the cash reaching equity without changing operating performance. A closed-loop model must therefore separate cash generation from claim distribution and reconcile the two through explicit sign, tax, and timing conventions.

10.1 Firm Cash Flow and Equity Cash Flow Are Different Claims

FCFF belongs conceptually to all providers of capital because it is measured after operating reinvestment but before the allocation of cash to interest-bearing debt and residual equity. FCFE belongs to the equity layer only after contractual financing claims and net debt movement have been recognised. The distinction is not presentational. It determines which risk, discount rate, and valuation bridge are appropriate.

$$\text{FCFE}_t = \text{FCFF}_t - \text{After-Tax Interest}_t + \text{Net Borrowing}_t$$

The model records debt movement using a repayment-oriented sign convention: a decrease in debt is positive and an increase in debt is negative. Under that convention, the equivalent formula is:

$$\text{FCFE}_t = \text{FCFF}_t - \text{After-Tax Interest}_t - \text{Decrease/(Increase) in Debt}_t$$

The two expressions are identical when the sign convention is observed. Confusion commonly arises when a model labels a row as "change in debt" but switches silently between debt raised and debt repaid. The label, sign, and economic interpretation must be frozen before the FCFE bridge is used.

FCFE should not be interpreted as the amount that may automatically be distributed. It is a residual cash measure. Boards must still consider liquidity reserves, covenant restrictions, scheduled maturities, regulatory capital, minority claims, and the productive needs of the next period.

10.2 Interest, Debt Movement, and the Tax-Shield Layer

Interest is a contractual charge for the use of debt capital. Because NOPLAT is measured before financing, the transition from FCFF to equity cash deducts interest after the associated tax effect. Principal movement is separate: repayment consumes cash available to equity, while additional borrowing temporarily increases it.

$$\text{After-Tax Interest}_t = \text{Interest Expense}_t \times (1 - \text{Tax Rate}_t)$$

The tax shield reduces the economic cost of interest but does not eliminate the debt claim. It must be represented once and only once. Deducting pretax interest from FCFF and adding the tax shield elsewhere can be correct if the bridge is explicit; deducting after-tax interest and then adding the shield again double counts the benefit. The model therefore requires a claim ledger that identifies gross interest, tax effect, after-tax interest, debt movement, and terminal debt separately.

Debt movement should also be separated from operating reinvestment. Debt raised to finance inventory or capital expenditure does not convert financing cash into operating cash. It changes how the operating investment is funded. The operating system still must earn the return required to support the claim.

10.3 Multiple Routes to FCFE

The closed-loop architecture does not accept FCFE from one preferred formula. It reconstructs the equity residual through independent routes whose agreement becomes a control.

Route	Construction	Primary control purpose
Enterprise-to-equity route	Begin with FCFF; deduct after-tax interest; add net borrowing or deduct debt repayment	Tests the direct allocation of enterprise cash among financing claims
Operating-surplus route	Begin with NOPLAT; deduct net investment, after-tax interest, and debt repayment	Connects operating return, state transition, and financing allocation
Accounting cash route	Begin with net income; restore noncash operating charges; deduct operating investment; incorporate financing movements and separately identified quasi-equity claims	Tests consistency with the statements and the model's claim boundary
Financing-flow route	Reconcile distributions and changes in financing and non-operating positions to the same residual cash amount	Tests whether the sources and uses of the residual claim close without an unexplained plug

The accounting route requires particular caution. The author-controlled workbook reports a residual labelled "FCF Equity & Quasi Equity" because minority interests and certain claim movements are included in the reconciliation. The book therefore preserves the workbook label when reporting the numerical evidence and does not silently reclassify the amount as pure common-equity FCFE. A common-equity valuation requires a later claim bridge that removes superior and non-common claims explicitly.

10.4 Scenario C: Explicit-Period Claim Distribution

Scenario C provides a five-period record of the transition from FCFF to the model-defined equity-and-quasi-equity residual. The operating cash sequence is the same as in Chapter 9. The financing bridge then identifies after-tax interest and the decrease or increase in debt. Debt repayment materially reduces the residual in 2006–2008, while the absence of debt repayment in 2009 allows most of FCFF to remain available to the residual claim.

Metric	2005	2006	2007	2008	2009
FCFF	3,252.59	4,622.75	7,284.71	9,717.63	12,001.31
After-tax interest expense	519	409	298	171	111
Metric	**2005**	**2006**	**2007**	**2008**	**2009**
Decrease/(increase) in debt	(57)	3,055	1,445	978	0
FCFE & quasi-equity residual	2,790.59	1,158.75	5,541.71	8,568.63	11,890.31
Reconciliation difference	0	0	0	0	0

Computational Record 10.1 — Scenario C Enterprise-to-Residual-Equity Cash Bridge

Source: author-controlled Scenario C fixed-WACC workbook, high-level values from the FCFF-for-equity and financing-flow schedules. Parentheses denote an increase in debt under the workbook's repayment-oriented sign convention. Executable formulas and cell addresses remain protected.

The 2005 debt movement is an increase of approximately 57 under the workbook sign convention. It partly offsets the after-tax interest deduction. In 2006, repayment of approximately 3,055 and after-tax interest of 409 absorb most of FCFF, leaving a residual of approximately 1,158.75. The pattern demonstrates why a decline in FCFE does not necessarily indicate operating deterioration: the cash may have been used to reduce a senior claim.

Conversely, a rise in FCFE does not automatically indicate stronger operations. It may reflect new borrowing, reduced debt repayment, temporary working-capital release, or deferred investment. The closed-loop explanation must identify the first layer at which the change entered.

10.5 Debt-Financed Distribution and False Cash Strength

Additional borrowing can make equity cash appear strong even when operating cash conversion is unchanged or weakening. The cash reaches equity in the current period, but the company also creates future interest, covenant, refinancing, and repayment obligations. A distribution financed by debt is therefore a transfer from future claim capacity, not evidence that the productive state created additional surplus.

Equity Cash Increase from Borrowing ≠ Operating Value Creation

The same caution applies when management reduces capital expenditure or releases working capital to preserve dividends. Current equity cash may rise while the productive state weakens. The board must distinguish earned distributions from financed or liquidating distributions. A useful control is to present FCFF, net borrowing, debt service, distributions, and closing debt on one schedule rather than reporting dividends or FCFE alone.

10.6 Claim Timing and Refinancing Exposure

A financing bridge can reconcile arithmetically while remaining economically fragile. Debt maturities may be concentrated before the operating investment produces cash. Floating-rate debt may increase the claim faster than NOPLAT. Covenant tests may restrict distributions even when the model reports positive FCFE. Refinancing may depend on market access that disappears in a downside scenario.

The timing review should therefore identify the opening debt balance, scheduled principal, new borrowing, interest basis, hedge treatment, maturity profile, collateral, covenant headroom, and the minimum liquidity reserve. Annual totals are insufficient when large claims fall within the period or when cash generation is seasonal.

The appropriate stress question is not merely whether forecast FCFE remains positive. It is whether the company can satisfy every senior claim when due without impairing the productive state or relying on unsupported refinancing. A closed-loop forecast that closes only after assuming permanent market access has not completed the risk analysis.

10.7 The Terminal Claim Bridge and the Financing Tax Effect

The continuing period must preserve the same claim logic as the explicit forecast. In the Scenario C evidence, continuing FCFF of approximately 120,290.05 is reconciled to an equityand-quasi-equity continuing cash amount of approximately 108,791.14, terminal debt movement of approximately 2,121, and a separately identified financing tax-effect component of approximately 9,377.91. The model's equality is:

$$120{,}290.05 \approx 108{,}791.14 + 2{,}121.00 + 9{,}377.91$$

This equation is a model-specific terminal claim reconciliation, not a universal shortcut. Its components must remain consistent with the debt policy, interest tax treatment, discount-rate framework, and continuing-state assumptions. The book reports the equality as evidence of the protected model's closure while reserving the detailed implementation and cell logic.

The terminal tax-effect component should not be confused with operating value creation. It is part of the allocation of value among financing claims. The operating continuing value remains governed by stable NOPLAT, reinvestment, incremental return, growth, and WACC. Claim allocation occurs after that operating value has been established.

10.8 Financing-Quality Decision Gate

Control gate	Proceed when	Escalate, redesign, or reject when
Operating support	Debt funds a defined productive need with credible cash generation	Debt replaces weak operating performance or funds recurring distributions
Maturity alignment	Principal falls after the related operating cash becomes available	A maturity wall precedes project recovery or depends on automatic refinancing
Interest resilience	Coverage and liquidity remain adequate under rate and operating stress	A modest downside creates a coverage or covenant failure
Distribution quality	Distributions are supported by durable FCFF after required reinvestment	Borrowing, asset sales, supplier stretch, or underinvestment funds distributions
Claim closure	FCFF, interest, debt movement, FCFE, and closing balances reconcile	Sign changes, duplicated tax shields, plugs, or unexplained claim residuals remain

The gate makes financing quality observable. Debt is not judged solely by its price or by whether it increases ROE. It is judged by the productive purpose it supports, the timing and resilience of the claim, the integrity of the cash bridge, and the effect on the residual equity layer.

10.9 Financing-Claim Closure

The required annual closure is:

$$FCFF_t = FCFE_t + \text{After-Tax Interest}_t - \text{Net Borrowing}_t$$

$$FCFF_t = FCFE_t + \text{After-Tax Interest}_t + \text{Decrease/(Increase) in Debt}_t$$

The first formula uses net borrowing; the second uses the workbook's repayment-oriented debt-movement convention. Only one sign system may be used in a given schedule. The resulting debt roll-forward must also reconcile the opening balance, principal movement, non-cash changes, and closing balance.

Mechanical closure proves that the operating cash has been allocated consistently. It does not prove that leverage is prudent, refinancing is available, or equity distributions are sustainable. Those conclusions require stress, maturity, covenant, and operating-state analysis.

10.10 Chapter Synthesis

FCFF and FCFE are not competing cash-flow definitions. They describe different positions in the claim hierarchy. FCFF is the cash generated by the operating system after reinvestment and before financing allocation. FCFE is the residual after interest and debt movement, subject to the precise claim boundary used by the model. Borrowing can strengthen current equity cash without creating operating value; repayment can weaken current equity cash while improving resilience.

Scenario C demonstrates the distinction. The same FCFF sequence produces very different equity residuals as debt is raised or repaid. The financing bridge closes to zero in every explicit year under the stated sign convention. The next chapter broadens the test by requiring all independent operating, accounting, and financing cash-flow routes to converge annually.

CHAPTER 11

Multi-Path Cash-Flow Closure

Academic proposition. Cash flow is derived from the capital system; it is not selected from whichever formula produces the preferred valuation. Independent constructions of FCFF, the financing allocation, and the equity residual must converge period by period. Their agreement is evidence of consistent boundaries, timing, taxes, signs, and claims. Their divergence is a diagnostic signal that the model must explain before value is accepted.

11.1 Cash Flow Is Derived, Not Chosen

Conventional valuation practice often presents FCFF, FCFE, operating cash flow, and adjusted cash flow as alternative starting points. The alternatives are legitimate only when they are traced to the same operating state and claim structure. A cash-flow definition cannot be selected because it produces the most attractive value or avoids a difficult reconciliation.

The closed-loop system treats each route as a representation of one economic process.
NOPLAT is converted into cash after reinvestment. Financing claims then allocate that cash. Accounting statements record the same transactions under accrual and balance-sheet conventions. If the definitions are consistent, the routes converge. If they do not, the difference must be investigated rather than averaged away.

11.2 Independent Construction as an Audit Principle

The model uses redundancy deliberately. A genuinely independent route can reveal an error that remains invisible within the first route. The principal cash-flow constructions are:

Independent route	Core construction	Required output
Operating-state route	NOPLAT − net investment	FCFF
Gross-cash route	NOPLAT + operating depreciation and amortisation − gross investment	FCFF
Sources-and-uses route	Gross operating cash sources − operating investment uses	FCFF
Financing-allocation route	FCFE residual + after-tax interest + debt repayment, under the stated sign convention	FCFF
Statement route	Net income, non-cash charges, operating balance-sheet movements, and financing movements	Equity and quasi-equity residual

Redundancy is useful only when the routes do not merely point to the same incorrect source cell. Validation should distinguish algebraic independence, data-source independence, and presentation variants. Two formulas that reference the same misclassified working-capital line do not provide two independent proofs.

11.3 Zero-Difference Closure and Diagnostic Residuals

Each reconciliation should produce an explicit residual. The accepted mechanical result is zero, subject only to a documented rounding tolerance. The residual is not a nuisance to be suppressed; it identifies where the system has broken.

$$\text{Closure Residual}_t = \text{Route A}_t - \text{Route B}_t$$

Accepted Mechanical Condition: Closure $\text{Residual}_t = 0$

A non-zero residual can arise from an inconsistent operating boundary, beginning-versusending capital mismatch, omitted working-capital movement, duplicated depreciation, noncash acquisition, debt-sign reversal, pretax-versus-after-tax interest mismatch, duplicated tax shield, minority-claim omission, unit scaling, or valuation-date drift. The diagnostic response is to trace the first divergence, not to insert a balancing item.

11.4 Scenario C: Annual Financing-Route Closure

The explicit-period Scenario C evidence permits a direct annual test of the financing route. Under the repayment-oriented sign convention, FCFE and quasi-equity residual plus debt movement plus after-tax interest must equal FCFF.

Year	FCFE & quasiequity residual	Decrease/ (increase) in debt	After-tax interest	Reconstructed FCFF	Difference from FCFF
2005	2,790.59	(57)	519	3,252.59	0
2006	1,158.75	3,055	409	4,622.75	0
2007	5,541.71	1,445	298	7,284.71	0
2008	8,568.63	978	171	9,717.63	0
2009	11,890.31	0	111	12,001.31	0

Computational Record 11.1 — Scenario C Annual Financing-Route Closure

Source: author-controlled Scenario C fixed-WACC workbook. Parentheses denote debt increase under the workbook sign convention. Values are reported at high level and may contain presentation rounding; the protected workbook maintains the governing precision.

The test is strongest in 2006, when debt repayment absorbs approximately 3,055 and after-tax interest absorbs 409. The equity residual is therefore only approximately 1,158.75 even though FCFF is approximately 4,622.75. The equality demonstrates that the cash has not disappeared; it has been allocated to a senior claim.

11.5 Operating-Route Closure

The same FCFF amounts must also emerge from the two operating constructions established in Chapter 9. The direct route deducts net investment from NOPLAT. The gross route adds back operating depreciation and amortisation and deducts gross investment. The state rollforward provides a third control on net investment.

$$\text{NOPLAT}_t - \text{Net Investment}_t = \text{NOPLAT}_t + \text{D\&A}_t - \text{Gross Investment}_t$$

$$\text{Net Investment}_t = \text{Gross Investment}_t - \text{D\&A}_t$$

$$\text{Net Investment}_t = \text{Ending Operating Capital}_t - \text{Beginning Operating Capital}_t$$

These identities force the income statement, cash-flow schedule, and operating balance sheet to describe the same investment process. A model can report plausible FCFF while one of these layers is wrong; the multi-path test makes the error visible.

11.6 Why Averaging and Plugging Are Prohibited

When two routes disagree, averaging them produces a number with no economic identity. Selecting the route nearest to management's expectation creates confirmation bias. Inserting a plug hides the point at which the statements, capital boundary, or claim allocation ceased to agree. None of these responses restores closure.

A temporary residual may be displayed during model development, but it must be named, isolated, and resolved before the model is approved. If the difference arises from information that cannot yet be obtained, the valuation should carry an explicit limitation or remain unapproved. Uncertainty may justify a range; it does not justify an unexplained accounting difference.

11.7 Annual Closure through the Explicit Forecast

Closure must be demonstrated in every forecast year, not only in total or at the valuation date. An error can reverse in a later year and disappear from the cumulative total while distorting annual cash, debt service, and risk. Period-by-period testing prevents such cancellation.4

Closure layer	Required identity	Testing frequency
Operating capital	Opening state + net investment = closing state	Every explicit year and T+1 where used
Operating income	Beginning operating capital × ROIC = NOPLAT	Every explicit year and the separately governed periodic T+1 test
FCFF	NOPLAT − net investment = gross cash flow − gross investment	Every explicit year
Financing allocation	FCFE residual + after-tax interest + debt repayment = FCFF	Every explicit year
Debt	Opening debt + borrowing − repayment + non-cash movements = closing debt	Every explicit year
Claims and distributions	Residual cash reconciles to distributions and closing claim balances	Every explicit year

The T+1 periodic-EVA test remains distinct from long-run stable-value mechanics. The T+1 formula follows the beginning-capital periodic identity. The stable incremental-return assumption used to derive terminal reinvestment belongs to the continuing-value system. Combining the two would create a false closure by mixing different analytical roles.

11.8 Institutional Cash-Flow Audit Protocol

Audit step	Required action
1. Freeze definitions	Document operating assets, operating liabilities, debt, quasi-equity, tax treatment, units, and signs
Audit step	**Required action**
2. Reconstruct independently	Build FCFF through net and gross investment routes and reconstruct the financing allocation separately
3. Calculate residuals	Display annual zero checks at every major boundary
4. Trace first divergence	Identify the earliest account, period, or formula where the routes cease to agree
5. Assess economic meaning	Determine whether the issue is mechanical, classificationbased, data-related, or a real risk signal
6. Approve or suspend	Approve only after mechanical closure and separate challenge of economic plausibility

The protocol separates mechanical correctness from economic judgment. A model may close perfectly while assuming unrealistic growth, margin, refinancing, or stable returns. Closure removes avoidable inconsistency; it does not certify the forecast. Institutional approval therefore requires both a zero-residual certificate and a documented challenge of the assumptions.

11.9 Cash-Flow System Closure

The cash system is mechanically closed only when the operating state, NOPLAT, reinvestment, FCFF, financing claims, and equity residual reconcile through independent routes for every relevant period. The core sequence is:

Operating State → NOPLAT → Reinvestment → FCFF → Financing Claims → FCFE Residual

Each arrow is a testable bridge. The final residual must be explainable by contractual and residual claims rather than by a chosen cash-flow definition. Divergence identifies a boundary, timing, tax, sign, or implementation failure. Convergence permits the model to proceed to valuation, but it does not remove the need for economic challenge.

11.10 Chapter Synthesis

Cash flow is not chosen. It is derived from the operating state and allocated through the financing structure. Scenario C demonstrates annual equality between the operating FCFF sequence and the financing reconstruction. The same FCFF must also close through netinvestment and gross-investment routes. These cross-checks convert cash flow from a narrative input into an auditable output.

With the cash system closed, the model can ask whether the future sequence justifies the capital committed. The next chapter develops valuation as economic proof by requiring DCF, economic-profit valuation, capital preservation plus intrinsic value added, and the enterpriseto-equity claim bridge to represent the same company.

CHAPTER 12

Valuation as Economic Proof

Academic proposition. Valuation becomes admissible only after the capital, income, cash-flow, and claim systems have closed. DCF, economic-profit valuation, capital preservation plus intrinsic value added, and the enterprise-to-equity bridge are not competing estimates when they are constructed from the same forecast. They are independent representations of one company. Their convergence is a structural proof condition; their divergence identifies a definition, timing, reinvestment, discount-rate, or claim-allocation failure.

12.1 From Estimation to Structural Permission

A conventional valuation can produce a plausible number even when the supporting schedules disagree. Growth may be inconsistent with reinvestment, the operating capital denominator may change across methods, or financing claims may be deducted more than once. The closed-loop framework reverses the burden of proof. A value is not accepted because one method appears reasonable; it is accepted only when the company can be reconstructed through equivalent routes without unexplained residuals.

Structural permission does not mean that the forecast is certain. It means that the forecast has one coherent economic meaning. Mechanical closure removes avoidable contradiction. Economic judgment must still challenge margins, capital intensity, growth, return persistence, risk, and terminal concentration.

12.2 Operating DCF as a Cash Representation

The operating DCF route discounts the FCFF generated by the closed operating system. Because FCFF is measured before financing allocation, the discount rate must price the same operating-capital risk. The explicit forecast and continuing period are valued separately and then combined.

Operating Enterprise Value = PV of Explicit FCFF + PV of Continuing Operating Value

DCF component	Present value
2005 FCFF present value	2,764.04
2006 FCFF present value	3,338.33
2007 FCFF present value	4,470.49
2008 FCFF present value	5,067.78
2009 FCFF present value	5,318.64
PV of explicit FCFF	20,959.29
PV of continuing operating value	53,309.17
Operating enterprise value	74,268.46

Computational Record 12.1 — Scenario C Operating DCF

Source: author-controlled Scenario C fixed-WACC workbook. Amounts follow the workbook's stated units and governing full precision; displayed values are rounded to two decimals.

The continuing period contributes most of the operating value. This does not make the calculation mechanically wrong, but it makes the terminal assumptions the dominant governance question. The DCF route is therefore complete only when the continuing state is derived from growth, reinvestment, incremental return, and WACC rather than inserted as an unexplained residual.

12.3 Economic-Profit Valuation as a Capital Representation

The economic-profit route starts from the productive capital already committed and adds the present value of future surplus after the required return has been charged. It represents the same operating forecast as DCF, but it separates recovery of the capital state from value created above that state.

Operating Enterprise Value = Beginning Operating Capital + PV of Future Economic Profit

Economic-profit component	Amount
Beginning operating capital	6,756.00
PV of explicit-period economic profit	23,418.61
PV of continuing economic profit	44,093.85
Total PV of economic profit	67,512.46
Operating enterprise value	74,268.46

Computational Record 12.2 — Scenario C Capital plus Economic-Profit Value

Source: author-controlled Scenario C fixed-WACC workbook. Explicit-period economic-profit present values are 4,339.43, 5,187.84, 4,897.70, 4,438.14, and 4,555.50.

The equality with DCF is not produced by forcing the final totals to match. It follows from the capital roll-forward and the identity connecting NOPLAT, reinvestment, FCFF, and economic profit. When those relationships are consistent, cash value and surplus value are two expressions of the same operating system.

12.4 Capital Preservation plus Intrinsic Value Added

At the equity level, the model preserves the opening common-equity capital and adds the intrinsic value created by the future economic-profit stream under the workbook classification. The capital anchor is not discounted or redefined as value created.

Common-Equity Value = Opening Common Equity + Intrinsic Value Added

73,718.46 = 6,206.00 + 67,512.46

This identity distinguishes capital recovery from economic surplus. The opening equity of 6,206 is the preserved residual capital claim. The 67,512.46 is the present value of future value added. The equality is reported at total-value level. The workbook's per-share row is excluded from the book's accepted numerical conclusions because the share-count scale has not been independently certified.

12.5 Enterprise-to-Equity Claim Closure

Operating enterprise value belongs to the productive system. Common-equity value requires a bridge for non-operating assets and superior claims. Each item must be added or deducted once and only once.

Bridge item	Amount	Interpretation
Operating enterprise value	74,268.46	Starting operating claim
Add: excess cash and marketable securities	3,978.00	Non-operating asset excluded from operating capital
Add: intangible assets and goodwill in the base classification	5,646.00	Separately bridged under the workbook treatment
Add: long-term non-operating investment	0.00	No amount in the controlling bridge
Less: opening interest-bearing debt	(7,542.00)	Senior contractual claim
Less: minority interest	(2,632.00)	Claim superior to common equity
Less: outstanding provision in the controlling bridge	0.00	No amount in the controlling bridge
Common-equity value	73,718.46	Residual claim under the workbook classification

Computational Record 12.3 — Scenario C Enterprise-to-Common-Equity Bridge

Source: author-controlled Scenario C fixed-WACC workbook. Parentheses denote deductions from the operating enterprise value.

The bridge prevents double counting. Surplus cash is not included in operating capital and is therefore added after operating value is calculated. Debt and minority interest are senior claims and are deducted. Goodwill treatment must remain consistent between the operating capital denominator, economic-profit calculation, and claim bridge.

12.6 Multi-Path Convergence

Valuation route	Construction	Closed result
Operating DCF	PV explicit FCFF + PV continuing operating value	74,268.46
Economic-profit valuation	Beginning operating capital + PV future economic profit	74,268.46
Common-equity capital-plus-valueadded	Opening common equity + intrinsic value added	73,718.46
Enterprise-to-equity bridge	Operating value + non-operating assets − superior claims	73,718.46

The operating routes converge to one operating enterprise value. The equity routes converge to one common-equity value after the claim boundary has been applied. The difference between 74,268.46 and 73,718.46 is not a valuation disagreement; it is the net effect of the nonoperating assets and superior claims in the bridge.

Convergence is a necessary control, not a guarantee of market accuracy. All routes can agree and still depend on unrealistic assumptions. The governance sequence is therefore: close the mechanics, identify value concentration, challenge the economics, document residual uncertainty, and only then approve the valuation range or decision.

12.7 Valuation-Date, Unit, and Scale Controls

Equivalent formulas will diverge if they are stated at different dates. A continuing value calculated at the end of 2009 must be discounted to the valuation date using the correct period count. A beginning-capital value and an end-of-period value cannot be added without aligning their dates. Units must also remain consistent across thousands, millions, share counts, and per-share values.

The model's total enterprise and common-equity amounts are accepted because their units and dates are internally controlled. The per-share output is not accepted for external conclusion because its share-count scale is not independently certified. Excluding an uncertified output is a control strength, not a weakness.

12.8 Valuation-Proof Closure

Valuation proof requires the following conditions simultaneously: the operating state is defined; NOPLAT and reinvestment close to FCFF; financing claims allocate cash consistently; DCF and economic-profit routes converge; the enterprise-to-equity bridge is applied once; and the continuing state is economically derived. The resulting value must then survive an independent challenge of the assumptions.

One Operating System → One Operating Value → One Explicit Claim Bridge → One Residual Equity Value

12.9 Chapter Synthesis

Scenario C produces an operating enterprise value of approximately 74,268.46 through both DCF and economic-profit valuation. The common-equity value of approximately 73,718.46 is independently reproduced through capital preservation plus intrinsic value added and through the enterprise-to-equity bridge. The equalities transform valuation from method selection into structural proof.

The largest part of operating value lies in the continuing period. The next chapter therefore examines the terminal state as an economic mechanism rather than a residual formula and separates the T+1 periodic-EVA test from the distinct long-run assumptions used to derive stable growth and reinvestment.

CHAPTER 13

Continuing Value as a Proven Economic State

Academic proposition. Continuing value is credible only when the post-forecast company remains the same closed economic system. Stable growth must require reinvestment; reinvestment must earn a specified incremental return; stable FCFF must follow from stable NOPLAT; and the discount rate must price the same operating claim. The terminal amount is not permitted to rescue weak explicit economics or conceal an unsupported assumption.

13.1 Why Terminal Value Cannot Be a Rescue Mechanism

A terminal formula can generate a large value from small changes in growth or discount rate. If it is treated as an independent plug, weak explicit-period economics can be overwhelmed by a favourable perpetuity. The closed-loop framework requires the terminal state to continue the same capital-return-cash relationships demonstrated during the forecast.

The continuing period must therefore identify stable NOPLAT, the productive capital required to support growth, the return earned on additional capital, the resulting reinvestment rate, stable FCFF, WACC, and the timing of the value. Any missing link creates a degree of freedom that can manufacture value without proving its economic source.

13.2 Stable Growth, Reinvestment, and Incremental Return

$$Stable\ Growth\ =\ Reinvestment\ Rate\ \times\ Return\ on\ Incremental\ Operating\ Capital$$

$$Reinvestment\ Rate\ =\ Stable\ Growth\ \div\ Return\ on\ Incremental\ Operating\ Capital$$

Scenario C uses stable growth of 7% and a stable incremental return of approximately 57.61%. The implied reinvestment rate is approximately 12.1511%. This means that approximately 12.1511% of stable-period NOPLAT must remain in the productive system, while approximately 87.8489% can be converted into FCFF.

The incremental return is not automatically equal to historical ROIC. Existing assets may possess advantages that new investment cannot reproduce. The terminal return must be justified by competition, capacity, technology, market size, regulation, and the economics of the next unit of capital.

13.3 Growing FCFF Continuing Value

The stable-period NOPLAT is approximately 14,617.60. Applying the implied reinvestment rate produces stable FCFF of approximately 12,841.40. With fixed WACC of approximately 17.6754% and growth of 7%, the end-of-forecast continuing operating value is:

$$Continuing\ Operating\ Value\ =\ FCFF_{t+1}\ \div\ (WACC\ -\ g)$$

$$120{,}290.05\ \approx\ 12{,}841.40\ \div\ (17.6754\%\ -\ 7.0000\%)$$

The formula is meaningful because the cash numerator is derived from NOPLAT and reinvestment rather than inserted separately. A growth rate without its required reinvestment would overstate FCFF. A discount rate inconsistent with the operating claim would misprice the same cash stream.

13.4 Continuing Economic Profit and Existing Capital

The economic-profit representation reaches the same continuing operating value by separating the closing operating capital from the present value, at the end of the forecast, of future economic surplus.

Continuing Operating Value = Closing Operating Capital + Continuing Economic-Profit Value

120,290.05 = 20,794.00 + 99,496.05

The continuing economic-profit value can be decomposed into approximately 61,906.42 from the persistence of the stable surplus on existing capital and approximately 37,589.62 from value-creating growth. The displayed components may sum to 99,496.04 after two-decimal rounding; 99,496.05 is the governing full-precision workbook value.

Growth creates value only when the return on incremental capital exceeds WACC. If the incremental return equals WACC, growth increases scale but adds no economic value. If the incremental return falls below WACC, growth destroys value even when revenue and accounting profit rise.

13.5 T+1 Periodic Closure versus Long-Run Stable Mechanics

The model contains two analytically distinct T+1 concepts that must not be combined. The periodic-EVA test extends the annual beginning-capital identity into T+1 under the fixed Scenario C hurdle. It reports periodic ROIC of approximately 70.30% and closes the two EVA formulas using beginning operating capital of approximately 20,794.

The stable incremental return of approximately 57.61% serves a different purpose. It links long-run growth to reinvestment in the continuing-value mechanism. Substituting the stable incremental return into the periodic EVA schedule, or using the periodic ROIC as the return on every future unit of capital, would mix two separate analytical roles and create false precision.

T+1 concept	Purpose	Return measure	Permitted use
T+1 periodic ROIC and EVA closure	Continue the annual ROIC, beginning-capital, and capital-charge identity	Approximately 70.30% periodic ROIC	Periodic performance and formula closure
Stable incremental-return assumption	Derive reinvestment required to support 7% long-run growth	Approximately 57.61%	Continuing-value economics

13.6 Terminal Concentration and Long-Duration Risk

The present value of the continuing period is approximately 53,309.17, compared with operating enterprise value of approximately 74,268.46. The continuing period therefore represents approximately 71.78% of operating value. This concentration is not a calculation error; it is a risk signal.

$$Continuing - Value\ Share \approx 53{,}309.17 \div 74{,}268.46 = 71.78\%$$

A value with this duration depends materially on the persistence of the spread between return and WACC, the feasibility of 7% growth, the reinvestment requirement, market capacity, competitive response, and the stability of the financing environment. Small changes in these assumptions can materially change equity value even when the explicit forecast remains unchanged.

13.7 Terminal-Value Governance

Governance test	Acceptable evidence	Escalation signal
Stable growth	Supported by addressable market, inflation, capacity, and competitive evidence	Growth exceeds the sustainable operating environment or is selected to reach a target value
Incremental return	Linked to the economics of new capital and allowed to fade where appropriate	Historical ROIC is assumed indefinitely without economic support
Reinvestment	Derived from growth and incremental return and reflected in the capital rollforward	Growth is combined with negligible capital absorption
WACC	Matched to the operating cash-flow risk and stated in the same nominal or real terms	The hurdle is lowered to offset weak cash or mismatched with the forecast
Claim bridge	Terminal debt, non-operating assets, tax effects, and minority claims are explicit	Claims disappear in the terminal period or are deducted twice
Concentration	The board understands sensitivity and approves the long-duration risk	Most value rests on an unchallenged terminal point estimate

Scenario analysis should vary the operating drivers separately from the discount rate. Changing growth, margins, capital intensity, WACC, and terminal return simultaneously creates a narrative case that cannot attribute the value movement. Controlled scenarios reveal which economic mechanism is responsible.

13.8 Continuing-State Closure

The continuing state is mechanically closed when stable growth, reinvestment, incremental return, NOPLAT, FCFF, WACC, and closing capital satisfy both the growing-FCFF and economic-profit representations. It is economically credible only after the assumptions are independently supported and the concentration risk is accepted explicitly.

$$\text{Growing-FCFF Value} = \text{Closing Capital} + \text{Continuing Economic-Profit Value}$$
$$120{,}290.05 = 120{,}290.05$$

13.9 Chapter Synthesis

Scenario C derives continuing operating value of approximately 120,290.05 from stable FCFF and independently from closing operating capital plus continuing economic profit. The equality proves formula consistency. It does not prove that 7% growth, 57.61% incremental return, or fixed WACC will persist. Those are governance assumptions that must be challenged and monitored. The T+1 periodic-EVA calculation remains separate from the longrun stable-return mechanism. Preserving that separation prevents an attractive terminal assumption from contaminating the annual performance test.

The periodic T+1 test begins with the operating state inherited at the start of the period. Using the workbook's T+1 NOPLAT of approximately 14,617.6017 and beginning operating capital of 20,794.00 produces a periodic ROIC of approximately 70.2972%. Applying the fixed operatingcapital WACC of approximately 17.6754% produces periodic EVA of approximately 10,942.19. The same EVA must be reproduced both by the spread form, (ROIC minus WACC) multiplied by beginning operating capital, and by the amount form, NOPLAT minus the capital charge. This is a period-performance certificate, not a terminal-value assumption.

The stable incremental return of approximately 57.6079% answers a different question. It measures the expected return on incremental operating capital committed in the continuing state. Combined with stable growth of 7%, it implies a reinvestment rate of approximately 12.1511% and supports the continuing FCFF mechanism. It does not replace the historical or
T+1 ROIC earned on the full operating-capital stock. Substituting the stable ROIIC into periodic EVA would merge a marginal long-run assumption with an annual realised-state test and would therefore destroy the interpretive boundary between performance measurement and continuing-value design.

The publication control is consequently two-layered. The T+1 periodic identity is read directly from the workbook's NOPLAT, beginning operating capital, and fixed-WACC schedules; the stable ROIIC remains separately identified as a continuing-state input. A reviewer must be able to challenge each layer independently. Periodic EVA can fail because an annual operating-state input or capital charge is unsupported. Continuing value can fail because growth, reinvestment, return persistence, or WACC is unsupported. Keeping the layers separate prevents a strong terminal assumption from repairing weak annual performance and prevents a temporary annual result from being mistaken for sustainable long-run economics.

CHAPTER 14

Return Metrics across Distinct Capital Claims

Academic proposition. An internal rate of return is meaningful only after the capital boundary, opening claim, interim cash flows, terminal recovery, and timing convention have been specified. The company does not possess one universal IRR. Total invested funds, operating capital, common equity, and debt are different claims on the same financial organism and therefore generate different return paths. Claim-specific IRR and XIRR are supplementary closure tests, not substitutes for ROIC, WACC, WACE, EVA, or DCF.

14.1 Why One Company Can Produce Several Correct Return Measures

A return percentage is not self-defining. It inherits its meaning from the capital invested at the opening date and the cash flows assigned to that investment. Total investor funds include productive and non-operating resources. Operating invested capital isolates the productive state. Common equity receives the residual after superior claims. Debt receives contractual principal and interest. Because the opening amounts and subsequent cash flows differ, the return measures should differ even when every path is mechanically correct.

The analytical error is not the existence of several returns. The error is to compare them as though they describe the same claim. A 113% operating-fund return cannot be presented as the debt return, the shareholder required return, or the company's WACC. The model must label each path by claim, cash-flow definition, date sequence, and terminal recovery.

14.2 IRR and XIRR: Periodic versus Date-Specific Closure

IRR assumes equally spaced periods. XIRR applies the actual dates assigned to the cash flows. When the dates are annual and consistently recorded, the two results should be close. A material difference may indicate a timing mismatch, duplicate date, omitted opening flow, or incorrectly dated terminal recovery.

$$IRR: 0 = \Sigma\,[Cash\ Flow_{\mathrm{t}} \div (1 + r)^{\mathrm{t}}]$$

$$XIRR: 0 = \Sigma\,[Cash\ Flow_{\mathrm{i}} \div (1 + r)^{\left(\frac{Date_{\mathrm{i}} - Date_0}{365}\right)}]$$

The workbook uses the proximity of IRR and XIRR within a claim as a timing control. It does not require different claims to produce the same percentage.

14.3 Total-Invested-Funds Return

The total-invested-funds path begins with the broader opening capital boundary of approximately 16,380. It then receives the annual operating cash flows and the continuing operating recovery. The periodic IRR is approximately 67.57%, while the date-specific XIRR is approximately 67.53%. Their proximity supports the annual timing convention used in this path.

This return belongs to the total-funds construction before the later bridge to common equity. It cannot be compared directly with ROIC because ROIC is a one-period operating transformation rate. It also cannot be compared directly with WACC, because the internal return reflects the complete modeled cash sequence and continuing recovery rather than the ex ante annual hurdle.

14.4 Operating-Invested-Funds Return

The operating-funds path begins with opening operating invested capital of approximately 6,756 and receives FCFF generated by that productive state. The periodic IRR is approximately 113.31%, and the corresponding XIRR is approximately 113.24%. The higher result relative to total

invested funds reflects the smaller productive opening base and the exclusion of nonoperating resources from the initial claim.

The result is a model-specific closure measure. It should not be generalized as a market return benchmark. It depends on the workbook's high operating returns, cash-flow timing, and continuing-value recovery. Its proper use is to verify that the operating cash path is internally compatible with the opening productive capital and the terminal operating state.

14.5 Common-Equity Return

The common-equity path begins with the preserved opening equity amount of approximately 6,206. Annual equity cash flows are obtained only after interest and debt movement have been allocated. The simple periodic equity return is approximately 104.03%, and the datespecific equity XIRR is approximately 103.96%.

This return is not WACE. WACE is the author-defined ex post period measure that explains the burden absorbed by the relevant equity state. Equity XIRR is a multi-period return on the modeled residual cash-flow sequence. Confusing the two would mix an annual structural attribution measure with a whole-horizon investment return.

14.6 Debt Return and the Difference between Principal Closure and Economic Return

The workbook separates two debt paths. The principal-movement path is constructed to produce an NPV of approximately zero and an XIRR effectively equal to zero. This is a reconciliation control: principal issued and principal repaid close without an unexplained amount. It is not the lender's economic return.

When contractual interest is added to the debt cash flows, the debt XIRR is approximately 6.08%. This path represents the return earned by the debt claim under the workbook's timing and after-tax cash-flow treatment. The distinction prevents a zero-check from being misreported as a zero cost of debt.

Claim path	Opening boundary	IRR	XIRR	Permitted interpretation
Total invested funds	16,380 opening totalfunds claim	67.57%	67.53%	Broad capital-system closure
Operating invested funds	6,756 opening productive capital	113.31%	113.24%	Operating FCFF closure
Common equity	6,206 preserved opening equity	104.03%	103.96%	Residual equity cashflow return
Debt principal only	7,542 opening principal claim	N.A.	≈0.00%	Principal reconciliation, not economic return
Debt plus interest	7,542 opening debt plus contractual cash receipts	N.A.	6.08%	Claim-specific lender return

Computational Record 14.1 — Claim-Specific Return Architecture

Source: author-controlled workbook, worksheet "IRR TO Equity and IRR Funds." Percentages are rounded from the stored workbook results.

14.7 The Anchor-Capital Reconciliation

The return schedules form part of a larger reconciliation. The total-funds cash path discounts to the broader opening invested-funds amount. After non-operating assets and superior claims are recognized,

the residual returns to the preserved common-equity anchor of approximately 6,206. The operating path separately returns to the productive opening capital of approximately 6,756. These are distinct anchors, not competing answers.

The anchor test provides a useful diagnostic. A cash sequence that fails to reproduce its opening claim under its own internal return contains a timing, sign, terminal, or boundary error. A sequence that reproduces a different claim may be mechanically balanced but economically mislabeled.

14.8 Return-Metric Governance

Control dimension	Required treatment	Escalation signal
Boundary	Identify the exact opening investment and excluded assets	A return is quoted without its capital base
Cash-flow ownership	Assign each inflow and outflow to the correct claim	FCFF, FCFE, interest, and principal are mixed
Timing	Use consistent dates and verify IRR-XIRR proximity where annual spacing is intended	Terminal value shares the wrong date or appears twice
Terminal recovery	State whether the recovery is enterprise, operating, equity, or debt value	A total-company terminal amount is inserted into an equity path without a claim bridge
Interpretation	Compare returns only after matching claim and horizon	Operating IRR is compared directly with debt cost or one-period ROIC
Release	Report model-specific results with limitations	A high internal return is marketed as a universal expected return

14.9 Return-Metric Closure

Return metrics close when every path reproduces its own opening claim, IRR and XIRR are consistent with the stated timing convention, and the cash flows belong to the identified stakeholder. Closure does not make the return externally achievable or eliminate forecast risk. It establishes that the percentage has one traceable economic meaning.

14.10 Chapter Synthesis

The workbook reports materially different internal returns for total invested funds, operating funds, common equity, and debt because those claims begin with different capital amounts and receive different cash flows. The results are strongest when used as labeled closure tests. They become misleading when detached from their boundaries or presented as interchangeable measures of company performance.

The next chapter moves from individual return paths to the computational architecture that allows the claims, statements, capital states, cash flows, and valuation routes to be tested as one protected system.

CHAPTER 15

The Computational Evidence Architecture

Academic proposition. The workbook is not a decorative appendix to the theory. It is a controlled evidence system in which the statements, capital boundary, operating returns, economic profit, cash conversion, financing claims, valuation routes, and stakeholder returns are implemented in separate but linked computational layers. The strength of the evidence lies in traceable redundancy and independent reconciliation, not in spreadsheet size alone.

15.1 Evidence, Not Disclosure of the Executable Engine

The book discloses the economic definitions, general equations, governing values, selected reconciliations, and static evidence needed to examine the claims. It does not disclose the executable workbook, cell addresses, hidden dependency graph, implementation order, or complete formula map. This boundary protects the author's computational know-how while leaving the academic propositions open to scrutiny.

A published figure should therefore answer three questions: what part of the system is shown, what equality or decision it proves, and which assumptions remain outside the figure. A screenshot that cannot answer those questions is decoration and should not enter the main argument.

15.2 The Twenty-Eight-Sheet Architecture

Each controlling workbook contains twenty-eight linked worksheets and approximately 8.5 thousand formula-bearing cells. Formula density is not itself evidence of correctness. It creates a need for stronger lineage, version, and independence controls. The sheets are organized by economic function rather than treated as one undifferentiated spreadsheet.

Evidence layer	Principal worksheets	Control purpose
Statement reconstruction	Income Statement for 10 Years; Balance Sheet; NOPLAT	Create the accounting state and operating-income numerator
Capital and hurdle	WACC; Inv Capital Calculation; ROIC; Economic Profit	Define productive capital, price it, and test the spread
Cash conversion	Free CFF; DISCOUNT Free CFF	Reconcile NOPLAT, reinvestment, FCFF, and present value
Value and claim bridge	DCF; Economic Value; Book Value & FCFF Deference; G & R and in	Prove DCF-EVA equivalence, continuing value, and enterprise-to-equity closure
Equity and financing closure	FCFF FOR Equity& DCF and EVA; Finance Analysis; Focus Operation Equity& Capital	Attribute operating surplus to financing claims and reproduce net income and FCFE
Annual evidence hubs	Summary 2005 through Summary 2009	Re-close the system year by year
Diagnostics and proof	ROIC TREE; Sophisticated Prove; ROIC Analysis; WACC Analysis; IRR TO Equity and IRR Funds	Test causality, alternative views, and stakeholder-specific returns
Comparative and explanatory layers	Next P. Comparative 1A, 1B, 1C; EVA Does	Explain equivalence and intended use without changing the governing calculations

Computational Record 15.1 — Functional Map of the Protected Workbook

Source: author-controlled twenty-eight-sheet workbooks. Worksheet names are reproduced solely to document the evidence architecture.

15.3 The Direction of Evidence

Evidence should flow from source statements to capital classification, from capital to return, from return to operating income, from operating income to reinvestment and cash, from cash to claims, and from

claims to value. A later valuation output must not silently overwrite an earlier statement or capital definition merely to force convergence.

Statements → Operating State → ROIC and NOPLAT → EVA and FCFF → Financing Claims → DCF and Equity Value → Return Tests

Feedback is permitted only as a control signal. When a later route diverges, the model returns the reviewer to the first inconsistent definition, sign, timing, or link. It does not back-solve the earlier state from the desired value.

15.4 Independent Routes and Shared Sources

Redundancy becomes evidence only when the routes possess meaningful independence. Two formulas that point to the same incorrect source cell do not constitute two proofs. The model therefore distinguishes between algebraically equivalent routes, independently reconstructed routes, and presentation variants.

Output	Route A	Route B	Evidence value
NOPLAT	Direct operating-statement construction	Reconciliation from net income and financing adjustments	Independent reconstruction of the operating numerator
FCFF	NOPLAT less net investment	Gross operating cash flow less gross investment	Independent cash-conversion routes
FCFE	FCFF adjusted for interest and debt movement	Net income and balance-sheet movement route	Claim-specific cash closure
Economic profit	ROIC-WACC spread times beginning capital	NOPLAT less capital charge	Periodic value-creation equality
Operating value	Discounted FCFF	Beginning operating capital plus PV of economic profit	Cash-value and surplus-value convergence
Common-equity value	Enterprise-to-equity bridge	Opening equity plus intrinsic value added	Residual-claim convergence

15.5 Annual Summary Sheets as Closure Hubs

The Summary 2005 through Summary 2009 worksheets are not merely reporting pages. They provide annual closure hubs in which the opening state, operating result, financing effects, equity absorption, and closing state can be viewed together. The annual sequence prevents a correct final valuation from concealing an intermediate-year failure.

The 2005 summary is especially important because it contains the negative operating-equity condition used to stress the WACE and net-income attribution logic. The later summaries show whether the same identities remain coherent as the capital and financing structure evolves.

15.6 Source Hierarchy and Evidence Codes

Every numerical conclusion in the manuscript is governed by a source hierarchy. The authorcontrolled workbook is the calculation authority; screenshots are evidence maps that direct the reader to relationships already established in Excel. Explanatory slides, prior manuscripts, and narrative recollection remain subordinate. A static image may clarify a formula path, but it cannot replace the workbook lineage from inputs through linked schedules to the governing output.

Priority	Source class	Permitted role
Level 1	Author-controlled Excel workbooks	Controlling numerical formulas, stored values, and scenario definitions
Level 2	Two governing papers	Conceptual propositions: valuation as proof and the ROIC-WACC-WACE bridge
Level 3	Author-supplied screenshots	Static visual confirmation of selected computational relationships
Level 4	Explanatory notes and earlier manuscripts	Terminology and intellectual source bank only; no automatic numerical authority

Each selected image should receive a unique evidence code and one primary location. Reuse is permitted only when the later context requires a materially different interpretation and the cross-reference makes the repetition explicit.

15.7 Formula, Sign, Unit, and Timing Controls

The evidence architecture requires four dictionaries. The formula dictionary defines the economic meaning of each major output. The sign dictionary distinguishes inflows, outflows, assets, claims, and deductions. The unit dictionary controls thousands, millions, shares, percentages, and dates. The timing dictionary states whether each denominator and value belongs to the opening, average, closing, or valuation date.

The exclusion of the workbook per-share row from accepted conclusions illustrates the control. Total common-equity value is supported, but the share-count scale is not independently certified. The correct response is to withhold the per-share conclusion rather than infer a scale from an attractive displayed result.

15.8 Version Control and Protected Reproducibility

Protected reproducibility means that an independent reviewer can verify the stated economic identities and principal numerical closures without receiving an unrestricted executable copy. The author retains the workbook, formula implementation, and complete dependency structure. A controlled review may be performed under a written confidentiality and limitsof-use arrangement.

Every released manuscript must identify the controlling workbook version, source date, approved numerical controls, excluded outputs, and whether any screenshot was resized or cropped. A production edit that changes a number, formula, image boundary, or scenario label requires renewed technical review.

15.9 Computational-Evidence Closure

The architecture is closed when each published conclusion can be traced to a controlling workbook block, every independent route has a documented purpose, residual differences are visible, and the static evidence does not reveal the protected engine beyond the intended disclosure boundary. Complexity is then converted from a source of opacity into a system of controls.

15.10 Chapter Synthesis

The twenty-eight-sheet model functions as a financial anatomy laboratory: statements establish the state, operating sheets measure transformation, cash schedules test circulation, claim schedules allocate the result, valuation sheets close the future, and return schedules test each stakeholder boundary. The next chapter assembles these elements into one fixed-hurdle demonstration rather than examining them as separate worksheets.

CHAPTER 16

Scenario C: A Fixed-Hurdle Closure Demonstration

Academic proposition. Scenario C is used as a controlled demonstration because the operating path is evaluated against one fixed operating hurdle. Holding WACC constant prevents movements in the required return from being mistaken for operating improvement or deterioration. The scenario is not presented as a prediction that risk remains constant; it is an experimental control that reveals whether the statements, capital state, returns, cash flows, claims, and valuation close as one five-year system.

16.1 The Purpose of the Fixed-Hurdle Experiment

When both operating performance and WACC change, the reason for a movement in economic profit or value can become ambiguous. Scenario C holds WACC at approximately 17.6754% across the explicit period. Changes in ROIC, EVA, and FCFF can therefore be attributed to operations, capital deployment, and reinvestment rather than to a moving hurdle.

This design is a diagnostic benchmark. A board should not infer that the company's future risk will actually remain constant. After the operating mechanism is understood, a marketresponsive hurdle path should be reintroduced as a separate sensitivity or scenario.

16.2 The Five-Year Operating State

Metric	2005	2006	2007	2008	2009
Beginning operating capital	6,756	9,804	14,098	17,286	19,134
NOPLAT	6,300.59	8,916.75	10,472.71	11,565.63	13,661.31
ROIC	93.26%	90.95%	74.29%	66.91%	71.40%
Fixed WACC	17.6754%	17.6754%	17.6754%	17.6754%	17.6754%
Economic profit	5,106.44	7,183.86	7,980.84	8,510.27	10,279.31
Net investment	3,048	4,294	3,188	1,848	1,660
FCFF	3,252.59	4,622.75	7,284.71	9,717.63	12,001.31

Computational Record 16.1 — Scenario C Five-Year Operating Chain

Source: author-controlled fixed-WACC workbook. Amounts follow the workbook's stated units; percentages and amounts are rounded for presentation.

The operating capital base almost triples while NOPLAT more than doubles. ROIC declines as the company absorbs additional capital, reaches its explicit-period low in 2008, and partially recovers in 2009. Economic profit nevertheless rises because the spread remains strongly positive and is applied to a larger productive state. The combined reading is more informative than either profit growth or ROIC alone.

16.3 Reinvestment and Cash Conversion

The scenario converts NOPLAT to FCFF only after recognizing the capital required to create the next state. Net investment peaks at 4,294 in 2006 and then declines to 1,660 in 2009. FCFF strengthens from approximately 3,252.59 to 12,001.31. The cash improvement is therefore produced by both higher operating income and a declining reinvestment burden.

The decline in net investment must be interpreted rather than automatically praised. It may reflect the completion of an expansion program, improved working-capital discipline, or more efficient use of capacity. It may also reflect deferred maintenance or underinvestment. Closure identifies the amount; operational evidence determines its quality.

16.4 Financing and Claim Evolution

Claim or resource	2005	2006	2007	2008	2009
Total interestbearing debt at year end	7,599	4,544	3,099	2,121	2,121
Common equity at year end	9,604.59	14,130.34	18,233.05	20,702.68	23,838.99
Excess cash and marketable securities	5,535.59	4,435.34	5,874.05	7,747.68	10,877.99
Total invested funds at year end	20,985.59	24,179.34	28,806.05	32,527.68	37,317.99

Debt falls materially during the early years and then stabilizes, while common equity and surplus financial resources increase. This evolution explains why the operating and equity return measures cannot be inferred from each other. The residual claim strengthens, but the growing non-operating asset position must remain outside the operating-capital denominator and be added only through the claim bridge.

16.5 Valuation Closure

Closure output	Result	Interpretation
PV of explicit FCFF	20,959.29	Cash generated during the five-year forecast
PV of continuing operating value	53,309.17	Long-duration value after the explicit period
Operating enterprise value	74,268.46	DCF and economic-profit routes converge
Common-equity value	73,718.46	Residual value after non-operating assets and superior claims
Continuing-value share of operating value	71.78%	Primary duration and governance concentration

The valuation is accepted mechanically because DCF and economic-profit representations reach the same operating value, and two equity routes reach the same residual value. The concentration in the continuing period remains an economic risk that requires sensitivity and governance review.

16.6 The Integrated Closure Certificate

Closure layer	Required equality	Scenario C result
Capital state	Opening capital + net investment = closing capital	Closed
Operating income	ROIC × beginning operating capital = NOPLAT	Closed
Periodic economic profit	Spread × beginning capital = NOPLAT − capital charge	Closed for 2005–2009 and T+1
FCFF	NOPLAT − net investment = gross cash flow − gross investment	Closed
Financing allocation	FCFF reconciles with interest, debt movement, and equity cash flow	Closed
Operating value	DCF = beginning operating capital + PV economic profit	74,268.46
Common-equity value	Claim bridge = opening equity + intrinsic value added	73,718.46
Claim returns	Each XIRR reproduces its own opening claim	Closed by stakeholder boundary

Computational Record 16.2 — Scenario C Integrated Closure Certificate

Source: author synthesis of the author-controlled fixed-WACC workbook. "Closed" denotes no unexplained structural residual under the stated definitions and timing.

16.7 What the Demonstration Does Not Prove

A closed model can still contain economically weak assumptions. Scenario C does not prove that the extraordinary explicit ROIC levels are repeatable, that 7% growth is sustainable indefinitely, that the fixed hurdle is a market forecast, or that the continuing-value concentration is acceptable for every decision. It proves that the stated assumptions describe one internally coherent company.

Economic challenge must therefore follow mechanical closure. Management should support the sales, margin, working-capital, capital-expenditure, return-persistence, refinancing, and terminal-growth assumptions with evidence outside the workbook. Closure removes contradiction; it does not remove uncertainty.

16.8 Scenario C as a Management Narrative

The five-year record describes a company that expands its productive state, generates increasing NOPLAT, experiences declining but still high ROIC, reduces debt, strengthens equity, and converts a larger share of operating income into cash. The same record also raises questions about capital intensity, the accumulation of non-operating assets, the source of declining reinvestment, and reliance on continuing value.

This is the purpose of financial anatomy. The model does not label the outcome simply good or bad. It identifies where value was created, where cash was absorbed, which claims were strengthened, and which assumptions now carry the greatest risk.

16.9 Fixed-Hurdle Demonstration Closure

Scenario C closes as one system under a fixed operating hurdle. The next chapter removes the artificial constancy of the hurdle and asks which conclusions survive when the requiredreturn path changes. Structural invariance requires the identities to remain valid even though the measured economic profit and value change.

CHAPTER 17

Structural Invariance under Alternative Assumptions

Academic proposition. A closed-loop framework is structurally invariant when changes in assumptions alter the appropriate economic outputs without breaking the governing identities. Fixed and floating WACC paths should produce different capital charges and economic profits, yet both must preserve the same definitions of operating capital, NOPLAT, reinvestment, cash flow, claims, and valuation date. Invariance means the architecture survives the change; it does not mean the numerical result remains constant.

17.1 Invariance Is Not Numerical Equality

A model is not robust because every scenario reaches the same value. That would often indicate that the changed assumption is not linked to the output. Robustness requires the opposite: a changed economic assumption should move the affected results while the accounting and financial identities continue to close.

The distinction separates structural law from scenario judgment. The capital roll-forward and FCFF identities should remain true under every coherent scenario. Economic profit, DCF, and claim returns should respond to the changed operating or risk assumptions.

17.2 Fixed versus Floating Operating WACC

The workbook contains a floating operating-WACC sequence derived from changing leverage, taxes, and the estimated cost of equity, alongside the fixed Scenario C hurdle of approximately 17.6754%. The floating WACC rises through the explicit period as the capital structure evolves, while the fixed path remains constant as an experimental control.

Hurdle path	2005	2006	2007	2008	2009
Floating operating WACC	15.3337%	15.8900%	16.9655%	17.4829%	17.7609%
Fixed operating WACC	17.6754%	17.6754%	17.6754%	17.6754%	17.6754%
Difference: fixed less floating	2.3417%	1.7853%	0.7099%	0.1924%	(0.0855%)

Computational Record 17.1 — Alternative Operating-Hurdle Paths

Source: author-controlled workbook, WACC worksheet. Floating WACC is the weighted operating-capital rate; fixed WACC is the Scenario C control rate.

The fixed hurdle is higher than the floating hurdle in the early years and slightly lower in 2009. The same operating performance should therefore generate lower fixed-hurdle EVA early in the period and slightly higher fixed-hurdle EVA in 2009. This is the expected economic response, not a failure of closure.

17.3 Economic-Profit Sensitivity while the Identity Remains Intact

Year	EVA under floating WACC	EVA under fixed WACC	Fixed less floating
2005	5,264.65	5,106.44	(158.21)
2006	7,358.89	7,183.86	(175.03)
2007	8,080.92	7,980.84	(100.08)
2008	8,543.53	8,510.27	(33.26)
2009	10,262.95	10,279.31	16.36

Computational Record 17.2 — EVA Response to the Hurdle Regime

Source: values derived directly from workbook NOPLAT, beginning operating capital, floating operating WACC, and fixed Scenario C WACC. Amounts are rounded to two decimals.

EVA = NOPLAT − (Operating WACC × Beginning Operating Capital)

The EVA amount changes because the capital charge changes. The two EVA constructions must nevertheless remain equal within each scenario: spread times beginning capital must equal NOPLAT less the scenario-specific capital charge. The invariant object is the identity, not the reported surplus.

17.4 Operating Assumptions versus Valuation Assumptions

A controlled scenario changes one economic mechanism at a time. An operating scenario may change sales, margins, working-capital days, capital expenditure, or productivity while leaving the hurdle path unchanged. A valuation scenario may change WACC or stable growth while preserving the operating case. Combining all changes in one optimistic or pessimistic label prevents attribution.

Scenario family	Primary assumptions	Outputs that should respond
Operating change	Sales, margin, working capital, capital expenditure, asset productivity	NOPLAT, operating capital, ROIC, reinvestment, FCFF
Financing change	Debt amount, interest cost, maturity, distribution policy	FCFE, coverage, equity burden, claim returns
Risk-pricing change	Operating WACC or equity benchmark	Capital charge, EVA, present value
Continuing-state change	Stable growth, incremental return, reinvestment, fade	Continuing FCFF and long-duration value

17.5 Boundary and Timing Invariance

Scenario comparison is valid only when definitions and timing remain stable. Surplus cash cannot enter operating capital in one scenario and remain outside it in another. Beginning capital cannot be replaced with average capital only when the result appears unfavorable. Goodwill, provisions, minority interests, and debt must be treated consistently across every path.

A scenario that changes the boundary is not a sensitivity of the same company; it is a redefinition of the economic object. Such changes may be necessary, but they must be presented as classification alternatives and reconciled separately.

17.6 The T+1 Periodic Closure Control

The periodic T+1 EVA test must continue the same beginning-capital convention used during 2005–2009. The periodic ROIC is approximately 70.30%, derived from T+1 NOPLAT and beginning operating capital of approximately 20,794. Under fixed WACC, the periodic EVA is approximately 10,942.19. A floating-hurdle sensitivity would change the capital charge, not the operating numerator or beginning-capital definition.

This periodic control remains separate from the long-run incremental-return assumption used to derive the stable reinvestment rate. Structural invariance requires both concepts to retain their assigned roles under every scenario.

17.7 Break Tests

Failure class	Example	Observable consequence
Denominator break	ROIC uses beginning capital but EVA uses ending or average capital	Periodic EVA routes diverge
Cash break	Growth changes without the related reinvestment	FCFF and continuing value become overstated
Claim break	Debt is deducted in FCFE and again in the equity bridge	Equity value is understated
Rate break	Nominal cash flows are discounted with a real rate or vice versa	Value changes without economic attribution
Terminal break	Stable return is inserted into the periodic EVA schedule	T+1 performance and long-run mechanics are mixed
Source break	A screenshot overrides the controlling workbook value	Published evidence loses lineage

Break tests are more informative than confirming only the base case. The model should deliberately vary one classification, timing rule, or assumption and show that the related zero check fails. A control that cannot detect an intentional error is not an effective control.

17.8 Scenario Governance and Approval

Every scenario should have a change register stating which assumptions changed, which definitions remained fixed, and which outputs were expected to move. Reviewers should compare the actual movement with that expectation. An unexpected unchanged result can indicate a broken link; an unexpected large movement can identify nonlinearity or hidden concentration.

The fixed-hurdle case is therefore approved as a closure benchmark, not as the sole forecast. Floating risk, operating downside, capital-intensity stress, and terminal fade should be evaluated separately. Management judgment begins after the paths are attributed, not before.

17.9 Structural-Invariance Closure

The framework survives alternative assumptions when the changed economic input alters the appropriate surplus, cash, or value output while all unaffected identities remain closed. Fixed and floating WACC illustrate this principle: economic profit changes, but the productive capital boundary, NOPLAT construction, and two EVA formulas remain coherent.

17.10 Chapter Synthesis

Structural invariance converts scenarios from narratives into controlled experiments. The fixed-hurdle case isolates operating performance; the floating-hurdle path restores capitalmarket responsiveness. Their numerical results need not agree. Their definitions, timing, and reconciliation rules must. The next chapter uses divergence from those rules as a diagnostic language for structural risk and financial radiology.

CHAPTER 18

Financial Radiology and Structural Risk

Academic proposition. Financial risk should be diagnosed by tracing a reported symptom back through the capital, return, cash, financing, and valuation layers that produced it. A closed model can reveal where a weakness entered the system, but mechanical closure does not make the economics safe. Financial radiology therefore combines identity-based reconciliation with causal interpretation, escalation thresholds, and evidence requirements.

18.1 From Reported Symptoms to Causal Layers

Conventional analysis often begins and ends with a symptom: lower margin, higher leverage, weaker cash flow, declining ROIC, or a larger terminal-value share. The closed-loop approach treats each symptom as the visible surface of a deeper process. A fall in FCFF may originate in margin compression, receivable growth, inventory accumulation, capital expenditure, acquisition spending, or a change in classification. A rise in ROE may reflect improved operations, a smaller equity denominator, additional debt, asset disposals, or a temporary non-operating gain. The same reported movement can therefore have materially different implications for value and resilience.

Financial radiology is the disciplined process of locating the first economically meaningful change and then following its transmission through the system. The analyst does not jump directly from a symptom to a conclusion. The sequence is reconstructed: operating driver, capital requirement, return effect, cash-conversion effect, financing response, claim allocation, and valuation consequence. This order prevents a later financing action from being mistaken for an operating cause.

Observed Symptom → Entry Point → State Change → Return Effect → Cash Effect → Claim Effect → Value and Risk Consequence

Reported symptom	Likely entry point	Primary evidence	Required interpretation
Sales growth with falling FCFF	Working-capital absorption or expansion expenditure	Receivables, inventory, capital expenditure, net investment	Test incremental ROIC and funding duration before treating growth as strength
Higher ROE with stable or weaker ROIC	Equity compression or leverage	Debt, equity roll-forward, after-tax interest, WACE	Separate operational improvement from financing amplification
Rising EVA with declining ROIC	Positive spread applied to a larger capital base	Opening operating capital, spread, incremental return	Determine whether new capital still earns above the hurdle
Stable profit with weaker liquidity	Accrual-to-cash deterioration	Receivable days, inventory days, payables, maintenance investment	Assess whether reported income can service contractual claims
Large valuation increase with modest explicit-period improvement	Continuing-value concentration	Stable growth, reinvestment, incremental ROIC, WACC	Escalate long-duration assumption risk

Diagnostic Record 18.1 — Symptom-to-Cause Mapping

Source: author-developed closed-loop risk protocol grounded in the two papers and the author-controlled workbooks.

18.2 Capital Intensity, Margin Pressure, and Cash Absorption

Capital intensity becomes risky when the operating state grows faster than the after-tax operating surplus it generates. Scenario C demonstrates why a simple growth narrative is insufficient. Beginning operating capital rises from approximately 6,756 to 19,134 over the explicit period, while NOPLAT rises from approximately 6,300.59 to 13,661.31. Both variables improve in absolute terms, yet ROIC declines from approximately 93.26% to 66.91% before recovering to approximately 71.40%. The business remains highly profitable in the model, but the direction of the return coefficient warns that each additional unit of capital may be producing less surplus than the earlier base.

The radiological question is not whether the company is profitable. It is whether the capital added for growth earns a sufficient incremental return and whether the resulting cash conversion can support the financing structure. Rising economic profit can coexist with declining ROIC because a positive spread is being applied to a larger capital base. This is not an inconsistency. It is a signal that value creation increasingly depends on scale rather than improving capital productivity.

Economic Profit Growth = Effect of Capital Growth + Effect of Spread Change

Margin pressure and capital intensity must also be separated. A lower ROIC can result from a weaker NOPLAT margin, a slower capital turnover, or both. Margin deterioration points toward pricing, cost, mix, productivity, or tax effects. Turnover deterioration points toward receivables, inventory, unused capacity, acquisition premiums, or other operating assets. The remedies differ, and a ratio alone cannot identify them.

Pattern	Probable economic cause	Evidence required	Management response
NOPLAT margin falls; turnover stable	Price, mix, operating cost, productivity, tax	Cost and margin bridge; unit economics	Restore operating surplus without indiscriminate capital cuts
Margin stable; turnover falls	Working capital, capacity utilization, fixed-asset intensity	Receivable/inventory days; asset utilization; capex schedule	Release idle capital or improve utilization
Margin and turnover both fall	Operating-model deterioration or poorly integrated growth	Full driver reconstruction	Reassess strategy, scale, and capital allocation
ROIC falls but remains above WACC	Value creation continues at lower efficiency	Incremental ROIC and EVA persistence	Do not reject growth automatically; require evidence of durable spread
Incremental ROIC falls below WACC	New capital destroys value	Project-level NOPLAT and investment	Stop, redesign, stage, or divest the investment

18.3 Cash Absorption and the Quality of Growth

Growth consumes cash before it proves value. Receivables must be financed until collection, inventory must be held until sale, and productive assets must be installed before their capacity is fully utilized. The closed-loop test therefore distinguishes between cash absorption that builds a productive future state and cash absorption that merely postpones recognition of weak economics.

Scenario C shows FCFF increasing from approximately 3,252.59 to 12,001.31 while net investment declines from approximately 3,048 to 1,660. The movement appears favorable, but radiological interpretation requires a cause. Lower net investment may reflect workingcapital efficiency, completion of an expansion cycle, asset-light growth, or a temporary release of capital. It may also reflect deferred maintenance or underinvestment. A high current FCFF is not automatically sustainable if the productive state is being consumed.

Sustainable Cash Conversion = Current FCFF + Evidence that the Future Productive State Is Preserved

The analyst should therefore reconcile cash conversion with maintenance requirements, capacity, service quality, product pipeline, and the closing operating-capital state. A cash improvement created by stretching suppliers, reducing essential maintenance, liquidating inventory below normal levels, or

delaying replacement investment should be classified as a risk transfer to future periods rather than durable operating improvement.

18.4 Leverage-Driven ROE and Equity Burden

Leverage can improve reported ROE without improving the operating engine. Debt reduces the equity capital supporting a given asset base and may therefore increase the ratio of net income to equity. This denominator effect becomes especially powerful when equity is compressed or negative. The closed-loop framework prevents the analyst from treating a high ROE as proof of superior management before reconstructing ROIC, after-tax financing cost, debt movement, WACE_OE, and WACE_OC.

The denominator-qualified WACE architecture is used here as an ex post structural diagnostic. WACE_OE reveals residual absorption by operating equity; WACE_OC expresses its contribution on operating capital. Neither is a market cost of equity or discount rate. A divergence between improving ROE and worsening WACE_OC, destabilising WACE_OE, weak
cash coverage, or declining refinancing resilience warns that apparent shareholder performance may be supported by structural fragility.

Observed combination	Structural interpretation	Risk conclusion
ROIC rises; leverage stable; FCFE improves	Operating improvement reaches equity	Generally constructive, subject to reinvestment quality
ROIC stable; leverage rises; ROE rises	Financing amplification	Require debt-service, maturity, covenant, and downside tests
ROIC falls; equity shrinks; ROE rises	Denominator compression masks deterioration	Treat ROE as potentially misleading
Positive net income; negative operating equity	Residual claim is structurally inverted	Use capital and cash bridges; do not interpret ROE conventionally
FCFE rises through net borrowing	Cash distribution is financed rather than earned	Classify as future claim creation, not operating strength

18.5 Terminal Concentration and Long-Duration Risk

A mechanically correct valuation may remain economically fragile when most of its value lies beyond the explicit forecast. Scenario C produces an explicit-period FCFF present value of approximately 20,959.29 and a continuing-period present value of approximately 53,309.17.
Continuing value therefore represents approximately 71.78% of operating enterprise value. The equality of the DCF and economic-profit routes proves that the formulas describe the same forecast. It does not prove that the forecast is likely to occur.

Long-duration risk arises because small changes in stable growth, WACC, reinvestment, return persistence, or the timing of convergence can materially alter value. The terminal state must therefore be examined as an economic operating state rather than as a mathematical remainder. Stable NOPLAT, stable ROIC, required reinvestment, competitive durability, market capacity, financing feasibility, and governance quality must form one credible narrative supported by evidence.

Long-Duration Risk Increases as Continuing-Value Share, Assumption Sensitivity, and Competitive Uncertainty Increase

The 7% stable growth assumption and approximately 57.61% stable incremental return in the workbook generate an implied reinvestment rate of approximately 12.1511%. This is a coherent terminal mechanism. The risk review asks whether a company of the modeled scale can sustain that return while reinvesting at that rate, whether competitors can enter, whether margins can persist, and whether the financing structure can support the growth. Coherence establishes permission to investigate; it does not remove the need for challenge.

18.6 Structural Risk Classes

Risk class	Origin	Observable consequence	Control response
Boundary risk	Operating and non-operating resources are mixed	ROIC, EVA, FCFF, and value move together for the wrong reason	Reconstruct the productive boundary and the claim bridge
Timing risk	Beginning, average, and ending capital are used inconsistently	Return and EVA routes diverge or become selectively favorable	Freeze one controlling timing convention
Cash-conversion risk	Profit is not converted after reinvestment	Debt and distributions depend on working-capital release or borrowing	Trace NOPLAT to FCFF through two routes
Financing risk	Debt cost, maturity, or refinancing is understated	FCFE appears stronger than the operating source permits	Rebuild claim-specific cash flows and downside liquidity
Terminal risk	Growth, return, reinvestment, and hurdle are not mutually consistent	Continuing value becomes a plug or rescue mechanism	Apply stable-state identity and sensitivity tests
Model risk	Formula, sign, unit, link, or override error	Independent paths fail to close	Suspend decision until zerodifference closure is restored
Governance risk	Assumptions are changed after outputs are observed	Selective scenarios and denominator shopping	Require version freeze, change log, independent approval

Diagnostic Record 18.2 — Closed-Loop Structural Risk Taxonomy

Source: author-developed synthesis of the two papers, the protected workbook architecture, and the institutional decision logic.

18.7 Early-Warning Escalation

Early warning should occur before the final valuation fails. A deterioration in receivable collection, inventory turnover, capital expenditure discipline, interest coverage, or incremental return often becomes visible one or more periods before enterprise value or equity value declines. The closed-loop architecture creates an escalation chain that links each warning to a responsible owner and a required response.

Escalation level	Trigger	Required action	Accountability
Level 1 — Observe	Single-period movement within expected range	Document cause and monitor next period	Business unit and finance
Level 2 — Investigate	Two linked metrics deteriorate or a control residual emerges	Driver analysis and targeted reconciliation	FP&A, treasury, controller
Level 3 — Restrict	Incremental ROIC approaches hurdle; cash coverage weakens	Limit new commitments, dividends, or borrowing	CFO, CRO, investment committee
Level 4 — Remediate	Sub-hurdle investment, covenant pressure, or repeated closure failure	Restructure, divest, recapitalize, or redesign	Board and senior management
Level 5 — Suspend	Material unexplained divergence or unsupported terminal value	Suspend approval and external release	Board audit/risk committee and independent validation

18.8 Risk Interpretation Limits

Structural diagnostics do not eliminate uncertainty. The model may close perfectly while the business assumptions are unrealistic. Historical margins may not persist, an acquisition may fail to integrate, customers may change behavior, regulation may alter economics, or capital markets may become unavailable. Closure identifies internal consistency; external evidence determines plausibility.

The framework also does not imply that every temporary decline is failure. A company may rationally accept lower current FCFF or ROIC while building a project whose expected incremental return exceeds the hurdle. The risk conclusion depends on the evidence supporting the future state, the reversibility of the commitment, the downside funding plan, and the quality of monitoring.

18.9 Structural-Risk Closure

Structural risk is closed only when the symptom, causal entry point, affected identities, cash consequences, financing response, and value effect have been connected without an unexplained residual. The analyst must then separate mechanical findings from economic judgment. A zero residual means the story is internally accounted for; it does not mean the story is safe.

18.10 Chapter Synthesis

Financial radiology turns ratios and valuation outputs into a causal diagnostic system. Scenario C demonstrates both strong value creation and meaningful risk signals: operating capital expands rapidly, ROIC moderates, cash conversion strengthens, and continuing value remains dominant. The proper conclusion is neither uncritical optimism nor automatic rejection. It is disciplined investigation of where value is created, where cash is absorbed, which claim bears the burden, and which assumptions dominate the future.

The next chapter uses the same loop to evaluate management quality. Management is assessed not by isolated earnings growth or a favorable valuation, but by the repeated quality of capital commitments, operating returns, cash conversion, financing decisions, and corrective action.

CHAPTER 19

Management Quality through the Capital Loop

Academic proposition. Management quality is revealed by the repeated transformation of entrusted capital into durable economic surplus and cash while preserving resilience. The relevant evidence is not a single year of earnings, a high ROE, or an optimistic strategy narrative. It is the full record of capital definition, incremental return, reinvestment, financing, distribution, control, and accountability through time.

19.1 Management as a Steward of the Productive State

Management receives an opening productive state inherited from prior decisions. It does not begin each period from zero. Receivables, inventory, productive assets, debt, contractual obligations, organizational capabilities, and retained earnings embody earlier commitments. Management quality is therefore partly measured by how well the inherited state is used and partly by whether the closing state is stronger, more productive, and more resilient.

A strong management team does not merely maximize current profit. It defines the operating boundary honestly, protects maintenance capacity, allocates incremental capital above the required return, releases capital from weak uses, avoids debt-supported distributions, and makes the assumptions behind long-duration value visible. Stewardship means that current outcomes and future claims are evaluated together.

Management Quality = Quality of Operating Transformation + Quality of Capital Allocation + Quality of Cash and Claim Discipline

19.2 Incremental ROIC and Capital Allocation Discipline

Average ROIC describes the performance of the existing operating state. Incremental ROIC tests the next commitment. A company with an exceptional historical ROIC can destroy value by investing new capital below WACC. Conversely, a mature company with a moderate average ROIC can create value when new projects earn a strong incremental spread. Management evaluation should therefore distinguish legacy economics from current allocation decisions.

Incremental ROIC = Change in NOPLAT ÷ Change in Operating Invested Capital

The numerator and denominator must be measured over a compatible interval and adjusted for ramp-up timing, acquisitions, disposals, and non-recurring effects. A project may require several periods before reaching normal capacity. The evaluation should compare the realized path with the approved path rather than judge an early period using a mature-state target. However, ramp-up explanations must be time-limited and supported by operational milestones.

Incremental-return condition	Decision treatment	Management-quality implication
Above-hurdle incremental ROIC with funded downside	Approve or continue, subject to monitoring	Capital creates additional economic profit
Incremental-return condition	**Decision treatment**	**Management-quality implication**
Above-hurdle base case but sub-hurdle downside	Stage investment, reduce scale, hedge, or change terms	Protect reversibility and liquidity

Sub-hurdle incremental ROIC with strategic option value	Fund a limited pilot with explicit learning milestones	Do not capitalize an undefined strategic narrative
Sub-hurdle incremental ROIC without credible remedy	Reject, stop, divest, or restructure	Growth would compound value destruction
Incremental return cannot be measured	Do not approve full commitment	Unmeasured capital is unmanaged capital

19.3 Working-Capital Release versus Operating Deterioration

Working-capital release can be evidence of excellent management or the beginning of operating damage. Faster collection, better inventory planning, improved supplier collaboration, and lower process variability release capital without weakening the business. By contrast, aggressive collection that damages customer relationships, inventory reduction that creates stock-outs, or supplier stretching that interrupts supply may improve current FCFF while reducing future NOPLAT and resilience.

The closed-loop evaluation therefore matches the cash release with service levels, sales retention, aging profiles, write-offs, supplier terms, production stability, and future investment needs. Management receives credit only when capital is released without transferring a hidden cost to another stakeholder or period.

Observed movement	Structural reading	Management assessment
Receivable days decline; bad debts stable; retention stable	Operational collection improvement	Positive
Receivable days decline through factoring or unusual discounts	Financing or margin trade-off	Neutral until full cost is recognized
Inventory declines; service level and throughput improve	Process and planning improvement	Positive
Inventory declines; stock-outs and lost sales rise	Understocking	Negative
Payable days rise within negotiated terms	Supplier-financing efficiency	Potentially positive
Payable days rise through overdue balances	Liquidity stress transferred to suppliers	Negative

19.4 Growth Quality, EVA Persistence, and Cash Conversion

High-quality growth expands NOPLAT, maintains an adequate spread over WACC, converts operating surplus into cash after necessary reinvestment, and does not create disproportionate refinancing or terminal-value dependence. Low-quality growth may raise revenue and accounting profit while consuming capital faster than it creates economic surplus.

Economic-profit persistence provides a stronger management signal than one-period EVA. A team may create a temporary positive spread through favorable prices, low maintenance, or a cyclical peak. Durable quality requires that the spread survive competition, normalization of working capital, maintenance investment, taxes, and financing. The relevant question is not whether EVA is positive today but whether management has built capabilities that can reproduce positive EVA without continually increasing risk.

19.5 Financing Discipline and Distribution Quality

Management controls not only investment but also the allocation of cash among debt reduction, dividends, repurchases, liquidity reserves, acquisitions, and reinvestment. A distribution is high quality when it is funded by durable residual cash after preserving the productive state and contractual

resilience. It is low quality when supported by additional borrowing, asset liquidation, supplier stretch, or deferred maintenance.

Debt can be appropriate when cash flows are durable, maturities are matched to asset life, covenant headroom is sufficient, and the downside can be funded. The quality test is not whether leverage increases or decreases. It is whether management has priced the claim correctly, preserved strategic flexibility, and avoided using optimistic terminal value as a substitute for near-term serviceability.

Allocation use	Primary closed-loop test	High-quality management behavior
Reinvestment	Incremental ROIC, EVA, milestone delivery, reversibility	Capital is committed only to evidenced value creation
Debt reduction	Liquidity, maturity profile, opportunity cost	Resilience improves without starving productive investment
Dividend	FCFE after maintenance and required reserves	Distribution is earned, not borrowed
Share repurchase	Intrinsic value, alternative uses, leverage effect	Repurchase is value-accretive and not denominator management
Acquisition	Purchase price, synergies, integration capital, incremental EVA	Goodwill and risk are fully charged
Cash retention	Operating need, optionality, return on surplus assets	Liquidity is purposeful rather than an unexamined drag

19.6 Management Quality across the Scenario-C Record

Scenario C provides a useful demonstration of balanced interpretation. NOPLAT more than doubles across the explicit period, economic profit rises materially, debt declines, and FCFF strengthens. These are constructive outcomes. At the same time, operating capital expands rapidly, ROIC moderates, and continuing value accounts for most of operating enterprise value. A high-quality management conclusion must therefore recognize both achievement and dependence.

The record suggests that management succeeds in generating a large positive spread and improving cash conversion, but future quality depends on whether the larger capital base can sustain the modeled return, whether lower net investment is efficient rather than deficient, and whether the stable-state assumptions remain credible. The closed-loop framework avoids both errors: rewarding growth without capital discipline and dismissing value creation merely because returns normalize from an unusually high starting level.

19.7 A Closed-Loop Management-Quality Scorecard

Assessment dimension	Strong evidence	Penalty evidence
Productive-state definition	Capital boundary is stable, transparent, and reconciled	Reclassification is used to improve ratios
Operating transformation	Margin and turnover drivers support ROIC	ROIC depends on temporary or unexplained factors
Incremental allocation	New capital earns above hurdle in credible cases	Average company return masks weak projects
Economic-profit durability	Positive spread persists after normalization	EVA depends on low maintenance, temporary price, or falling hurdle

Cash conversion	FCFF follows NOPLAT after adequate reinvestment	Cash is produced by underinvestment or working-capital stress
Financing discipline	Debt and distributions match durable residual cash	Borrowing funds distributions or hides operating weakness
Risk and downside	Funding and covenants survive credible stress	Base case is unfunded or dependent on refinancing
Terminal discipline	Long-run growth, reinvestment, return, and WACC are evidenced	Terminal value rescues a weak explicit period
Correction and learning	Post-investment variances lead to action	Failed commitments are repeatedly renarrated
Governance transparency	Overrides, versions, and assumptions are traceable	Selective metrics and late changes dominate reporting

Management Record 19.1 — Closed-Loop Management-Quality Scorecard

Source: author-developed institutional application of the closed-loop capital, return, cash, claim, and value architecture.

19.8 Incentives and the Prevention of Metric Gaming

A compensation system based on one metric invites optimization of that metric at the expense of the whole company. Revenue targets can encourage low-quality sales, profit targets can encourage underinvestment, ROE targets can encourage leverage, and cash targets can encourage supplier stretch or asset liquidation. The closed-loop scorecard reduces this risk by requiring simultaneous performance across return, capital, cash, financing, and durability.

Incentives should recognize multi-year outcomes, capital charges, downside risk, and postinvestment performance. Deferred compensation and clawback mechanisms may be appropriate when value depends on long-duration assumptions. The purpose is not to eliminate managerial judgment but to ensure that judgment remains accountable to the productive state and the claims created by current decisions.

19.9 Management-Quality Closure

Management quality closes when the operating result, incremental capital, economic profit, cash conversion, financing response, distribution, and closing state form a coherent record and when deviations from the approved path are explained and acted upon. A favorable outcome without traceable stewardship is not enough; an unfavorable short-term outcome with disciplined learning may still reflect strong management when the long-term state is protected.

19.10 Chapter Synthesis

The capital loop converts management assessment from reputation and narrative into an auditable record of stewardship. Strong management creates operating surplus, invests additional capital above the hurdle, converts value into cash, finances the system prudently, distributes only earned residuals, and corrects weak commitments. The next chapter translates these principles into decision protocols for boards, credit committees, and risk functions.

CHAPTER 20

Board, Credit, and Risk Decision Protocols

Academic proposition. Institutional decisions should be presented as controlled capital commitments rather than isolated valuation outputs. Boards, lenders, and risk functions examine different claims on the same operating system, but all require a common record of the productive state, operating return, reinvestment, cash conversion, financing obligations, downside funding, valuation dependence, and post-decision accountability.

20.1 The Board Capital-Commitment Question

The central board question is not whether a proposal has a positive NPV, increases earnings, or supports strategy. It is whether the capital commitment strengthens the company after considering the full operating and financing loop. The proposal must identify the opening capital required, the operating mechanism, expected NOPLAT, incremental ROIC, economic profit, cash needs, financing plan, downside path, continuing-value dependence, and decision reversibility.

A board should reject false precision. Long-range forecasts will remain uncertain, and strategic options may be difficult to quantify. The protocol does not demand certainty. It demands that uncertainty be placed in the correct layer, that the amount at risk be visible, and that approval conditions reflect the evidence actually available.

Board dimension	Required question	Minimum evidence
Capital committed	What productive and non-productive resources are required?	Operating capital schedule and claim bridge
Operating mechanism	Which price, volume, margin, productivity, or capacity driver creates NOPLAT?	Driver model and accountable owner
Return quality	Does incremental ROIC exceed the hurdle in credible cases?	Incremental EVA and sensitivity
Cash requirement	When does the project consume and release cash?	FCFF path and working-capital/capex schedule
Financing	Which claims fund the shortfall, and when must they be serviced?	Debt, interest, maturity, covenant, and equity plan
Downside	Can the company fund the adverse path without unacceptable damage?	Liquidity and covenant stress
Long duration	How much value lies beyond the evidenced period?	Continuing-value share and assumption map
Control	How will performance be monitored and who can stop or redesign the commitment?	Milestones, thresholds, and escalation rights

Decision Record 20.1 — Board Capital-Commitment Template

Source: author-developed institutional protocol derived from the closed-loop framework.

20.2 Credit as a Senior Claim on the Same Operating System

Credit analysis begins with the same operating engine used in equity valuation, but the decision objective differs. The lender does not receive the residual value of the company. It receives contractual principal, interest, fees, collateral rights, and protective covenants. Credit quality therefore depends on the reliability and timing of cash available after preserving the operating system, not on enterprise value alone.

A profitable borrower can remain weak credit when growth absorbs cash, maintenance is deferred, debt maturities are concentrated, or refinancing is assumed rather than committed. Conversely, a company with modest accounting profit may possess strong credit quality if cash conversion is durable, capital needs are low, liquidity is ample, and the lender's claim has substantial protection.

Debt-Service Capacity = Operating Cash after Necessary Reinvestment, before Discretionary Equity Distribution

Credit layer	Evidence	Decision question
Operating source	NOPLAT, margin, capital turnover, volatility	Can the operating engine produce cash under stress?
Reinvestment burden	Working capital, maintenance capex, committed projects	How much operating cash is unavailable to debt service?
Claim structure	Debt amount, seniority, security, guarantees, leases, provisions	Which claims rank ahead of or alongside the lender?
Service schedule	Interest, amortization, maturity, cash sweeps	Does timing match cash generation?
Liquidity	Cash, facilities, market access, trapped cash	Can temporary shortfalls be funded?
Covenants	Headroom, cure rights, distribution locks	How early does deterioration become actionable?
Recovery	Collateral, enterprise resilience, restructuring options	What protects the claim if cash flow fails?

20.3 Scenario Approval and Downside Funding

A scenario is a controlled experiment, not a label such as optimistic, base, or pessimistic. Each scenario should identify which assumptions change, which remain fixed, and why the changes belong together. Operating assumptions should be separated from financing assumptions and from valuation assumptions. Otherwise, a favorable scenario can be created by simultaneously increasing sales, margin, leverage, terminal growth, and reducing WACC without attribution.

Downside funding is the institutional test that converts scenario analysis into a decision. A proposal may create value in the base case yet remain unacceptable if the company cannot fund the adverse path. The board and credit committee should identify the maximum cash deficit, timing of the deficit, covenant consequences, collateral or reserve requirements, and actions available before value is permanently impaired.

Scenario family	Controlled change	Primary affected layer
Operating downside	Lower price, volume, margin, productivity, or utilization	NOPLAT and ROIC decline
Capital downside	Higher working capital, capex, integration cost, or maintenance	FCFF and liquidity weaken
Financing downside	Higher interest, shorter maturity, lower availability	FCFE and debt-service resilience weaken
Valuation downside	Lower stable return or growth; higher WACC	Long-duration value contracts
Combined stress	Correlated operating, capital, and financing shock	Tests survival and management action

20.4 Board Approval Gates

Approval gate	Pass condition	Reject or redesign condition
Gate 1 — Boundary	Capital and claims are complete and consistently classified	Unexplained assets, claims, or unit/sign differences
Gate 2 — Operating case	Drivers produce a credible NOPLAT and incremental ROIC path	Narrative growth without operational mechanism
Gate 3 — Value creation	Incremental EVA and DCF are positive and reconcile	Value depends on plugs or incompatible routes
Gate 4 — Cash and funding	FCFF, financing, and downside liquidity are funded	Liquidity or covenant break before recovery
Gate 5 — Terminal state	Growth, reinvestment, stable return, and WACC are mutually consistent	Terminal value rescues weak explicit economics
Gate 6 — Control	Milestones, owner, review date, and stop rights are documented	Approval cannot be reversed or monitored

20.5 Monitoring, Override, and Escalation Rules

Approval is not the end of governance. The closing state of one review becomes the opening state of the next. Monitoring should compare actual capital, NOPLAT, incremental return, net investment, FCFF, debt, and milestones with the approved path. Variances should be attributed to volume, price, margin, timing, capital intensity, financing, or external conditions rather than combined into a single explanation.

Overrides are sometimes necessary. Markets change, data arrive late, and strategic action may be urgent. An override becomes dangerous when it is embedded invisibly, has no expiry, or changes the decision after the output is observed. Every material override should state the original input, revised input, reason, approving authority, affected outputs, expiry condition, and remediation plan.

Change class	Examples	Required control
Minor	Formatting, label, or explanatory text with no calculation impact	Peer review and version note
Moderate	Input mapping or reporting change with limited decision effect	Owner approval and targeted regression test
Major	Capital boundary, formula, WACC, terminal value, or claim bridge	Full impact assessment and independent revalidation
Emergency	Temporary change required for an immediate decision	Time-limited authority, explicit risk acceptance, retrospective validation

20.6 The Fifteen-Minute Institutional Brief

Senior decision-makers often have limited time, but brevity must not remove the structure of the decision. A disciplined fifteen-minute brief can present the closed loop in seven blocks: the decision, capital committed, operating mechanism, return and EVA, cash and funding, downside and terminal dependence, and requested approval with monitoring conditions.

Brief block	Required content
1. Decision	What is being approved, for how much, by whom, and when?
2. Productive state	Opening capital, new capital, and excluded non-operating items
3. Operating result	NOPLAT, ROIC, incremental return, principal drivers
4. Value creation	EVA, DCF, convergence, and sensitivity
5. Cash and claims	FCFF, FCFE, debt service, distributions, liquidity
6. Risk	Downside deficit, covenant risk, continuing-value share, invalidation conditions
7. Approval	Conditions, owner, milestones, review date, escalation and stop rights

20.7 Credit and Risk Committee Escalation

Credit and risk committees should escalate when operating closure remains intact but economic resilience weakens, and they should suspend decisions when mechanical closure fails. The distinction matters. A borrower may have a coherent model showing an unacceptable downside; the decision is then economic. A model with unexplained residuals cannot support any reliable conclusion, favorable or unfavorable.

Escalation category	Trigger	Institutional response
Mechanical failure	Independent paths do not reconcile	Suspend approval; correct model and revalidate
Economic weakness	Model closes but return, cash, or coverage is inadequate	Reject, reduce, reprice, secure, or restructure
Assumption concentration	Decision depends on one long-duration or refinancing assumption	Add conditions, reserves, hedges, or staged commitment
Governance weakness	Late changes, selective scenarios, missing ownership	Require independent review and stronger authority controls
Monitoring breach	Actual path crosses a stated threshold	Escalate according to pre-approved action ladder

20.8 Decision Rights and Accountability

Decision rights should follow the source of risk. Business management owns the operating assumptions and execution milestones. Finance owns capital classification, cash-flow integration, and valuation mechanics. Treasury owns financing availability, interest, maturity, and liquidity. Risk challenges downside design and concentration. Independent validation tests the model. The board or delegated committee accepts the residual risk and authorizes the capital commitment.

Shared responsibility must not become diluted responsibility. Each controlling assumption should have one named owner, one evidence source, one approval status, and one monitoring frequency. A decision is institutionally incomplete when everyone participates but no one is accountable for the assumption that fails.

20.9 Decision-Protocol Closure

A board, credit, or risk decision closes when the capital boundary, operating mechanism, required return, economic profit, cash and claim sequence, downside funding, long-duration assumptions, approval conditions, and monitoring responsibilities are recorded in one traceable package. The model may inform the decision, but the institution must explicitly accept the assumptions and residual risk.

20.10 Chapter Synthesis

Institutional use is where the closed-loop framework becomes more than a valuation method. It establishes a common language for boards, lenders, risk functions, and management while preserving the differences among their claims. The next chapter applies the same discipline to new products, projects, and production lines, where external comparables may be weak and incremental capital must be evaluated on its own economics.

CHAPTER 21

New Products, Projects, and Production Lines

Academic proposition. A new product, project, or production line should be evaluated as an incremental closed loop with its own productive capital, operating result, reinvestment, cash conversion, financing consequences, and value-creation test. External comparables can inform judgment, but they cannot replace internal structural proof. Approval requires both positive economics and a controlled path from commitment to post-investment review.

21.1 The Project as an Incremental Closed Loop

A project is often presented as an isolated NPV calculation. The closed-loop approach treats it as a new state-transition process embedded within the company. The project receives capital, transforms that capital through operating drivers, generates NOPLAT, consumes additional working capital and fixed investment, produces FCFF, creates financing obligations, and changes the closing state of the company. Each of these elements must be identified before the project value can be accepted.

The project boundary should include only the resources and claims caused by the decision, while recognizing interactions with shared capacity, corporate services, tax, cannibalization, and financing. Allocated overhead that will not change should not be treated as incremental cost merely because accounting assigns it to the project. Conversely, a corporate resource consumed by the project should not be excluded merely because it is not directly invoiced. Incremental Project $State_{t+1}$ = Incremental Project $State_t$ + Incremental Net $Investment_t$

21.2 Product-Level Operating Capital and NOPLAT

Product-level operating capital may include dedicated receivables, inventory, production equipment, tooling, software, distribution assets, customer-acquisition investment, and a share of genuinely constrained common resources. Non-interest-bearing operating liabilities are deducted when they arise directly from the product cycle. Surplus cash and financing balances remain outside the operating boundary.

The project NOPLAT should be constructed from incremental revenue, variable cost, avoidable fixed cost, operating depreciation or amortization, and operating tax. Transfer prices and shared services require transparent policies. A project should not appear profitable because costs are shifted to another business unit, nor should it be rejected because unavoidable corporate cost is assigned to it.

Project component	Required content	Control principle
Revenue	Price, volume, mix, ramp-up, cannibalization	Use contract, pipeline, pilot, and market evidence
Operating cost	Variable cost, avoidable fixed cost, yield, productivity	Separate incremental cash cost from allocated accounting cost
Working capital	Receivables, inventory, payables, customer advances	Model timing and peak funding, not only annual averages
Fixed and intangible capital	Equipment, installation, software, launch, development	Include commissioning, integration, and maintenance requirements
Tax	Incremental operating tax and usable shields	Do not assume tax benefits that cannot be realized
Closure	Project NOPLAT, capital, and cash reconcile to company totals	Prevent double counting and leakage across business units

21.3 Incremental EVA and FCFF

Incremental EVA tests whether the project compensates the capital committed to it.
Incremental FCFF tests whether the project converts that operating surplus into cash after the investment required to sustain the next state. The two measures answer different but connected questions: whether value is created and when cash becomes available.

$$\text{Project EVA}_t = \text{Project NOPLAT}_t - \text{Project WACC}_t \times \text{Beginning Project Operating Capital}_t$$

$$\text{Project FCFF}_t = \text{Project NOPLAT}_t - \text{Project Net Investment}_t$$

A project may report positive accounting profit and negative EVA when the capital charge exceeds the operating surplus. It may also report positive EVA and negative early FCFF while building capacity. The decision should therefore evaluate the whole path, including funding needs, ramp-up, stable economics, and the cost of delay or failure.

21.4 Decision Gates without External Comparables

New products and internal projects frequently lack reliable comparables. The absence of a peer does not remove the need for evidence. It increases the importance of internal consistency, operational milestones, reversible learning, and scenario design. External benchmarks may support demand, pricing, cost, or risk assumptions, but the project must still close on its own capital and cash mechanics.

Approval gate	Accept or condition	Reject or redesign
Strategic mechanism	The project addresses a defined customer, capacity, cost, regulatory, or technology need	Narrative opportunity without measurable operating driver
Incremental economics	ROIC exceeds hurdle; EVA and DCF are positive in credible cases	Average company economics are used to mask weak project returns
Cash and funding	Peak deficit, working capital, capex, and downside funding are identified	Funding is assumed to appear after commitment
Execution	Milestones, owner, dependencies, and resource constraints are explicit	Success depends on undefined capability or timing
Reversibility	Pilot, stage gates, contractual protection, or exit path limits loss	Irreversible full-scale commitment precedes evidence
Terminal state	Stable growth, return, reinvestment, and maintenance are coherent	Terminal value rescues a weak explicit path

Project Record 21.1 — Incremental Closed-Loop Approval Gate

Source: author-developed application of the closed-loop framework to projects, products, and production lines.

21.5 Ramp-Up, Learning, and Option Value

Early project performance should be interpreted against the approved ramp-up curve rather than a mature-state target. However, ramp-up must not become an unlimited explanation for weak results. The project should specify learning milestones such as technical yield, customer conversion, unit cost, cycle time, regulatory approval, capacity utilization, and workingcapital behavior. Failure to meet a milestone triggers redesign, staging, or termination.

Strategic option value can justify a pilot whose stand-alone EVA is initially weak when the pilot purchases valuable information or preserves access to a future opportunity. The option claim must identify the decision unlocked by the learning, the maximum loss, the expiry date, and the evidence required before further capital is released. Undefined strategic value should not be capitalized as a substitute for economics.

21.6 Financing and Project-Level Risk

Project financing can isolate risk or concentrate it. Debt matched to project cash flows may improve discipline, but it can also create completion tests, reserve requirements, distribution locks, and refinancing exposure. Corporate funding may provide flexibility while transferring project risk to the wider company. The decision should identify who bears construction, operating, market, interest-rate, currency, and terminal risks.

The project should be stress-tested before debt is introduced, then again after the contractual waterfall is applied. A project that creates value at enterprise level may leave the commonequity claim unattractive if senior claims absorb the cash or if downside support is unlimited.

21.7 Post-Investment Review

A post-investment review compares the approved loop with the realized loop. The objective is not to punish all variance. It is to identify which assumptions were wrong, which execution actions changed the result, and whether continuing capital should be committed. Actual capital, NOPLAT, incremental ROIC, EVA, FCFF, funding, and milestones should be reconstructed using the same definitions approved at inception.

Variance family	Causal decomposition	Required response
Demand variance	Price, volume, mix, timing	Update capacity and commercial plan
Margin variance	Input cost, productivity, yield, service cost	Correct operations or reprice
Capital variance	Working capital, capex, integration, maintenance	Reassess scale and incremental return
Timing variance	Delay, commissioning, approval, customer adoption	Measure carrying cost and lost option value
Financing variance	Interest, availability, covenant, currency	Rebuild FCFE and downside resilience
Terminal variance	Stable return, growth, reinvestment, market capacity	Reduce long-duration value or redesign strategy

21.8 Project-System Closure

A project closes when its incremental operating capital, NOPLAT, EVA, FCFF, financing claims, value, and company-level reconciliation are complete and when the post-investment review can reproduce the approved definitions. The project may still fail economically, but the institution will know why and can stop further loss. The strongest decision system is not one that predicts perfectly; it is one that exposes error early and preserves the right to act.

21.9 Chapter Synthesis

The incremental closed loop permits rigorous evaluation of projects even when external comparables are limited. It connects strategy to capital, return, cash, claims, and monitoring. The next chapter extends the same logic across companies by ranking structural quality before introducing market price and portfolio judgment.

CHAPTER 22

Structural Peer Ranking and Investment Judgment

Academic proposition. Peer comparison should rank companies by the quality of their capital transformation rather than by isolated growth, ROE, or accounting profit. The ranking system normalizes the operating boundary, rewards durable economic profit and cash conversion, penalizes leverage-driven equity optics, and then separates corporate quality from the price paid for the residual claim.

22.1 Ranking Operating Quality before Market Price

A peer ranking begins with a common economic question: how effectively does each company transform a comparable productive state into durable after-tax operating surplus and cash? Market price is deliberately excluded from the first stage because a high-quality company can be overpriced and a weak company can be attractive at a distressed price. Corporate quality and investment attractiveness are related but distinct judgments.

Normalization is essential. Companies differ in accounting policy, leases, goodwill, surplus cash, acquisitions, pension obligations, minority interests, and business mix. A ranking that compares unadjusted ROIC or ROE may reward classification differences rather than economics. The productive boundary, timing convention, tax treatment, and claim bridge should be standardized before scores are assigned.

22.2 Capital Efficiency, Economic Profit, and Cash Conversion

The first ranking layer evaluates operating-capital efficiency through ROIC level, trend, and incremental return. The second evaluates economic value creation through the spread over WACC and the persistence of EVA. The third evaluates cash conversion through FCFF relative to NOPLAT and the reinvestment burden. No single layer is sufficient. High ROIC with weak reinvestment opportunity may not support growth, while rising NOPLAT with poor cash conversion may signal capital absorption or accounting fragility.

Ranking dimension	Metric family	Economic purpose
Operating-capital efficiency	ROIC level, trend, incremental ROIC, turnover	Reward efficient transformation; penalize capital-heavy income growth
Economic value creation	ROIC-WACC spread, EVA level and persistence	Separate value creation from scale alone
Cash conversion	FCFF/NOPLAT, working-capital and capex burden	Penalize earnings without durable cash
Growth quality	Incremental EVA, reinvestment opportunity, stable-state credibility	Reward growth only when incremental capital earns above hurdle
Financing quality	Leverage, coverage, maturity, claim allocation	Penalize fragile or debt-supported equity outcomes
Governance and closure	Reconciliation, disclosure, restatement, scenario discipline	Reward auditable systems and transparent correction

22.3 Penalising Leverage-Driven ROE

ROE can rise when operating performance improves, but it can also rise when equity shrinks or leverage increases. The ranking therefore compares ROE with ROIC, the equity-tooperating-capital relationship,

after-tax interest, debt movement, cash coverage, WACE_OE, and WACE_OC. A company receives no quality premium merely because a smaller equity denominator magnifies residual income.

Negative or very low equity requires special treatment. Conventional ROE may become unstable or reverse sign. The company should remain rankable through operating capital, NOPLAT, EVA, FCFF, debt resilience, and the equity-absorption bridge. Removing the company from the ranking because ROE is inconvenient would discard precisely the condition that reveals structural risk.

Observed pattern	Structural reading	Ranking treatment
ROE and ROIC both improve; leverage stable	Operating and equity performance reinforce each other	Positive
ROE improves; ROIC stable; leverage rises	Financing amplification	Penalty unless cash and resilience justify it
ROE improves; ROIC falls; equity contracts	Denominator compression	Strong penalty
ROE unavailable due to negative equity; operations strong	Use operating and claim-specific measures	Neutral until financing risk is assessed
FCFE supported by net borrowing	Distribution is financed rather than earned	Penalty

22.4 Normalization and Sector Adaptation

The general architecture applies widely, but the state variable may require sector adaptation. For a bank, the productive state includes earning assets, deposits, funding, liquidity, credit risk, and regulatory capital. For insurance, reserves, invested assets, underwriting risk, and solvency capital become central. For regulated utilities, the rate base and allowed return may replace conventional operating capital. The principle remains constant: the return numerator, capital denominator, cash conversion, and claims must describe the same economic system.

Sector adaptation should not become permission for arbitrary ratios. Each modification must state the economic reason, preserve numerator-denominator matching, and permit a traceable bridge to cash and value. Cross-sector ranking may require broader normalization or may be inappropriate when the operating systems are too different.

22.5 From Corporate Quality to Security Value

After structural quality is ranked, the investor introduces price. Enterprise value is compared with the operating value range, then surplus cash, non-operating assets, debt, provisions, minority interests, and other senior claims are bridged to common equity. The price of the security is then assessed against the residual value, uncertainty, liquidity, and portfolio alternatives.

Investment Attractiveness = Structural Corporate Quality + Valuation Margin − Claim Risk − Uncertainty and Portfolio Costs

A high-quality company may offer a poor return when the market price assumes perfect execution or an unusually durable spread. A lower-quality company may be attractive when the price implies an excessively pessimistic outcome and the claim has recovery or restructuring options. The ranking should therefore inform the investment thesis, not replace valuation and portfolio construction. **22.6**

The Investment Thesis Register

Register field	Required content
Structural reason	Why the company ranks well or poorly on capital, EVA, cash, and financing
Expected state path	Opening capital, incremental commitments, return, cash, and claims
Valuation range	Operating value, claim bridge, residual value, and market price
Catalysts	Events that can close the gap between price and value
Monitoring indicators	ROIC, incremental return, FCFF, leverage, working capital, terminal assumptions
Invalidation conditions	Specific evidence that makes the thesis wrong
Portfolio role	Risk contribution, liquidity, diversification, sizing, and horizon

22.7 Ranking-and-Value Closure

Ranking closes when all companies are measured using documented boundaries, timing, units, and claim treatments, and when the result is separated from market price. Investment judgment closes when the residual claim is valued explicitly, uncertainty is recognized, and invalidation conditions are stated. The framework does not produce an automatic buy or sell decision; it creates a disciplined research input.

22.8 Chapter Synthesis

Structural peer ranking rewards operating efficiency, durable EVA, cash conversion, financing quality, and governance while penalizing leverage-driven optics and capital-heavy growth. The next chapter addresses the model itself as an institutional asset whose data, formulas, versions, confidentiality, and publication outputs require governance equal to the decisions it supports.

CHAPTER 23

Model Governance and Protected Reproducibility

Academic proposition. A financial model that influences capital allocation, credit, risk, valuation, or publication is an institutional asset. Its governance must cover purpose, ownership, data lineage, formulas, independent validation, scenario control, overrides, confidentiality, and release. Reproducibility requires enough evidence to test the claims without surrendering the protected executable engine.

23.1 The Financial Model as a Controlled Institutional Asset

A model is not merely a spreadsheet file. It contains economic definitions, assumptions, data transformations, formulas, judgment, and decision rights. Its risk depends on the size and reversibility of the decisions it supports, the complexity of the architecture, the frequency of change, and the availability of independent challenge. The twenty-eight-sheet workbook therefore requires a formal inventory, named ownership, approved uses, prohibited uses, and a materiality classification.

The owner is responsible for purpose and decision use. The developer is responsible for implementation. Data owners certify sources. Independent validation challenges conceptual soundness and implementation. Users remain responsible for interpreting outputs within stated limitations. These roles may be held by the same person in a small setting, but the responsibilities must remain distinct.

23.2 Data Lineage, Formula Governance, and Version Control

Data lineage identifies the source, date, unit, currency, sign, transformation, and destination of each material input. Manual inputs, overrides, external links, hidden rows, and missing values require explicit flags. A change in classification can affect operating capital, NOPLAT, FCFF, WACC, and the claim bridge simultaneously; impact analysis must follow the full loop.

Formula governance distinguishes intentional complexity from accidental complexity. Repeated logic should be standardized, hard-coded constants minimized, and forecast formulas consistent across periods unless an economic reason is documented. Circular references, arrays, macros, named ranges, and hidden sheets receive enhanced review. A formula dictionary should state the economic definition, timing, sign, unit, source, and expected control result for each critical calculation.

Control artifact	Minimum content	Purpose
Version identifier	Unique date and revision number	Prevents use of obsolete or mixed files
Change log	Who changed what, why, and which outputs moved	Supports impact analysis and accountability
Frozen baseline	Author-approved or committee-approved controlled file	Creates a comparison point for regression testing
Control artifact	**Minimum content**	**Purpose**
Source archive	Statements, assumptions, images, and evidence used	Permits reconstruction of the released result
Release package	Word, PDF, model certificate, limitations	Ensures external outputs match the approved source

23.3 Independent Validation and Regression Testing

Independent validation should examine purpose, conceptual soundness, data, implementation, outcomes, sensitivity, and governance. It should reconstruct critical outputs rather than merely inspect whether formulas exist. Redundant paths must be classified by independence. A second formula referencing the same source is not an independent test; a reconstruction from a different statement or identity provides stronger evidence.

Validation workstream	Required conclusion
Purpose and scope	Model is suitable for the decision; exclusions are explicit
Conceptual soundness	Capital boundary, return, reinvestment, claims, and terminal logic are defensible
Data testing	Source accuracy, completeness, timing, units, and transformations are verified
Implementation	Critical formulas, signs, links, and exceptional cells are recalculated
Outcome analysis	Outputs are explained through drivers and compared with actual results when available
Sensitivity and stress	Dominant assumptions, nonlinearities, and break points are identified
Governance	Access, change control, documentation, competence, and release controls are adequate

Regression testing compares a changed model with the frozen baseline. Expected changes should occur only in affected outputs; unaffected identities should remain closed. A change to a T+1 input, for example, must be tested against explicit-period EVA, continuing-value mechanics, DCF, economic-profit value, and captions to ensure that the change does not silently alter unrelated results.

23.4 Confidentiality of the Executable Engine

Academic disclosure and computational secrecy are compatible when the boundary is clear. The book may disclose definitions, general equations, governing values, selected reconciliations, and static screenshots sufficient to examine the claims. It need not disclose cell addresses, hidden formulas, dependency order, linked-sheet mechanics, passwords, or an executable workbook.

Static evidence should be selected for scientific relevance, not volume. Each figure identifies the scenario, source, output, and interpretation. Screenshots should not reveal confidential comments, unrelated cells, personal information, or formula bars that disclose protected mechanics. The original workbook remains under the author's control and can be examined only under a separate written arrangement defining confidentiality, purpose, and limits of use.

23.5 Evidence Release and Representation Controls

External representation creates a second model-risk environment. Transcription, reformatting, image reduction, and equation conversion can change symbols, decimal points, minus signs, percentages, subscripts, table alignment, and image boundaries. Any released representation must therefore be reconciled with the governing values, equations, and source lineage before it is treated as reliable evidence.

Galley control	Required test
Title and author	Exact controlling title; correct author name and affiliation
Equations	No missing signs, converted symbols, broken fractions, or infinity marks
Numbers	Values, decimals, percentages, dates, units, and scenario labels match source
Tables	Rows and columns remain aligned; headers and notes remain attached
Images	No crop removes a controlling row, formula, date, or reconciliation
Rights	Copyright, confidentiality, and approval language remain unchanged
Metadata	Abstract, keywords, ISBN/DOI data, and author contact are approved

23.6 Governance-and-Reproducibility Closure

Model governance closes when an approved decision can be traced from source data through formulas and assumptions to the released evidence, and when an independent reviewer can test the reported identities without receiving the protected executable engine. Evidence release closes only when definitions, equations, numbers, tables, images, claim boundaries, and limitations remain consistent with the controlled analytical source.

23.7 Chapter Synthesis

The protected workbook and the manuscript form one governed evidence system, but they serve different purposes. The workbook executes the closed loop; the book explains and tests it. The final chapter integrates the theoretical, computational, managerial, and institutional contributions and states the limits of responsible use.

CHAPTER 24

Institutional Synthesis and Final Conclusions

Academic proposition. The company is a controlled capital-transformation organism: productive capital generates operating return; operating return creates after-tax surplus; reinvestment determines cash; financing allocates claims; and valuation represents the expected future of the same recursive system. The closed-loop framework does not replace professional judgment. It makes the boundaries, assumptions, reconciliations, risks, and accountability of that judgment explicit.

24.1 The Company as a Controlled Capital-Transformation Organism

The book began with the proposition that a company should be read as one financial organism rather than as a collection of statements, ratios, and valuation methods. The opening productive state is transformed through operations. Taxes, reinvestment, debt, and distributions allocate the result. The closing state becomes the next opening state. Value is the present expression of the future transformations expected from that recursive system.

This perspective changes the role of financial analysis. The analyst no longer chooses a preferred ratio or valuation method and then defends it. The analyst defines the state, reconstructs the transformation, tests cash conversion, allocates claims, and requires theoretically equivalent routes to reconcile. Divergence becomes information: it identifies a boundary, timing, sign, unit, formula, claim, or assumption that requires investigation.

24.2 The Governing Structural Propositions

No.	Governing proposition
1	Operating capital is the primary productive state variable when its boundary matches NOPLAT.
2	ROIC is the transformation coefficient connecting beginning operating capital to after-tax operating surplus.
3	Operating-capital WACC is the ex ante hurdle applied to the same productive denominator.
4	Author-defined WACE is an ex post equity-absorption diagnostic, not a discount rate or market cost of equity.
5	Net income is a fixed point that should be reproducible through operating, financing, and equity-absorption paths.
6	Economic profit is NOPLAT less the capital charge and is equal to the ROIC-WACC spread applied to beginning capital.
7	Net investment carries the operating state from one period to the next and converts NOPLAT into FCFF.
8	FCFF and FCFE are claim-specific cash flows and should reconcile through independent constructions.
9	DCF and economic-profit valuation are equivalent representations under matched assumptions, timing, and claims.
10	Continuing value must arise from coherent growth, reinvestment, stable return, and required return; it cannot rescue weak explicit economics.
11	IRR and XIRR belong to specified capital claims and serve as supplementary closure tests.
12	A mechanically closed model can still contain unrealistic assumptions; closure is necessary but not sufficient for decision quality.

Synthesis Record 24.1 — Twelve Governing Propositions

Source: author-developed synthesis of the two papers and the protected computational evidence.

24.3 Implications for Boards, Banks, Investors, and Researchers

Boards should receive capital commitments in closed-loop form: capital, operating mechanism, incremental return, EVA, cash, funding, downside, long-duration dependence, and monitoring. Banks should begin with the operating engine and then trace cash to the senior claim, recognizing that profit, value, and debt-service capacity are different concepts. Investors should rank structural quality before introducing price and should value the residual claim after the full enterprise-to-equity bridge.

Researchers can use the framework to examine whether valuation methods that should be equivalent actually converge in applied models and to study the causes of divergence. The author-defined WACE construct invites further theoretical and empirical examination as an equity-absorption diagnostic distinct from CAPM and implied cost of equity. Auditors and regulators can use the reconciliation architecture to identify selective definitions, plugs, timing mismatches, and unsupported long-duration assumptions.

24.4 Limits, Research Agenda, and Responsible Use

The framework is primarily structural and methodological. It does not eliminate forecast uncertainty, estimate market risk automatically, or claim that one numerical case proves empirical universality. The workbooks demonstrate implementation and internal closure. External application requires company-specific data, sector adaptation, independent economic assumptions, and professional judgment.

Future research can test the framework across industries, business cycles, countries, and accounting regimes; compare operating-capital WACC and WACE dynamics; study the predictive content of closure residuals; evaluate management-quality scores against subsequent performance; and develop stochastic or probabilistic extensions. Research should preserve the distinction between identity-based proof and empirical hypothesis testing.

Research stream	Core question
Cross-sectional evidence	Do closed-loop quality measures explain future cash conversion, distress, or valuation error?
WACE dynamics	How does the equity burden behave across leverage cycles, restructuring, and negative-equity states?
Scenario residuals	Can emerging divergence predict operational or model failure before conventional ratios?
Sector adaptation	What state variable best represents banks, insurers, utilities, technology, and infrastructure?
Governance outcomes	Do institutions using explicit closure protocols make better capital-allocation decisions?
Stochastic extension	How should probability distributions and option states enter without breaking structural identities?

24.5 Final Conclusion: Where Value Exists, the Closed Loop Reveals It

Valuation becomes credible when capital is preserved, operating return is matched to the productive state, economic profit compensates the required return, reinvestment explains cash, financing allocates claims, and independent value routes converge. Under those conditions, value is not manufactured by a preferred method. It is revealed by a system in which no material economic consequence can disappear.

Where the loop fails, the appropriate response is not to average the answers, insert a plug, or strengthen the narrative. The response is to locate the break. The break may lie in the capital boundary, timing convention, tax, reinvestment, debt, equity absorption, terminal state, or formula implementation. Repairing the system is part of analysis, not an inconvenience preceding it.

The central standard is therefore demanding but practical: if value cannot survive the full capital-return-income-cash-claim-time sequence, it should not be claimed. If it does survive, the company, board, bank, investor, and researcher possess more than an estimate. They possess an auditable explanation of why the value exists, which assumptions support it, which risks threaten it, and which decisions can preserve or destroy it.

APPENDICES

The appendices provide the formal proof, numerical certificates, control dictionaries, institutional protocols, research agenda, and evidence-lineage architecture supporting the reconstructed manuscript. They are part of the academic argument, not supplementary decoration. Each appendix is designed to make one layer of the closed-loop system independently auditable while preserving the confidentiality of the executable workbook.

APPENDIX A

Formal Mathematical Foundations of the Closed-Loop System

Appendix proposition. The closed-loop system can be stated as a finite set of definitions, accounting identities, state-transition equations, claim-allocation bridges, and valuation equivalences. The proof does not require a preferred valuation method. It requires the same capital state, operating forecast, reinvestment path, claim structure, timing convention, and required-return regime to govern every route.

A.1 Notation and Economic Domains

Symbol	Definition	Domain	Unit
OC_t	Beginning operating invested capital for period t	Operating state	Currency
OC_{t+1}	Closing operating capital after period-t net investment	Operating state	Currency
NOA_t	Net non-operating assets at the valuation date	Non-operating state	Currency
E_t	Common equity or the defined equity layer	Equity claim	Currency
D_t	Interest-bearing debt within the relevant claim boundary	Debt claim	Currency
NOPLAT_t	After-tax operating profit before financing effects	Operating transformation	Currency/period
NI_t	Net income attributable to the defined common-equity claim	Equity transformation	Currency/period
ROIC_t	NOPLAT relative to the controlling operating-capital convention	Operating return	Rate/period
WACC_t	Required return applied to the same operating-capital boundary	Capital hurdle	Rate/period
WACE_t	Author-defined ex post equityabsorption diagnostic	Equity absorption	Rate/period
EVA_t	Economic profit after charging operating capital	Value creation	Currency/period
NI_t^{op}	Net investment in the operating state during period t	State transition	Currency/period
FCFF_t	Cash available to all capital providers after operating reinvestment	Operating cash	Currency/period
FCFE_t	Residual cash available to common equity after senior financing flows	Equity cash	Currency/period
g	Long-run growth rate of the relevant stable-state variable	Continuing state	Rate/period
ROIIC	Return on incremental operating capital	Growth productivity	Rate/period
CV_T	Continuing operating value at terminal date T	Valuation	Currency at T
EV_0	Operating enterprise value at valuation date 0	Valuation	Currency at 0
EQV_0	Common-equity value after the claim bridge	Valuation	Currency at 0
PV_0(.)	Present-value operator using the risk-matched discount rate	Timing	Currency at 0

The notation table separates economic domains because most apparent contradictions in corporate finance are boundary errors. A rate calculated on operating capital cannot be applied to total capital without an explicit bridge. A firm cash flow cannot be called an equity cash flow without recognizing debt and other senior claims. A stable incremental return used to derive continuing value cannot silently replace the annual ROIC used to test periodic EVA.

A.2 The State-Transition Identity

$$OC_{\{t+1\}} = OC_t + Net\ Investment_t$$

This identity is the recursive backbone of the book. The closing productive state is not a residual balance-sheet number. It is the economic result of the capital committed, consumed, released, or added during the period. When the identity is implemented consistently, the closing state becomes the opening state of the next period and prevents a forecast from creating income without carrying the required productive resources.

Net investment may be positive, zero, or negative. Positive net investment expands the productive state. Zero net investment maintains the measured capital state after depreciation and disposals. Negative net investment represents capital release, contraction, asset disposal, or underinvestment. The sign is not a quality judgment; the subsequent incremental return and operating resilience determine whether the transition creates or destroys value.

A.3 Operating Return and NOPLAT

$$ROIC_t = \frac{NOPLAT_t}{OC_t}$$

$$NOPLAT_t = ROIC_t \times OC_t$$

The second expression is more than an algebraic rearrangement. It states the transformation represented by ROIC. The operating-capital state is converted into after-tax operating surplus. The equality is definitional only after the numerator, denominator, and timing convention have been matched. If surplus cash is excluded from operating capital, its income must also be excluded from NOPLAT. If goodwill is included, the interpretation changes from return on identifiable operating assets to return on the full acquisition investment.

A.4 Economic-Profit Equality

$$EVA_t = NOPLAT_t - WACC_t \times OC_t$$

$$EVA_t = (ROIC_t - WACC_t) \times OC_t$$

Substituting NOPLAT_t = ROIC_t × OC_t into the first equation produces the second. The equality is a mandatory implementation control. It proves that the monetary capital charge and the return-spread representation describe the same economic event. A difference between the two routes indicates a capital-timing mismatch, a rounded or inconsistent hurdle, a formula-link error, or an incorrect operating boundary.

Positive EVA permits a value-creation claim but does not validate the forecast. The result may still depend on temporary margins, unsustainable working-capital release, an understated required return, or a terminal assumption that cannot be financed. Mechanical equality is therefore followed by economic challenge.

A.5 Reinvestment and the Two FCFF Routes

$$FCFF_t = NOPLAT_t - Net\ Investment_t$$
$$FCFF_t = NOPLAT_t + Depreciation_t - Gross\ Investment_t$$
$$Net\ Investment_t = Gross\ Investment_t - Depreciation_t$$

The two FCFF routes must converge when depreciation, fixed-asset additions, working capital, intangible investment, acquisitions, and disposals are classified consistently. The first route emphasizes the state transition. The second emphasizes sources and uses of operating cash. Their equality makes cash conversion auditable and prevents the analyst from presenting free cash flow independently of the capital needed to support the forecast.

A.6 Financing and Equity-Cash Allocation

$$FCFE_t = FCFF_t - After-tax\ Interest_t + Net\ Borrowing_t - Other\ Senior - Claim\ Flows_t$$

The generic bridge is adapted to the workbook classification. Net borrowing is debt issued less debt repaid. Other senior-claim flows may include preferred claims, minority distributions, provisions treated as financing equivalents, lease principal, or other contractual allocations. The bridge does not transform financing into operating cash. It explains how the operating cash available to all providers is distributed among claims.

An increase in FCFE caused by borrowing is not equivalent to an increase caused by operating performance. The former transfers cash from future periods and increases claim pressure. The latter reflects surplus generated after reinvestment. This distinction is fundamental to board, lender, and investor interpretation.

A.7 Net Income as a Fixed Point and WACE Closure

$$NI_t = NOPLAT_t - After-tax\ Financing\ Cost_t + Net\ Non-operating\ Income_t - Other\ Equity\ Adjustments\_t$$
$$WACE_t = \frac{NI_t}{Defined\ Equity\ Layer_t}$$
$$NI_t = WACE_t \times Defined\ Equity\ Layer_t$$

In the author-defined framework, WACE is an ex post absorption diagnostic. It records the rate at which the defined equity layer absorbs the net-income result after operating and financing effects. It is not a market-required return, not a CAPM substitute, and not a discount rate. Its analytical value is greatest when the relationship between total equity and operating equity is unusual, including negative operating-equity states.

The fixed-point claim is that net income reproduced through the operating-capital route and through the equity-absorption route must agree with the accounting net-income result under the same definitions. A difference is a diagnostic residual, not an invitation to average the routes.

A.8 Enterprise DCF and Economic-Profit Valuation Equivalence

$$EV_0 = \Sigma_{\{t=1..T\}} PV_{0(FCFF_t)} + PV_{0(CV_T)}$$
$$EV_0 = OC_0 + \Sigma_{\{t=1..T\}} PV_{0(EVA_t)} + PV_{0(Continuing\ EVA_T)}$$

The equivalence follows from substituting FCFF_t = NOPLAT_t − (OC_{t+1} − OC_t), writing NOPLAT_t as EVA_t plus the capital charge, and telescoping the discounted capital rollforward. The opening operating capital remains as a preserved state; future value is represented by the present value

of economic profit. DCF and economic-profit valuation are therefore two representations of the same forecast, not competing stories.

Step	Transformation	Proof function
1	Start with FCFF_t = NOPLAT_t − ΔOC_t.	Connect operating income to the state transition.
2	Replace NOPLAT_t with EVA_t + WACC_t × OC_t.	Separate required return from economic surplus.
3	Discount each term at the matched operating hurdle.	Move all flows to one valuation date.
4	Combine the capital-charge and ΔOC terms.	Create the telescoping capital roll-forward.
5	Preserve OC_0 and cancel intermediate capital states.	Show why opening capital remains in the residual-income form.
6	Apply the same logic to the continuing state.	Prove equality beyond the explicit forecast.

A.9 Continuing-Value Equivalence

$$CV_T = \frac{FCFF_{\{T+1\}}}{(WACC - g)}$$

$$FCFF_{\{T+1\}} = NOPLAT_{\{T+1\}} \times \left(1 - \frac{g}{ROIIC}\right)$$

$$CV_T = OC_T + Continuing\ Economic - Profit\ Value_T$$

The growth formula is legitimate only when growth, reinvestment, and incremental return form one stable mechanism. The reinvestment rate g/ROIIC is not an arbitrary plug. It states how much of after-tax operating profit must be retained to support the assumed growth at the assumed incremental return. If ROIIC falls toward WACC, the value-creating growth component contracts. If ROIIC is below WACC, growth destroys value even when accounting income rises.

Scenario C demonstrates continuing-value equality under its stated fixed-hurdle assumptions. The equality verifies formula consistency. It does not prove that the stable return, growth rate, or fixed WACC will occur. Those assumptions remain subject to capacity, competition, financing, regulation, execution, and governance challenge.

A.10 Closure Theorem and Refusal Conditions

A closed-loop valuation is mechanically admissible when all of the following conditions hold simultaneously: the operating-capital boundary matches NOPLAT; capital rolls forward without an unexplained residual; the two EVA formulas agree; the two FCFF routes agree; firm cash reconciles with financing allocation; DCF and economic-profit values converge; the enterprise-to-equity bridge is applied once; and terminal growth, reinvestment, return, and discounting are mutually consistent.

Refusal class	Condition
Boundary refusal	The numerator and denominator describe different economic objects.
Timing refusal	Beginning, average, ending, or mid-year conventions are mixed without an explicit bridge.
Cash refusal	FCFF routes or FCFF-to-FCFE allocation leave an unexplained difference.
Value refusal	DCF, EVA, residual-income, or claim bridges fail to converge under matched assumptions.
Terminal refusal	Growth is not supported by reinvestment and incremental return, or WACC ≤ g without a defensible finite-life mechanism.
Unit refusal	Currency, scale, share count, dates, or percentage formats are incompatible.
Governance refusal	A manual override, hidden formula, or version change cannot be traced and approved.

APPENDIX B

Weighted Average Cost of Equity (WACE): Derivation, Boundary Cases, and Responsible Interpretation

Appendix proposition. WACE is a structural diagnostic that closes the operating-to-equity transmission chain ex post. Its contribution lies in revealing how the defined equity layer absorbs the realised net-income result. It must be separated from ex ante market-required returns and from conventional ROE interpretation.

B.1 The Analytical Gap Addressed by WACE

ROIC explains what the operating system earned on the productive capital base. WACC states the ex ante opportunity-cost hurdle applied to that same operating boundary. ROE reports net income relative to an equity denominator. What is commonly missing is an explicit bridge showing how the operating surplus, financing cost, non-operating components, and relative capital layers combine to produce the equity result. WACE is introduced to make that absorption visible.

The term "weighted average" reflects the internal composition of the equity burden within the author's operating-capital architecture. It does not mean a market portfolio average. The calculation is an ex post mapping from net income to the defined equity layer and must be labelled with the exact denominator used: total book equity, operating equity, or another explicitly reconciled equity equivalent.

B.2 Ex Ante and Ex Post Measures Must Not Be Confused

Measure	Time orientation	Primary source	Proper use	Principal limitation
CAPM or factor-model cost of equity	Ex ante	Market-priced risk and expected return	Discounting and opportunity-cost benchmark	Can be unstable when betas or premia are poorly estimated
Implied cost of equity	Ex ante / market-implied	Observed price and forecast cash flows	Market-consistency analysis	Circularity and forecast dependence
ROE	Ex post accounting	Net income divided by book equity	Shareholder performance description	Distorted by leverage, buybacks, revaluation, or small/negative equity
Author-defined WACE	Ex post structural	Net income divided by the defined equityabsorption layer	Operating-to-equity diagnostic and closure test	Not a market required return and not a discount rate

B.3 Operating Equity versus Total Equity

Total book equity finances both operating and non-operating resources. Operating equity is the portion attributed to the productive operating system after the model separates surplus securities, goodwill treatment, minority claims, debt, and other defined adjustments. The two quantities can differ materially. A company can possess positive total book equity while the operating-equity layer is small or negative.

$$\text{Operating Equity} = \text{Total Equity} - \text{Equity Supporting Net Non-operating Assets} \pm \text{Defined Claim Adjustments}$$

The equation is a classification bridge rather than a universal published formula. Every adjustment must be documented. A negative result does not automatically mean legal insolvency or negative accounting equity. It means that the model's defined common-equity support for the operating state is negative after the specified non-operating and financing components are separated.

B.4 Interpretation under Negative Operating Equity

Negative operating equity is a boundary condition that exposes the weakness of unqualified ROE interpretation. Dividing positive net income by a negative denominator produces a negative percentage even though the company may be profitable. The sign does not describe business quality by itself. It describes an inverted relationship between the residual income and the defined equity layer.

Boundary state	Mechanical result	Responsible interpretation
E_op < 0; NI > 0	WACE is negative	Positive residual income is absorbed by a negative defined operating-equity layer. Interpret as an inverted capital state, not as a negative market-required return.
E_op < 0; NI < 0	WACE is positive	Losses and negative operating equity produce a positive ratio. The result signals compounding structural burden, not attractive performance.
E_op ≈ 0	WACE becomes extremely large or unstable	Use absolute income and capital bridges; do not rely on the ratio.
E_op > 0; NI > 0	WACE is positive	Interpret jointly with ROIC, WACC, debt cost, non-operating income, and changes in the equity denominator.
E_op > 0; NI < 0	WACE is negative	The equity layer absorbed a loss. Identify whether the cause is operations, financing, or non-operating items.

B.5 The Operating-to-Equity Transmission Chain

$$OC_t \times ROIC_t = NOPLAT_t$$

$$NOPLAT_t - After-tax\ Financing\ Cost_t + Non-operating\ Adjustments_t = NI_t$$

$$NI_t = Defined\ Equity\ Layer_t \times WACE_t$$

The chain makes the attribution sequence explicit. Operating performance determines NOPLAT. Financing and non-operating effects explain the movement from NOPLAT to net income. WACE then describes the absorption of that net income by the defined equity layer. A change in WACE must be attributed to the numerator, denominator, or both; it cannot be interpreted as a stand-alone improvement or deterioration.

Notation control. The workbook contains both a raw return on operating equity and a weighted contribution expressed on the operating-capital base. The manuscript therefore uses denominator-qualified notation: WACE_OE = NI/OE for the raw operatingequity absorption rate; Appendix M may also denote the same ratio r_OE for compact algebra. WACE_OC = NI/OC is the author-defined weighted operating-equity contribution on operating capital, and ROE = NI/E. Every numerical WACE must state its denominator subscript.

$$NI = OC\ x\ WACE_{OC} = OE\ x\ WACE_{OE}\ (= OE\ x\ r_{OE}) = E\ x\ ROE$$

B.6 Diagnostic Decomposition

Diagnostic component	Question isolated	Typical drivers
Operating-return effect	Change in ROIC with operating capital held conceptually constant	Margin, turnover, pricing, productivity, utilisation
Capital-scale effect	Change in operating capital with ROIC held conceptually constant	Growth, acquisition, working capital, asset additions
Debt-cost effect	Change in after-tax interest or operating debt burden	Leverage, refinancing, rates, tax shield
Non-operating effect	Change in income from surplus or unrelated assets	Investment income, disposals, revaluation, one-offs

Equity-boundary effect	Change in the defined operating-equity denominator	Debt movement, non-operating asset allocation, goodwill, buybacks
Tax and minority effect	Change in taxes, minority claims, or preferred allocations	Jurisdiction, tax losses, ownership, claim structure

B.7 Governance Rules for WACE

- Always state the exact equity denominator and reconcile it to total book equity.
- Do not call WACE the market cost of equity, expected shareholder return, or discount rate.
- Do not interpret the percentage without the sign and magnitude of the equity denominator.
- Reproduce net income independently from the accounting statement and the operating bridge.
- Use WACE as a longitudinal and diagnostic measure, not as an automatic ranking rule.
- Escalate material divergence between assumed equity pricing and realised equity absorption for investigation, not automatic correction.
- Preserve the author-defined terminology and limitations in external publication.

B.8 Research Propositions for WACE

Code	Testable proposition
W1	Persistent adverse WACE divergence predicts future cash-conversion stress after controlling for ROIC and leverage.
W2	WACE changes identify financing-driven ROE improvement that conventional performance analysis misclassifies as operating improvement.
W3	The absolute WACE burden becomes more informative than ROE during restructuring, negative-equity, and denominatorcompression states.
W4	A widening gap between ex ante cost of equity and ex post WACE is associated with capital-allocation or claim-allocation tension.
W5	Operating-equity normalisation across firms improves structural peer ranking relative to unadjusted ROE comparisons.

APPENDIX C

Definition, Timing, Unit, and Sign-Control Dictionary

Appendix proposition. A closed-loop model can be mathematically sophisticated and still fail because a term, date, unit, or sign changes silently between schedules. This appendix defines the minimum control dictionary required before a numerical result is accepted.

C.1 Core Definition Dictionary

Term	Controlled definition	Boundary warning
Operating invested capital	Net resources required by the productive operating system	Exclude surplus financial assets unless their income is included in NOPLAT.
Total investor funds	Operating capital plus net non-operating assets financed by investor and claim capital	Used for reconciliation, not automatically as the ROIC denominator.
NOPLAT	After-tax operating profit before actual financing effects	Remove interest and align tax with operating profit.
Net income	Residual accounting income attributable to common equity after financing and other effects	Must reconcile with the operating-to-equity bridge.
Economic profit / EVA	NOPLAT less the required return on beginning operating capital	Two formula routes must agree.
Net investment	Change in the defined operating-capital state	Must match the capital roll-forward.
Gross investment	Capital expenditure, working-capital additions, and other operating additions before depreciation	Classification must match the gross-cashflow route.
FCFF	Operating cash after reinvestment, before financing allocation	Available to all capital providers.
FCFE	Residual cash after senior financing flows and net borrowing	Claim-specific; not interchangeable with FCFF.
Operating enterprise value	Value of the forecast operating cash and economic-profit system	Excludes separately valued non-operating assets.
Common-equity value	Operating value plus net non-operating assets less debt and other senior claims	Bridge each item once.
Continuing value	Value beyond the explicit forecast under a defined stable-state mechanism	Not a balancing plug.
ROIIC	Return earned on the incremental capital supporting growth	Distinct from average or beginning-capital ROIC.

C.2 Timing Convention Dictionary

Convention	Meaning	Control requirement
Beginning capital	Capital available at the start of the period	Primary periodic ROIC and EVA path in the controlling Scenario C schedule.
Average capital	Approximation when additions contribute through the period	Sensitivity, not a silent substitute for beginning capital.
Ending capital	Closing state after current-period investment	Opening state of the following period; not normally the current-period return denominator.
Year-end discounting	Cash assumed at the end of each annual period	Use integer exponents from the valuation date.
Mid-year discounting	Cash assumed to arise through the year	Use adjusted exponents consistently across explicit and continuing value.
Valuation date	Date to which all values and claims are reconciled	Non-operating assets and debt must be measured at the same date.
T+1 periodic row	First period after the explicit forecast used in periodic or terminal analysis	Do not replace corrected periodic ROIC with the stable incremental-return assumption.

C.3 Unit and Scale Controls

Control	Required state	Failure example
Currency	All amounts in the same reporting currency or translated consistently	Mixing local currency, USD, or nominal/real figures without translation.
Scale	Units, thousands, or millions stated for every exhibit	Combining 6,206 with 6,206,000.
Percentages	Rates stored as decimals and displayed as percentages	17.6754 treated as 1,767.54% or 0.176754 treated as 0.18%.
Share count	Shares expressed on the same scale as equity value	Per-share output excluded until share-count scale is certified.
Dates	All explicit cash flows mapped to actual or standardised dates	IRR and XIRR compared without recognising date differences.
Nominal/real	Nominal cash flows with nominal rates; real cash flows with real rates	Inflation embedded in only one side.
Pre-tax/after-tax	Cash-flow and discount-rate tax basis aligned	Pre-tax debt cost applied to after-tax FCFF.

C.4 Sign Convention

Item	Controlled sign	Interpretation rule
Revenue and operating income	Positive inflow / result	Keep statement presentation separate from cash-flow signs.
Operating costs and taxes	Negative in bridge schedules	May display as positive expenses in statement format; transform explicitly.
Capital expenditure and working-capital increase	Negative cash use / positive investment	Do not reverse twice.
Depreciation	Negative expense in EBIT; positive add-back in gross cash flow	Do not add back if already excluded from EBIT.
Debt issuance	Positive financing inflow	Increases FCFE but not FCFF.
Debt repayment	Negative financing flow	Reduces FCFE and outstanding debt.
Dividends and repurchases	Negative equity distribution	Do not classify as operating investment.
Non-operating asset sale	Positive non-operating cash flow	Separate recurring operating cash from portfolio liquidation.

C.5 Boundary-Change Register

Any reclassification of cash, goodwill, leases, supplier finance, provisions, pension obligations, minority interests, or acquisition assets must be recorded in a boundary-change register. The register should state the old treatment, new treatment, reason, effective date, affected numerator, affected denominator, cash-flow consequence, valuation consequence, and whether historical comparatives were restated.

Register field	Minimum content
Change ID	Unique sequential identifier
Requested by	Owner of the proposed change
Economic rationale	Why the old boundary no longer represents the productive system
Affected statements	Balance sheet, income, cash flow, or notes
Affected model paths	ROIC, EVA, FCFF, FCFE, DCF, WACE, claim bridge
Regression tests	Independent equalities rerun after the change
Approval	Model owner, finance owner, validator, and evidence-release owner
Version	New frozen workbook and manuscript identifier

APPENDIX D

Scenario C Numerical Closure Certificate

Appendix proposition. Scenario C is used as a fixed-hurdle demonstration because it isolates operating and capital-state changes from annual movement in the required return. The certificate records accepted governing values and the closure tests they support. It is not a forecast warranty and does not disclose or distribute the protected executable workbook.

D.1 Explicit-Period Operating Record

Metric	2005	2006	2007	2008	2009	T+1 / stable reference
Beginning operating capital	6,756.00	9,804.00	14,098.00	17,286.00	19,134.00	20,794.00
NOPLAT	6,300.59	8,916.75	10,472.71	11,565.63	13,661.31	14,617.60
ROIC	93.26%	90.95%	74.29%	66.91%	71.40%	70.30%
Fixed WACC	17.6754%	17.6754%	17.6754%	17.6754%	17.6754%	17.6754%
Economic profit	5,106.44	7,183.86	7,980.84	8,510.27	10,279.31	10,942 approx.
Net investment	3,048.00	4,294.00	3,188.00	1,848.00	1,660.00	Stable-state mechanism disclosed separately
FCFF	3,252.59	4,622.75	7,284.71	9,717.63	12,001.31	12,841.40 stable FCFF

The T+1 ROIC and periodic EVA row uses the beginning-capital formula. The stable incremental-return assumption used to derive long-run reinvestment and continuing value is a separate input. This separation is a controlling analytical rule because substituting stable ROIIC into periodic EVA would merge two different questions.

D.2 Periodic Identity Certificate

Identity	Certified result	Control note
NOPLAT = beginning operating capital × ROIC	Closes for 2005–2009 and T+1	Full-precision workbook values; display rounding may create immaterial differences.
EVA = NOPLAT − capital charge	Closes for 2005–2009 and T+1	Fixed WACC applied to beginning operating capital.
EVA = (ROIC − WACC) × beginning capital	Closes to the first EVA route	Same rate precision and capital convention required.
Ending capital = beginning capital + net investment	Closes across explicit periods	Classification of working capital, fixed assets, and intangible investment must remain stable.
FCFF = NOPLAT − net investment	Closes across explicit periods	No financing item included.
FCFF = gross operating cash − gross investment	Closes to direct FCFF	Depreciation and gross investment treated symmetrically.
Financing reconstruction = FCFF	Closes across explicit periods	Debt, after-tax interest, distributions, and other claim flows included once.

D.3 Valuation Closure Certificate

Certified value	Amount	Interpretation
Present value of explicit FCFF	20,959.29	Five annual FCFF amounts discounted under the Scenario C fixed-hurdle convention.
Present value of continuing value	53,309.17	Discounted from terminal date using the same valuation-date convention.
Operating enterprise value	74,268.46	Explicit value plus continuing value.
Common-equity value	73,718.46	Operating value plus net non-operating assets less debt and other superior claims under the workbook classification.
Continuing operating value at T	120,290.05	Stable FCFF divided by WACC less growth.
Closing operating capital at T	20,794.00	Preserved productive state entering the continuing period.
Continuing economic-profit value	99,496.05	Continuing operating value less closing operating capital.
Displayed no-growth EP component	61,906.42	Display amount; full precision governs.
Displayed growth EP component	37,589.62	Displayed components may sum to 99,496.04 after two-decimal rounding.

D.4 Stable-State Mechanism

Stable-state input/output	Governing value	Governance interpretation
Long-run growth g	7.00%	Scenario assumption requiring marketcapacity and financing challenge.
Stable incremental return / ROIIC	Approximately 57.61%	Used in terminal reinvestment mechanics; not substituted into periodic EVA.
Implied reinvestment rate g / ROIIC	Approximately 12.1511%	Portion of stable NOPLAT retained to support growth.
Cash-conversion factor	Approximately 87.8489%	One minus the reinvestment rate.
Stable NOPLAT	14,617.60	First post-forecast operating-profit reference.
Stable FCFF	12,841.40	Stable NOPLAT multiplied by the cashconversion factor under the workbook mechanism.
Fixed WACC	Approximately 17.6754%	Control hurdle in Scenario C, not a claim that risk can never change.

D.5 Rounding and Numerical Presentation Control

The workbook is authoritative at full internal precision. The manuscript may display two or four decimals for readability. A display difference is acceptable only when the full-precision routes close and the rounded presentation is labelled. No rounded value may be fed back into another published calculation when doing so changes the governing result.

- Operating enterprise value 74,268.46 and common-equity value 73,718.46 are accepted total-value conclusions.
- The per-share row remains excluded because the share-count scale has not been independently certified.
- No screenshot caption may override a governing value from the controlling workbook.
- The T+1 periodic-EVA identity and the terminal stable-return assumption must remain separately labelled.
- Any external change to digits, signs, percentages, equations, or cropped evidence requires source re-verification.

APPENDIX E

Cash-Flow and Claim-Allocation Audit Protocol

Appendix proposition. Cash-flow closure is established by reconstructing the same operating cash through independent routes and then allocating that cash to financing claims without crossing boundaries. The audit distinguishes operating generation, reinvestment, debt service, equity distribution, and non-operating flows.

E.1 Operating Cash-Conversion Audit

Audit block	Evidence	Output	Audit question
Sales and margin bridge	Revenue, price, volume, mix, operating cost	NOPLAT source	Does the income result follow from documented operating drivers?
Working-capital bridge	Receivables, inventory, payables, operating accruals	Net investment	Is growth absorbing or releasing cash for defensible reasons?
Fixed-asset bridge	Capital expenditure, depreciation, disposals, impairment	Gross and net investment	Is maintenance separated from expansion and acquisition investment?
Intangible bridge	Capitalised development, software, acquired intangibles, amortisation	NOPLAT and capital	Are adjustments symmetric between numerator and denominator?
FCFF route 1	NOPLAT less net investment	Direct FCFF	Does the state transition convert correctly into cash?
FCFF route 2	NOPLAT plus depreciation less gross investment	Independent FCFF	Do gross flows reconcile to the direct route?

E.2 Financing-Claim Waterfall

Waterfall item	Economic meaning	Claim layer	Control
FCFF	Cash available before financing	Operating system	Starting point for claim allocation.
After-tax interest	Contractual debt-service cost after tax shield	Debt claim	Deduct in equity-cash bridge; do not deduct twice in FCFF.
Debt issuance	New contractual funding	Financing inflow	Raises FCFE temporarily and raises future claim pressure.
Debt repayment	Principal settlement	Financing outflow	Reduces FCFE and outstanding debt.
Lease principal / debt equivalents	Contractual financing use	Senior claim	Classify consistently with debt and WACC.
Minority and preferred distributions	Senior or separate residual claims	Non-common claim	Deduct before common-equity cash.
Common dividends / repurchases	Distribution of residual cash	Common equity	Compare with sustainable FCFE and capital needs.
Retained equity cash	Residual retained after distribution	Closing equity state	Should reconcile to the equity roll-forward.

E.3 Distribution-Quality Tests

Distribution pattern	Structural evidence	Interpretation
Earned distribution	FCFE is supported by operating FCFF after sustainable reinvestment	Favourable when leverage and liquidity remain resilient.
Debt-funded distribution	Distribution exceeds internally generated residual cash and is funded by borrowing	Escalate unless part of a documented recapitalisation with adequate coverage.
Asset-sale distribution	Cash generated by disposal of non-operating or productive assets	Separate recurring and non-recurring capacity; test future earnings loss.
Underinvestment distribution	Cash increased by deferring maintenance or growth investment	Treat as fragile; current cash may conceal future state deterioration.
Working-capital liquidation	Cash released from receivables or inventory contraction	Favourable only if operational quality and customer/service capacity are preserved.
Tax-timing distribution	Cash supported by temporary tax deferral	Recognise future reversal and legal constraints.

E.4 Cash-Flow Failure Codes

Code	Observed failure	Primary investigation
CF-01	FCFF routes differ	Depreciation, capex, working capital, acquisition, or sign error
CF-02	FCFF and financing reconstruction differ	Debt movement, interest, distribution, or non-operating flow omitted
CF-03	Cash rises while EVA falls persistently	Borrowing, asset sale, working-capital liquidation, or underinvestment
CF-04	FCFE rises faster than FCFF	Increasing net borrowing or falling debt service
CF-05	Distribution exceeds FCFE	Balance-sheet funding or unrecorded claim movement
CF-06	Closing debt does not equal opening debt plus net borrowing	Debt classification, foreign exchange, fair value, or non-cash movement
CF-07	Retained earnings do not roll forward	Net income, dividends, OCI, or equity transaction missing
CF-08	Cash flow closes only after a plug	Model is not mechanically admissible

APPENDIX F

Continuing-Value Governance, Sensitivity, and Failure Analysis

Appendix proposition. Continuing value is a governed economic state, not an endpoint formula. Its inputs must preserve the same operating boundary, tax basis, capital intensity, return mechanism, cash conversion, claim structure, and discount-rate logic used in the explicit forecast.

F.1 Stable-State Entry Conditions

Stable-state variable	Required condition	Governance warning
Operating margin	Stable or explicitly fading toward a defendable level	Avoid terminal margins that exceed competitive and capacity evidence without explanation.
Capital turnover	Stable or linked to a mature working-capital and asset-intensity assumption	Growth cannot occur without the capital required by the business model.
ROIC / ROIIC	Incremental return linked to competitive advantage and reinvestment opportunity	Do not use current exceptional ROIC indefinitely by default.
Growth	Compatible with market size, nominal economy, capacity, and financing	High perpetual growth requires exceptional evidence.
Reinvestment	Derived from growth and incremental return	Do not insert FCFF independently of the capital needed for growth.
WACC	Matched to stable-state cash-flow risk and capital structure	A fixed-hurdle scenario is a control experiment, not a universal forecast.
Claims	Debt, leases, minority interests, pensions, and other claims reach a coherent state	Refinancing assumptions must be explicit.

F.2 Value-Driver Sensitivity Logic

Continuing value is nonlinear. Small changes in WACC and growth can produce large changes when the spread WACC − g is narrow. Sensitivity analysis must therefore change the economic mechanism, not only the final denominator. A higher growth rate generally requires more reinvestment; a lower incremental return raises the reinvestment burden and can reduce value even when growth increases.

Economic state	Condition	Value implication
Value-creating growth	ROIIC > WACC; reinvestment earns positive spread	Growth adds economic-profit value.
Value-neutral growth	ROIIC = WACC	Growth increases scale but does not add intrinsic value beyond capital recovery.
Value-destroying growth	ROIIC < WACC	Growth consumes capital and reduces value.
No-growth mature state	g = 0; maintenance investment preserves capacity	Value derives from existing operating surplus and capital recovery.
Finite-life decline	g < 0 or explicit run-off	Use a finite forecast or declining perpetuity consistent with asset exhaustion.
High-growth transition	Temporary high g followed by a lower stable state	Use a multi-stage model; do not force one perpetual rate.

F.3 Terminal-Value Concentration

In Scenario C, the present value of the continuing period is approximately 53,309.17, about 71.78% of operating enterprise value. This concentration is not automatically an error. It is a governance signal that

the value conclusion depends materially on post-forecast economics. The reviewer must therefore challenge stable return, reinvestment, growth, WACC, competitive durability, and financing capacity with greater intensity than an explicit forecast that contributes most of the value.

Continuing-value share	Indicative interpretation	Required response
Below 40%	Explicit period carries most value	Continue normal terminal review; concentration risk is moderate.
40%–60%	Balanced explicit and continuing contribution	Require transparent value-driver decomposition.
60%–80%	Continuing assumptions dominate	Escalate stable-state evidence, reverse stress, and alternative fade paths.
Above 80%	Valuation is highly dependent on longduration assumptions	Consider longer explicit forecast, finite-life alternatives, or wider valuation range.

F.4 Reverse-Stress Questions

1. What stable ROIC or ROIIC is implied by the current enterprise value after solving for the return consistent with the cash-flow and capital path?
2. What WACC increase would eliminate the growth component of continuing economicprofit value?
3. How much additional operating capital is required if working-capital days or fixed-asset intensity revert to historical or peer norms?
4. What margin decline would reduce EVA to zero in the continuing period?
5. What refinancing cost or debt reduction is required to preserve common-equity distributions?
6. What duration of competitive advantage is embedded in the no-fade assumption?
7. What finite-life value results if terminal growth is replaced by an explicit run-off or concession end?

F.5 Continuing-Value Failure Codes

Code	Failure	Consequence
TV-01	Growth inserted without reinvestment	FCFF overstated and capital state understated.
TV-02	Stable ROIIC substituted into periodic EVA	Annual performance test contaminated by terminal mechanics.
TV-03	WACC ≤ g without finite-life or special justification	Formula unstable or economically implausible.
TV-04	Terminal margin jumps without operating bridge	Value rescued by an unsupported end-state assumption.
TV-05	Debt refinanced indefinitely without cost or covenant effect	Equity value and liquidity resilience overstated.
TV-06	Continuing value discounted from the wrong date	Timing error affects a large portion of total value.
TV-07	Closing capital omitted from economic-profit value	DCF and EVA routes diverge.
TV-08	Non-operating asset included in both FCFF and equity bridge	Double counting.

APPENDIX G

Claim-Specific IRR and XIRR Mapping

Appendix proposition. Internal rates of return are supplementary closure measures tied to specific opening claims and cash-flow sequences. A high rate is not a universal performance conclusion. Each result must be labelled by the capital boundary, dates, interim flows, and terminal recovery that generate it.

G.1 Governing Claim-Specific Results

Claim path	Governing indication	Cash-flow boundary	Interpretation
Total invested funds	Approximately 67.53% XIRR; approximately 67.57% IRR in the detailed worksheet	Broad investor-funds boundary and associated distributions/recovery	Returns the discounted sequence to the anchor equity amount of approximately 6,206 under the model path.
Operating invested funds	Approximately 113.24% XIRR	Operating-capital opening state and FCFF path	Not comparable directly with totalfund or equity return because the base and claims differ.
Common equity	Approximately 103.96% XIRR	Equity cash-flow sequence after financing effects	Residual-claim return; highly sensitive to leverage and initial equity base.
Debt cash flow including interest	Approximately 6.08% XIRR	Debt funding, interest, and principal recovery	Contractual claim return, not company operating performance.

G.2 Why the Rates Differ

Different internal returns are expected because the claims do not share the same opening investment, interim cash flows, seniority, timing, or terminal recovery. The operating-fund path begins with operating capital and uses FCFF. The equity path begins with the equity claim and uses residual cash after debt. The debt path follows contractual interest and principal. The total-invested-fund path includes a broader asset and claim boundary.

The correct validation is within each path: IRR and XIRR should agree when dates are equally spaced and timing conventions match; the present value at the calculated rate should return to the stated opening anchor; and the cash-flow signs should contain at least one economically valid change from investment to recovery. Cross-path ranking is generally meaningless without reconciling the claims.

G.3 IRR Control Checklist

Control	Required evidence
Opening amount	Matches the defined claim and valuation date
Interim cash flows	Include only cash belonging to the claim
Terminal recovery	Matches the residual capital or value allocated to the claim
Dates	Actual dates used for XIRR; standard periods used for IRR
Signs	Investment and recovery signs are economically coherent
Multiple roots	Cash-flow pattern tested for more than one sign change
Reinvestment assumption	IRR not interpreted as an actual reinvestment rate without evidence
Comparison	Rates compared only after boundary and risk reconciliation

APPENDIX H

Financial Radiology, Structural Risk, and Management-Quality Diagnostics

Appendix proposition. Financial radiology identifies the earliest point at which the capitalreturn-cash-value system begins to diverge. The diagnostic objective is not to label every adverse movement as failure. It is to separate operating deterioration, capital-intensity pressure, financing fragility, accounting noise, and model error before the final value conclusion becomes unreliable.

H.1 Structural Risk Taxonomy

Risk family	Trigger	Observable consequence
Boundary risk	Assets, liabilities, income, or claims move between operating and non-operating categories	ROIC, EVA, FCFF, and value change simultaneously without an economic event.
Return risk	ROIC or incremental return declines	Margin pressure, turnover decline, poor investment, or competitive erosion.
Reinvestment risk	Growth requires more capital than forecast	FCFF disappoints despite accounting-profit growth.
Cash-conversion risk	Receivables, inventory, capex, or taxes absorb operating surplus	Profit does not become distributable cash.
Financing risk	Debt service, maturity, covenant, or refinancing pressure rises	FCFE and liquidity weaken before enterprise economics fail.
Equity-absorption risk	ROE or WACE changes because the equity denominator compresses or becomes negative	Leverage-driven optics replace operating improvement.
Terminal risk	Most value depends on unproven stablestate assumptions	Small input changes produce large valuation movement.
Model risk	Independent paths do not close	Formula, timing, unit, sign, or link error.
Governance risk	Overrides, assumptions, or versions are not controlled	Decision cannot be defended or reproduced.

H.2 Early-Warning Indicator Register

Signal	Structural interpretation	Required response
ROIC falls while NOPLAT rises	Capital is growing faster than operating profit	Test incremental ROIC and capital-intensity drivers.
EVA rises while spread falls	Larger capital base is supporting total EVA	Determine whether new capital still earns an adequate incremental return.
FCFF rises because net investment falls sharply	Cash conversion improves mechanically	Distinguish efficiency from deferred maintenance or depleted growth pipeline.
ROE rises while ROIC is flat or falling	Financing or denominator effect	Reconcile debt, buybacks, non-operating income, and operating equity.
FCFE exceeds FCFF persistently	Net borrowing or claim release supports equity cash	Test refinancing and future debt-service capacity.
Debt declines but supplier finance rises	Financing moved to operating liabilities	Reclassify the capital boundary and recalculate returns.
Continuing-value share increases after revisions	Value moved beyond the observable period	Require stronger stable-state evidence and reverse stress.
DCF and EVA diverge after a model update	Implementation or definition failure	Suspend decision until regression tests identify the break.
Per-share value changes without total equity-value change	Share-count scale or unit issue	Exclude external per-share conclusion until certified.

H.3 Management-Quality Attribution

Dimension	Management standard	Evidence
Capital discipline	Allocates capital only where incremental return exceeds the hurdle	Growth accompanied by positive incremental EVA and transparent postinvestment review.
Operating execution	Improves margin and turnover without compromising resilience	ROIC improvement traceable to operating drivers rather than accounting reclassification.
Cash discipline	Converts NOPLAT into cash while funding maintenance and justified growth	FCFF quality, working-capital control, and credible capex schedule.
Financing discipline	Uses debt to support productive capital rather than distributions or weak operations	Coverage, maturity, covenant headroom, and claim-aligned distributions.
Portfolio discipline	Releases capital from sub-hurdle activities and redeploys it productively	Disposals and closures evaluated through incremental EVA and cash consequences.
Disclosure discipline	Explains assumptions, boundaries, deviations, and failed cases	No hidden plugs or selective metrics.
Learning discipline	Compares approved project economics with realised outcomes	Post-investment review changes future decision rules.

H.4 Diagnostic Escalation Levels

Level	Definition	Institutional response
Level 0 — Closed	All material identities close and assumptions are supported	Normal monitoring.
Level 1 — Observation	Adverse trend with no mechanical failure	Assign owner and enhanced monitoring.
Level 2 — Investigation	Material trend or unexplained variance affects value or liquidity	Independent bridge and root-cause analysis.
Level 3 — Decision condition	Base case closes but downside funding, terminal dependence, or execution risk is material	Conditional approval, staging, covenants, reserves, or revised terms.
Level 4 — Refusal	Mechanical closure fails or evidence is materially unsupported	Suspend valuation and decision.
Level 5 — Remediation	Approved decision or model has breached conditions	Capital action, model correction, revalidation, and governance escalation.

APPENDIX I

Institutional Decision Protocols for Boards, Banks, Investors, and Project Committees

Appendix proposition. A decision is institutionally complete only when the economic mechanism, mechanical closure, residual risk, authority, conditions, and monitoring responsibility are recorded separately. The protocols convert the model into accountable action without pretending that formulas replace judgment.

I.1 Board Capital-Allocation Memorandum

Memorandum block	Required content
Decision requested	Amount, timing, legal entity, purpose, and decision authority
Operating mechanism	Price, volume, margin, capacity, working capital, maintenance, and execution drivers
Capital state	Opening capital, incremental capital, non-operating assets, and claim funding
Return test	Existing and incremental ROIC, WACC, EVA, and value range
Cash test	FCFF, FCFE, peak funding, liquidity, and distribution consequences
Downside case	Operational, financing, and terminal stress with break points
Strategic options	Stage, delay, pilot, partner, lease, acquire, dispose, or reject
Conditions	Milestones, covenants, reserves, hedges, approvals, and stop-loss triggers
Monitoring	Owner, reporting frequency, post-investment review date, and invalidation conditions

I.2 Credit Committee Protocol

Credit block	Required analysis
Borrower operating state	Productive capital, ROIC, margin, turnover, and capital intensity
Cash conversion	NOPLAT-to-FCFF bridge and working-capital/capex requirements
Debt service	Interest, amortisation, maturity, covenant, and refinancing schedule
Claim priority	Collateral, guarantees, structural subordination, minority and lease claims
Downside liquidity	Minimum cash, revolver access, sponsor support, and asset-sale feasibility
Terminal/refinancing dependence	Value and repayment reliance beyond the explicit period
Management response	Evidence of capital release, pricing action, cost correction, and governance
Decision	Approve, approve with conditions, restructure, monitor, or decline

I.3 Investor Research Protocol

Research layer	Minimum requirement
Corporate quality	ROIC, incremental ROIC, EVA persistence, cash conversion, financing quality
Claim quality	Enterprise-to-equity bridge, debt, provisions, minority interests, pension, leases
Growth quality	Capital required per unit of NOPLAT and incremental EVA
Management quality	Capital-allocation record, disclosure, post-investment accountability
Valuation	DCF/EVA convergence, continuing-value share, scenario range
Price	Market price relative to claim value and downside recovery
Portfolio context	Liquidity, concentration, correlation, mandate, and transaction costs
Thesis controls	Expected path, monitoring indicators, invalidation conditions

I.4 New-Project Approval Gate

Approval gate	Acceptable evidence
Strategic necessity	Project addresses a defined constraint or opportunity with measurable drivers
Incremental boundary	Only project-specific operating capital, income, and cash are included
Economic return	Incremental ROIC exceeds the hurdle and EVA remains positive in credible cases
Funding	Peak cash need and downside funding are available
Reversibility	Stage gates, options, salvage, and termination rights are explicit
Closure	Project statements, FCFF routes, financing, and value reconcile
Terminal dependence	Residual value is supported by useful life, market, and reinvestment
Post-investment review	Realised capital, return, cash, and value compared with approval case

I.5 Decision Record and Accountability

The final record should distinguish four decisions: the model owner certifies mechanical closure; the business sponsor accepts the operating assumptions; the risk or credit authority accepts the downside and claim consequences; and the board or delegated committee authorises the capital commitment. Combining these roles in one undifferentiated approval weakens accountability.

Role	Accountability
Model owner	Definitions, formulas, data lineage, closure tests
Business sponsor	Operating assumptions, execution plan, benefits, and resources
Finance / treasury	Funding, WACC, liquidity, debt, hedging, and distributions
Risk / credit	Downside, covenants, concentration, recovery, and escalation
Independent validator	Conceptual soundness, implementation testing, and limitations
Decision authority	Capital commitment, conditions, residual-risk acceptance
Monitoring owner	Ongoing indicators, breaches, and post-investment review

APPENDIX J

Model Governance, Protected Reproducibility, and Evidence Release Control

Appendix proposition. Scientific transparency requires that readers can understand and test the reported economic propositions. Intellectual-property protection requires that the executable workbook, cell references, hidden formulas, dependency graph, and implementation know-how remain controlled. The two objectives are compatible when the disclosure boundary is explicit.

J.1 Protected Reproducibility Boundary

Disclosure class	Content
Publishable	Definitions, general equations, governing values, assumptions, selected static evidence, reconciliation results, limitations
Controlled review only	Full-precision schedules, selected independent recalculations, formula dictionary, change log
Confidential	Executable workbook, cell addresses, hidden formulas, linked-sheet logic, macros, dependency order, passwords
Prohibited without written authorisation	Distribution, adaptation, extraction, model replication, training use, commercial reuse, or disclosure of source files

J.2 Model Inventory and Materiality

Inventory field	Required record
Model identity	Unique name, owner, developer, version, date, and location
Purpose	Decisions supported and prohibited uses
Materiality	Financial, regulatory, strategic, and reputational impact
Architecture	Sheets, modules, inputs, calculations, outputs, and interfaces
Data	Sources, dates, transformations, manual inputs, and overrides
Assumptions	Operating, financing, tax, risk, and terminal assumptions
Controls	Reconciliations, regression tests, access, change log, and backup
Validation	Independent reviewer, scope, findings, limitations, and remediation
Monitoring	Performance, drift, breaches, and review cycle

J.3 Independent Validation Program

Validation layer	Minimum work
Conceptual soundness	Challenge the capital boundary, economic logic, required returns, claim treatment, and terminal state.
Data integrity	Verify source completeness, dates, units, signs, transformations, and manual inputs.
Implementation	Recalculate critical identities and inspect formula consistency across periods.
Outcome analysis	Compare forecasts, decisions, and realised results where applicable.
Stress testing	Identify nonlinearity, break points, concentration, and assumptions dominating value.
Governance	Review access, documentation, overrides, competence, approval, and monitoring.
Evidence release	Confirm Word, PDF, equations, images, captions, rights, and metadata match the controlled source.

J.4 Change-Control Classification

Class	Examples	Required action
Minor	Formatting, spelling, or label with no numerical effect	Peer review and version note
Moderate	Input mapping, explanatory table, or noncritical formula	Developer testing, owner approval, targeted regression
Major	Capital boundary, cash-flow logic, WACC, WACE definition, terminal value, claim bridge	Full impact assessment and independent revalidation
Emergency	Temporary override for an immediate decision need	Time-limited approval, explicit rationale, retrospective validation
Evidence-release critical	Any change to accepted numbers, equations, images, rights, title, author data, or metadata	Renewed author review and written approval

J.5 Galley-Proof Zero-Tolerance Controls

Control	Zero-tolerance test
Symbols	No substitution of infinity signs, corrupted minus signs, or malformed equation characters
Numbers	Every accepted amount and percentage compared with the controlled manuscript
Images	No crop removes a controlling row, date, formula, or reconciliation
Titles	No duplicate chapter, heading, caption, or appendix title
Scenario labels	Every numerical exhibit states the controlling workbook/scenario
Rights	Copyright, confidentiality, and approval language preserved
Author data	Correct name, professional status, biography, and contact details
Release	No external release before source verification and rights confirmation

APPENDIX K

Literature Context, Scientific Contribution, and Research Agenda

Appendix proposition. The book builds on established corporate-finance, valuation, residualincome, governance, and financial-statement traditions. Its distinctive contribution is the integration of those traditions into one controlled capital-return-income-cash-claim-time architecture supported by original computational evidence and explicit refusal conditions.

K.1 Intellectual Context

Source tradition	Principal contribution	Role in this book
Modigliani and Miller	Capital structure, cost of capital, and financing propositions	Provides the benchmark for separating operating economics from financing effects.
Jensen and Meckling	Agency costs and ownership/financing conflicts	Supports governance analysis of capital allocation and residual claims.
Jensen	Free cash flow and managerial discretion	Supports the distinction between distributable cash, overinvestment, and financing discipline.
Ohlson; Feltham and Ohlson	Clean surplus and residual-income valuation	Provides the accounting foundation for book value plus present value of residual income.
Lundholm and O'Keefe	Reconciliation of DCF and residual-income estimates	Supports the equivalence principle under consistent forecasts and accounting.
Stewart	Economic Value Added and capital charge	Provides the economic-profit framework used as a periodic value-creation test.
Koller, Goedhart, and Wessels; Copeland et al.	Value drivers, ROIC, growth, and DCF	Supports operating-capital and value-driver analysis.
Penman	Financial-statement analysis and valuation	Supports statement-based reconstruction and residual-income interpretation.
Damodaran	Valuation methods, risk, growth, and terminal value	Provides broad methodological and practical context.
Badr 2026 Paper 1	Closed-loop valuation from estimation to economic proof	Provides capital preservation, convergence, temporal closure, and institutional framing.
Badr 2026 Paper 2	ROIC-to-equity burden and author-defined WACE	Provides the top-down operating-to-equity bridge and negative-equity analysis.

K.2 Distinctive Scientific Contribution

The book does not claim that DCF, EVA, FCFF, FCFE, ROIC, residual income, or capital budgeting were previously unknown. The contribution is architectural: the methods are implemented as mutually constraining representations of one company, year by year and into the continuing state. Each identity becomes a control on the others. The model therefore converts valuation equivalence from a textbook proposition into an auditable workflow.

Contribution	Description
State variable	Operating invested capital is treated as the recursive productive state connecting statements, return, cash, and value.
Top-down equity bridge	Operating return is traced through financing and non-operating layers to net income and the author-defined WACE diagnostic.
Multi-path cash proof	FCFF is derived through net and gross investment routes and reconciled with financing allocation.
Multi-path value proof	DCF, economic-profit, capital-preservation, and enterprise-to-equity routes are required to converge.
Temporal closure	The system re-closes in each period rather than relying on terminal reconciliation.
Boundary-condition analysis	Negative operating equity and denominator compression are analysed rather than normalised away.
Institutional protocols	The framework is translated into board, credit, risk, investor, project, and governance decisions.
Protected reproducibility	Scientific claims are testable while the executable engine remains confidential.

K.3 Empirical and Theoretical Research Agenda

Research stream	Question
Closure residuals and forecast error	Do small unexplained reconciliation differences predict later earnings, cash-flow, or valuation error?
Incremental ROIC and management quality	Does capital-allocation quality measured by incremental EVA predict long-run shareholder outcomes?
WACE and distress	Does the author-defined equity-absorption burden improve early warning during leverage and restructuring cycles?
Terminal concentration	Are valuations with higher continuing-value shares more prone to revision, impairment, or market disappointment?
Credit risk	Does operating-state cash closure improve default and recovery prediction beyond conventional coverage ratios?
Peer ranking	Does closed-loop structural ranking outperform rankings based on growth, ROE, or multiples alone?
Sector state variables	How should the productive state be defined for banks, insurers, utilities, infrastructure, and intangible-intensive firms?
Governance adoption	Do explicit closure and approval protocols reduce capital-allocation errors and post-investment variance?
Stochastic extension	How can probability distributions, options, and path dependence be added without breaking accounting identities?
Machine validation	Can automated formula-lineage and reconciliation tools identify model risk while protecting proprietary logic?

K.4 Limits of the Present Evidence

The original workbooks demonstrate structural implementation and numerical closure; they do not constitute a cross-sectional empirical sample. The case values are illustrative of the author-controlled model and should not be generalised as industry benchmarks. Very high internal returns are claim-specific model outputs, not universal expected returns. Scenario C uses a fixed WACC to isolate operating effects; market-responsive risk requires separate analysis. Continuing-value equality proves formula consistency, not the certainty of stablestate assumptions.

The author-defined WACE requires further theoretical critique and empirical testing. Its proper role in this book is diagnostic and explanatory. It does not replace CAPM, factor models, implied cost of equity, or market valuation. These limitations strengthen rather than weaken the research agenda because they distinguish proven identities from hypotheses requiring external evidence.

K.5 Selected References

Badr, H. H. (2026). Closed-Loop Financial Valuation: From Estimation to Economic Proof. SSRN Working Paper 6064066.

Badr, H. H. (2026). From ROIC to Equity Burden: A Closed-Loop Structural Derivation of the Weighted Average Cost of Equity (WACE). SSRN Working Paper 6132991.

Feltham, G. A., and Ohlson, J. A. (1995). Valuation and clean surplus accounting for operating and financial activities. Contemporary Accounting Research, 11(2), 689–731.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. American Economic Review, 76(2), 323–329.

Jensen, M. C., and Meckling, W. H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360.

Lundholm, R., and O'Keefe, T. (2001). Reconciling value estimates from the discounted cash flow model and the residual income model. Contemporary Accounting Research, 18(2), 311– 335.

Modigliani, F., and Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. American Economic Review, 48(3), 261–297.

Modigliani, F., and Miller, M. H. (1963). Corporate income taxes and the cost of capital: a correction. American Economic Review, 53(3), 433–443.

Ohlson, J. A. (1995). Earnings, book values, and dividends in equity valuation. Contemporary Accounting Research, 11(2), 661–687.

Stewart, G. B. The Quest for Value. HarperBusiness.

Penman, S. H. Financial Statement Analysis and Security Valuation. McGraw-Hill.

Koller, T., Goedhart, M., and Wessels, D. Valuation: Measuring and Managing the Value of Companies. Wiley.

Damodaran, A. Investment Valuation. Wiley.

APPENDIX L

Glossary of Closed-Loop Corporate Finance and Valuation

Appendix proposition. The glossary standardises the book's terminology and prevents familiar words from carrying incompatible meanings across operating, financing, accounting, and valuation domains.

After-tax financing cost: Interest and other financing expense after recognising the applicable tax effect. It belongs in the bridge from operating surplus to equity income, not in the core NOPLAT definition.

Beginning capital: The operating-capital state available at the opening of the period. It is the controlling denominator for the primary periodic ROIC and EVA schedules in Scenario C. **Boundary:** The explicit classification rule defining which assets, liabilities, income, cash flows, and claims belong to a measured economic object.

Capital charge: Beginning operating capital multiplied by the matched required return. Deducting it from NOPLAT produces economic profit.

Capital preservation: Recognition that committed capital is a starting state or claim that must be recovered or rolled forward before surplus is called value creation.

Capital turnover: Revenue relative to operating invested capital. Together with operating margin, it explains ROIC.

Cash-conversion factor: The portion of NOPLAT available as FCFF after the reinvestment required by the growth and incremental-return mechanism.

Claim bridge: The reconciliation that converts operating enterprise value or firm cash flow into the value or cash belonging to a specific financing claim.

Closed loop: A recursive financial system in which opening capital, operating return, income, reinvestment, cash, financing, value, and closing capital reconcile as one process. **Closure residual:** Any unexplained difference remaining between routes that should be equivalent under matched definitions. The residual is a diagnostic signal.

Common-equity value: The value attributable to common shareholders after adding net nonoperating assets and deducting debt and other senior claims from operating value.

Continuing economic-profit value: The value at the terminal date of economic profit expected after the explicit forecast.

Continuing value: The value of the operating system beyond the explicit forecast under a defined stable, fading, or finite-life mechanism.

DCF: Discounted cash-flow valuation. In this book, enterprise DCF is an operating-value route that must reconcile with economic-profit valuation.

Defined equity layer: The precisely reconciled equity denominator used in an author-defined WACE calculation, such as total book equity or operating equity.

EVA: Economic Value Added; used in the book as a periodic economic-profit measure and valuation bridge.

Economic profit: NOPLAT less the required return on beginning operating capital; also the ROIC–WACC spread multiplied by that capital.

Enterprise value: The value of the productive operating system before allocating value to debt and other financing claims.

Explicit forecast: The period for which operating statements, capital, cash flows, financing, and value drivers are modelled individually.

FCFE: Free cash flow to equity; residual cash available to common equity after senior financing flows.

FCFF: Free cash flow to the firm; operating cash available to all capital providers after reinvestment and before financing allocation.

Financial radiology: Diagnostic reading of structural relationships to identify where deterioration or model failure first enters the capital loop.

Fixed point: A result, such as net income, that is reproduced identically through independent analytical paths under the same definitions.

Fixed-hurdle scenario: A controlled scenario holding WACC constant to isolate changes in operating performance and capital state.

Floating WACC: A required-return path that changes with capital structure or market-risk inputs over time.

Goodwill-inclusive ROIC: Return calculated with goodwill included in the capital denominator, addressing return on the full acquisition investment.

Gross investment: Operating additions before depreciation, including capital expenditure, working-capital changes, and other defined operating investment.

IRR: Internal rate of return using equally spaced periods. It belongs to the exact capital and cash-flow boundary used in its calculation.

Incremental EVA: Economic profit generated by additional capital relative to the required return on that capital.

Incremental ROIC: Change in NOPLAT relative to the additional operating capital required to generate it.

Mechanical closure: Numerical reconciliation of identities and paths. It is necessary but does not prove economic plausibility.

NOPLAT: Net operating profit less adjusted taxes; after-tax operating income before actual financing effects.

Net borrowing: Debt issued less debt repaid during the period.

Net investment: Change in operating invested capital; equivalently gross investment less depreciation under matched definitions.

Net non-operating assets: Non-operating assets less associated non-operating liabilities or claims, added separately in the equity-value bridge.

Operating capital: Capital employed in the productive operating system, excluding separately identified non-operating resources.

Operating equity: The model-defined equity support attributed to the operating system after separating non-operating resources and financing claims.

Operating margin: NOPLAT or operating profit relative to revenue, depending on the stated definition.

Operating-state variable: The productive capital quantity carried from one period to the next and transformed into operating income by ROIC.

Per-share control: Verification that total equity value and share count use compatible units. The book excludes per-share conclusions until certified.

Periodic EVA: Economic profit for a specific period using the stated annual capital and WACC convention.

Protected engine: The confidential executable workbook, formulas, dependency logic, and implementation know-how retained under the author's control.

ROE: Net income divided by book equity. It requires careful interpretation when leverage, buybacks, or negative equity affect the denominator.

ROIC: NOPLAT divided by the controlling operating-capital denominator; the transformation coefficient of the productive state.

ROIIC: Return on incremental invested capital used to assess growth economics and stablestate reinvestment.

Reinvestment rate: The portion of operating profit retained to support growth, often expressed as g divided by the return on incremental capital in a stable state.

Residual claim: A claim receiving value or cash after senior contractual obligations are satisfied; common equity is the principal residual claim.

Scenario attribution: Identification of which changed input first caused a changed operating, cash, financing, or value result.

Scenario invariance: Preservation of definitions and closure rules when economic assumptions change.

Senior claim: Debt, preferred equity, minority interest, pension, lease, provision, or other claim ranking ahead of common equity under the stated bridge.

Stable state: A coherent long-duration relationship among growth, return, reinvestment, cash conversion, capital structure, and required return.

Structural proof: Demonstration that independent routes representing the same economic process reconcile under explicit definitions and assumptions.

Structural refusal: Suspension of a result when a mandatory identity, boundary, timing, unit, or governance condition fails.

Tax shield: Reduction in tax arising from deductible financing cost; recognised in the financing bridge and cost of debt.

Terminal concentration: The share of total value represented by the continuing period, used as a governance and sensitivity signal.

Total investor funds: The broad capital financed by equity, debt, and other claims after including operating and non-operating resources.

Valuation-date control: Requirement that cash flows, assets, debt, and value are measured or discounted to the same date.

Value legitimacy: The condition that operating surplus exceeds the required return and survives cash, claim, timing, and scenario tests.

WACC: Weighted average cost of capital applied to the matched operating cash-flow and capital boundary.

WACE: Author-defined ex post equity-absorption architecture. Every numerical use must carry a denominator qualifier. WACE_OE denotes the raw operating-equity absorption rate NI/OE and may also be written r_OE in the computational appendix. WACE_OC denotes the weighted operating-equity contribution expressed on operating capital, NI/OC. Neither measure is a market cost of equity, expected return, or discount rate.

Working-capital investment: Cash absorbed or released by receivables, inventory, payables, and other operating current balances.

XIRR: Date-specific internal rate of return using actual cash-flow dates.

L.1 Abbreviation Index

Abbreviation	Meaning
DCF	Discounted Cash Flow
EVA	Economic Value Added / economic profit
FCFF	Free Cash Flow to the Firm
FCFE	Free Cash Flow to Equity
IRR	Internal Rate of Return
XIRR	Date-specific Internal Rate of Return
NI	Net Income
NOPLAT	Net Operating Profit Less Adjusted Taxes

OC / OIC	Operating Capital / Operating Invested Capital
ROE	Return on Equity
ROIC	Return on Invested Capital
ROIIC	Return on Incremental Invested Capital
WACC	Weighted Average Cost of Capital
WACE	Author-defined Weighted Average Cost of Equity diagnostic

APPENDIX M

Appendix M. Workbook-First Discovery Atlas: The 2005 Top-Down ROIC– WACE Architecture–ROE Proof

This appendix converts a set of visually dense workbook maps into a controlled academic proof. The executable Excel model is the governing source. The screenshots are discovery maps: they identify unusual relationships, weights, denominator changes, and closure points that must be verified in the linked worksheets before they are accepted in the manuscript. No conclusion in this appendix is taken from an image alone.

Central proposition. The same 2005 net income is reproduced from operating capital, operating equity, total equity, and total invested capital through explicit denominator bridges. The percentages differ because the capital bases differ; the monetary result does not. Net income is therefore the fixed point of the top-down operating-to-equity system.

M.1 Evidence Authority and Discovery Protocol

The analysis follows a strict hierarchy. First, the original workbook formulas and linked worksheets establish the definitions and arithmetic. Second, the reported workbook outputs are independently recomputed through algebraic identities. Third, the screenshots identify the most informative regions for publication. Fourth, the manuscript explains the economic meaning and governance consequences. This ordering protects both accuracy and the proprietary implementation.

Priority	Evidence layer	Function in the book	Evidence boundary
1	Original Excel formulas and linked sheets	Governing source for definitions, values, signs, timing, and closure	Executable formulas, cell addresses, dependency graph, and hidden implementation remain protected
2	Verified workbook outputs	Numerical evidence for the stated identities and reconciliations	Only values necessary to explain the proof are published
3	Author-supplied screenshots	Discovery map and visual confirmation of the relevant analytical block	Used selectively; not treated as the source of truth
4	Academic narrative	Explains theory, limitations, interpretation, and decision relevance	Every statement must trace back to the governing workbook evidence

The principal workbook locations used in this appendix are the sheets “Focus Operation Equity & Capital”, “Summary 2005”, “ROIC Analysis”, “WACC Analysis”, “Sophisticated Prove”, “Income Statement for 10 Years”, and “Inv Capital Calculation”. Sheet names are disclosed to establish evidence lineage; cell addresses and implementation logic are not.

M.2 Standardised Notation for the Author-Defined WACE Architecture

The workbook uses several labels for the equity result generated by the operating system. To prevent a large percentage under negative operating equity from being confused with the weighted contribution used in the top-down bridge, this appendix standardises the notation.

Symbol	Definition	2005 value	Interpretive role
OC	Operating invested capital	6,756.00	Productive capital denominator used by ROIC and the operating-return bridge
E	Total book equity	6,206.00	Reported equity denominator used by ROE
OE	Operating equity under the workbook boundary	(786.00)	Residual equity support attributed to operations after the stated financing and non-operating classifications
NI	Net income	4,887.59	Fixed monetary result reproduced by the independent return paths
WACE_OC	Weighted operating-equity contribution on operating capital: NI / OC	72.3444%	Top-down equityattributable return expressed on the operatingcapital base
r_OE	Raw return on operating equity: NI / OE	(621.8308%)	Unweighted raw rate on the operating-equity denominator; diagnostic under negative OE
ROE	Return on total equity: NI / E	78.7559%	Reported equity return after denominator transformation

Terminology limit. WACE_OC is not CAPM, an expected shareholder return, an implied market cost of equity, or a discount rate. It is an ex post weighted contribution produced by the author-defined operatingequity architecture. The raw NI/OE rate is shown separately as r_OE.

M.3 The Workbook Formula Lineage from ROIC to WACE_OC

The sheet "Focus Operation Equity & Capital" constructs the annual equity-attributable income return by starting with ROIC and then applying three model-defined adjustments, each expressed as a percentage of operating invested capital: interest income, debt cost, and the change in intangible assets and related items. The workbook then multiplies the resulting return by operating capital to reproduce net income.

$$WACE\_OC,t = ROIC\_t + \text{Interest-income effect}\_t - \text{Debt-cost effect}\_t - \text{Intangible-and-related change effect}\_t$$

$$NI\_t = WACE\_OC,t \times OC\_t$$

For 2005, the workbook reports the following exact bridge:

$$93.2592\% + 0.5181\% - 7.6821\% - 13.7507\% = 72.3444\%$$

$$72.3444\% \, x \, 6{,}756.00 = 4{,}887.59$$

The aggregate reduction from NOPLAT to net income is 1,413.00. Within the workbook's 2005 attribution block, this amount is composed of interest income of 35.00, debt cost of 519.00, and a 929.00 change in intangible assets and related items. The manuscript preserves the workbook labels and treats their accounting composition as model-specific; it does not silently relabel the 929.00 item as interest, amortisation, or another claim.

2005 bridge component	Amount	Effect on OC	Cumulative return
ROIC / NOPLAT generation	6,300.59	93.2592%	93.2592%
Interest income	35.00	0.5181%	93.7772%
Debt cost	(519.00)	(7.6821%)	86.0952%
Change in intangible assets and related items	(929.00)	(13.7507%)	72.3444%
Net income fixed point	4,887.59	72.3444%	72.3444%

M.4 ROIC as the Top-Level Transformation Coefficient

ROIC is the starting coefficient because it links the productive capital state to after-tax operating income before actual financing and non-operating attribution. The 2005 identity is direct:

$$\text{OC x ROIC} = \text{NOPLAT}$$

$$6{,}756.00 \text{ x } 93.2592\% = 6{,}300.59$$

The economic meaning is stronger than a ratio description. The identity says that the opening operating-capital state generated the measured NOPLAT. Any later equity interpretation must begin from this operating result and then explain every deduction, addition, and denominator change. ROE cannot replace this stage because ROE mixes operating performance with the location and sign of equity.

M.5 Operating Equity as a Residual Capital State

Under the workbook's 2005 boundary, operating debt and leases amount to 7,542.00 while operating invested capital is 6,756.00. Operating equity is therefore negative:

$$OE = OC - Operating\ debt\ and\ leases$$

$$OE = 6{,}756.00 - 7{,}542.00 = (786.00)$$

This does not mean that total accounting equity is negative. Total book equity remains 6,206.00. The result means that, after the model separates the operating state from nonoperating assets and allocates the stated financing claims, the equity support assigned to operations is negative. The condition is a capital-location statement, not a legal insolvency conclusion.

Boundary interpretation. Positive total equity and negative operating equity can coexist because total equity supports the full company, including resources outside the operating-capital denominator. The model therefore asks not only how much equity exists, but where it is economically located.

M.6 The Two Operating-Equity Weights

The images contain two negative percentages that look similar but answer different questions. The workbook distinguishes them through different denominators.

$$w\_OE|OC = OE / OC = (786.00) / 6{,}756.00 = (11.6341\%)$$

$$w\_OE|E = OE / E = (786.00) / 6{,}206.00 = (12.6652\%)$$

The first weight states the operating-equity share of operating capital and is used to recover the raw return on operating equity from WACE_OC. The second states the operating-equity share of total book equity and is used to translate the raw operating-equity return into reported ROE. Treating the two weights as interchangeable would break the model even though both contain the same numerator.

Weight	Numerator	Denominator	2005 value	Bridge function
w_OE|OC	Operating equity	Operating invested capital	(11.6341%)	Connects WACE_OC to the raw return on operating equity
w_OE|E	Operating equity	Total book equity	(12.6652%)	Connects the raw return on operating equity to ROE
E/OC	Total book equity	Operating invested capital	91.8591%	Inverse denominator bridge from ROE back to WACE_OC
OC/E	Operating invested capital	Total book equity	108.8624%	Direct denominator bridge from WACE_OC to ROE

M.7 Raw Return, Weight, and Weighted Contribution

The extreme 2005 percentage is not an arithmetic error. It is the raw return obtained when positive net income is divided by negative operating equity:

$$r_{OE} = \frac{NI}{OE} = \frac{4{,}887.59}{786.00} = (621.8308\%)$$

The same result is recovered from the operating-capital bridge:

$$r_{OE} = WACE_{OC}/w_{\mathrm{OE|OC}} = 72.3444\% \,/\, (11.6341\%) = (621.8308\%)$$

The raw rate is not interpreted as a market return, cost of equity, or stand-alone performance score. It records the mathematical relationship between a positive income numerator and a negative operating-equity denominator. The weighted contribution is recovered when the raw rate is multiplied by the appropriate capital weight.

WACE_OC = r_OE x w_OE|OC

(621.8308%) x (11.6341%) = 72.3444%

Why the two negatives matter. The negative sign of r_OE and the negative sign of the operating-equity weight offset one another. The positive weighted contribution is therefore a structural result of the capital boundary, not a manual correction or a suppression of the negative operating-equity condition.

M.8 The Direct Denominator Bridge from WACE_OC to ROE

The return expressed on operating capital becomes ROE when the numerator remains net income and the denominator changes from operating capital to total equity. The bridge is exact:

ROE = WACE_OC x (OC / E)

ROE = 72.3444% x (6,756.00 / 6,206.00)

ROE = 72.3444% x 108.8624% = 78.7559%

The higher ROE does not mean that a second layer of income was created. It is the same 4,887.59 divided by the smaller total-equity denominator. The equation makes denominator compression visible and prevents a high ROE from being mistaken automatically for a superior operating result.

M.9 The Operating-Equity Route to ROE

The same ROE is independently obtained through the operating-equity layer:

ROE = r_OE x w_OE|E

ROE = (621.8308%) x (12.6652%) = 78.7559%

Both factors are negative, so their product is positive. This route reveals how the location of equity within the company affects reported ROE. The direct WACE_OC route and the operating-equity route must agree; if they do not, the boundary or weight definitions are inconsistent.

M.10 Net Income as the Fixed Point of Three Return Systems

The central closure is monetary rather than rhetorical. Three denominators and three return expressions reproduce one net income:

NI = OC x WACE_OC

NI = OE x r_OE

NI = E x ROE

4,887.59 = 6,756.00 x 72.3444% = (786.00) x (621.8308%) = 6,206.00 x 78.7559%

This equality is the strongest evidence that net income functions as a fixed point. The operating-capital path, the operating-equity path, and the total-equity path use different denominators and different percentages, yet they converge on the same accounting result. A percentage can change dramatically without changing the economic amount because each percentage is a coordinate of the same fixed monetary outcome.

M.11 The Inverse Bridge as an Independent Control

A robust bridge must work in both directions. Starting from ROE, the workbook returns to WACE_OC through the inverse denominator ratio:

$$\text{WACE\_OC} = \text{ROE} \times (\text{E} / \text{OC})$$

$$\text{WACE\_OC} = 78.7559\% \times 91.8591\% = 72.3444\%$$

The inverse calculation is not redundant. It detects sign mistakes, denominator reversal, and hidden use of average versus beginning capital. A bridge that works only in the favourable direction is not a closed-loop control.

M.12 Four Denominators, One Net-Income Numerator

The workbook deliberately displays several returns using the same 4,887.59 numerator. The purpose is not to multiply metrics; it is to show how different capital boundaries answer different questions.

Return expression	Calculation	2005 result	Economic question
Return on total invested capital	NI / total investor funds	29.839%	How large is net income relative to the broad company capital system?
WACE_OC / equity return on operating capital	NI / operating invested capital	72.344%	How much equityattributable income was produced per unit of productive operating capital?
ROE	NI / total book equity	78.756%	How much net income was produced per unit of total book equity?
Raw return on operating equity	NI / operating equity	(621.831%)	What rate corresponds to the model-defined operating-equity layer, including its negative sign?

The four percentages are simultaneously correct only when their denominators are stated. Publishing one without the denominator, capital boundary, and sign would convert a structural proof into a misleading ranking statistic.

M.13 Total-Capital Dilution and the Non-operating Capital Share

The 2005 workbook classifies total investor funds of 16,380.00 and operating capital of 6,756.00. The balance outside the operating-capital denominator is therefore 9,624.00.

$$\text{OC} / \text{Total investor funds} = 6{,}756.00 / 16{,}380.00 = 41.2454\%$$

$$\text{Capital outside OC} / \text{Total investor funds} = 9{,}624.00 / 16{,}380.00 = 58.7546\%$$

$$\text{NI} / \text{Total investor funds} = \text{WACE\_OC} \times (\text{OC} / \text{Total investor funds})$$

$$29.839\% = 72.3444\% \times 41.2454\%$$

The lower return on total invested capital is therefore a denominator effect rather than a contradiction. It also creates a governance question: why does the model classify more than half of total investor funds outside the productive operating-capital denominator? The answer may involve marketable securities, goodwill, intangible assets, non-operating investments, or other stated items, but each component must be traced through the workbook rather than inferred from the screenshot.

M.14 Five-Year Continuity of the Top-Down Cascade

The 2005 case is analytically dramatic because operating equity is negative. The full workbook shows that the architecture continues to close as the capital state changes from 2006 to 2009. The extreme raw return normalises as operating equity becomes positive, while the fixedpoint identities remain intact.

Year	ROIC	Interest income effect	Debt cost effect	Intangible / related change	WACE_OC	Operating capital	Net income
2005	93.26%	0.52%	(7.68%)	(13.75%)	72.34%	6,756	4,887.59
2006	90.95%	1.83%	(4.17%)	(14.08%)	74.53%	9,804	7,306.75
2007	74.29%	0.16%	(2.11%)	(11.49%)	60.84%	14,098	8,577.71
2008	66.91%	0.17%	(0.99%)	(10.45%)	55.64%	17,286	9,618.63
2009	71.40%	0.32%	(0.58%)	(11.30%)	59.84%	19,134	11,450.31

Three patterns are visible. First, ROIC remains positive but declines as operating capital expands, with a partial recovery in 2009. Second, the adjustment block is not constant; therefore WACE_OC cannot be inferred from ROIC by a fixed haircut. Third, net income rises because a lower return is applied to a much larger operating-capital base. This is exactly why percentage and amount must be reviewed together.

M.15 Five-Year Equity-Denominator Transition

Year	OE / OC	Raw NI / OE	OE / E	ROE	Total equity	E / OC
2005	(11.63%)	(621.83%)	(12.67%)	78.76%	6,206.00	91.86%
2006	22.49%	331.37%	22.96%	76.08%	9,604.59	97.97%
2007	67.77%	89.78%	67.61%	60.70%	14,130.34	100.23%
2008	82.07%	67.80%	77.81%	52.75%	18,233.05	105.48%
2009	88.92%	67.30%	82.18%	55.31%	20,702.68	108.20%

The series shows a transition from negative operating equity in 2005 to a strongly positive operating-equity share by 2009. The raw return on operating equity moves from an extreme negative percentage to approximately 67.30% because the denominator changes sign and magnitude. ROE declines even as net income grows because total equity rises and the operating return moderates. These changes are economically interpretable only when numerator and denominator are examined together.

M.16 Mandatory Closure and Falsification Tests

The top-down bridge is not accepted because the percentages look plausible. It is accepted only when every linked identity closes. The following tests should be automated in the workbook and reproduced independently in model validation.

Test	Required equality	Failure indicated
Operating transformation	OC x ROIC = NOPLAT	Wrong capital timing, operating boundary, or NOPLAT construction
Operating-to-equity attribution	ROIC + stated adjustments = WACE_OC	Missing, duplicated, or mis-signed financing / non-operating item
Operating-capital fixed point	OC x WACE_OC = NI	Return and amount do not describe the same operating-capital base
Raw operating-equity rate	WACE_OC / (OE/OC) = NI/OE	Operating-equity weight or denominator is inconsistent
Operating-equity contribution to ROE	(NI/OE) x (OE/E) = ROE	Weight uses the wrong equity base or sign
Direct denominator bridge	WACE_OC x (OC/E) = ROE	Operating capital and total equity are not measured at the same date or unit
Reported-equity fixed point	E x ROE = NI	ROE denominator, equity timing, or net-income mapping is wrong
Total-capital bridge	WACE_OC x (OC/TIF) = NI/TIF	Operating and non-operating capital classification does not reconcile

Structural refusal rule. If any mandatory equality fails beyond an explicitly stated rounding tolerance, the model must refuse the associated interpretation. No averaging of paths, balancing plug, or preferred denominator is permitted.

M.17 Academic Contribution of the Denominator-Bridge Proof

The contribution is not the discovery that ratios change when denominators change. The contribution is the integration of four capital denominators into one linked operating-toequity system in which the monetary result is conserved and each ratio becomes a control on the others. The workbook does not treat ROIC, WACE_OC, the raw return on operating equity, ROE, and return on total investor funds as independent indicators. It organises them as coordinate transformations around a fixed net-income result.

This structure adds three analytical capabilities. First, it distinguishes operating performance from capital location. Second, it interprets negative operating equity without normalising or suppressing the sign. Third, it exposes how a high ROE can coexist with lower ROIC, a large non-operating capital share, or debt exceeding the operating-capital base. The result is a topdown alternative to purely descriptive ratio decomposition.

The framework remains falsifiable. It fails if net income cannot be reproduced through each stated denominator; if the two operating-equity weights are confused; if the adjustment bridge from ROIC to WACE_OC does not equal the monetary movement from NOPLAT to net income; or if the asset-side and financing-side capital classifications do not reconcile.

M.18 Board, Credit, Investor, and Management Implications

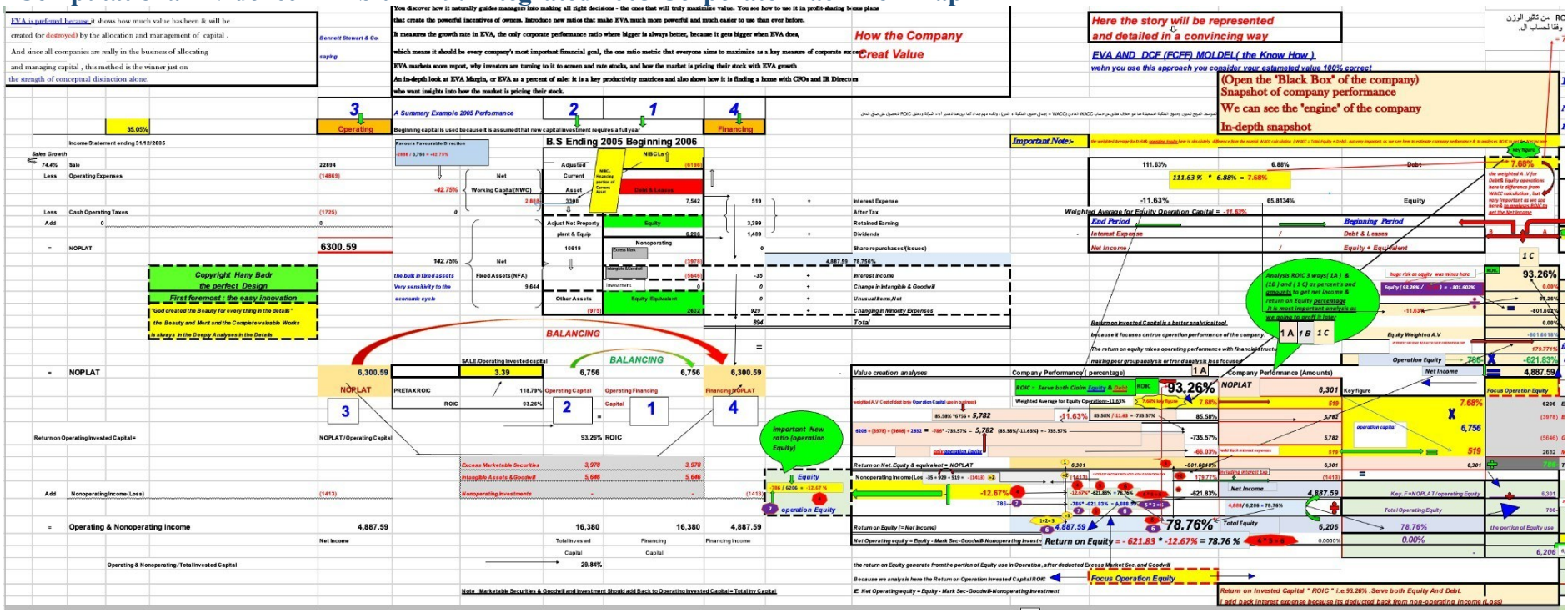
Institutional user	Question revealed by the workbook	Required response
Board and senior management	Why is ROE higher than the equityattributable return on operating capital, and what part of the difference is denominator geometry rather than new economic surplus?	Review ROIC, WACE_OC, capital location, and the non-operating capital share before approving distributions or expansion
Credit committee	Why do operating debt and leases exceed operating capital in 2005, and can durable operating cash support the claim structure?	Test debt service, refinancing dependence, covenant resilience, and the transition of operating equity through time
Investor	Does high ROE reflect strong operations, a compressed denominator, non-operating assets, or leverage?	Compare NI/OC, NI/E, NI/TIF, and incremental ROIC; do not rank companies on ROE alone
Risk function	Which adjustment first converts ROIC into a weaker equity-attributable return?	Monitor debt cost, intangible / related changes, non-operating income, and capital reclassification as separate earlywarning channels
Management accounting / FP&A	Can the company link operational decisions to the capital and equity layers they affect?	Maintain a driver-to-capital-to-return bridge and perform post-investment reviews against the same denominator definitions

M.19 Integrated 2005 Corporate Black-Box Map

Purpose of inclusion. To show the entire operating, financing, non-operating, equity, and netincome architecture before the individual bridges are enlarged.

How to read the exhibit. Begin at the income-statement and operating-capital blocks, follow ROIC to NOPLAT, then trace the stated adjustment channels to WACE_OC, the operating-equity layer, ROE, and the repeated 4,887.59 net-income result.

Computational Evidence Exhibit M-19: Integrated 2005 Corporate Black-Box Map



Source and evidence identification. Author-supplied master screenshot used as a discovery map. Governing values and relationships verified in the author-controlled workbook, principally the sheets "Summary 2005", "Focus Operation Equity & Capital", "ROIC Analysis", and "WACC Analysis".

Workbook-derived interpretation. The master map contains multiple correct ratios because the same net income is expressed on total investor funds, operating capital, total equity, and operating equity. The workbook proves that the amounts converge even when the percentages differ sharply.

Academic significance. The image visually establishes the book's central claim: a company can be reconstructed as one capital-return-income system rather than a collection of independent ratios.

Control or reconciliation test. All highlighted paths must reproduce 4,887.59 and reconcile the stated capital boundaries. The image is not accepted as evidence without the workbook-based checks in Sections M.3-M.16.

Decision and governance implication. Boards and analysts should use the map to identify where a changed assumption first enters the system, rather than jumping directly from an operating narrative to ROE or value.

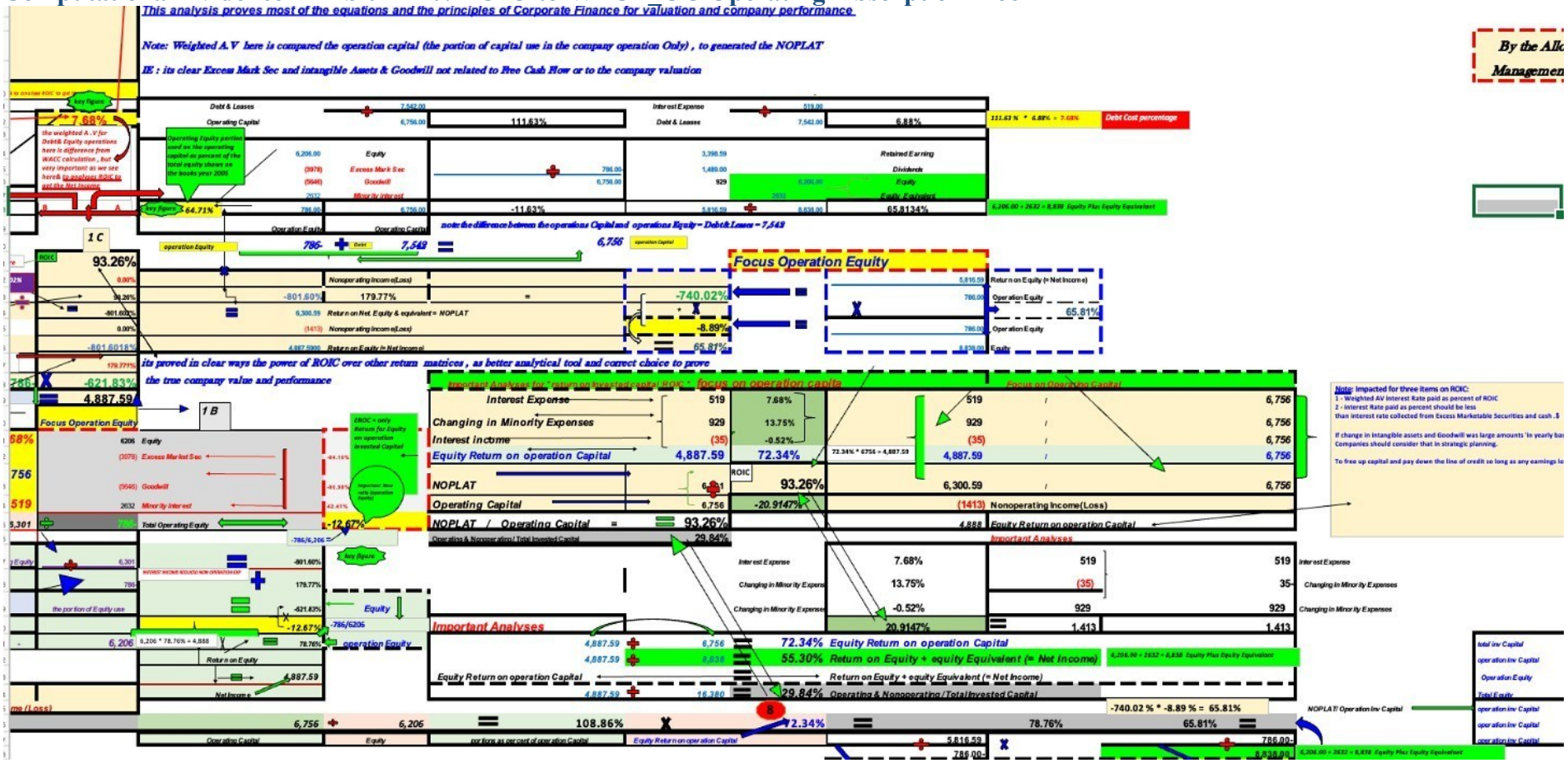
Connection to the next exhibit. The next exhibit enlarges the ROIC-to-WACE_OC adjustment block that is too dense to read reliably in the master view.

M.20 ROIC-to-WACE_OC Operating-Absorption Block

Purpose of inclusion. To isolate the exact path by which ROIC is adjusted for interest income, debt cost, and the model-defined change in intangible assets and related items before net income is reproduced.

How to read the exhibit. Read the percentage bridge first: 93.26% + 0.52% - 7.68% - 13.75% = 72.34%. Then read the amount bridge: 6,300.59 + 35 - 519 - 929 = 4,887.59. Finally verify 72.34% x 6,756 = 4,887.59.

Computational Evidence Exhibit M-20: ROIC-to-WACE_OC Operating-Absorption Block



Source and evidence identification. Focused crop from an author-supplied screenshot. All amounts and formulas verified in the workbook sheet "Focus Operation Equity & Capital" and reconciled to "Summary 2005".

Workbook-derived interpretation. The percentage bridge and the amount bridge are the same economic transformation expressed in different units. The image also shows why ROIC cannot be interpreted as the shareholder result without explaining the intervening absorption channels.

Academic significance. This exhibit provides a top-down attribution mechanism that connects operating performance to equity income without accepting net income as an unexplained accounting endpoint.

Control or reconciliation test. The percentage sum, monetary sum, and multiplication by operating capital must all close. Failure in any one of the three tests identifies a sign, classification, or denominator error.

Decision and governance implication. Management can see which channel erodes the transfer from operating performance to equity income and can assign accountability to debt cost, nonoperating return, or capitalised / intangible items.

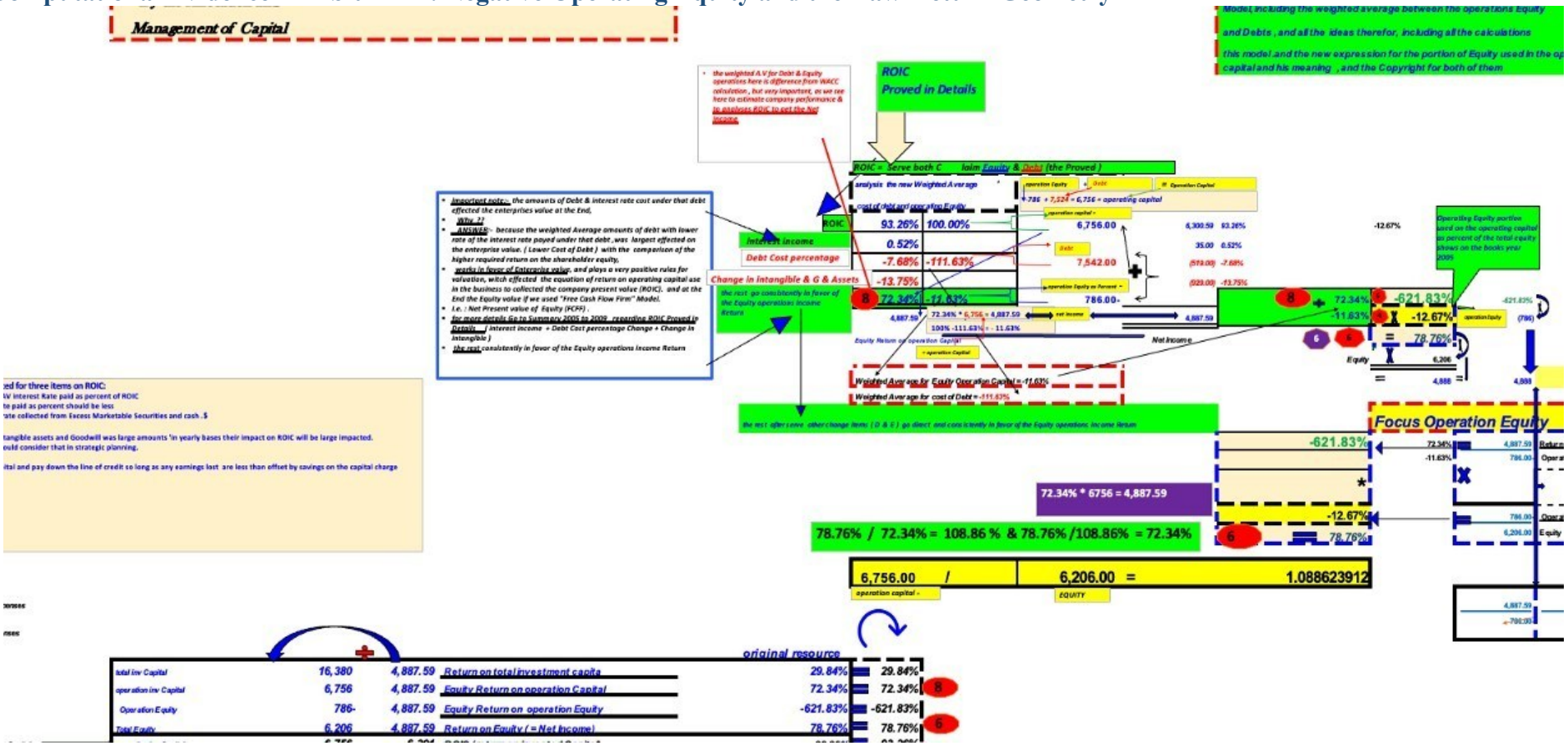
Connection to the next exhibit. The next exhibit moves from the operating-capital return to the negative operating-equity denominator and distinguishes raw return from weighted contribution.

M.21 Negative Operating Equity and the Raw-Return Geometry

Purpose of inclusion. To explain why operating equity equals negative 786, why the operating-equity weights are negative, and why the raw NI/OE percentage becomes an extreme negative value without invalidating the system.

How to read the exhibit. Identify operating capital of 6,756 and operating debt and leases of 7,542. Their difference produces operating equity of negative 786. Then distinguish OE/OC of negative 11.63% from OE/E of negative 12.67%.

Computational Evidence Exhibit M-21: Negative Operating Equity and the Raw-Return Geometry



Source and evidence identification. Focused crop from an author-supplied screenshot. Governing capital and return values verified in "Summary 2005" and "Focus Operation Equity & Capital".

Workbook-derived interpretation. The image reveals that capital location matters. Positive total equity does not imply positive equity support inside the operating boundary. It also shows that raw return, weight, and weighted contribution are separate objects.

Academic significance. The boundary condition provides a rigorous explanation for a percentage that conventional ratio analysis may dismiss as meaningless. The sign is information about the state, not a defect to be normalised away.

Control or reconciliation test. The raw return must equal NI/OE and WACE_OC divided by OE/OC. The two weights must reconcile independently to their own denominators.

Decision and governance implication. Credit and risk reviewers should treat debt exceeding operating capital as a funding-structure signal and test the cash path, not merely celebrate a high reported ROE.

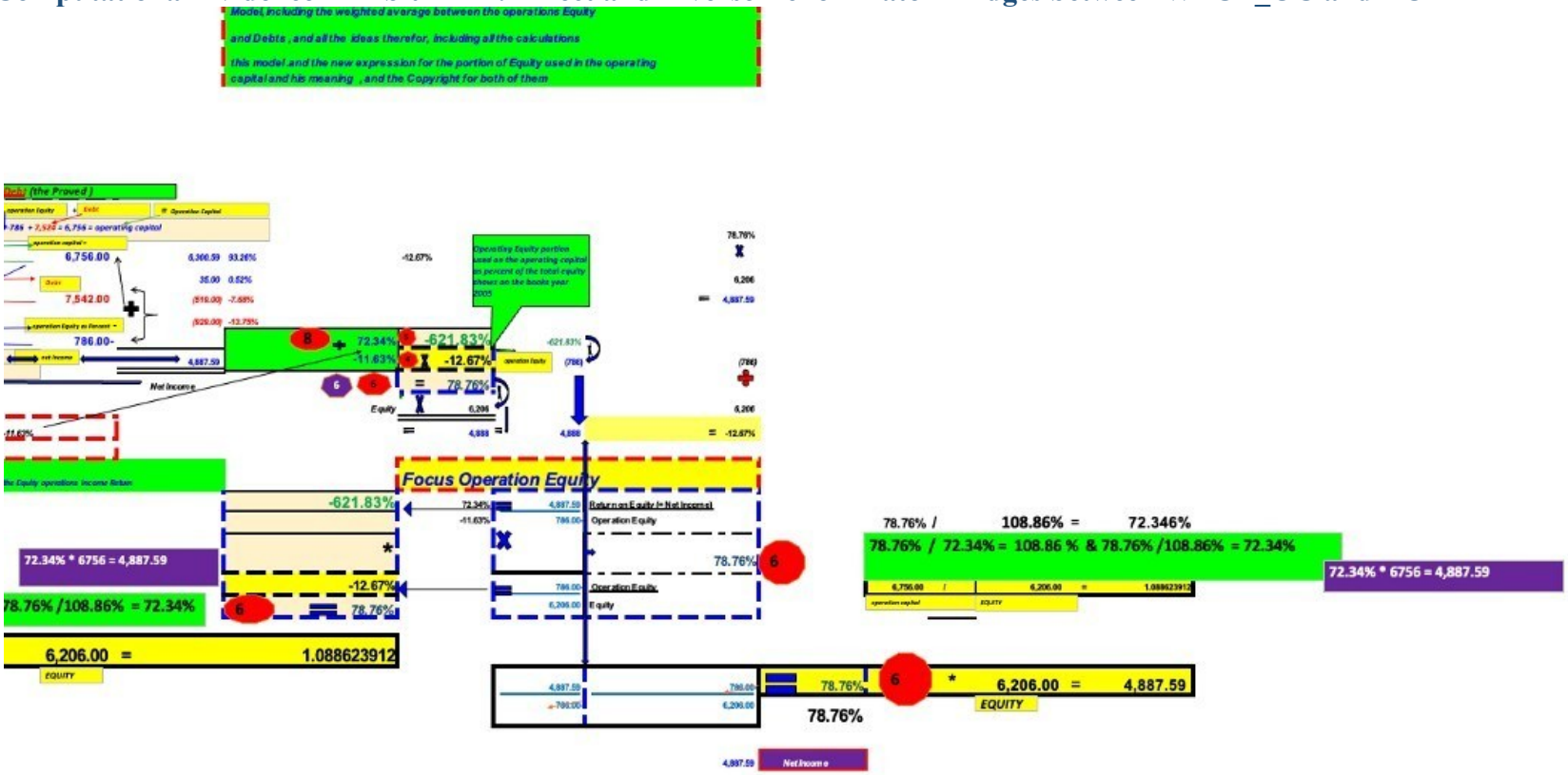
Connection to the next exhibit. The next exhibit isolates the direct and inverse denominator bridges between WACE_OC and ROE.

M.22 Direct and Inverse Denominator Bridges between WACE_OC and ROE

Purpose of inclusion. To make the denominator transformation readable without the visual density of the complete model map.

How to read the exhibit. Follow the direct bridge 72.3444% x (6,756 / 6,206) = 78.7559%. Then reverse it: 78.7559% x (6,206 / 6,756) = 72.3444%. Finally verify that either rate multiplied by its own denominator produces 4,887.59.

Computational Evidence Exhibit M-22: Direct and Inverse Denominator Bridges between WACE_OC and ROE



Source and evidence identification. Focused crop from an author-supplied screenshot. The ratio transformations were independently verified from the workbook values OC = 6,756, E = 6,206, WACE_OC = 72.3444%, and ROE = 78.7559%.

Workbook-derived interpretation. The exhibit proves that the difference between 72.34% and 78.76% is not unexplained performance. It is a change of coordinate from operating capital to total equity with the numerator held constant.

Academic significance. The two-way bridge is a denominator-control theorem within the workbook: any reversal, timing mismatch, or unit difference appears immediately as a failed inverse calculation.

Control or reconciliation test. The direct and inverse calculations must return exactly to 72.3444% and 78.7559%, and both rates must reproduce 4,887.59 on their own denominators.

Decision and governance implication. ROE should be interpreted only after management and investors understand the operating-capital return and the OC/E transformation factor.

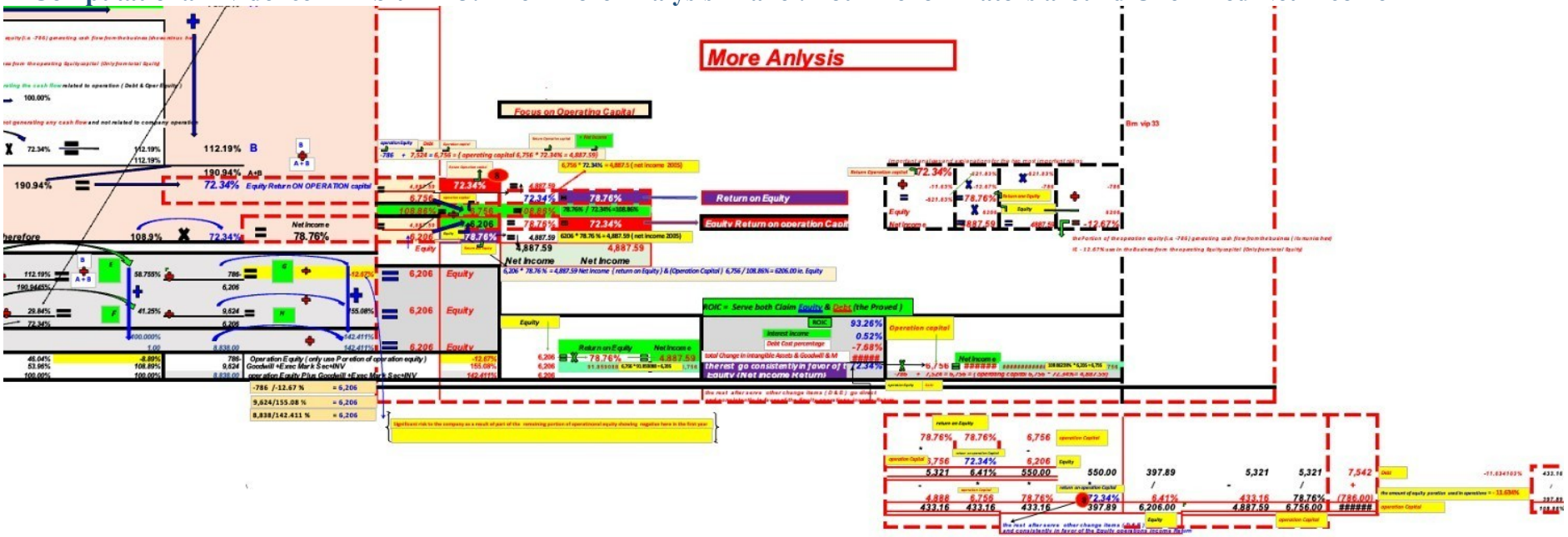
Connection to the next exhibit. The next exhibit integrates the four-denominator return matrix and shows how the same fixed point supports broader management analysis.

M.23 The "More Analysis" Panel: Four Denominators around One Fixed Net Income

Purpose of inclusion. To show how the workbook extends the fixed-point logic beyond ROE to total investor funds, operating capital, total equity, and operating equity, while retaining one monetary result.

How to read the exhibit. Read each ratio with its denominator. Do not compare 29.84%, 72.34%, 78.76%, and negative 621.83% as if they were alternative estimates of the same metric. They are different coordinates of the same 4,887.59 numerator.

Computational Evidence Exhibit M-23: The "More Analysis" Panel: Four Denominators around One Fixed Net Income



Source and evidence identification. Focused crop from an author-supplied screenshot. Governing values verified in the original workbook; the image is used to identify the multidenominator relationships and management questions.

Workbook-derived interpretation. The panel demonstrates why dense ratio architecture is not redundant when every ratio has a defined structural role. The ratios cross-check capital allocation, operating performance, equity absorption, and the effect of capital outside the operating denominator.

Academic significance. The exhibit converts ratio proliferation into a closed system: each ratio can be derived from another through a stated capital weight and all routes return to net income.

Control or reconciliation test. Each displayed return must equal net income divided by its labelled denominator, and the capital-weight transformations must reconcile without a plug.

Decision and governance implication. Boards can use the panel to distinguish a genuine operating improvement from an optical change caused by leverage, denominator compression, or reclassification of capital.

Connection to the next analytical stage. Appendix N extends the same workbook-first method to the remaining hidden relationships in the summary, financing, DCF, EVA, continuing-value, and IRR blocks.

M.24 Integrated Reading Sequence for the Five Exhibits

1. Exhibit M-19 establishes the full company map and identifies the principal capital, operating, financing, and equity layers.
2. Exhibit M-20 proves the top-down movement from ROIC to WACE_OC and net income through both percentage and amount bridges.
3. Exhibit M-21 opens the negative operating-equity boundary and separates raw return from capital weight and weighted contribution.
4. Exhibit M-22 proves the direct and inverse denominator transformations between WACE_OC and ROE.
5. Exhibit M-23 places the same net income against four capital denominators and converts the ratio system into management and governance questions.

The sequence is deliberately pedagogical. The reader first sees the whole system, then the operating bridge, then the exceptional operating-equity state, then the denominator algebra, and finally the full return matrix. This order prevents the screenshots from becoming decorative evidence and turns them into a controlled map of the workbook's hidden logic.

M.25 Final Appendix Conclusion

The 2005 workbook evidence supports a precise top-down conclusion. Operating capital generates NOPLAT through ROIC. Stated financing and non-operating adjustments transform ROIC into WACE_OC. The operating-equity state and its weights reveal the raw return on operating equity. A denominator bridge converts WACE_OC into reported ROE. Every route reproduces the same net income. The system is therefore closed not because the percentages are equal, but because the capital weights explain why they differ while the monetary result is conserved.

OC x ROIC -> NOPLAT -> stated absorption -> OC x WACE_OC = OE x WACE_OE (= OE x r_OE) = E x ROE = NI

The images are valuable because they reveal where to investigate. The Excel workbook remains the authority because it establishes what each box, arrow, weight, and equation actually means. The next appendix will apply the same workbook-first discipline to the remaining DCF, EVA, continuing-value, financing-claim, and IRR discoveries.

APPENDIX N

Appendix N. Workbook-First Closure of Cash Flow, Value, Continuing Economics, Financing Claims, and Internal Returns

Authority of this appendix. Every accepted amount and identity in this appendix is derived from the controlling Excel workbook ranges. Screenshots may later be used to direct the reader to a visual block, but they do not establish the amount, formula, timing convention, or conclusion. The workbook is the source; visual evidence is secondary.

N.1 Purpose and Logical Position

Appendix M opened the operating-to-equity return engine and demonstrated how one monetary result can be expressed through ROIC, WACE_OC, WACE_OE (also denoted r_OE in the computational algebra), reported ROE, and several capital denominators. Appendix N follows the same workbook-first discipline after net income has been explained. Its task is to prove how operating income is converted into free cash flow, how cash is allocated among financing claims, how the explicit and continuing periods form one operating value, and why DCF, economic-profit, enterprise-to-equity, and claim-specific return routes must describe the same company.

The appendix deliberately separates four questions that are often compressed into one valuation output. First, did the operating system convert NOPLAT into cash after the capital required for the next state? Second, did the financing bridge allocate that cash without double counting debt, interest, provisions, distributions, or non-operating resources? Third, did the continuing period preserve the same relationship among growth, reinvestment, return, and the hurdle? Fourth, do the internal return measures correspond to clearly identified capital claims rather than being compared as though they were interchangeable performance ratios?

Operating state -> NOPLAT -> net investment -> FCFF -> financing claims -> FCFE -> DCF / EVA closure -> claim-specific return tests

N.2 Evidence Hierarchy and Accepted Computational Boundary

Level	Evidence object	Permitted use	Prohibited inference
1	Controlling Excel formulas and linked worksheets	Defines amounts, signs, timing, capital boundaries, formula lineage, and zero checks.	No published conclusion may contradict the workbook formula chain.
2	Verified workbook outputs in the controlling 2005-2009 and T+1 ranges	Supports the numerical tables and closure certificates in this appendix.	A displayed value cannot be generalized outside its stated claim, period, or denominator.
3	Author screenshots and focused crops	Helps the reader locate a hidden relationship and understand the visual sequence.	A screenshot alone cannot settle a formula, ambiguous label, or broken legacy reference.
4	Academic narrative	Explains economic meaning, institutional use, and limits of interpretation.	Narrative cannot repair a failed identity or override a workbook inconsistency.

The accepted computational boundary includes the valid five-year forecast, the stated stableperiod mechanics, the DCF and economic-value schedules, the enterprise-to-equity bridge, and the claim-specific cash-flow series identified below. Broken historical formulas that survive in unused extended ranges are documented as source-control exceptions. They are neither hidden nor promoted into accepted evidence.

N.3 The Operating-State Recursion behind Free Cash Flow

Free cash flow cannot be interpreted independently of the capital state. Beginning operating capital is the productive state inherited from the preceding period. Net investment changes that state. Ending operating capital becomes the opening capital of the next period. The cashflow deduction is therefore not an arbitrary adjustment to profit; it is the monetary cost of moving the operating system from one state to another.

$$\text{Ending Operating Capital}_t = \text{Beginning Operating Capital}_t + \text{Net Investment}_t$$

$$\text{FCFF}_t = \text{NOPLAT}_t - \text{Net Investment}_t$$

The recursion allows every annual FCFF amount to be challenged through the balance sheet. If an analyst reports a net investment amount that does not reconcile the beginning and ending capital states, the cash flow has not been proven. Conversely, a correct state transition explains why a highly profitable company may report lower current cash when it is committing capital to future operations.

Year	Beginning operating capital	NOPLAT	Net investment	FCFF	Ending operating capital
2005	6,756	6,300.59	3,048.00	3,252.59	9,804
2006	9,804	8,916.75	4,294.00	4,622.75	14,098
2007	14,098	10,472.71	3,188.00	7,284.71	17,286
2008	17,286	11,565.63	1,848.00	9,717.63	19,134
2009	19,134	13,661.31	1,660.00	12,001.31	20,794

The table shows a capital base that rises from 6,756 at the opening of 2005 to 20,794 at the end of 2009. The same five-year sequence converts NOPLAT of 50,917.00 into cumulative FCFF of approximately 36,878.99 after net investment of approximately 14,038.01. Small total differences may appear when displayed annual amounts are rounded to two decimals; the workbook uses full-precision formulas as the governing amounts.

N.4 Two Independent FCFF Constructions

The workbook does not rely on one cash-flow formula. It constructs FCFF through a direct state-transition route and through a gross cash-flow route. Their equality is important because the two routes expose different classes of error.

N.4.1 Direct NOPLAT-minus-net-investment route

$$\text{FCFF}_t = \text{NOPLAT}_t - (\text{Ending Operating Capital}_t - \text{Beginning Operating Capital}_t)$$

This route is sensitive to the definition of operating capital, the treatment of working capital, acquisitions, disposals, goodwill, and non-operating resources. A silent change in the capital boundary immediately affects both net investment and cash flow.

N.4.2 Gross operating cash-flow-minus-gross-investment route

$$\text{FCFF}_t = \text{Gross Operating Cash Flow}_t - \text{Gross Investment}_t$$

$$\text{Gross Operating Cash Flow}_t = \text{NOPLAT}_t + \text{Depreciation and Operating Amortisation}_t$$

$$\text{Net Investment}_t = \text{Gross Investment}_t - \text{Depreciation and Operating Amortisation}_t$$

The gross route is sensitive to depreciation, capital expenditure, working-capital additions, intangible investment, and non-cash asset movements. It is particularly valuable when a model appears to produce correct FCFF while using an inconsistent depreciation or capital expenditure convention.

Five-year workbook aggregate	Amount	Structural interpretation
Gross investment	30,191.00	Total cash committed to working capital, productive assets, and other operating investment under the workbook classification.
Depreciation and operating amortization	16,153.00	Non-cash operating charge added back in the gross cash-flow route and deducted from gross investment to obtain net investment.
Net investment	14,038.00	Increase in the productive operating state across the explicit period.
Opening operating capital	6,756.00	State available at the beginning of the first explicit period.
Ending operating capital	20,794.00	Closing state after cumulative net investment; also the capital entering the continuing-value decomposition.
Cumulative FCFF	36,878.99	Cash generated for all capital providers after operating reinvestment.

Control conclusion. The equality of the two FCFF routes is not a decorative check. It simultaneously tests the income statement, operating-capital roll-forward, depreciation policy, investment classification, and cashflow construction. A non-zero difference suspends valuation until the source is identified.

N.5 From Operating Cash to Financing-Flow Closure

FCFF belongs to all capital providers before financing allocation. The workbook therefore constructs a financing-flow schedule that explains where the operating cash goes. The schedule is not a second definition of FCFF. It is a sources-and-uses reconciliation between the operating layer and the claim layer.

FCFF_t = Financing Flow_t, after all stated claim movements and distributions are mapped consistently

Five-year financing component	Amount	Interpretive role
After-tax interest income	(329.00)	Income associated with financial or non-operating balances, presented with the workbook sign convention.
Movement in excess cash and marketable securities	6,899.99	Change in resources held outside the operating-capital denominator.
After-tax interest expense	1,508.00	Cash burden of interest-bearing claims after the model tax treatment.
Movement in provisions and related claims	(829.00)	Change in claim balances requiring sign and classification control.
Net debt movement	5,421.00	Borrowing less repayment across the explicit period.
Dividends and distributions	24,208.00	Cash transferred to equity holders under the workbook sequence.
Total financing flow	36,878.99	Amount reconciling to cumulative FCFF.

The financing closure has two governance implications. First, distributions should not be described as generated by operations unless the operating FCFF route supports them. Second, borrowing can increase cash available to equity in a period without improving the operating engine. The reconciliation therefore protects the reader from confusing financing quantity with financing quality.

At the annual level, a residual difference may indicate that debt has been entered with the wrong sign, interest has been deducted twice, non-operating cash has been treated as operating cash, a provision movement has been omitted, or distributions have been recorded in a different period. The correct response is investigation, not insertion of a balancing plug.

N.6 Explicit-Period DCF: Five Annual Cash Flows, One Valuation Date

The enterprise DCF begins only after FCFF has passed the operating and financing closure tests. The five explicit cash flows are discounted at the fixed Scenario C hurdle of approximately 17.675365%. The fixed hurdle is a controlled analytical regime: it isolates the effect of operating and capital-state changes. It should not be interpreted as evidence that economic risk remains constant in all real-world periods.

Year	FCFF	Discount factor	Present value	Cumulative PV
2005	3,252.59	0.8497955	2,764.04	2,764.04
2006	4,622.75	0.7221525	3,338.33	6,102.37
2007	7,284.71	0.6136819	4,470.49	10,572.86
2008	9,717.63	0.5215042	5,067.78	15,640.65
2009	12,001.31	0.4431719	5,318.64	20,959.29

The full-precision workbook total for the explicit period is approximately 20,959.29. The progression of present values is analytically informative: later FCFF amounts are larger, but they are more heavily discounted. A reviewer should therefore examine both the operating growth that produces the cash and the timing risk that determines its present value.

N.6.1 Valuation-date discipline

Every cash flow, capital claim, and bridge item must be placed on the same valuation date. A one-period timing shift can preserve the appearance of a coherent schedule while materially changing value. The discount exponent, beginning-versus-ending convention, and treatment of the first forecast period must therefore be stated before the result is accepted.

N.6.2 Units and scale

The workbook values are reported in the model's stated monetary units. Enterprise value, debt, non-operating assets, and equity value must remain on the same scale. The workbook per-share row is not accepted in this manuscript because its share-count scale has not been independently certified. Excluding an uncertified output is a control strength, not an omission.

N.7 Continuing Value as a Derived Operating State

The continuing period is not introduced as an unexplained terminal amount. It is derived from a stable operating state in which NOPLAT growth, incremental return, reinvestment, cash conversion, and the hurdle are mutually constrained. This is the point at which a conventional perpetuity formula becomes an economic proof rather than a terminal shortcut.

$$\text{Reinvestment Rate} = g \,/\, \text{Stable Return on Incremental Operating Capital}$$

$$\text{Stable FCFF} = \text{NOPLAT}_{(t+1)} \times (1 - g \,/\, \text{Stable Return})$$

$$\text{Continuing Operating Value}_t = \text{Stable FCFF}_{(t+1)} \,/\, (\text{WACC} - g)$$

Stable-period variable	Workbook value	Meaning and control question
NOPLAT t+1	14,617.60	After-tax operating income entering the stable state. Is the level supported by the explicit-period operating trajectory?
Long-run growth g	7.00%	Growth assumption to be funded by reinvestment, not added independently to cash flow.
Stable incremental return	57.6079%	Return earned on the next unit of operating capital in the terminal mechanics; distinct from the periodic T+1 ROIC earned on the full operating-capital stock.
Implied reinvestment rate	12.1511%	Portion of NOPLAT retained to support 7% growth at the stated incremental return.
Cash-conversion factor	87.8489%	Portion of stable NOPLAT available as FCFF after required reinvestment.
Stable FCFF t+1	12,841.40	Cash flow entering the growing perpetuity.
WACC minus g	10.6754%	Capitalisation spread; must remain positive and economically defensible.
Continuing operating value	120,290.05	End-of-explicit-period value of the stable operating state.

The stable incremental return is the critical economic constraint. If growth rises without a corresponding increase in reinvestment, or if the incremental return falls while the reinvestment rate is held constant, the terminal state no longer closes. The formula may still produce a number, but the number would not represent the same operating system.

Essential distinction. The stable incremental return used in continuing-value mechanics is not substituted into the periodic EVA schedule. Periodic EVA for 2005–2009 and T+1 uses the stated beginning-capital convention. The terminal value-driver return answers a different question: what return is earned on incremental capital required to sustain stable growth?

N.8 The Concentration of Value in the Continuing Period

Operating-value component	Present value	Share of operating enterprise value	Interpretation
Explicit FCFF, 2005-2009	20,959.29	28.2210%	Value supported by five individually modelled annual cash flows.
Continuing operating value	53,309.17	71.7790%	Value dependent on the stable relationship among NOPLAT, growth, incremental return, reinvestment, and WACC.
Operating enterprise value	74,268.46	100.0000%	Combined value of the explicit and continuing operating states.

A continuing-value share of approximately 71.78% is not automatically an error. It is a governance signal. It tells the board, investor, or credit committee that most of the operating value depends on economics beyond the explicit five-year period. The appropriate response is not to reject the model mechanically, but to increase the burden of evidence around stable margins, market capacity, reinvestment needs, incremental ROIC, the hurdle, competitive fade, and financing resilience.

N.8.1 Concentration test

The concentration test asks what would remain if the stable spread narrows, if the growth rate falls, or if reinvestment becomes more capital intensive. Sensitivity should be applied to the relationship among variables, not to one terminal parameter in isolation. For example, reducing growth while leaving the stable return and reinvestment rate unchanged violates the value-driver identity unless the entire stable state is recalculated.

N.9 Enterprise-to-Equity Bridge: Converting the Operating Asset into the Residual Claim

Operating enterprise value is not common-equity value. The bridge adds resources excluded from the operating cash-flow denominator and subtracts claims senior to common equity. Each item must be included exactly once. An asset excluded from operating capital and FCFF should normally be added in the bridge; a debt claim already reflected in equity cash flow must not be subtracted a second time.

Bridge item	Amount	Sign	Reason for treatment
Operating enterprise value	74,268.46	Base	Present value of explicit and continuing FCFF.
Excess cash and marketable securities	3,978.00	Add	Non-operating resource excluded from the operating return and FCFF boundary.
Goodwill and identified intangible position	5,646.00	Add under workbook classification	Resource classified outside the controlling operating-value route in the stated bridge.
Long-term non-operating investment	0.00	Add	No amount in the controlling bridge.
Interest-bearing debt	7,542.00	Subtract	Senior financing claim.
Minority interest and related superior claim	2,632.00	Subtract	Claim on enterprise value not attributable to common shareholders.
Provisions / other stated claim	0.00	Subtract	No amount in the controlling bridge.
Common-equity value	73,718.46	Result	Residual value after nonoperating resources and senior claims.

74,268.46 + 3,978.00 + 5,646.00 - 7,542.00 - 2,632.00 = 73,718.46

The bridge explains why common-equity value can be close to operating enterprise value even when several large items are added and subtracted: the positive non-operating resources and senior claims offset one another. The equality is economically meaningful only because the operating boundary was defined before valuation. Without that boundary, the same asset or claim could be embedded in cash flow and repeated in the bridge.

N.10 Periodic Economic Profit: The Annual Legitimacy Test

DCF measures value through cash after reinvestment. Economic profit measures the annual surplus after charging the opening operating-capital state for its required return. The two methods use different representations of the same forecast. Their equivalence is not achieved by tuning a residual; it follows from the capital recursion when timing and boundaries are consistent.

$$EVA\_t = NOPLAT\_t - WACC \times Beginning\ Operating\ Capital\_t$$

$$EVA\_t = (ROIC\_t - WACC) \times Beginning\ Operating\ Capital\_t$$

Year	Beginning operating capital	ROIC	Fixed WACC	ROIC-WACC spread	Economic profit
2005	6,756	93.26%	17.6754%	75.58%	5,106.44
2006	9,804	90.95%	17.6754%	73.27%	7,183.86
2007	14,098	74.29%	17.6754%	56.61%	7,980.84
2008	17,286	66.91%	17.6754%	49.23%	8,510.27
2009	19,134	71.40%	17.6754%	53.72%	10,279.31

Economic profit remains positive throughout the explicit period because ROIC exceeds the fixed hurdle by a wide margin. Yet the spread narrows as the operating-capital base expands. This combination is analytically important: absolute EVA can rise while return efficiency declines. A board that sees only rising EVA may miss deterioration in incremental capital productivity; a board that sees only falling ROIC may miss the fact that a larger capital base is still earning a substantial positive spread.

N.11 Present Value of Economic Profit and the DCF Equivalence

Year	Economic profit	Discount factor	Present value of EVA
2005	5,106.44	0.8497955	4,339.43
2006	7,183.86	0.7221525	5,187.84
2007	7,980.84	0.6136819	4,897.70
2008	8,510.27	0.5215042	4,438.14
2009	10,279.31	0.4431719	4,555.50

The present value of explicit-period EVA is approximately 23,418.61 using the displayed discount factors. Adding the present value of continuing economic profit of approximately 44,093.85 produces total intrinsic value added of approximately 67,512.46. The opening operating capital of 6,756 is then added once, because DCF returns the capital through cash whereas the EVA representation begins with the capital already committed.

$$\text{Operating Value} = \text{Opening Operating Capital} + \text{Present Value of Future EVA}$$

$$74{,}268.46 = 6{,}756.00 + 67{,}512.46$$

The equality with DCF demonstrates that the methods do not create separate values. If DCF and economic-profit valuation diverge, the reviewer should investigate timing, capital rollforward, discounting, terminal reinvestment, non-operating classifications, and the valuation date. Averaging the two values would conceal the error rather than resolve it.

N.12 Continuing Economic Profit and the Stable-State Decomposition

The continuing operating value can also be represented as the closing operating-capital state plus the value of economic profit expected after the explicit period. This provides an independent test of the growing-FCFF value.

$$\text{Continuing Operating Value} = \text{Closing Operating Capital} + \text{Continuing Economic-Profit Value}$$

$$120{,}290.05 = 20{,}794.00 + 99{,}496.05$$

Continuing-value component	Amount	Economic interpretation
Closing operating capital	20,794.00	Productive state already accumulated by the end of 2009.
Continuing economic-profit value	99,496.05	Value of future returns above the hurdle after the explicit period.
No-growth / existing stable-spread component	61,906.42	Value generated by maintaining economic profit on the stable capital state without attributing the full amount to new growth.
Value-creating growth component	37,589.62	Additional value generated because incremental return exceeds WACC while growth is funded consistently.
Continuing operating value	120,290.05	Same end-of-period operating value produced by growing FCFF.

Displayed two-decimal components may sum to 99,496.04 because of rounding; 99,496.05 is the governing full-precision workbook result. This is an example of a legitimate rounding difference. It should be disclosed rather than "corrected" by changing a source amount.

N.12.1 Growth creates value only under a positive incremental spread

Growth does not create value merely because NOPLAT increases. The growth component exists because the assumed return on incremental operating capital exceeds WACC. If the stable return equals WACC, value-creating growth falls to zero even when accounting profit and cash flow continue to grow. If the incremental return falls below WACC, growth destroys value and the economic-profit representation must reflect that destruction.

N.13 Periodic T+1 Closure versus Terminal-Value Mechanics

Two different T+1 concepts appear in the model and must never be merged. The periodic-EVA T+1 column extends the explicit-period formula by applying the stated ROIC to beginning operating capital under the fixed hurdle. The terminal value-driver schedule uses a stable incremental return of approximately 57.6079% to determine how much reinvestment is required for 7% growth. These are related through the overall model, but they are not the same variable and do not answer the same question.

Concept	Capital base	Return concept	Purpose	Prohibited substitution
Periodic EVA T+1	Beginning operating capital entering T+1	Corrected periodic ROIC under the explicit EVA convention	Tests whether the annual spread-timescapital and NOPLATless-capital-charge routes remain equal.	Do not replace with the stable incremental return merely because both appear in T+1related schedules.
Terminal value-driver return	Incremental capital required to support stable growth	Stable return on incremental operating capital	Derives reinvestment rate, stable FCFF, and continuing value.	Do not insert into the periodic EVA row or use it to rewrite historical ROIC.

Analytical boundary. Any exhibit or caption that labels the stable incremental return as periodic T+1 ROIC, or vice versa, is materially wrong even if continuing value remains numerically unchanged. The distinction must be preserved in text, equations, tables, and image annotations.

N.14 Claim-Specific Internal Returns

The workbook calculates internal returns for several capital claims. The rates differ because the initial investments, interim cash flows, terminal recoveries, and claim priorities differ. A high operating-fund return does not imply that debt, equity, and total investor funds earned the same return. The correct analytical unit is the cash-flow series attached to a named claim.

Claim / capital boundary	Initial claim	IRR	XIRR	What the rate tests
Total invested funds	(16,380.00)	67.5717%	67.5306%	Return implied by the broad investor-fund boundary and its complete cash-flow series.
Operating invested funds	(6,756.00)	113.3123%	113.2446%	Return implied by the productive operatingcapital layer and FCFFrelated recoveries.
Common equity	(6,206.00)	—	103.9647%	Residual return implied by FCFE after debt and financing claims.
Debt cash flow including interest	(7,542.00)	—	6.0824%	Return to the debt claim when principal and interest cash flows are included.
Debt-only zero-NPV control	Claim-specific	—	Approximately 0%	Mechanical control for the isolated debt-only sequence under the stated construction.

The closeness of IRR and XIRR for the annual total-fund and operating-fund series supports timing consistency when dates are approximately annual. It is not evidence that the rates are market-required returns or transferable benchmarks. The rates are endogenous closure results for the modelled cash paths.

N.15 Cash-Flow Series behind the Claim Returns

Claim	Initial outflow	2005	2006	2007	2008	2009	Terminal / final recovery
Operatingcapital / FCFF path	(6,756.00)	3,252.59	4,622.75	7,284.71	9,717.63	12,001.31	Continuing operating value and stated closing recovery
Common-equity / FCFE path	(6,206.00)	2,790.59	1,158.75	5,541.71	8,568.63	11,890.31	108,791.14
Debt path	(7,542.00)	462.00	3,464.00	1,743.00	1,149.00	111.00	2,121.00

The table demonstrates why the rates cannot be ranked without reconciling claims. Equity receives the residual after financing movements and includes a different terminal recovery. Debt receives a contractual sequence with lower risk and a lower implied rate. Operating capital is measured against FCFF and continuing operating value. Total invested funds include a broader opening boundary. Each path is valid only for its own cash-flow definition.

N.15.1 IRR as a supplementary closure test

IRR solves for the rate that sets the present value of a specified cash-flow series to zero. It does not prove that the cash flows were classified correctly. For that reason, the workbook uses IRR after the operating, financing, and valuation bridges have been established. A plausible IRR from a misclassified cash-flow series is not a valid result.

N.15.2 Multiple roots, non-conventional cash flows, and interpretation limits

Where a cash-flow series changes sign more than once, IRR may have multiple solutions or become economically unstable. XIRR also depends on the actual date pattern. Reviewers should inspect the cash-flow signs, terminal recovery, and date sequence before accepting a rate. The present workbook rates are reported as claim-specific diagnostics, not as universal measures of performance quality.

N.16 The Unified Multi-Path Closure Matrix

Closure layer	Primary route	Independent route	Required result	Failure usually indicates
Operating state	Beginning capital + net investment	Ending operating-capital reconstruction	Same closing capital	Boundary, timing, acquisition/disposal, or working-capital error.
Cash conversion	NOPLAT - net investment	Gross operating cash flow - gross investment	Same annual FCFF	Depreciation, capex, working capital, intangible, or sign error.
Claim allocation	Cumulative FCFF	Financing-flow sources and uses	36,878.99 on both routes	Debt, interest, distribution, provision, or non-operating-cash omission.
Explicit value	Discount each annual FCFF	Sum of period present values	20,959.29	Discount factor, date, exponent, or cash-flow timing error.

Continuing value	Growing stable FCFF	Closing capital + continuing economic profit	120,290.05	Growth, reinvestment, incremental return, WACC, or timing inconsistency.
Operating value	Explicit PV + continuing PV	Opening capital + PV future EVA	74,268.46	Capital recursion or DCF/EVA boundary mismatch.
Equity value	Enterprise-to-equity bridge	Book equity + intrinsic value added under model definitions	73,718.46	Duplicate asset/claim, omitted senior claim, or mixed valuation date.
Internal returns	IRR for each claim series	XIRR using dated cash flows	Close within timing expectations for the same claim	Date, cash-flow series, terminal recovery, or claim-boundary error.

N.17 Diagnostic Interpretation: What Each Divergence Reveals

A closed-loop model is valuable not because every route must always agree automatically, but because disagreement is localized and interpretable. The direction of the divergence often identifies the first area to investigate.

Observed divergence	First diagnostic question	Likely sources	Required response
FCFF direct route differs from gross route	Does net investment equal the change in the operating-capital state?	Depreciation, capital expenditure, working capital, intangible investment, acquisition/disposal, or classification error.	Suspend valuation; rebuild the capital roll-forward and both cash-flow routes.
Financing flow differs from FCFF	Are debt, interest, distributions, provisions, and non-operating cash mapped once and with correct signs?	Claim omission, duplicated interest, debt sign, period mismatch, or distribution classification.	Reconcile sources and uses by claim before calculating FCFE or equity returns.
DCF differs from opening capital plus PV EVA	Are capital and cash discounted from the same date using the same operating boundary?	Timing, terminal reinvestment, capital charge, discount exponent, or boundary mismatch.	Trace each period from beginning capital through NOPLAT, EVA, net investment, and FCFF.
Growing FCFF differs from capital plus continuing EP	Are g, stable return, reinvestment, and WACC mutually consistent?	Unfunded growth, wrong incremental return, duplicate closing capital, or terminal timing error.	Recalculate the entire stable state; do not insert a plug.
Enterprise value bridge fails	Has each non-operating asset and senior claim been added or subtracted exactly once?	Double counting, omitted debt/minority claim, mixed date, or scale error.	Freeze the bridge and document each line item's origin and treatment.
IRR and XIRR materially diverge for the same annual path	Are dates truly annual and are all cash flows assigned to correct dates?	Irregular timing, omitted flow, terminal date, or sign error.	Inspect the dated series; report both measures and explain the timing difference.

N.18 Source-Control Warning: Broken Legacy Cells outside the Governing Range

The workbook contains historical or extended-range cells displaying errors such as #REF!, #VALUE!, and #DIV/0!. These cells are not located in the controlling five-year and stableperiod ranges used for the accepted conclusions in this appendix. Their presence must nevertheless be disclosed because publication-quality evidence requires a defined source boundary.

Control rule	Application in this manuscript
No silent concealment	The existence of broken legacy or unused extended-range cells is recorded explicitly.
No contamination	No accepted numerical conclusion is taken from a cell containing an error or from a formula dependent on an unresolved broken reference.
Controlling-range certificate	The stated 2005-2009, T+1, DCF, economic-value, bridge, and claim-return results are traced to valid workbook formulas and outputs.
No screenshot override	A visually appealing screenshot cannot convert a broken or ambiguous cell into accepted evidence.
Evidence remediation	Before releasing an executable workbook, legacy cells should be repaired, isolated, or removed in a separately controlled version. The present book does not distribute the executable engine.

Protected-engine boundary. The manuscript publishes general equations, verified values, economic interpretations, and sufficient reconciliations to challenge the reported conclusions. It does not publish cell addresses, hidden formulas, dependency graphs, implementation order, or the executable workbook. This preserves academic falsifiability while protecting the author's computational know-how.

N.19 Falsification Tests for the Accepted Numerical Conclusions

The framework is not protected from criticism by complexity. Each major conclusion can be falsified by a specific failed equality. The following tests define the minimum burden of proof.

1. Recalculate every annual net investment as ending operating capital minus beginning operating capital; reject the FCFF schedule if the difference does not match the cash-flow deduction.
2. Reconstruct FCFF through gross operating cash flow less gross investment; reject the cash path if it differs from NOPLAT less net investment beyond documented rounding.
3. Sum the stated financing components under the workbook sign convention; reject the claim allocation if the result does not equal cumulative FCFF.
4. Discount each explicit FCFF from the stated valuation date at the fixed hurdle; reject the explicit DCF total if it does not reproduce approximately 20,959.29.
5. Derive stable reinvestment as g divided by the stable incremental return, then derive stable FCFF; reject continuing value if growth is not funded by the resulting reinvestment.
6. Reconstruct continuing operating value as closing operating capital plus continuing economic-profit value; reject the terminal model if it does not equal the growing-FCFF result of approximately 120,290.05.
7. Add opening operating capital to the present value of future EVA; reject multi-path valuation if it does not reproduce operating enterprise value of approximately 74,268.46.
8. Apply the enterprise-to-equity bridge once; reject common-equity value if the bridge does not reproduce approximately 73,718.46 under the workbook classification.
9. Recalculate claim-specific IRR and XIRR from the stated cash-flow series; reject any rate that cannot be tied to a named initial claim, dates, interim flows, and terminal recovery.

N.20 Institutional Decision Protocol

N.20.1 Board and capital-allocation use

A board should not receive only enterprise value or NPV. The decision pack should show the operating-capital path, ROIC and incremental-return path, annual NOPLAT, net investment, FCFF, financing allocation, explicit-value contribution, continuing-value concentration, and the enterprise-to-equity bridge. The board should separately approve the operating case, the funding case, the stable-state case, and the residual claim.

N.20.2 Credit and risk use

Credit analysis begins with the same operating cash engine but gives priority to claim coverage, refinancing dependence, distribution locks, and downside liquidity. A borrower can report positive EVA and high equity value while remaining vulnerable to timing, covenant, or maturity concentration. The financing-flow reconciliation shows whether debt service is supported by operations, new borrowing, asset release, or reduced reinvestment.

N.20.3 Investor use

An investor should separate corporate quality from security price. The workbook demonstrates operating quality through ROIC, EVA, and cash conversion; it demonstrates claim quality through the enterprise-to-equity bridge, leverage, and FCFE; and it demonstrates valuation dependence through the continuing-value share. A structurally strong company can still be a poor investment at an excessive price.

N.20.4 Model-risk and audit use

Independent validation should reproduce the major outputs without relying on copied formulas. The validator should rebuild capital, NOPLAT, FCFF, the bridge, continuing value, and at least one claim-specific return from certified inputs. Agreement between two cells that share the same wrong precedent is not independent evidence.

N.21 Academic Contribution of the Multi-Path Closure

The individual identities used in this appendix are established in corporate finance and accounting. The distinctive contribution lies in their simultaneous implementation as a single recursive proof system. Capital formation constrains income; income and reinvestment constrain cash; financing claims constrain residual cash; growth and incremental return constrain continuing value; DCF and economic profit constrain one another; and claimspecific returns are derived only after the cash-flow boundaries close.

The architecture changes the role of redundancy. In a permissive model, multiple schedules may repeat the same assumption and create an illusion of confirmation. In the closed-loop system, alternative routes are valuable only when they are economically distinct and capable of failing for different reasons. The direct and gross FCFF routes, DCF and EVA routes, operating and equity cash routes, and IRR and XIRR timing routes therefore function as controlled cross-examinations of the same company.

This approach also clarifies the boundary between proof and judgment. Closure can prove that the model is internally coherent; it cannot prove that 7% growth, a stable 57.6079% incremental return, or a 17.675365% hurdle will occur. Those assumptions require external evidence, scenario challenge, and governance approval. Mechanical proof removes avoidable inconsistency so that professional judgment can focus on the genuine economic uncertainty.

N.22 Final Appendix Synthesis

The workbook evidence supports one connected conclusion. The operating-capital state generates NOPLAT. Net investment carries the state forward and converts NOPLAT into FCFF. The financing schedule allocates the same cash among financial assets, debt, provisions, distributions, and residual claims. The explicit cash flows and stable operating state produce operating enterprise value. The economic-profit route reaches the same value by adding opening capital to the present value of future surplus. The enterprise-to-equity bridge then identifies the common residual claim, and the IRR/XIRR schedules test returns for separately defined capital boundaries.

$$\text{FCFF direct} = \text{FCFF gross} = \text{financing-flow closure}$$

PV explicit FCFF + PV continuing value = Opening operating capital + PV future EVA = Operating enterprise value

Operating enterprise value + non-operating resources - senior claims = Common-equity value

Each IRR / XIRR belongs to one named claim and one dated cash-flow series

The appendix therefore extends the fixed-point logic of Appendix M. Appendix M showed that capital weights explain different return percentages while preserving one net income. Appendix N shows that operating, cash-flow, value, and claim routes use different representations while preserving one company. In both cases, the diversity of outputs is legitimate only because definitions, timing, units, and capital claims explain why the numbers differ and the monetary system closes.

APPENDIX O

Appendix O. Workbook-Led Visual Evidence for Cash, Value, Claims, and Return Closure

Appendix proposition. Appendix N established the governing equations and numerical reconciliations directly from the author-controlled Excel workbook. Appendix O now publishes selected visual plates only after that workbook-first analysis. The screenshots are not treated as the source of truth; they reveal the location and architecture of the evidence already verified in Excel. Each plate therefore carries a title above the image, a source and lineage statement, a reading sequence, a precise academic interpretation, a closure test, and a decision implication.

Evidence-authority rule. No value, formula, or conclusion is accepted from a screenshot alone. The executable workbook and independently reconstructed identities govern. The image may reveal a hidden relationship, but the manuscript accepts that relationship only after the workbook formula lineage and cross-path closure have been verified.

O.1 Visual-Evidence Selection and Interpretation Protocol

Stage	Question	Required supporting evidence
Discovery	What unusual box, arrow, ratio, or equality is the image pointing to?	Identify the exact workbook schedule and the economic question represented by the visual region.
Formula lineage	Which inputs, definitions, timing convention, and signs produce the result?	Trace the relationship in Excel without publishing protected cell addresses or the dependency graph.
Independent reconstruction	Can the result be reproduced outside the displayed formula path?	Recalculate the monetary and percentage identities and compare independent routes.
Visual evidence	Which screenshot or focused crop best explains the verified relationship?	Use the smallest readable image that preserves the controlling rows, columns, dates, and reconciliation.
Academic interpretation	What does the relationship add beyond arithmetic?	Explain the theory, limits, falsification test, and connection to the complete capital-return-cash-value system.
Governance use	Who should act on the evidence and what should they ask?	State the board, credit, investor, risk, audit, or management implication.

The exhibit sequence follows the causal order of the model: operating cash construction, financing allocation, equity cash, enterprise DCF, enterprise-to-equity conversion, economicprofit valuation, stable-state derivation, and claim-specific returns. This order prevents the reader from treating valuation as an isolated terminal calculation.

Evidence exclusion. Any per-share value visible inside a source screenshot is retained only as part of the historical workbook image and is not an accepted numerical conclusion of this manuscript. Total operating enterprise value and total commonequity value remain the controlling outputs until the share-count scale is independently certified.

O.2 The Enterprise DCF Master Plate: Capital State, FCFF, Continuing Value, and Equity Bridge

Purpose of inclusion. To present the entire cash-to-value architecture on one plate before focused regions are enlarged.

Workbook lineage. The plate links the operating-capital roll-forward, annual ROIC and NOPLAT, net investment, FCFF, discount factors, continuing value, enterprise value, financing flow, and the common-equity bridge.

How to read the exhibit. Read from the beginning operating-capital row through ROIC and NOPLAT, subtract net investment to obtain FCFF, discount the five explicit cash flows, add the present value of continuing operations, and only then apply the non-operating-asset and senior-claim bridge.

Computational Evidence Exhibit O-1: The Enterprise DCF Master Plate: Capital State, FCFF, Continuing Value, and Equity Bridge

FCF = NOPLAT - Net investment
FCF =(NOPLAT + Depreciation) - (Net investment + Depreciation)
FCF = Gross cash flow - Gross investment
* Net investment = Gross investment - Depreciation

Example DCF for Firm

No of day to end of the Year: 365 | 365 | 1.00000

WACC: Fixed 2005 t0 2009 % — 0 — 10.6754%

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Valuation date: 0 — 31/12/2004

		Base Years							
	Year	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	t + 1	
	Add: Short-Term Debt (A)	2368	3733	1644	1166	1154	1154		
	Add: CPLTD (A)	0	0	0	0	0			
Balance sheet	Add: Long- Term Debt (A)	5174	3866	2900	1933	967	967		
Balance sheet	Add: Shareholders Equity	6206	9605	14130	18233	20703	23,839	23,839- 6,206	17,633
	Add: Deferred Taxes (B)	0	0	0	0	0	0		
	Add: Provisions (B)	0	221	564	913	1337	829		
	Add: Minority interest (B)	2632	3561	4941	6561	8367	10529		
	Less: Excess marketable securities (C)	3978	5536	4435	5874	7748	10878		
	Less: Intangible & Goodwill (C)	5646	5646	5646	5646	5646	5646		
	Less: Long - Term investment (C)	0	0	0	0	0	0		
Net investment = NOPLAT - FCF	Total Operation Invested capital end of year	6756	9804	14098	17286	19134	20794		
	Operation Invested capital Beginning of year		6756	9804	14098	17286	19134	20,794.00	
Balance sheet	*Total Invested Funds end of year*	16380	20986	24179	28806	32528	37318		
	ROIC		93.26%	90.95%	74.29%	66.91%	71.40%	70.30%	
	NOPLAT	4939	6301	8917	10473	11566	13661	14,617.60	
	Net investment		3048	4294	3188	1848	1660		14038
	FCFF		3253	4623	7285	9718	12001	120,290.05	Terminal Value
	Discount factor		0.849796	0.722152	0.613682	0.521504	0.443172	0.443172	
	DCFF		2764	3338	4470	5068	5319	53309	
	Add: Excess Cash & Marketable Securities							74,268.46	
	Add: Intangible & Goodwill 2024							add back as deducted	3978
	Add: Long - term Investment							from operation capital	5646
	Less: Minority Interest	[Other Claims Superior to the residual equity]						in base year 2024 (C)	0
	Less: Outstanding Debt 2024							deducted back as	2632
	Less: Outstanding Provisions							already add to operation (A+B)	7542
	Equity value							capital in base year 2024	0
	Equity value per share								73,718.46
									335.0839028132270

NOPLAT t+1 =	14,617.60
g =	7.00%
ROIC or r =	57.61%
WACC t+1 =	17.6754%
NOPLAT t+1 (1 - g / ROIC) = / WACC - g	120,290.05
Total Net Investment	6756
	14038
	20,794.00
	74,268.46
	(67512.5)
	67,512-
67,512.46	Shareholders value Add
3.069	Intrinsic value
0.282090909	Book value

key figure

Total investor funds must be the same whether calculated from asset perspective or the sources of capital perspective

Financing flow	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09
After-tax interest income		(35)	(179)	(23)	(30)	(62)
Increase/ (Decrease)in Non-Operating Investments		0	0	0	0	0
Increase/ (Decrease)in excess cash		1558	(1100)	1439	1874	3130
After-tax interest expense		519	409	298	171	111
Decrease/(Increase) in debt		(57)	3055	1445	978	0
Minority interest		0	0	0	0	0
Provision	0	(221)	(343)	(349)	(424)	508
Retained Earning		0	0	0	0	0
Common dividends		1489	2781	4475	7149	8314
Share repurchases/(issues)		0	0	0	0	0
Total financing flow		3252.59	4622.75	7284.71	9717.63	12001.31
		0	0	0	0	0

Year 2029	
20,794	Operation Invested capital Beginning of year
5,646	Add: Non operating Investments
10,878	Add: Excess Cash & Marketable Securities
0	Add:non operating investment
37,318	Total invested capital
(1154)	Less: Short- Term Debt
(967)	Less: Long-term Debt
0	Less: CPLTD
(829)	Less: Provisions
(10529)	Less: Minority interest
0	Less: Deferred Taxes
23,839	Net Worth 2029

Other claims superior to the residual equity

all this numbers is double check to prove the calculation of FCFF and financel flow was 100% correct

This analysis proves most of the equation and the principles of Corporate Finance for valuation and con

Minority Interest

	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09
NOPLAT	6300.59	8916.75	10472.71	11565.63	13661.31
Net investment	3048	4294	3188	1848	1660
Depreciation	2091	2708	3298	3787	4269
Amortization					
Gross cash flow	8391.59	11624.75	13770.71	15352.63	17930.31
Gross Investment	5139	7002	6486	5635	5929
FCFF= Gross CF - Gross investment	3,253	4,623	7,285	9,718	12,001
FCFF= NOPAT - Net investment	3,253	4,623	7,285	9,718	12,001

FCF = NOPLAT - Net investment
FCF =(NOPLAT + Depreciation) - (Net investment + Depreciation)
FCF = Gross cash flow - Gross investment
* Net investment = Gross investment - Depreciation

Source and evidence identification. Author-supplied Scenario C screenshot, "DCF for Firm" architecture. Governing amounts were verified in the fixed-WACC workbook and reconstructed in Appendix N. The visible per-share row is retained as source evidence but remains excluded from accepted conclusions because the share-count scale is not independently certified.

What the Excel workbook proves. The same workbook page contains the state, transformation, cash-conversion, valuation, and claim-allocation layers. Operating enterprise value of approximately 74,268.46 is not an isolated output; it is the end of a chain that begins with operating capital and annual NOPLAT. Common-equity value of approximately 73,718.46 is obtained only after the claim bridge.

Academic significance. The plate is a visual representation of the book's central systems proposition: valuation belongs to the same recursive company that produces the statements and cash flows. The diagram therefore replaces a terminal "answer" with a traceable economic process.

Control or reconciliation test. Annual beginning capital must roll to ending capital through net investment; direct FCFF, gross FCFF, and financing flow must agree; explicit and continuing present values must sum to enterprise value; and the claim bridge must be applied once.

Decision and governance implication. A board should require this complete map when approving a major investment or valuation. It should not accept a single DCF number without seeing the capital required, cash conversion, terminal dependence, and claim allocation.

Connection to the next exhibit. The next exhibit enlarges the annual FCFF and DCF core so the controlling numbers and timing can be read without relying on the master plate.

O.3 Focused Enterprise DCF Core: Five Explicit FCFFs and the Terminal Operating State

Purpose of inclusion. To isolate the annual operating cash series, valuation date, discount factors, terminal state, and enterprise-to-equity transition.

Workbook lineage. The relevant workbook blocks are the operating-capital calculation, ROIC/NOPLAT schedule, FCFF row, fixed-WACC discount factors, stable NOPLAT and ROIIC inputs, and the bridge to common equity.

How to read the exhibit. Begin with operating capital of 6,756, 9,804, 14,098, 17,286, and 19,134; read NOPLAT and net investment beneath it; verify the annual FCFF values 3,252.59, 4,622.75, 7,284.71, 9,717.63, and 12,001.31; then read the present values and the stable operating value.

Computational Evidence Exhibit O-2: Focused Enterprise DCF Core: Five Explicit FCFFs and the Terminal Operating State

				No of day to end of the Year	365							10.6754%
iation)	Example DCF for Firm				365	1.00000				Copyright Hany Badr the perfect Design		
						Fixed			0	First foremost : the easy Innovation		
		Base Years			WACC	2005 t0 2009 %	0		Valuation date			
	Year	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09	t + 1	31/12/2004	NOPLAT t+1 =		14,617.60
	Add: Short-Term Debt	2368	3733	1644	1166	1154	1154			g =		7.00%
	Add: CPLTD (A)	0 (A)	0	0	0	0						
Balance sheet	Add: Long- Term Debt	5174	3866	2900	1933	967	967			ROIC or r =		57.61%
Balance sheet	Add: Shareholders Equity	6206	9605	14130	18233	20703	23,839		23,839- 6,206 17,633	WACC t+1 =		17.6754%
	Add: Deferred Taxes	0	0	0	0	0	0					
	Add: Provisions (B)	0 (B)	221	564	913	1337	829					
	Add: Minority interest	2632	3561	4941	6561	8367	10529					
	Less: Excess marketable securities	3978	5536	4435	5874	7748	10878					
	Less: Intangible & Goodwill (C)	5646 (C)	5646	5646	5646	5646	5646					
	Less: Long - Term investment	0	0	0	0	0	0					
	Total Operation Invested capital end of year	6756	9804	14098	17286	19134	20794			NOPLAT t+1 (1 - g / ROIC) =		120,290.05
	Operation Invested capital Beginning of year		6756	9804	14098	17286	19134	20,794.00		WACC - g		
Balance sheet	Total Invested Funds end of year	16380	20986	24179	28806	32528	37318					
	ROIC		93.26%	90.95%	74.29%	66.91%	71.40%	70.30%				
	NOPLAT	4939	6301	8917	10473	11566	13661	14,617.60				6756
	Net investment		3048	4294	3188	1848	1660		14038	Total Net Investment		14038
	FCFF		3253	4623	7285	9718	12001	120,290.05	Terminal Value			20,794.00
	Discount factor		0.849796	0.722152	0.613682	0.521504	0.443172	0.443172				
	DCFF		2764	3338	4470	5068	5319	53309				
	Add: Excess Cash & Marketable Securities							74,268.46		74,268.46		
	Add: Intangible & Goodwill 2024							add back as deducted	3978			
	Add: Long - term Investment							from operation capital	5646 (C)			
	Less: Minority Interest	[Other Claims Superior to the residual equity]						in base year 2024	0			(67512.5)
	Less: Outstanding Debt 2024							deducted back as	2632			
	Less: Outstanding Provisions							already add to operation	7542 (A+B)			67,512-
	Equity value							capital in base year 2024	0			
	Equity value per share								73,718.46	67,512.46	Shareholders value Add	
	Total investor funds must be the same whether calculated from asset perspective or the sources of capital perspective								335.0839028132270	3.069	Intrinsic value	

Source and evidence identification. Focused crop from the same Scenario C "DCF for Firm" worksheet. Values verified in Appendix N from the controlling Excel model.

What the Excel workbook proves. The five FCFFs have a present value of approximately 20,959.29. The continuing operating value of approximately 120,290.05 at the terminal date has a present value of approximately 53,309.17. Their sum produces operating enterprise value of approximately 74,268.46.

Academic significance. The focused plate demonstrates why the terminal value is not freestanding. The terminal amount inherits the same operating-capital boundary, cash-flow definition, WACC, and valuation-date discipline as the explicit period.

Control or reconciliation test. The present value rows must reproduce the full-precision workbook total; the terminal calculation must use NOPLAT t+1, growth, stable incremental return, reinvestment, and WACC consistently; and the combined value must equal the independent EVA route.

Decision and governance implication. The exhibit allows investment and credit committees to see that approximately 71.78% of operating value comes from the continuing period. That concentration raises the evidence threshold for stable return, growth, reinvestment, and competitive durability.

Connection to the next exhibit. The next exhibit shows that each FCFF is supported by two operating constructions and a separate financing-flow reconciliation.

O.4 Dual FCFF Construction and Financing-Flow Reconciliation

Purpose of inclusion. To demonstrate that cash conversion and financing allocation are separate layers that nevertheless reconcile to the same total cash generated by the operating system.

Workbook lineage. The workbook calculates FCFF as NOPLAT less net investment and independently as gross operating cash flow less gross investment. It then maps the same cash into interest, financial-asset movement, debt movement, provisions, distributions, and retained financing.

How to read the exhibit. Read the annual financing-flow rows and confirm that their stated signs aggregate to the same annual FCFF. Then read the lower dual-route block and compare the direct and gross FCFF rows year by year.

Computational Evidence Exhibit O-3: Dual FCFF Construction and Financing-Flow Reconciliation

Less: Outstanding Provisions							already add to operation		7542		67,512-
Equity value							capital in base year 2024		0		
Equity value per share									73,718.46	67,512.46	Shareholders value Add
Total investor funds must be the same whether calculated from asset perspective or the sources of capital perspective									335.0839028132270	3.069	Intrinsic value
Financing flow	Dec-04	Dec-05	Dec-06	Dec-07	Dec-08	Dec-09				0.282090909	Book value
After-tax interest income		(35)	(179)	(23)	(30)	(62)			Year 2029		
Increase/ (Decrease)in Non-Operating Investments		0	0	0	0	0			20,794	Operation Invested capital Beginning of year	
Increase/ (Decrease)in excess cash		1558	(1100)	1439	1874	3130			5,646	Add: Non operating Investments	
After-tax interest expense		519	409	298	171	111			10,878	Add: Excess Cash & Marketable Securities	
Decrease/(Increase) in debt		(57)	3055	1445	978	0			0	Add:non operating investment	
Minority interest		0	0	0	0	0			37,318	Total invested capital	
Provision	0	(221)	(343)	(349)	(424)	508			(1154)	Less: Short- Term Debt	
Retained Earning		0	0	0	0	0			(967)	Less: Long-term Debt	
Common dividends		1489	2781	4475	7149	8314			0	Less: CPLTD	Other claims superior to
Share repurchases/(issues)		0	0	0	0	0			(829)	Less: Provisions	
Total financing flow		3252.59	4622.75	7284.71	9717.63	12001.31			(10529)	Less: Minority interest	the residual equity
		0	0	0	0	0			0	Less: Deferred Taxes	
This analysis proves most of the equation and the principles of Corporate Finance for valuation and con									23,839	Net Worth 2029	
Minority Interest											
NOPLAT		6300.59	8916.75	10472.71	11565.63	13661.31					
Net investment		3048	4294	3188	1848	1660					
Depreciation		2091	2708	3298	3787	4269					
Amortization											
Gross cash flow		8391.59	11624.75	13770.71	15352.63	17930.31					
Gross Investment		5139	7002	6486	5635	5929					
FCFF= Gross CF - Gross investment		3,253	4,623	7,285	9,718	12,001					
FCFF= NOPAT - Net investment		3,253	4,623	7,285	9,718	12,001					

FCF = NOPLAT - Net investment
FCF =(NOPLAT + Depreciation) - (Net investment + Depreciation)
FCF = Gross cash flow - Gross investment
* Net investment = Gross investment - Depreciation

Source and evidence identification. Focused crop from the Scenario C DCF/FCFF workbook page. The annual and cumulative equalities were independently reconstructed in Appendix N.

What the Excel workbook proves. Cumulative FCFF of approximately 36,878.99 is reproduced by the financing-flow schedule. At the operating level, depreciation and gross investment reconcile to the same net investment deducted from NOPLAT. The equality means that the cash has been traced, not that financing items have been reclassified as operating cash.

Academic significance. This exhibit turns the cash-flow statement into a closure test. It shows that accrual income, capital investment, non-cash charges, debt, and distributions are mutually constrained components of one period-by-period system.

Control or reconciliation test. For each year: NOPLAT minus net investment must equal gross operating cash flow minus gross investment; the resulting FCFF must equal the fully mapped financing flow. Any residual indicates a timing, sign, classification, or omitted-flow error.

Decision and governance implication. Management should use this reconciliation to distinguish earned distributions from debt-supported distributions and genuine cash conversion from temporary working-capital release or underinvestment.

Connection to the next exhibit. The next exhibit isolates the algebraic relation between equity cash, debt movements, interest, and FCFF.

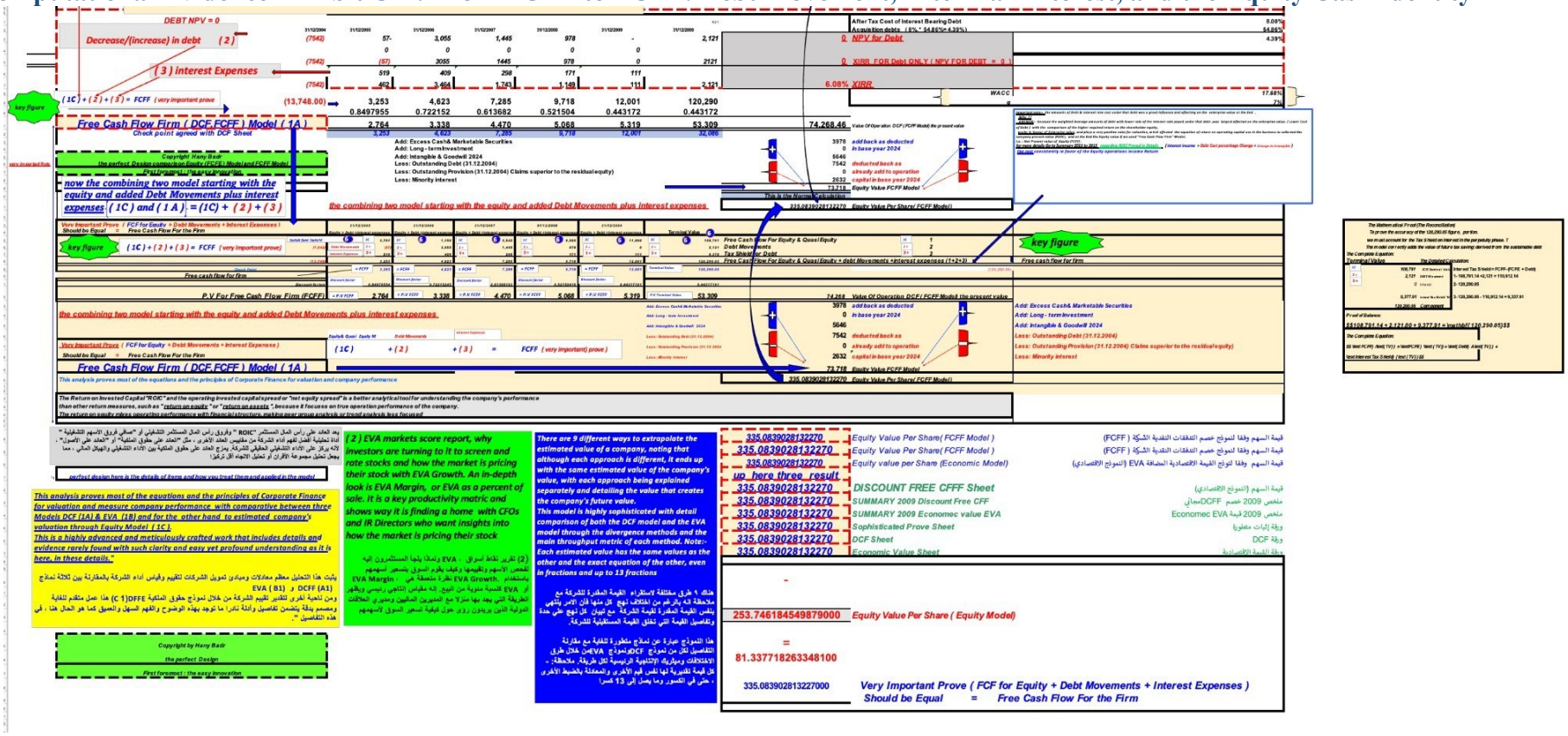
O.5 From FCFE to FCFF: Debt Movement, After-Tax Interest, and the Equity Cash Identity

Purpose of inclusion. To prove that equity cash flow and firm cash flow are not competing definitions but claim-specific views of the same cash system.

Workbook lineage. The workbook combines residual equity cash with the stated debt movement and interest burden to reconstruct FCFF, then discounts the operating cash and applies the enterprise-to-equity bridge.

How to read the exhibit. Follow the highlighted identity labelled (1C)+(2)+(3). Begin with the equity cash sequence, add or deduct debt movement using the workbook sign convention, add the after-tax financing cost, and compare the result with the FCFF row. Then follow the enterprise value into the residual equity bridge.

Computational Evidence Exhibit O-4: From FCFE to FCFF: Debt Movement, After-Tax Interest, and the Equity Cash Identity



Source and evidence identification. Author-supplied screenshot of the integrated FCFE/FCFF and equity-value workbook block. Governing cash-flow identities were verified from the original model. Visible alternative per-share figures are not accepted manuscript conclusions.

What the Excel workbook proves. The plate shows that FCFE can rise because of operating strength or because of borrowing. Reconstructing FCFF from equity cash and financing movements reveals the source. It also shows why debt is not deducted twice when moving from an equity-cash model to an enterprise-value bridge.

Academic significance. The academic contribution is claim closure: the same company can be viewed before financing allocation or after financing allocation, provided the debt and interest bridge is explicit and the discount rate matches the cash-flow claim.

Control or reconciliation test. The reconstructed annual FCFF must equal the operating FCFF schedule. A debt-only cash series discounted at its contractual rate should have zero NPV under the model convention. The final enterprise-to-equity bridge must not double count debt already embedded in the cash path.

Decision and governance implication. Credit committees can identify whether equity distributions are supported by operations or refinancing. Equity investors can distinguish operating value from leverage-created timing effects.

Connection to the next exhibit. The next exhibit enlarges the final enterprise-to-equity conversion and identifies which assets and claims are outside the operating-value denominator.

O.6 Enterprise-to-Equity Conversion: Non-Operating Resources and Senior Claims

Purpose of inclusion. To make the claim conversion legible and to prevent operating enterprise value from being mistaken for common-equity value.

Workbook lineage. The crop begins with operating enterprise value and then adds the separately valued non-operating resources while deducting long-term investment or claim adjustments, minority interest, debt, and provisions under the workbook classification.

How to read the exhibit. Read the operating value first. Then follow each plus or minus item exactly once. Confirm that resources excluded from operating capital are added separately and that senior claims are deducted before the residual common-equity value is stated.

Computational Evidence Exhibit O-5: Enterprise-to-Equity Conversion: Non-Operating Resources and Senior Claims

94			NOPLAT$_{t+1}$ (1 - g / ROIC) =		120,290.05
34	20,794.00		WACC - g		
18					
71.40%	70.30%				
13661	14,617.60				6756
1660		14038	Total Net Investment		14038
12001	120,290.05	Terminal Value			20,794.00
43172	0.443172				
5319	53309				
	74,268.46		74,268.46		
	add back as deducted	3978			
	from operation capital	C 5646			
	in base year 2024	0			(67512.5)
	deducted back as	2632			
	already add to operation	A+B 7542			67,512-
	capital in base year 2024	0			
		73,718.46	67,512.46	Shareholders value Add	
		335.0839028132270	3.069	Intrinsic value	
Dec-09			0.282090909	Book value	
(62)		Year 2029			
0		20,794	Operation Invested capital Beginning of year		
3130		5,646	Add: Non operating Investments		
111		10,878	Add: Excess Cash & Marketable Securities		
0		0	Add:non operating investment		all th
0		37,318	Total invested capital		is do
508		(1154)	Less: Short- Term Debt		to pr
0		(967)	Less: Long-term Debt		calcu
8314		0	Less: CPLTD	Other claims superior to	and f
0		(829)	Less: Provisions		was
001.31		(10529)	Less: Minority interest	the residual equity	
0		0	Less: Deferred Taxes		

Source and evidence identification. Focused crop from the Scenario C enterprise DCF worksheet. Bridge values and classifications were verified against the author-controlled workbook and Appendix N. Any visible per-share row remains excluded from accepted conclusions pending independent certification of the share-count scale.

What the Excel workbook proves. Operating enterprise value of approximately 74,268.46 converts to common-equity value of approximately 73,718.46. The difference is fully explained by the stated non-operating resources and senior claims; it is not an unexplained valuation discount.

Academic significance. The bridge establishes that "the company" and "the common share" are different economic objects. Enterprise performance can be strong while the residual claim is weakened by debt, provisions, minority interests, or other senior claims.

Control or reconciliation test. Each bridge item must be traceable to the capital-boundary classification and must appear once. The common-equity result must reconcile with the independent book-equity-plus-value-added representation.

Decision and governance implication. Boards and investors should review the bridge whenever an acquisition, disposal, refinancing, pension adjustment, or reclassification changes the location of value between operations and claims.

Connection to the next exhibit. The next exhibit demonstrates that economic-profit valuation reaches the same operating and equity values without using the FCFF present-value path as its starting point.

O.7 Economic-Profit Valuation: Explicit EVA, Continuing EVA, and Equality with DCF

Purpose of inclusion. To show that EVA is both a periodic value-creation test and an independent valuation representation of the same operating forecast used by DCF.

Workbook lineage. The workbook calculates annual EVA from the ROIC-WACC spread on beginning operating capital, discounts the annual amounts, derives continuing economicprofit value, adds opening operating capital, and applies the same claim bridge used by enterprise DCF.

How to read the exhibit. Read across the annual ROIC, WACC, spread, beginning capital, EVA, discount factor, and present-value columns. Then read the continuing row, the present value of all economic profit, opening capital, operating value, and common-equity value. Finally read the zero check 120,290.05 = 20,794 + 99,496.05.

Computational Evidence Exhibit O-6: Economic-Profit Valuation: Explicit EVA, Continuing EVA, and Equality with DCF

Fixed WACC 2005 to 2009 %

YEAR	ROIC	WACC	Spread	Operating invested capital	Economic profit	Discount factor	Present value of economic profit	Equity value
		1						6,206.00
2005	5 93.26%	17.68%	75.58%	6756	5106.44	0.849795535	2 4,339.43	10,545.43
2006	3 90.95%	17.68%	73.27%	9804	7183.86	0.722152452	1 5,187.84	15,733.27
2007	4 74.29%	17.68%	56.61%	14098	7980.84	0.613681929	3 4,897.70	20,630.97
2008	2 66.91%	17.68%	49.23%	17286	8510.27	0.521504163	5 4,438.14	25,069.11
2009	1 71.40%	17.68%	53.72%	19134	10279.31	0.44317191	4 4,555.50	29,624.61
Continuing value	70.30%	17.68%	52.62%	20,794.00	99,496.05	0.44317191	44,093.85	73,718.46

Present value of economic profit [Stockholders value add(Losses)]				67,512.46
Invested capital (beginning of forecast)31/12/2011				6,756.00
Value of operation				74,268.46
Add: Excess Cash & Marketable Securities		*add back as deducted*	C	3,978.00
Add: Intangible & Goodwill 2024		*from operation capital*		5,646.00
Add: Long - term Investment		*in base year 2024*		-
Less: Minority Interest	[Other Claims Superior to the residual equity]	*deducted back as*	A+B	2,632.00
Less: Outstanding Debt 2024	Other Claims Superior to the residual equity	*already add to operation*		7,542.00
Less: Provision Outstanding2004		*capital in base year 2024*		-
Equity value				73,718.46
Equity value per share				335.0839028132270

No of Share	22,000
3.1	Intrinsic value
0.28	BOOK VALUE
0.0	

120,290.05 =	20,794.00 +	99,496.05	
120,290.05			
0.00 ⟹	*this is important chick points and always should be equal zero*		

This analysis proves most of the equation and the principles of Corporate Finance for valuation and company performance

CV =	Economic Profit T+1 / WACC	+	(NOPLAT T+1)	(g/ROIC) (ROIC - WACC) / WACC(WACC - g)			
61,906.42	+	14,617.60	12.15% / 0.018869098	39.93%	=	709.28 / 0.018869098	37,589.62
		=	61,906.42	+	37,589.62	=	99,496.05

As a side note: the Continuing value using a discounted cash flow approach will equal the sum of the economic profit continuing value plus the amount of invested .rw

	Equity Performance	Equity Growth		EVA/Sales	
Dec-24					
Dec-25	69.92% (2)	69.92%	1	18.95%	1
Dec-26	83.6% (1)	49.20%	2	17.65%	2
Dec-27	78.92% (3)	31.13%	3	14.17%	3
Dec-28	71.51% (5)	21.51%	4	11.66%	4
Dec-29	73.40% (4)	18.17%	5	10.70%	5

(1) EVA is much more powerful and much easier to use than ever before. It measures the growth rate in EVA. It is the only corporate performance ratio where bigger always is better, because it gets bigger when EVA does, which means it should be every company's most important financial goal, the one ratio metric that everyone aims to maximize as key measure of corporate success.

Bennett Stewart & Co. saying

(2) EVA markets score report, why investors are turning to it to screen and rate stocks and how the market is pricing their stock with EVA Growth. An in-depth look is EVA Margin, or EVA as a percent of sale. It is a key productivity matric and shows way it is finding a home with CFOs and IR Directors who want insights into how the market is pricing their stock

key figure

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Source and evidence identification. Author-supplied Scenario C economic-profit screenshot. The periodic EVA, present values, continuing economic-profit value, operating value, and equity bridge were independently verified from the workbook. The visible per-share row is historical source evidence only and is not an accepted conclusion of this edition.

What the Excel workbook proves. The present value of explicit and continuing EVA is approximately 67,512.46. Adding opening operating capital of 6,756 produces operating value of approximately 74,268.46. The bridge produces common-equity value of approximately 73,718.46, matching the DCF route. At the terminal date, closing operating capital of 20,794 plus continuing economic-profit value of 99,496.05 equals continuing operating value of 120,290.05.

Academic significance. This is the central methodological equivalence of the book. DCF discounts cash remaining after reinvestment; EVA adds committed capital to the present value of surplus after the capital charge. When definitions, timing, and continuing-state mechanics match, the two are the same valuation.

Control or reconciliation test. Annual EVA must close through both spread-times-capital and NOPLAT-less-capital-charge routes. Opening capital plus present value of EVA must equal DCF enterprise value, and closing capital plus continuing EVA must equal growing-FCFF continuing value.

Decision and governance implication. The exhibit gives boards a direct attribution of value into committed capital and future surplus. It also reveals whether growth increases EVA or merely expands accounting earnings and capital employed.

Connection to the next exhibit. The next two exhibits open the stable-state mechanics that produce the continuing cash flow and prevent terminal value from becoming an unsupported residual.

O.8 Historical Incremental-Return Diagnostics before the Stable State

Purpose of inclusion. To distinguish historical incremental-return volatility from the separate stable incremental-return assumption used in continuing-value mechanics.

Workbook lineage. The panel compares changes in NOPLAT with changes in operating invested capital, derives annual return on incremental capital, and then identifies the stable return used to fund long-run growth.

How to read the exhibit. Read the annual NOPLAT growth, beginning capital, increase in NOPLAT, and increase in operating capital. Interpret each annual incremental return only for the exact change pair that produces it. Then compare, but do not substitute, the stable 57.6079% input.

Computational Evidence Exhibit O-7: Historical Incremental-Return Diagnostics before the Stable State

PV of Visible revenue Streams	20,959.29
Continuing value	53,309.17
Company total value	74,268.46
Add: Excess Cash& Marketable Sec	3978
Add: Intangible & Goodwill 2024	5645
Add: Long - term Investment	2832
Less: Outstanding Debt (31.12.20	3444
Equity Value	73,748.46

NOPLAT	g	oper. Inv Capital	ROIC	increased in NOPLAT	In/net increase Operation invested Capital)	r
6,301		6,756	93.26%			
8,917	-58.48%	9,804	90.95%	2,616	3048	-121%
10,473	17.45%	14,098	74.29%	1,556	4294	36.24%
11,566	10.44%	17,286	66.91%	1,093	3188	34.28%
13,661	18.12%	19,134	71.40%	2,096	1848	113.40%
14,618	7.00%	20,794	70.30%	956	1660	34.28%
t+1						57.61%

key figure

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In/net increase Operation invest. NOPLAT g

3,048.00 = 6,301 * -58.48% / r

r = 6,301 * -58.48% / 3,048 6,301 * (0.000191855) = -120.88%

in = r 6,301 * -58.48% / -120.88% = 3,048.00

g -58.48%

In/net increase Operation invest. NOPLAT g

4,294.00 = 8,917 * 17.45% / r

r = 8,917 * 17.45% / 4,294 8,917 * 0.000040638 = 36.24%

in = r 8,917 * 17.45% / 36.24% = 4,294.00

g 17.45%

In/net increase Operation invest. NOPLAT g

3,188.00 = 10,473 * 10.44% / r

r = 10,473 * 10.44% / 3,188 10,473 * 0.000032735 = 34.28%

Source and evidence identification. Focused upper panel from the author-supplied stable-growth and value-driver worksheet. The displayed annual changes and returns were checked against the underlying operating-capital and NOPLAT sequences.

What the Excel workbook proves. The historical incremental-return sequence is uneven and includes a negative early observation. The model therefore does not infer the stable return by averaging the displayed history mechanically. The terminal return is a separate long-run economic assumption that must be justified and stress-tested.

Academic significance. The exhibit prevents a common terminal-value error: using a convenient stable ROIC as if it were an observed historical constant. It makes the transition from evidence to assumption explicit.

Control or reconciliation test. Each annual incremental return must equal the relevant change in NOPLAT divided by the corresponding increase in operating capital under the workbook convention. The stable return must remain separately labelled and must not replace the T+1 periodic-EVA ROIC.

Decision and governance implication. Management and investors should ask whether competitive advantage, capacity, pricing, and capital intensity can support the assumed incremental return as scale increases.

Connection to the next exhibit. The next exhibit shows how the chosen stable return, growth, and reinvestment rate combine to produce stable FCFF and continuing operating value.

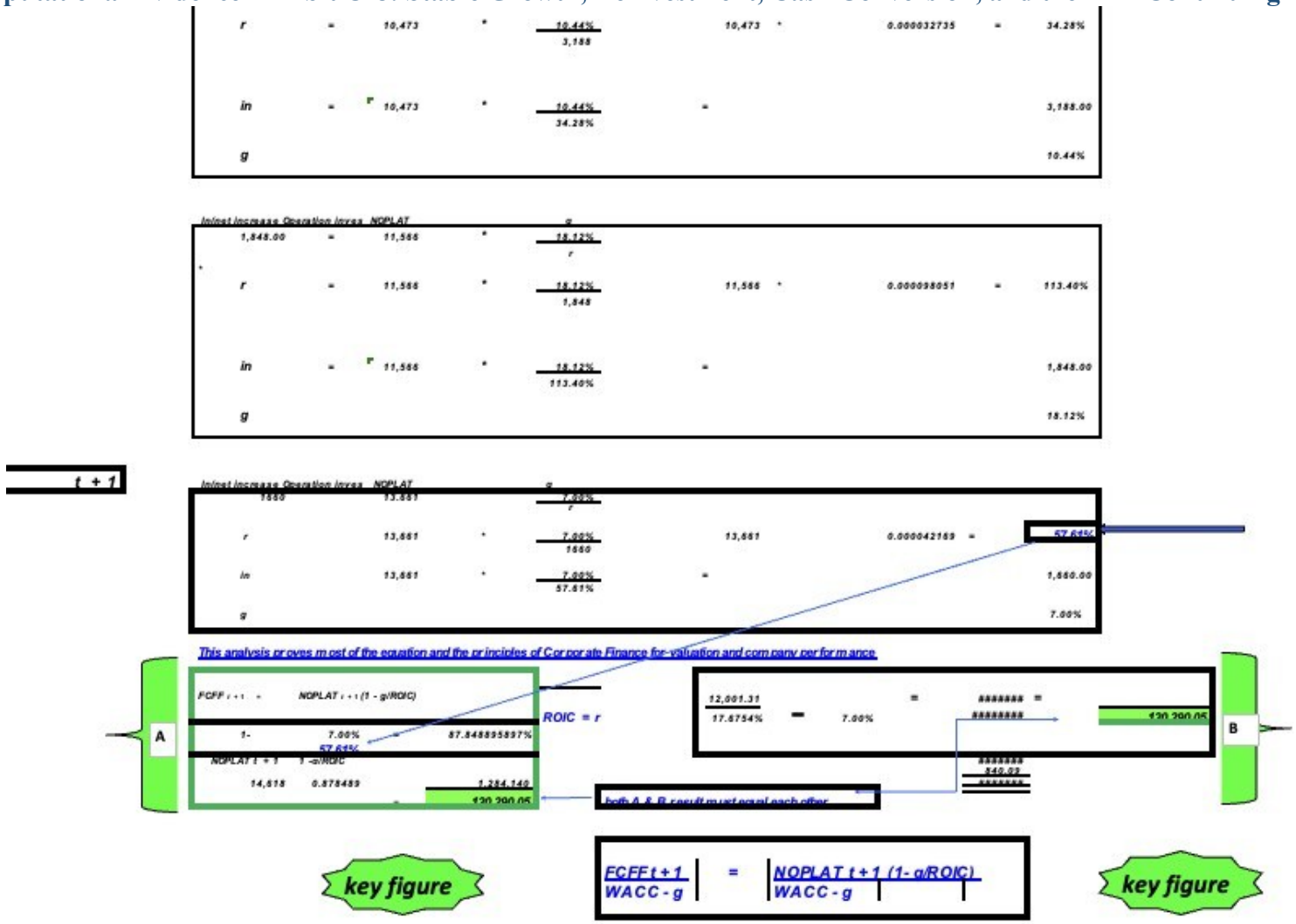
O.9 Stable Growth, Reinvestment, Cash Conversion, and the A=B Continuing-Value Proof

Purpose of inclusion. To expose the economic engine inside the terminal value instead of presenting only the final perpetuity formula.

Workbook lineage. The workbook sets NOPLAT t+1, growth, stable incremental return, and WACC. It derives reinvestment as g divided by the stable return, converts NOPLAT to FCFF, and calculates continuing value through independent but equivalent formula routes labelled A and B.

How to read the exhibit. Read NOPLAT t+1 of 14,617.60, growth of 7%, stable return of approximately 57.6079%, and WACC of approximately 17.6754%. Derive the reinvestment rate of approximately 12.1511% and cash-conversion factor of approximately 87.8489%, producing FCFF t+1 of approximately 12,841.40. Then compare the two continuing-value routes.

Computational Evidence Exhibit O-8: Stable Growth, Reinvestment, Cash Conversion, and the A=B Continuing-Value Proof



Source and evidence identification. Focused lower panel from the Scenario C stable-value worksheet. Governing stable NOPLAT, growth, incremental return, reinvestment, FCFF, WACC, and continuing value were verified in Appendix N.

What the Excel workbook proves. Both routes produce continuing operating value of approximately 120,290.05 at the terminal date. The equality is generated because growth, incremental return, reinvestment, FCFF, and the capitalisation spread describe one stable operating state.

Academic significance. The exhibit turns terminal value into a falsifiable value-driver model. Growth creates value only when the return on incremental capital exceeds the required return and when the associated reinvestment is funded.

Control or reconciliation test. Reinvestment must equal g divided by stable return; stable FCFF must equal NOPLAT times one minus the reinvestment rate; the two continuing-value formulas must agree; and closing capital plus continuing EVA must reach the same terminal operating value.

Decision and governance implication. A board should challenge the stable return and reinvestment need together. Raising growth without funding the required capital, or lowering return without recalculating reinvestment, invalidates the terminal state even if the spreadsheet still displays a value.

Connection to the next exhibit. The next exhibit completes the sequence by showing that internal return measures belong to distinct claims and cannot be compared without reconciling their cash-flow boundaries.

O.10 Claim-Specific IRR and XIRR: Total Funds, Operations, Equity, and Debt

Purpose of inclusion. To show that a single company can generate different valid internal rates because each rate belongs to a different initial claim and cash-flow sequence.

Workbook lineage. The worksheet separates total invested funds, total operating invested funds, equity cash, debt principal, and debt plus interest. It calculates IRR and date-specific XIRR for each named path and includes zero-NPV controls for the relevant claims.

How to read the exhibit. Read the path label before the percentage. Compare IRR with XIRR within the same path, not across paths. Then inspect the opening amount, annual cash flows, debt changes, interest, and terminal recovery that generate the rate.

Computational Evidence Exhibit O-9: Claim-Specific IRR and XIRR: Total Funds, Operations, Equity, and Debt

the difference between Book Equity value and Equity cost for Acquisition	-									
		Not applied for the FLOATING WACC			Applied only for Fixed WACC			key figure		
			Calculation	WACC	return Equity	IRR TOTAL INVESTED FUNDS		67.572%	67.531%	XIRR for Total Inv Funds
Equity cost for Acquisition	6,206.00	45.14%	29.43%	13.29%	29.43%	XIRR for Cash Flow For Debt Plus Interest		6.08%	6.08%	XIRR for Cash Flow For Debt Plus Interest
Acquisition debts	7,542.00	54.86%	8.00%	4.39%	0%	XIRR FOR Debt ONLY (NPV FOR DEBT = 0)		0.00%	0.00%	XIRR FOR Debt ONLY (NPV FOR DEBT = 0)
Total	13,748.00			17.68%	29.43%		NPV for Equity	104.0326%	103.9647%	XIRR for Equity
			if any risk premium	0.00%	0.00%	IRR Total Operation Invested Funds		113.31%	113.24%	XIRR For Total Operation Invested Funds
			WACC	17.68%	29.43%					
	7,542.00	54.86%	8.00%	4.39%						
	13,748.00									

This analysis proves most of the equations and the principles of Corporate Finance for valuation and company performance.

All percentages numbers (the Equations IRR & XIRR and NPV) was double checked - two ways calculations - (A) to calculate Internal Rate of Return by new technique for calculated IRR in logic and with easy ways , everyone can understanding it & (B) XIRR)

To proved the Following Equations : -

1- calculated IRR & XIRR for total invested funds
2- calculated operation invested Funds IRR & XIRR
3 - NPV for Equity & XIRR Equity
4- NPV for Debt & XIRR Debt only = 0
5- XIRR Debt Cash Flow plus Interest for Debt

* All the above mentions percentages was correct nearly by 100% and Equal each other

	31/12/2004	31/12/2005	31/12/2006	31/12/2007	31/12/2008	31/12/2009	31/12/2009	18.69%	11.69%	
								Equity Rate	7.00%	Capitalization RATE
		2,791	1,159	5,542	8,569	11,890				
FCF for Equity	6,206	2,790.59	1,158.75	5,541.71	8,568.63	11,890.31	108,791.14	103.96%	XIRR for equity	
FCF for Equity with Cost of Acquisition	-6206.00	2790.59	1158.75	5541.71	8568.63	11890.31	108791.14	103.96%	XIRR for equity + Acquisition cost	
			Equity Hurdle Rate	104.0326%						
	6,206	2,790.59	1,158.75	5,541.71	8,568.63	11,890.31	108,791.14			
		0.49012	0.24002	0.11773	0.05770	0.02828	0.02828			
	6,206	1,367.72	278.35	652.45	494.44	336.28	3,076.77	0.00	NPV	
	6,206	1,367.72	278.35	652.45	494.44	336.28	3,076.77	0		

	31/12/2004	31/12/2005	31/12/2006	31/12/2007	31/12/2008	31/12/2009	31/12/2009		
Free cash Flow for the Firm	(16380)	3,252.59	4,622.75	7,284.71	9,717.63	12,001.31	120,290.05	67.531%	XIRR for Total Inv Funds
Interest paid		519.00	409.00	298.00	171.00	111.00	-		
debt Change	0	57.00	3,055.00	1,445.00	978.00	-	2,121.00		
FCF for Equity	6,206	2,790.59	1,158.75	5,541.71	8,568.63	11,890.31	108,791.14	103.96%	XIRR for Equity
						18.69%			

	31/12/2004	31/12/2005	31/12/2006	31/12/2007	31/12/2008	31/12/2009	31/12/2009		
Interest paid	0	519	409	298	171	111	-		
debt Change	(7542)	57-	3,055	1,445	978	-	2,121	0.00%	XIRR FOR Debt ONLY (NPV FOR DEBT = 0)
Cash Flow for Debt	7,542	462	3,464	1,743	1,149	111	2,121	6.08%	XIRR for Cash Flow For Debt Plus Interest

	31/12/2004	31/12/2005	31/12/2006	31/12/2007	31/12/2008	31/12/2009	31/12/2009		
Total Operation Funds	6,756	3,253	4,623	7,285	9,718	12,001	120,290	113.24%	XIRR For Total Operation Invested Funds

Source and evidence identification. Author-supplied claim-return worksheet under the fixed-WACC scenario. The approximate IRR/XIRR results and associated cash-flow boundaries were verified from the original workbook and summarised in Appendix N.

What the Excel workbook proves. The approximate results include 67.57% IRR and 67.53% XIRR for total invested funds, 113.31% and 113.24% for operating invested funds, about 104.03% NPV-equivalent and 103.96% XIRR for equity, 0% for the debt-principal-only zero NPV path, and approximately 6.08% for debt cash including interest. The differences are expected because the claims differ.

Academic significance. The exhibit rejects the idea of one universal "company IRR." Return is claim-specific and boundary-specific. The proper role of IRR/XIRR here is supplementary closure, not a substitute for ROIC, WACC, EVA, DCF, or risk analysis.

Control or reconciliation test. IRR and XIRR should be close within each equally spaced path; the calculated rate should return the stated cash-flow series to its opening anchor or zero NPV under the path convention; and every rate must carry a named claim and dated sequence.

Decision and governance implication. Credit committees should focus on the debt cash path, equity investors on the residual path, and boards on the operating and total-fund paths. Crosspath ranking without reconciling claims is analytically invalid.

Connection to the next exhibit. The final section integrates the nine plates into one reading order and states the interpretive limits of the visual evidence.

O.11 Integrated Reading Sequence and Academic Synthesis

1. Exhibit O-1 shows the whole cash-to-value system and establishes that valuation is the closing stage of a capital process.
2. Exhibit O-2 makes the explicit FCFF sequence, terminal state, and value concentration readable.
3. Exhibit O-3 proves cash conversion through two operating routes and closes the same cash through financing allocation.
4. Exhibit O-4 converts residual equity cash and financing movements back into FCFF, demonstrating claim-specific consistency.
5. Exhibit O-5 separates operating enterprise value from common-equity value through an explicit non-operating and senior-claim bridge.
6. Exhibit O-6 proves the equivalence of DCF and economic-profit valuation in both the explicit and continuing periods.
7. Exhibits O-7 and O-8 separate historical incremental-return evidence from the stable-state assumption and derive terminal cash from growth and reinvestment.
8. Exhibit O-9 maps IRR and XIRR to distinct capital claims, preventing one return statistic from being used outside its cash-flow boundary.

Taken together, the images do not merely illustrate formulas. They provide a visual audit trail showing where each equation lives inside the integrated model. Their academic value comes from the workbook-first verification that precedes them: every screenshot is subordinate to the formula lineage, every percentage is attached to a denominator or claim, and every valuation result is subject to an independent closure route.

Final visual-evidence conclusion. The images point to the hidden architecture; Excel proves it. Evidentiary quality depends on preserving the analytical sequence, titles above the images, governing values, source notes, and explanatory text. Cropping, re-labelling, or isolating a result from its workbook boundary would destroy the meaning of the plate.

O.12 Visual-Evidence Interpretation Checklist

Control	Pass condition	Failure consequence
Title above image	The title identifies the scenario, economic relationship, period, and closure role.	The image becomes an unexplained screenshot and cannot remain in the academic edition.
Workbook authority	Every stated amount and formula has been verified in the governing Excel file.	The visual observation is provisional and must not support a conclusion.
Readable scale	Controlling rows, columns, dates, signs, and totals are legible at normal page scale.	Use a focused crop or a dedicated fullwidth page; do not shrink the evidence beyond comprehension.
Purpose and reading order	The text states why the plate appears and how the reader should follow it.	The image interrupts rather than advances the theoretical argument.
Academic significance	The explanation identifies the structural contribution and its limits.	The exhibit remains descriptive rather than analytical.
Closure test	A specific equality or zero-residual condition is stated.	The reader cannot falsify or audit the claim.
Governance implication	The relevant board, credit, investor, risk, audit, or management question is identified.	The evidence is disconnected from institutional decision use.
Connection to next plate	The transition shows how the next exhibit advances the capital-return-cashvalue sequence.	The atlas becomes a collection of unrelated screenshots.
Protected-engine boundary	No cell addresses, hidden formulas, dependency graphs, or executable workbook are disclosed.	The author's protected implementation is exposed without improving academic understanding.

APPENDIX P

Appendix P. Advanced Structural Stress Tests, Falsification Cases, and Institutional Adoption Roadmap

Appendix proposition. Mechanical closure is the starting condition for stress analysis, not its conclusion. A closed model can still contain economically fragile assumptions, concentrated value, adverse claim timing, or a denominator whose interpretation collapses under stress. This appendix converts the workbook-verified architecture into a systematic challenge program. The objective is to identify the first variable, boundary, claim, or time period at which a plausible adverse change makes the operating-to-equity and cash-to-value system economically or mechanically unacceptable.

Stress principle. A valid stress changes an economic mechanism and then allows every linked statement, capital state, return, cash flow, claim, and value to respond. It does not change the final value directly, hold contradictory variables constant, or use a plug to restore closure.

P.1 Certified Baseline before Stress

Stress results have meaning only when the starting model is mechanically closed and the baseline is frozen. The following values form the principal reference state for the tests in this appendix. They are not market forecasts or industry benchmarks; they are governing workbook outputs and derived identities used to show how the closed system responds to challenge.

Baseline layer	Governing value	Control meaning
2005 operating capital	6,756.00	Productive denominator for the top-down ROIC and WACE_OC proof.
2005 NOPLAT	6,300.59	After-tax operating income generated by the operating-capital state.
2005 ROIC	93.2592%	Operating transformation coefficient.
2005 net income	4,887.59	Fixed monetary result reproduced through operating capital, operating equity, and total equity.
2005 operating equity	(786.00)	Exceptional residual operating-equity state requiring sign-aware interpretation.
2005 WACE_OC	72.3444%	Author-defined equity-attributable return expressed on operating capital.
2005 ROE	78.7559%	Net income divided by total book equity.
Explicit-period FCFF PV	20,959.29	Value supported by five individually modelled annual cash flows.
Continuing-value PV	53,309.17	Value dependent on stable growth, incremental return, reinvestment, and WACC.
Operating enterprise value	74,268.46	DCF and EVA operating-value fixed point.
Common-equity value	73,718.46	Residual value after the stated claim bridge.

Before any stress is accepted, the model owner should certify the workbook version, data date, currency and unit scale, scenario label, capital boundary, discount-rate regime, terminal mechanism, and claim bridge. A stress performed on an unfrozen or unreconciled base cannot distinguish economic sensitivity from model instability.

P.2 Stress-Test Taxonomy

Stress family	Primary variable changed	First expected transmission	Mandatory closure response
Operating demand	Price, volume, mix, or utilisation	Revenue, margin, working capital, and NOPLAT	Recalculate taxes, capital requirements, FCFF, financing need, and value.
Operating efficiency	Unit cost, productivity, maintenance, or capacity	EBIT/NOPLAT and maintenance investment	Recalculate ROIC, EVA, cash conversion, and stable margin.
Capital intensity	Receivables, inventory, payables, fixed assets, or intangibles	Operating capital and net investment	Recalculate ROIC, FCFF, funding, and terminal reinvestment.
Financing cost	Interest rate, spread, tax shield, or refinancing fee	After-tax financing burden and residual equity income	Recalculate WACE_OC, ROE, FCFE, debt capacity, and equity value.
Capital structure	Debt issuance/repayment, distributions, buybacks	Claim allocation and equity denominator	Recalculate FCFE, claim coverage, WACE/ROE geometry, and bridge.
Required return	WACC or claim-specific hurdle	Capital charge and discount factors	Recalculate EVA, DCF, continuing value, and claim NPVs.
Stable state	Growth, ROIIC, fade, or finite life	Reinvestment, stable FCFF, terminal spread	Rebuild the complete continuing-value mechanism.
Boundary	Operating/non-operating or debt/equity classification	Numerators, denominators, and claim bridge	Restate every affected period and reject silent reclassification.
Timing and liquidity	Collection delay, capex timing, maturity, or distribution date	Cash availability and claim service	Use dated cash flows, XIRR, liquidity buffers, and covenant tests.
Model and data	Source error, formula drift, override, or unit mismatch	Unexpected closure residual	Suspend decision until lineage and independent reconstruction are restored.

The taxonomy separates an economic stress from a model failure. A price decline that reduces NOPLAT but leaves all identities closed is an economic result. A change in price that produces different FCFF through two theoretically equivalent routes is a model or classification failure. The decision process should record these categories separately because their remedies differ.

P.3 Boundary and Denominator Stress

The most dangerous stress may not change a forecast assumption; it may change the economic object being measured. Reclassifying cash, goodwill, leases, supplier finance, provisions, or acquisition assets can alter ROIC, WACC, EVA, FCFF, FCFE, and the enterprise to-equity bridge simultaneously. Boundary stress therefore begins by changing one classification and tracing every downstream effect.

Boundary change	ROIC / EVA effect	Cash-flow effect	Value / claim effect	Required control
Move surplus cash into operating capital	Lowers ROIC and raises capital charge unless related income enters NOPLAT	Can distort net investment when cash changes	Risks embedding cash in operating value and adding it again in the bridge	Match income and capital; apply the bridge once.
Exclude goodwill from operating capital	Raises identifiable-asset ROIC and lowers periodic capital charge	No cash effect unless acquisition or amortisation treatment also changes	Goodwill or related investment must be valued or added separately	Show goodwill-inclusive and excluding returns; do not mix them.
Reclassify supplier finance as debt	May lower operating liabilities and raise operating capital	Changes financing flow and interest treatment	Increases senior claims and may reduce equity value	Restate historical comparatives and covenant metrics.
Move leases between operating and financing layers	Changes capital and operating/financing expense classification	Changes FCFF/FCFE bridge and debt service	Changes WACC weights and enterprise-equity deductions	Use one consistent lease policy across all paths.
Change provision classification	Can alter operating capital or senior-claim treatment	Changes operating or financing cash depending on nature	Changes equity bridge and risk assessment	Document economic purpose and expected settlement timing.

Boundary falsification test. Recalculate the asset-side and financing-side capital routes after every boundary stress. If total investor funds, NOPLAT attribution, net investment, or the enterprise-to-equity bridge cannot be reconciled without an unexplained residual, the stressed result is not admissible.

P.4 Operating-Margin Stress and the ROIC Cascade

An operating-margin stress should enter the system before ROIC, not after it. Lower price, weaker mix, or higher unit cost changes EBIT and NOPLAT. With the opening capital state initially fixed, ROIC falls one-for-one with NOPLAT relative to the denominator. EVA then changes by the same monetary NOPLAT movement unless the capital charge also changes. Working capital, capacity, tax, and financing effects should be introduced only where the economic mechanism requires them.

Stressed NOPLAT_t = Baseline NOPLAT_t x (1 + operating-income shock_t)

Stressed ROIC_t = Stressed NOPLAT_t / Beginning operating capital_t

Stressed EVA_t = Stressed NOPLAT_t - WACC_t x Beginning operating capital_t

NOPLAT shock	Stressed NOPLAT	ROIC on 6,756	EVA at fixed WACC	Illustrative NI if bridge items unchanged
-30%	4,410.41	65.28%	3,216.27	2,997.41
-20%	5,040.47	74.61%	3,846.32	3,627.47
-10%	5,670.53	83.93%	4,476.38	4,257.53
+0%	6,300.59	93.26%	5,106.44	4,887.59
+10%	6,930.65	102.59%	5,736.50	5,517.65

The final column is a controlled diagnostic, not a complete forecast. It assumes the 2005 financing and non-operating bridge items remain unchanged solely to isolate operating transmission. A full scenario must reconsider interest, taxes, working capital, debt need, and any non-operating item that responds to the operating shock.

P.4.1 Zero-EVA operating threshold

Under a fixed capital base and hurdle, the zero-EVA NOPLAT threshold equals the capital charge. For 2005, this threshold is approximately the fixed WACC multiplied by 6,756. A company can remain accounting-profitable below its historical NOPLAT while ceasing to create economic value. The board should therefore monitor the distance from NOPLAT to the capital charge, not only the distance from revenue to accounting break-even.

P.5 Capital-Intensity and Reinvestment Stress

A growth case can preserve margins and still destroy value when the additional capital required grows faster than operating profit. The stress should therefore change receivable days, inventory days, payable terms, capacity, maintenance, or acquisition capital and allow net investment to determine FCFF. Holding FCFF constant while increasing required capital would conceal the cash cost of growth.

$$FCFF\_t = NOPLAT\_t - Net\ investment\_t$$

2009 net-investment multiple	Stressed net investment	Stressed FCFF	FCFF / NOPLAT	Change from baseline FCFF
0.50x	830.00	12,831.31	93.92%	830.00
0.75x	1,245.00	12,416.31	90.89%	415.00
1.00x	1,660.00	12,001.31	87.85%	0.00
1.25x	2,075.00	11,586.31	84.81%	(415.00)
1.50x	2,490.00	11,171.31	81.77%	(830.00)
2.00x	3,320.00	10,341.31	75.70%	(1,660.00)

The table isolates the cash consequence of capital intensity using the 2009 NOPLAT level. It is not a forecast that operating profit remains unchanged when investment changes. In practice, lower investment may signal efficiency or dangerous underinvestment; higher investment may support future growth or reflect deteriorating working-capital control. The stress conclusion therefore requires a physical or commercial explanation for the changed capital need.

P.5.1 Incremental-return gate

Additional capital should be accepted only when the incremental NOPLAT it produces earns more than the matched hurdle and the funding path remains feasible. Existing high ROIC cannot be transferred automatically to the next project or capacity increment.

Incremental ROIC = Change in NOPLAT / Change in operating invested capital

Incremental EVA = Change in NOPLAT - Required return x Change in operating invested capital

P.6 Working-Capital, Maintenance, and Growth Decomposition

Net investment should be decomposed before management is praised for strong FCFF. A reduction in investment can result from better collections, lower inventory, supplier support, delayed maintenance, asset sales, or the exhaustion of growth opportunities. These mechanisms have different implications for value and risk.

Investment component	Favourable interpretation	Adverse interpretation	Evidence required
Receivables	Improved collection discipline or lower credit exposure	Sales quality deterioration, factoring, or temporary collection pressure	Aging, bad debts, customer concentration, terms, and cash receipts.
Inventory	Lean operations, better planning, lower obsolescence	Stock-outs, deferred maintenance spares, or demand weakness	Turnover by category, service levels, write-offs, and production plan.
Payables	Negotiated supplier terms and efficient cash management	Supplier stretch, distress, or hidden financing	Aging, supplier concentration, overdue balances, and finance classification.
Maintenance capex	Reliability improvement or lower replacement need	Deferred maintenance that inflates current FCFF	Asset condition, downtime, safety, capacity, and lifecycle plan.
Growth capex	Value-creating capacity or technology investment	Capital-heavy expansion below the hurdle	Project-level ROIC, milestones, demand evidence, and postinvestment review.
Intangibles / goodwill	Acquired capability or multiperiod investment	Overpayment, impaired economics, or inconsistent capitalisation	Purchase-price allocation, amortisation, impairment, and adjusted return schedules.

P.7 Financing-Cost and Debt-Service Stress

A financing stress begins with contractual cash burden and claim timing. It should not be implemented by increasing WACC alone while leaving interest, debt service, FCFE, and the equity bridge unchanged. The model must distinguish the operating hurdle from the actual financing flows that allocate cash among debt and equity.

Stressed net income = NOPLAT - Stressed after-tax financing burden + Other stated adjustments
Stressed FCFE = FCFF - Stressed after-tax interest + Net borrowing

2005 financing-burden multiple	After-tax / model debtcost amount	Illustrative net income	WACE_OC	ROE
0.50x	259.50	5,147.09	76.19%	82.94%
0.75x	389.25	5,017.34	74.26%	80.85%
1.00x	519.00	4,887.59	72.34%	78.76%
1.25x	648.75	4,757.84	70.42%	76.67%
1.50x	778.50	4,628.09	68.50%	74.57%
2.00x	1,038.00	4,368.59	64.66%	70.39%

This controlled table changes only the 519.00 debt-cost amount identified in the 2005 workbook bridge. It does not change debt principal, WACC weights, non-operating income, taxes, or refinancing availability. A complete financing scenario must rebuild those linked effects and test cash coverage, maturity concentration, covenants, and the enterprise-toequity bridge.

P.7.1 Refinancing and liquidity sequence

1. Identify contractual principal and interest by date, currency, and legal claim.
2. Reconstruct operating cash available before financing and the minimum liquidity buffer.
3. Apply mandatory debt service, covenant tests, and distribution restrictions in legal order.
4. Introduce refinancing only after documenting amount, pricing, collateral, tenor, conditions, and failure case.
5. Recalculate FCFE, debt NPV, claim-specific XIRR, and common-equity value.
6. Escalate any scenario in which accounting profit remains positive but the cash waterfall breaks before recovery.

P.8 WACE, ROE, and Negative-Operating-Equity Stress

The author-defined WACE architecture is especially informative under denominator stress. WACE_OE—the raw operating-equity rate, also denoted r_OE in Appendix M—can change sign or become extreme as operating equity approaches zero, while WACE_OC and ROE remain tied to net income and their own denominators. A reviewer must therefore separate a change in economic income from a change in the location or sign of equity.

P.8.1 Net-income stress with fixed 2005 denominators

NI shock	Net income	WACE_OC = NI/OC	ROE = NI/E	Raw r_OE = NI/OE
-30%	3,421.31	50.64%	55.13%	(435.28%)
-20%	3,910.07	57.88%	63.00%	(497.46%)
-10%	4,398.83	65.11%	70.88%	(559.65%)
+0%	4,887.59	72.34%	78.76%	(621.83%)
+10%	5,376.35	79.58%	86.63%	(684.01%)
+20%	5,865.11	86.81%	94.51%	(746.20%)
+30%	6,353.87	94.05%	102.38%	(808.38%)

All three rates move with the same numerator, but the raw operating-equity return has the opposite sign because OE is negative. This is not an independent deterioration signal. The stress must be interpreted through the monetary result, the sign of OE, and the capital weights.

P.8.2 Pure denominator-location stress

Illustrative operating equity	OE / OC weight	Raw NI / OE	Weighted contribution on OC
(2,000)	(29.60%)	(244.38%)	72.34%
(1,500)	(22.20%)	(325.84%)	72.34%
(1,000)	(14.80%)	(488.76%)	72.34%
(786)	(11.63%)	(621.83%)	72.34%
(500)	(7.40%)	(977.52%)	72.34%
(250)	(3.70%)	(1,955.04%)	72.34%
250	3.70%	1,955.04%	72.34%
500	7.40%	977.52%	72.34%
1,000	14.80%	488.76%	72.34%
2,000	29.60%	244.38%	72.34%

This table is an algebraic denominator test, not a forecast of capital restructuring. With net income and operating capital fixed, the raw rate changes dramatically as OE moves and becomes undefined at zero, yet the weighted contribution remains NI/OC. The invariant result demonstrates why the raw rate must never be presented without its weight and why denominator compression can make a percentage appear economically spectacular while adding no new income.

WACE interpretation limit. A change in WACE_OC reflects a change in net income, operating capital, or both. A change in raw r_OE may result largely from the operating-equity denominator. Neither measure is a market cost of equity or a discount rate.

P.9 FCFF Multi-Path Break Tests

The two FCFF routes are designed to fail for different reasons. The direct route is sensitive to NOPLAT and the operating-capital roll-forward. The gross route is sensitive to depreciation, non-cash charges, and the classification of gross investment. A stress program should deliberately introduce common implementation errors and confirm that the closure residual identifies them.

Injected failure	Direct FCFF response	Gross FCFF response	Diagnostic residual	Correct remediation
Omit working-capital increase	FCFF overstated because net investment is understated	Gross investment may retain the cash use and produce a lower FCFF	Difference equals omitted working-capital investment	Restore working-capital mapping and reclose capital.
Deduct depreciation twice	Direct route unchanged if net investment is correct	Gross route overstated or understated depending on sign	Difference equals duplicated depreciation	Use one gross-to-net investment bridge.
Treat asset sale as operating inflow without reducing capital	FCFF may rise without a matching state change	Gross route may include proceeds separately	Capital roll-forward and cash route disagree	Record disposal, gain/loss, proceeds, and capital reduction consistently.
Capitalise expense without adjusting NOPLAT	Operating capital rises while NOPLAT remains unadjusted	Gross investment rises but income treatment is asymmetric	ROIC, EVA, and FCFF become mutually inconsistent	Restate NOPLAT and amortisation symmetrically.
Enter capex in wrong period	Annual FCFF paths differ by timing	Cumulative totals may still appear correct	Annual residual with possible cumulative cancellation	Correct date and use XIRR / valuation-date controls.

P.10 Explicit-Period and Continuing-Value Concentration Stress

Scenario C derives approximately 28.22% of operating value from the five explicit FCFFs and approximately 71.78% from the continuing period. This does not invalidate the valuation, but it means that terminal economics deserve at least the same review intensity as the explicit forecast. A stress should report the contribution of each component, not only the combined value.

Component	Baseline PV	Baseline share	Primary stress variable	Governance question
Explicit period	20,959.29	28.2210%	Annual NOPLAT, net investment, and discount timing	Are the first five years supported by driver-level evidence and funding capacity?
Continuing period	53,309.17	71.7790%	Stable ROIIC, growth, reinvestment, WACC, and fade	How much value survives if competitive advantage and cash conversion normalise?
Operating enterprise value	74,268.46	100.0000%	Combined operating path	Is the value conclusion robust to coherent changes rather than isolated parameter edits?

P.10.1 Explicit-cash-flow haircut

Explicit-FCFF PV shock	Stressed explicit PV	Enterprise value if continuing PV unchanged	Continuing-value share
+0%	20,959.29	74,268.46	71.78%
-5%	19,911.33	73,220.50	72.81%
-10%	18,863.36	72,172.53	73.86%
-20%	16,767.43	70,076.60	76.07%
-30%	14,671.50	67,980.67	78.42%
-40%	12,575.57	65,884.74	80.91%

Holding continuing value unchanged is intentionally restrictive and should not be treated as a complete forecast. A sustained explicit-period deterioration would normally affect the entry state, stable NOPLAT, reinvestment capacity, risk, and terminal value. The table demonstrates how an apparently modest explicit haircut increases reliance on terminal assumptions.

P.11 Stable-State Sensitivity: WACC, Growth, and Incremental Return

Terminal sensitivity should preserve the value-driver identity. For each growth rate and stable incremental return, reinvestment is recalculated as g divided by ROIIC, stable FCFF is derived from NOPLAT, and continuing value is capitalised using WACC minus g. This approach avoids the contradictory practice of changing growth while holding both reinvestment and cash flow fixed.

$$CV = NOPLAT\_(t+1) \times (1 - g / ROIIC) / (WACC - g)$$

P.11.1 WACC-growth matrix at the baseline stable ROIIC

WACC	g = 3%	g = 5%	g = 7%	g = 9%
15.000%	115,470	133,489	160,517	205,565
17.675%	94,419	105,314	120,290	142,172
20.000%	81,508	88,993	98,780	112,126
22.500%	71,058	76,279	82,848	91,362
25.000%	62,984	66,744	71,341	77,087

The matrix is a coherent stable-state calculation, but it still assumes that NOPLAT t+1 and the stable ROIIC remain achievable as the risk and growth environment changes. The sharp changes illustrate duration and capitalisation risk, not probability-weighted forecasts.

P.11.2 Growth-ROIIC matrix at the baseline WACC

Stable ROIIC	g = 3%	g = 5%	g = 7%	g = 9%
25.00%	87,654	92,258	98,588	107,837
35.00%	91,069	98,848	109,543	125,168
45.00%	92,966	102,509	115,628	134,796
57.61%	94,419	105,314	120,290	142,172
70.00%	95,338	107,086	123,236	146,832
90.00%	96,286	108,916	126,278	151,646

At a given WACC and NOPLAT entry level, higher ROIIC reduces the reinvestment required to support growth and therefore increases stable FCFF. When ROIIC approaches growth, almost all operating profit must be reinvested and distributable cash collapses. When ROIIC is below WACC, growth can expand the business while destroying economic value even if the perpetuity formula remains mathematically defined.

P.12 Reverse-Stress and Break-Even Questions

Forward sensitivities show the result of chosen assumptions. Reverse stress begins with a limit—zero EVA, a minimum coverage ratio, a maximum terminal-value share, or a protected equity value—and solves for the assumption that reaches it. Reverse stress is often more useful for governance because it reveals how much deterioration the conclusion can absorb before the decision fails.

1. Solve for the NOPLAT level at which periodic EVA becomes zero for each explicit year and for the stable state.
2. Solve for the stable ROIIC at which value-creating growth disappears, holding WACC and the capital boundary constant.
3. Solve for the WACC at which continuing value falls to a board-approved maximum percentage of enterprise value.
4. Solve for the net-investment level at which annual FCFF becomes zero and identify the funding required before recovery.
5. Solve for the financing burden that reduces net income or FCFE to the minimum acceptable distribution or covenant level.
6. Solve for the debt repayment or equity injection required to restore positive operating equity under the stated boundary.
7. Solve for the market, margin, or utilisation assumption that makes a proposed project's incremental EVA zero.

Break-even value-creation rule. Stable growth ceases to create economic value when the return on incremental capital equals the required return. Growth may still increase revenue, NOPLAT, assets, and enterprise scale, but the growth component of economic profit is zero at ROIIC = WACC and negative below it.

P.13 Claim Waterfall, Covenant, and Distribution Stress

Enterprise value can remain positive while a specific claim becomes impaired because claim timing and priority determine who receives cash. The stress should therefore build a legal and economic waterfall rather than assume that aggregate value protects every stakeholder.

Waterfall layer	Cash source or use	Stress question	Decision response
Operating liquidity	FCFF before financing allocation	Does the operating engine cover maintenance, working capital, tax, and required reserves?	Restrict expansion or distributions if the cash engine is structurally deficient.
Senior debt service	Interest, scheduled principal, fees, and hedges	Is service covered without new borrowing, asset sales, or supplier stretch?	Require refinancing plan, collateral, sponsor support, or restructuring.
Covenant and reserve layer	Minimum cash, DSRA, leverage, coverage, and distribution tests	Which covenant breaks first and how much headroom remains?	Set early-warning triggers and automatic distribution locks.
Other senior claims	Pensions, provisions, minority, preferred, tax, or contingent consideration	Are expected settlements included in the cash and value bridge?	Create reserves, change terms, or reduce residual value.
Residual equity	Dividends, buybacks, or retained cash	Are distributions earned after all senior needs and future capital requirements?	Approve only sustainable residual distributions; prohibit debt-funded optics.

A credit committee should distinguish a value problem from a timing problem. A borrower may have positive long-run operating value but insufficient cash at a specific maturity. Conversely, temporary liquidity may be preserved by underinvestment or delayed suppliers while economic value erodes. Both conditions require escalation, but the remedy and claim outcome differ.

P.14 Scenario Attribution and Root-Cause Protocol

A scenario should change a controlled set of inputs and identify the first point at which the outcome diverges from the baseline. Labels such as “growth,” “downside,” or “management case” are insufficient when they simultaneously change sales, margin, working capital, capex, debt, WACC, and terminal growth. The change register should preserve causal attribution.

Attribution step	Required record	Example diagnostic question
1. Input change	Old value, new value, reason, evidence, owner, and effective period	Was sales growth changed because of price, volume, mix, capacity, or acquisition?
2. First statement effect	Earliest revenue, cost, working-capital, asset, or claim line affected	Did the scenario first change margin, capital intensity, or financing?
3. State transition	Effect on opening/closing operating capital and claims	How much additional capital is carried into the next period?
4. Return formation	Effect on ROIC, ROIIC, EVA, WACE_OC, and ROE	Is a higher ROE produced by operations or denominator compression?
5. Cash conversion	Effect on net investment, FCFF, FCFE, and liquidity	Does reported growth consume more cash than it generates?
6. Valuation	Effect on explicit value, continuing value, bridge, and claim-specific returns	Which assumption explains most of the value change?
7. Governance	Approver, conditions, monitoring metric, and invalidation trigger	Who accepted the residual risk and what evidence would reverse the decision?

P.15 Model-Risk, Data-Quality, and Override Stress

Model-risk stress deliberately challenges the architecture rather than the economics. The validator changes signs, units, dates, links, and overrides in a controlled copy to confirm that reconciliation controls detect the error and that no downstream output remains silently accepted.

Control challenge	Expected detection	Unacceptable outcome
Change one annual formula to a hardcoded value	Formula-consistency or regression test flags the period	The result changes without an alert because the output still appears plausible.
Shift one cash flow by one year	Annual FCFF and XIRR / valuation-date tests reveal timing change	Only the total cash is checked and the value change remains unexplained.
Enter a value in units rather than thousands	Scale, reasonableness, and bridge controls fail	Enterprise or per-share value is published on incompatible units.
Reverse the sign of debt repayment	Financing-flow and debt roll-forward residuals appear	FCFE is inflated and the model balances through an unrelated plug.
Break one image source or crop a controlling row	Evidence-lineage and visual QA fail	The evidence record retains an image that no longer shows the claimed proof.
Insert an override after approval	Change register and version hash detect the modification	A late presentational change alters a formula, value, or rights statement without renewed approval.

P.16 Formal Falsification Cases

The following cases define conditions under which the book's principal claims must be rejected, narrowed, or restated. Falsifiability protects the framework from becoming a narrative that explains every outcome after the fact.

Claim	Falsification condition	Required scholarly response
Operating capital is the controlling state variable	The stated NOPLAT cannot be matched to the capital boundary or a different state variable explains the system more coherently	Redefine the boundary or limit the framework to cases where operating capital is appropriate.
ROIC transforms the operating state into NOPLAT	ROIC x the controlling capital denominator does not reproduce NOPLAT under the stated timing	Correct the denominator or abandon the claimed transformation for that schedule.
Net income is a fixed point	Independent operating-capital, operatingequity, and total-equity paths do not reproduce the same NI	Identify the missing claim or reject the fixedpoint conclusion.
WACE_OC is a valid ex post diagnostic	The rate cannot be reconciled to NI/OC or is interpreted as a market-required return without evidence	Correct the definition and restrict the claim; do not use it as a discount rate.
FCFF routes are equivalent	NOPLAT-net investment and gross cashgross investment differ after all definitions and timing are matched	Reject the cash-flow schedule until the residual is resolved.
DCF and EVA values converge	Opening capital plus PV of EVA does not equal enterprise DCF under identical assumptions	Correct reinvestment, capital charge, timing, or terminal mechanics; reject valuation if unresolved.
Continuing value is economically derived	Growth, ROIIC, reinvestment, FCFF, and WACC cannot be made mutually consistent	Replace the terminal model with a coherent fade, finite-life, or run-off mechanism.
Claim-specific IRR is a closure measure	The rate cannot reproduce zero NPV for its named cash-flow series or the claim boundary is undefined	Withdraw the percentage and rebuild the cash-flow map.

P.17 Institutional Adoption Architecture

Adoption should proceed as a controlled operating model rather than a one-time valuation project. The institution needs ownership of definitions, source data, formula lineage, scenario design, independent validation, decision use, and post-decision monitoring. The following architecture separates responsibilities so that no single sponsor can design, approve, and validate the same result.

Role	Primary responsibility	Prohibited shortcut
Board / delegated committee	Approve capital boundary, major assumptions, residual risk, and decision conditions	Approving only an NPV, EPS-accretion figure, or management narrative.
Business sponsor	Provide driver evidence, operational ownership, milestones, and post-investment accountability	Changing the denominator or hurdle after observing the result.
Finance / FP&A	Maintain linked statements, capital rollforward, scenario register, and decision pack	Using disconnected ratio schedules or undocumented manual bridges.
Treasury	Map debt, interest, liquidity, covenants, hedges, and refinancing	Treating borrowing as operating cash generation.
Risk / credit	Challenge downside, claim coverage, concentration, and invalidation conditions	Relying on accounting profit without testing cash and capital.
Model owner	Maintain version, formula dictionary, controls, and protected engine	Embedding invisible overrides or undocumented external links.
Independent validation	Reconstruct critical paths, stress assumptions, and assess limitations	Confirming outputs by copying the same formulas or source links.
Internal audit	Review governance, access, change control, decision evidence, and monitoring	Treating a successful recalculation as sufficient governance.

P.18 Ninety-Day Adoption Roadmap

Period	Required work	Deliverable	Exit criterion
Days 1-15	Inventory models, decisions, data sources, owners, and materiality; freeze definitions and units	Model inventory and sourcecontrol map	No material decision model remains unowned or undocumented.
Days 16-30	Build operating-capital, NOPLAT, investment, FCFF, financing, and claim dictionaries	Definition and formula dictionary	Numerator, denominator, timing, sign, unit, and source are approved.
Days 31-45	Implement two-sided capital reconciliation and dual FCFF routes	Mechanical closure certificate	Capital and cash residuals are zero or explicitly resolved.
Days 46-60	Implement DCF/EVA convergence, continuing-value driver model, and claim bridges	Valuation closure certificate	Independent value routes converge under matched assumptions.
Days 61-75	Design scenarios, reverse stresses, claim waterfalls, and early-warning indicators	Stress and governance pack	Downside funding, covenant, and terminal dependence are documented.
Days 76-90	Perform independent validation, user training, decision pilot, and change-control rehearsal	Validation report and pilot decision record	Approvers can trace every conclusion and the model refuses broken cases.

The ninety-day roadmap is scalable. A smaller institution may use a compact workbook and manual certification; a larger bank or corporate group may embed the architecture in planning, risk, treasury, and model-governance systems. The controlling principle is the same: the economic definitions and closure tests must be shared even when the technology differs.

P.19 Decision-Pack Templates

P.19.1 Board capital-allocation pack

- Decision objective, strategic mechanism, alternatives, reversibility, and decision owner.
- Opening operating capital, incremental capital, expected ROIC/ROIIC, NOPLAT, EVA, and cash-conversion path.
- Funding structure, liquidity, claim waterfall, covenant headroom, and distribution effect.
- Explicit value, continuing-value share, stable-state assumptions, and reverse-stress thresholds.
- Independent closure certificate, economic challenges, conditions, monitoring dates, and invalidation triggers.

P.19.2 Credit committee pack

- Borrower operating-capital state, ROIC trend, working-capital absorption, maintenance need, and FCFF.
- Debt service by date, interest sensitivity, refinancing dependence, collateral, and covenant waterfall.
- Base, downside, and recovery scenarios with minimum liquidity and sponsor-support conditions.
- Enterprise-to-claim bridge, debt NPV/XIRR, and residual value after senior obligations.
- Early-warning indicators, information undertakings, distribution locks, and escalation authority.

P.19.3 Investor research pack

- Normalised operating capital, ROIC and incremental return, EVA persistence, and cash conversion.
- WACE_OC and ROE bridge with denominator and leverage interpretation.
- Operating enterprise value, non-operating assets, senior claims, and common-equity value range.
- Terminal-value concentration, fade and capital-intensity sensitivities, and thesis invalidation conditions.
- Comparison with market price, alternatives, liquidity, diversification, and mandate constraints.

P.20 Post-Decision Monitoring and Learning Loop

The closed loop is incomplete if the institution approves a forecast but never compares the realised capital state with the promised mechanism. Post-decision review should preserve the original baseline, approved conditions, and version so that management quality can be evaluated through repeated capital outcomes rather than retrospective storytelling.

Review question	Measured evidence	Possible management conclusion
Was the capital committed as approved?	Actual working capital, capex, acquisition price, implementation timing, and funding	Scope control, execution discipline, or hidden capital escalation.
Did the operating mechanism occur?	Price, volume, mix, unit cost, utilisation, customer retention, and capacity	Commercial or operational competence versus narrative miss.
Was incremental return above the hurdle?	Actual incremental NOPLAT and capital compared with approval case	Value-creating allocation, delayed maturation, or sub-hurdle investment.
Did income convert to cash?	FCFF routes, collection, inventory, maintenance, and tax	Cash discipline, temporary release, or underinvestment.
Were financing and distributions sustainable?	Interest, debt movement, covenant headroom, dividends, buybacks, and liquidity	Prudent claim management or leveragedriven optics.
Did the terminal thesis strengthen or weaken?	Market capacity, competitive advantage, ROIIC, reinvestment need, and WACC	Durable value, required fade, or impairment of the original thesis.

P.21 Empirical and Theoretical Research Designs

The workbook supplies structural and computational evidence, not a cross-sectional empirical sample. Future research can test whether the proposed diagnostics predict cash resilience, value creation, management quality, and claim outcomes across firms and industries. Research design should preserve the distinction between identities that hold by construction and hypotheses about economic behaviour.

Research question	Possible design	Primary variables	Falsifiable expectation
Does capital-boundary correction improve ROIC comparability?	Panel of firms with reported and reconstructed operating capital	Reported ROIC, adjusted ROIC, nonoperating assets, goodwill, leases	Adjusted measures should better explain EVA and cash conversion if the boundary is economically superior.
Does incremental ROIC predict future EVA and FCFF?	Project, segment, or firm-year longitudinal study	Incremental NOPLAT, incremental capital, WACC, future EVA/FCFF	Sub-hurdle incremental return should predict weaker future economic profit and cash conversion.
Does WACE_OC reveal equity absorption not captured by ROE?	Firm-year study with operatingequity reconstruction	WACE_OC, r_OE, ROE, leverage, non-operating assets, NI	Divergence should be attributable to denominator location, financing, and non-operating effects.
Does multi-path closure quality predict restatement or model error?	Audit or model-validation sample	Closure residuals, overrides, formula drift, restatements	Models with unexplained divergence should have higher error and governance risk.
Does terminal-value concentration predict forecast error?	Valuation study comparing forecast and realised outcomes	Terminal share, stable ROIIC, reinvestment, WACC/g spread	High concentration without evidence should predict larger valuation error or revision.
Do closed-loop decision protocols improve capital allocation?	Matched organisational or beforeafter study	Decision quality, post-investment EVA, cost overruns, write-offs	Institutions using explicit closure and monitoring should show better accountability and lower hidden capital escalation.

P.22 Final Stress and Adoption Acceptance Gate

Gate	Accept when	Condition / remediation	Reject or suspend when
Mechanical closure	Capital, income, cash, valuation, and claim paths reconcile	Minor rounding or documentation issue with dated remediation	Unexplained residual, plug, sign error, broken link, or unit mismatch.
Economic plausibility	Drivers, return, reinvestment, funding, and stable state are evidenced	Stage, scale, price, hedge, or revise assumptions	Narrative growth, sub-hurdle capital, unsupported margin, or unfunded reinvestment.
Downside resilience	Liquidity, covenants, claims, and recovery remain acceptable	Add reserves, sponsor support, milestones, or distribution restrictions	Cash break, covenant breach, refinancing dependence, or unrecoverable claim impairment.
Value and claim integrity	DCF/EVA and enterprise-equity routes converge; price/terms are acceptable	Negotiate price or terms; separate options and claims	Value depends on double counting, per-share unit error, or unsupported terminal rescue.
Governance and ownership	Owner, validator, approver, conditions, monitoring, and version are recorded	Complete missing documentation before use	Uncontrolled override, conflicted validation, or release without independent revalidation.

The acceptance gate preserves the distinction between a model that closes, an investment that creates value, a claim that is protected, and a decision that is governed. All four conditions matter. Mechanical closure without economic plausibility produces precise fiction; attractive economics without funding produces an infeasible plan; enterprise value without claim analysis can mislead equity and creditors; and a correct model without ownership can be changed or misused after approval.

P.23 Final Appendix Conclusion

The stress program extends the book's closed-loop logic from proof to resilience. A valid operating shock enters the statements, changes the capital state, forms a new return, alters reinvestment and cash, passes through financing claims, and reaches value. A valid modelrisk test breaks one control and confirms that the system refuses the result. A valid governance process records who accepted the

economic assumptions, who certified the mechanical closure, who accepted the residual claim risk, and how the decision will be monitored.

Closed baseline + coherent economic stress -> closed stressed outcome

Injected model error -> visible residual -> structural refusal

Approved decision + monitored capital outcome -> institutional learning loop

The framework therefore does not promise that value estimates will be certain. It imposes a higher standard: uncertainty must be expressed through coherent states rather than hidden inconsistencies. The model earns institutional credibility not because it always produces an answer, but because it can identify when the economic system, cash path, claim structure, or evidence is too weak to justify one.

Appendix Q. Final Source-Lineage Register, Analytical Concordance, and Independent Validation Protocol

Appendix proposition. A complex financial manuscript is publication-ready only when every major claim can be traced to a controlling source, every equation preserves its defined boundary and timing, every figure is subordinate to the workbook evidence, every crossreference leads to the intended argument, and every excluded output remains excluded. This appendix is the final control layer of the book. It does not introduce a new valuation claim. It documents how the theoretical, computational, visual, institutional, and publication components form one auditable manuscript.

Controlling rule. The author-controlled Excel workbooks are the numerical authority. The two papers establish the conceptual and methodological propositions. Static images identify and communicate workbook discoveries but do not override formulas, linked schedules, or verified workbook outputs. Earlier books are excluded as manuscript templates.

Q.1 Authority Hierarchy and Source-Control Boundary

Authority level	Controlling source	Permitted use	Prohibited substitution
1 - Computational authority	hany (4).xlsx and the authorcontrolled Scenario C fixed-WACC workbook	Verify formulas, linked schedules, annual values, zero checks, scenario mechanics, and claim-specific cash paths.	No screenshot, earlier book, typed summary, or rounded table may override a workbook result.
2 - Conceptual authority	Closed-Loop Financial Valuation: From Estimation to Economic Proof	Define capital preservation, valuation as proof, cash-flow convergence, temporal closure, and institutional discipline.	The paper does not replace workbook verification of numerical claims.
3 - Methodological authority	From ROIC to Equity Burden: A Closed-Loop Structural Derivation of WACE	Define the top-down ROIC-toequity architecture, the authordefined WACE diagnostic, denominator logic, and netincome fixed point.	WACE must not be presented as CAPM, a market expected return, or a discount rate.
4 - Visual evidence	Author-supplied screenshots and workbook-derived static plates	Guide the reader to hidden relationships and display selected verified evidence with titles and detailed explanations.	Images do not independently certify formulas or authorize disclosure of the protected engine.
5 - Narrative synthesis	The current author-controlled manuscript dated 28 July 2026	Integrate the verified theory, equations, evidence, applications, and controls into one coherent academic book.	No superseded manuscript edition is a controlling template.

The source hierarchy resolves conflicts in advance. If a screenshot contains a rounded amount that differs from full-precision workbook arithmetic, the workbook governs and the caption explains the rounding. If a prior narrative uses a different title, scenario label, formula convention, or per-share conclusion, the current manuscript and the certified source register govern. If the workbook contains an apparent inconsistency, the result is suspended until the formula lineage is investigated; the narrative may not repair it by assertion.

Q.2 Controlling File Register

Source code	File / source	Role in the book	Confidentiality and evidencerelease treatment
P1	Closed-Loop Financial Valuation: From Estimation to Economic Proof (SSRN Working Paper 6064066)	The philosophical and institutional argument that valuation becomes proof through capital preservation, economic profit, cash convergence, and time closure.	Citable conceptual source; wording is rewritten and integrated rather than reproduced mechanically.
P2	From ROIC to Equity Burden: A Closed-Loop Structural Derivation of WACE (SSRN Working Paper 6132991)	The top-down operating-capital, ROIC, WACC, WACE, ROE, and net-income derivation.	Citable methodological source; WACE is clearly labelled authordefined and ex post.
X1	hany (4).xlsx	Twenty-eight-sheet authorcontrolled computational engine and principal source of statement, capital, return, cash, financing, valuation, and claim evidence.	Protected engine; no cell addresses, hidden dependency graph, executable formulas, or full workbook distribution.
X2	Scenario C fixed-WACC workbook	Controlled fixed-hurdle demonstration used for periodic EVA, FCFF, DCF, continuing value, enterprise-equity closure, and claim-specific return tests.	Protected engine; selective verified totals and static evidence only.
IMG	Author-supplied images dated 25-28 July 2026	Visual maps that identify workbook discoveries, especially the ROIC-WACE-ROE-net-income geometry and cash-to-value paths.	Each published image requires a title above it, source identification, purpose, reading instructions, academic significance, closure test, and transition.
M	Current author-controlled master manuscript	The only controlling book manuscript.	Superseded drafts, withdrawn compilations, and incorrect prior assemblies are excluded as templates.

Q.3 Twenty-Eight-Sheet Workbook Function Map

No.	Worksheet	Primary computational function	Book-level proof role
1	Income Statement for 10 Years	Reported revenue, cost, EBIT, financing items, tax, and netincome source record.	Statement transformation; netincome reconciliation target.
2	Balance Sheet	Asset, liability, debt, equity, and non-operating account source record.	Opening/closing state and capitalboundary reconstruction.
3	NOPLAT	Direct after-tax operating-income construction.	ROIC numerator, EVA numerator, and FCFF starting point.
4	WACC	Operating-capital hurdle, debt/equity weights, tax shield, fixed/floating rate structure.	Required-return matching and capital charge.
5	Inv Capital Calculation	Operating capital and total investor funds from asset and financing perspectives.	State variable, boundary control, and zero check.
6	Economic Profit	Spread-times-capital and NOPLATless-capital-charge calculations.	Periodic EVA equality and T+1 control.
7	ROIC	NOPLAT divided by beginning, average, and goodwill-inclusive capital bases.	Return formation and denominator sensitivity.
8	Free CFF	NOPLAT, depreciation, gross investment, net investment, FCFF, and financing flow.	Dual cash-conversion routes.
9	DISCOUNT Free CFF	Discount factors, explicit FCFF present values, continuing value, and operating value.	Enterprise DCF closure.
10	Book Value & FCFF Deference	Book capital, value added, and FCFF/equity difference analysis.	Book-value-plus-value-added reconciliation.

11	Next P .Comparative 1A , 1B ,1C	Scenario comparison and formulapath juxtaposition.	Controlled scenario attribution and invariance.
12	FCFF FOR Equity& DCF and EVA	Integrated FCFF, FCFE, DCF, EVA, continuing value, and claim bridges.	Multi-path closure hub.
13	Finance Analysis	Debt, interest, provisions, minority interest, financing movements, and distributions.	Claim allocation and FCFF-to-FCFE bridge.
14	ROIC TREE	Margin, turnover, capital, and return-driver decomposition.	Causal interpretation of ROIC.
15	EVA Does	Interpretive notes on what EVA measures and controls.	Economic-profit meaning and management use.
16	Summary 2005	Integrated annual map including the negative-operating-equity stress case.	Primary top-down ROIC-WACEROE-net-income proof.
17	Summary2006	Annual integrated closure for 2006.	Multi-year persistence test.
18	Summary2007	Annual integrated closure for 2007.	Multi-year persistence test.
19	Summary2008	Annual integrated closure for 2008.	Multi-year persistence test.
20	Summary2009	Annual integrated closure for 2009 and explicit-period endpoint.	Terminal transition and five-year synthesis.
21	Focus Operation Equity& Capital	Operating-capital path, operatingequity absorption path, WACE geometry, ROE, and net-income reproduction.	Central fixed-point and denominator-bridge evidence.
22	Sophisticated Prove	Redundant independent paths and advanced zero checks.	Structural proof beyond one formula route.
23	ROIC Analysis	Expanded return analysis and denominator interpretation.	Return-quality and management diagnosis.
24	WACC Analysis	Expanded hurdle, weight, taxshield, and financing-cost analysis.	Required-return governance.
25	DCF	Enterprise and equity discountedcash-flow architecture.	Value derivation and date control.
26	Economic Value	Economic-profit valuation and capital-plus-value-added closure.	DCF-EVA equivalence.
27	G & R and in	Growth, reinvestment, incremental return, stable FCFF, and continuing-value identities.	Terminal economics and A=B proof.
28	IRR TO Equity and IRR Funds	IRR/XIRR for total funds, operations, equity, debt, and debt plus interest.	Claim-specific supplementary closure.

Workbook map interpretation. The sheets are not twenty-eight independent stories. They are linked layers of one recursive company. The statement sheets define the record; capital and return sheets define the operating state and transformation; cash and finance sheets allocate the result; DCF and economic-value sheets close value; summary and proof sheets test whether independent routes reproduce the same outcomes.

Q.4 Chapter-Level Source-Lineage Register

Ch.	Title	Controlling sources	Central claim controlled
1	The Company as a Closed Financial Organism	P1; P2; X1	System metaphor, recursive sequence, and limits of analogy.
2	Capital Preservation and the Productive State	P1; X1 sheets 2, 5	Operating boundary, investor funds, equity, debt, and state continuity.
3	Financial Statements as the Anatomical Record of the Loop	X1 sheets 1-3, 16-20	Statements read as one timeordered system.
4	ROIC as the Generator of Operating Surplus	P2; X1 sheets 3, 7, 14, 23	ROIC as transformation coefficient and driver architecture.
5	Pricing the Productive State: Operating-Capital WACC	P2; X1 sheets 4, 24; X2	Matched hurdle, tax shield, fixed/floating regimes.
6	WACE and the Equity Burden	P2; X1 sheets 16, 21	Author-defined WACE, negative operating equity, and denominator geometry.
7	Net Income as the Fixed Point between Operations and Equity	P2; X1 sheets 1, 3, 13, 16, 21	Independent reproduction of one monetary net income.
8	Economic Profit and the Legitimacy of Value	P1; X1 sheets 6, 15; X2	Periodic EVA, value-creation gate, and equality routes.
9	Reinvestment and the Transition to Free Cash Flow	P1; X1 sheets 5, 8	Capital recursion, net/gross investment, and FCFF.

10	Financing Claims, FCFE, and the Distribution of Cash	P1; P2; X1 sheets 8, 13	Claim allocation, interest, debt movement, and residual cash.
11	Multi-Path Cash-Flow Closure	P1; X1 sheets 8, 12, 13, 22	Direct, gross, financing, and equity cash paths.
12	Valuation as Economic Proof	P1; X1 sheets 9, 12, 25, 26; X2	DCF, EVA, book-value-plus-valueadded convergence.
13	Continuing Value as a Proven Economic State	P1; X1 sheets 26-27; X2	Growth, ROIIC, reinvestment, stable FCFF, and terminal equality.
14	Return Metrics across Distinct Capital Claims	P1; X1 sheet 28	Claim-specific IRR/XIRR and boundary discipline.
15	The Computational Evidence Architecture	X1; X2; IMG	Workbook roles, evidence hierarchy, and source protection.
16	Scenario C: A Fixed-Hurdle Closure Demonstration	X2; X1 comparative sheets	Five-year and T+1 fixed-hurdle proof.
17	Structural Invariance under Alternative Assumptions	X1 comparative architecture; P1; P2	Definitions preserved while economics change.
18	Financial Radiology and Structural Risk	P1; X1 summaries and diagnostics	First-entry diagnosis and earlywarning logic.
19	Management Quality through the Capital Loop	X1 multi-year records; P1	Capital efficiency, incremental return, and cash discipline.
20	Board, Credit, and Risk Decision Protocols	P1; X1/X2 evidence	Institutional decision architecture and escalation.
21	New Products, Projects, and Production Lines	P2 applications; incremental identities	Project-level capital, return, cash, and value gates.
22	Structural Peer Ranking and Investment Judgment	P1; P2; closed-loop metrics	Cross-firm structural quality separated from price.
23	Model Governance and Protected Reproducibility	X1/X2; evidence-control protocol	Formula lineage, validation, secrecy, version, and override control.
24	Institutional Synthesis and Final Conclusions	All controlling sources	Integrated propositions, limits, applications, and final conclusion.

Q.5 Governing Numerical-Conclusion Lineage

Conclusion	Governing amount	Workbook lineage	Economic role	Validation control
Opening total book equity	6,206.00	Inv Capital Calculation; Summary 2005	Preserved total-equity anchor and ROE denominator.	Accepted total amount; not discounted as if it were future surplus.
2005 operating invested capital	6,756.00	Inv Capital Calculation; ROIC; Focus Operation Equity& Capital	ROIC, WACE_OC, EVA, and capital-state denominator.	Beginning-capital convention must remain explicit.
2005 operating debt / financing claim	7,542.00	Inv Capital Calculation; Summary 2005	Explains operating equity of -786 and debt weight above 100%.	Classification must match operating-capital boundary.
2005 operating equity	(786.00)	Focus Operation Equity& Capital; Summary 2005	Exceptional negative denominator and WACE geometry.	Not the same as total book equity.
2005 NOPLAT	6,300.59	NOPLAT; ROIC; Economic Profit	After-tax operating income before actual financing effects.	Authoritative operating numerator.
2005 ROIC	93.2592%	ROIC; Focus Operation Equity& Capital	NOPLAT divided by beginning operating capital.	Alternative average/goodwill denominators are labelled sensitivities.
2005 net income	4,887.59	Income Statement; Summary 2005; Focus Operation Equity& Capital	Fixed monetary result reproduced by operatingcapital, operating-equity, and total-equity paths.	Accepted after cross-path reconciliation.
2005 WACE_OC	72.3444%	Focus Operation Equity& Capital	NI divided by operating capital; author-defined ex post absorption rate.	Not a market cost of equity or discount rate.
2005 raw return on operating equity	(621.8308%)	Focus Operation Equity& Capital	NI divided by negative operating equity.	Must be interpreted with negative weight, not as stand-alone performance.
2005 ROE	78.7559%	Focus Operation Equity& Capital; Summary 2005	NI divided by total book equity.	Separate from WACE_OC and raw operating-equity return.

2005 EVA	5,106.44	Economic Profit	ROIC-WACC spread times beginning capital; also NOPLAT less capital charge.	Two periodic routes must agree.
Explicit FCFF series	3,252.59; 4,622.75; 7,284.71; 9,717.63; 12,001.31	Free CFF; DCF; integrated closure sheets	Annual cash after net investment.	Direct and gross routes must agree annually.
PV of explicit FCFF	20,959.29	DISCOUNT Free CFF; DCF	Value supported by five explicit annual cash flows.	Valuation-date and fullprecision controls apply.
Stable NOPLAT t+1	14,617.60	G & R and in; Economic Value	Operating income entering the stable-state valuedriver mechanism.	Separate from the periodic T+1 numerator because stable ROIIC is a marginal continuingstate return assumption.
Stable ROIIC	57.6079%	G & R and in	Return on incremental capital used to derive longrun reinvestment.	Long-run assumption; not substituted into historical periodic ROIC.
Stable reinvestment rate	12.1511%	G & R and in	g divided by stable ROIIC.	Must change when growth or ROIIC changes.
Stable FCFF t+1	12,841.40	G & R and in; DCF	Stable NOPLAT after required reinvestment.	Must reconcile with valuedriver formulas.
Continuing operating value at terminal date	120,290.05	DCF; Economic Value; G & R and in	Growing-FCFF value and closing-capital-pluscontinuing-EVA equality.	Full-precision governing amount.
PV of continuing value	53,309.17	DISCOUNT Free CFF; DCF	Continuing-period contribution at the valuation date.	Approximately 71.78% of operating value; governance signal.
Operating enterprise value	74,268.46	DCF; Economic Value; integrated sheet	PV explicit FCFF plus PV continuing value; also opening capital plus PV EVA.	Accepted operating-value fixed point.
Common-equity value	73,718.46	DCF; Finance Analysis; integrated bridge	Operating value plus net non-operating resources less senior claims.	Accepted total commonequity value under workbook classification.
Per-share output	Excluded	Visible in historical source images/workbook row	Would require independently certified share-count scale.	Excluded from the accepted conclusion set.

Numerical lineage and structural-refusal rule. Every amount in the narrative, table, caption, and conclusion must agree with the governing register. Rounded values are acceptable only when the fullprecision result and rounding effect are known. If equivalent routes diverge beyond explained rounding, the result is rejected until the boundary, timing, sign, unit, formula, or claim failure is identified.

Q.6 Equation Concordance and Closure Purpose

Identity / test	Equation	Workbook evidence	Analytical purpose
Operating return	ROIC_t = NOPLAT_t / Beginning operating capital_t	ROIC; NOPLAT; capital schedules	Transforms the opening productive state into after-tax operating income.
Operating income reproduction	NOPLAT_t = ROIC_t x Beginning operating capital_t	ROIC and NOPLAT	Confirms numerator-denominator matching.
Capital recursion	Ending OC_t = Beginning OC_t + Net investment_t	Inv Capital Calculation; Free CFF	Carries the operating state to the next period.
Direct FCFF	FCFF_t = NOPLAT_t - Net investment_t	Free CFF	Converts accrual operating income into cash after reinvestment.
Gross FCFF	FCFF_t = NOPLAT_t + Depreciation_t - Gross investment_t	Free CFF	Independent cash-conversion route.
Net investment	Net investment_t = Gross investment_t - Depreciation_t	Free CFF; capital schedules	Links cash investment to the capital roll-forward.
Periodic EVA - spread route	EVA_t = (ROIC_t - WACC_t) x Beginning OC_t	Economic Profit	Measures value creation after the required return.
Periodic EVA - charge route	EVA_t = NOPLAT_t - WACC_t x Beginning OC_t	Economic Profit	Independent equality control.
Top-down equity income	Equity-attributable income = NOPLAT - stated financing and non-operating absorption	Summary 2005; Focus; Finance Analysis	Explains how operating surplus reaches equity.
WACE_OC	WACE_OC,t = NI_t / OC_t	Focus Operation Equity& Capital	Author-defined ex post equityabsorption rate on operating capital.

Raw operating-equity return	r_OE,t = NI_t / OE_t	Focus Operation Equity& Capital	Shows the return on the modeldefined operating-equity layer.
ROE	ROE_t = NI_t / E_t	Summary and Focus sheets	Reported-equity return on total book equity.
Net-income fixed point	OC x WACE_OC = OE x r_OE = E x ROE = NI	Focus Operation Equity& Capital	Proves that different denominators preserve one monetary result.
FCFF-to-FCFE bridge	FCFE = FCFF - after-tax interest + net borrowing + stated claim adjustments	Finance Analysis; integrated sheet	Allocates firm cash to residual equity.
Enterprise DCF	EV = PV(explicit FCFF) + PV(continuing value)	DISCOUNT Free CFF; DCF	Operating value from cash.
Economic-profit valuation	EV = Opening OC + PV(future EVA)	Economic Value	Operating value from committed capital plus future surplus.
DCF-EVA equality	PV FCFF = Opening OC + PV EVA	DCF; Economic Value	Proves equivalent representations of one forecast.
Stable reinvestment	Reinvestment rate = g / ROIIC	G & R and in	Links growth to the capital required to support it.
Stable cash conversion	FCFF_t+1 = NOPLAT_t+1 x (1 - g/ROIIC)	G & R and in	Derives cash rather than choosing it.
Growing-FCFF continuing value	CV_T = FCFF_T+1 / (WACC - g)	DCF; G & R and in	Capitalises stable operating cash at the terminal date.
Continuing EVA value	CV_T = Closing OC_T + PV_T(continuing EVA)	Economic Value	Independent continuing-value representation.
Enterprise-equity bridge	Equity value = Operating EV + net non-operating assets - senior claims	DCF; Finance Analysis	Allocates operating value to common equity.
IRR condition	NPV of named cash-flow path at IRR = 0	IRR TO Equity and IRR Funds	Claim-specific internal-return closure.
XIRR condition	NPV of dated named cash-flow path at XIRR = 0	IRR TO Equity and IRR Funds	Date-specific timing control.

Q.7 Cross-Reference Architecture by Chapter and Appendix

Origin	Primary subject	Required destination / crossreference	Reason
Chapters 1-3	Company, capital state, and statement anatomy	Chapters 4-8	Defines the state and operating result before return and value are interpreted.
Chapters 4-7	ROIC, WACC, WACE, ROE, and net income	Appendix M	Provides the theory that Appendix M proves numerically and visually for 2005 and 2005-2009.
Chapters 8-13	EVA, reinvestment, FCFF/FCFE, DCF, and continuing value	Appendices N-O	Provides the cash-to-value logic that N verifies from Excel and O displays visually.
Chapter 14	Claim-specific returns	Appendix N and Exhibit O-9	Prevents IRR/XIRR from being interpreted outside the named claim boundary.
Chapters 15-17	Evidence architecture and scenarios	Appendices M-O	Defines how workbooks, scenarios, and images are used without source confusion.
Chapters 18-22	Risk, management, institutions, projects, and ranking	Appendix P	Transforms proof into stress, falsification, adoption, and decision protocols.
Chapter 23	Model governance and protected reproducibility	Appendix Q	Connects source lineage, confidentiality, model governance, and evidence release.
Chapter 24	Institutional synthesis and conclusions	Appendix Q final certificate	Ensures that the concluding claims match certified theory and numbers.
Appendices A-B	Formal identities and definitions	All chapters and Appendices M-N	Control vocabulary, sign, timing, units, and formula meaning.
Appendices C-E	Evidence and scenario architecture	Chapters 15-17; Appendices M-O	Control workbook labels, scenario attribution, and numerical closure.
Appendices F-K	Institutional protocols and validation	Chapters 18-23; Appendix P	Operationalise board, credit, investor, model-risk, and research use.
Appendix L	Glossary	Entire book	Prevents familiar terms from carrying incompatible meanings.
Appendix M	ROIC-WACE-ROE-net-income workbook proof	Chapters 4-7 and key images	Central top-down fixed-point evidence.
Appendix N	FCFF-DCF-EVA-claims workbook proof	Chapters 8-14	Central cash-to-value and claimclosure evidence.

Appendix O	Workbook-led visual evidence	Appendices M-N	Displays only relationships already verified from Excel.
Appendix P	Stress, falsification, and adoption	Chapters 18-23	Tests resilience and defines institutional implementation.
Appendix Q	Lineage, concordance, index, and independent validation	Entire manuscript	Final source, equation, evidence, and limitation concordance.

Q.8 Visual-Evidence Lineage and Caption Controls

Exhibit	Evidence subject	Controlling workbook lineage	What the image is allowed to demonstrate
M-1 to M-5	2005 corporate black-box and focused ROIC-WACE-ROE-netincome panels	Summary 2005; Focus Operation Equity& Capital; NOPLAT; Inv Capital Calculation	Capital weights, negative operating equity, denominator bridges, and net-income fixed point.
O-1	Enterprise DCF master plate	DCF; integrated FCFF/DCF/EVA sheet	Whole capital-to-cash-to-value-toequity map.
O-2	Focused enterprise DCF core	DCF; DISCOUNT Free CFF	Five explicit FCFFs, terminal state, and value concentration.
O-3	Dual FCFF and financing-flow reconciliation	Free CFF; Finance Analysis	Direct/gross cash equality and financing allocation.
O-4	Equity cash and reconstruction to FCFF	Integrated FCFF/Equity sheet; Finance Analysis	Residual cash, debt movement, interest, and firm-cash recovery.
O-5	Enterprise-to-equity bridge	DCF; Finance Analysis	Non-operating resources and senior claims allocated exactly once.
O-6	DCF and economic-profit valuation equality	DCF; Economic Value	Opening capital plus PV EVA equals PV FCFF.
O-7	Historical incremental-return diagnostics	G & R and in; capital/NOPLAT schedules	Separates historical ROIIC evidence from stable-state assumption.
O-8	Stable growth, reinvestment, and continuing-value proof	G & R and in; DCF; Economic Value	Derives stable FCFF and A=B continuing value.
O-9	Claim-specific IRR/XIRR	IRR TO Equity and IRR Funds	Labels each return by its exact opening claim and cash-flow series.

Every visual exhibit must retain the following order: academic title above the image; source and evidence identification; purpose of inclusion; how to read the exhibit; workbook-proven finding; academic significance; control or reconciliation test; decision implication; and connection to the next exhibit. A source image is never self-explanatory. A title that merely repeats a worksheet name is insufficient.

Q.9 Scenario, Timing, Sign, and Unit Control Matrix

Control dimension	Required declaration	Frequent failure	Mandatory response
Scenario	Workbook and scenario label on every numerical exhibit.	A/B/C/FIRST or fixed/floating results are mixed.	Withdraw the exhibit until the source path is reconstructed.
Period	Historical year, explicit forecast year, T+1, or stable state.	T+1 periodic EVA is confused with stable ROIIC mechanics.	Separate the schedules and explain their distinct purposes.
Capital timing	Beginning, average, ending, or goodwill-inclusive denominator.	The most favourable ROIC denominator is selected after seeing the result.	Pre-specify the controlling convention and label sensitivities.
Valuation date	Date to which cash and claims are discounted.	Enterprise assets and debt are measured at different dates.	Restate to one date before applying the claim bridge.
Sign	Cash inflow/outflow, asset/liability, claim/payment, and negative denominator.	A negative operating-equity return is interpreted without its negative weight.	Show the sign geometry and monetary fixed point.
Unit	Currency, thousands/millions, percentage/decimal, and sharecount scale.	A total equity value is divided by an uncertified share count.	Exclude per-share output until scale is independently certified.
Rounding	Display decimals versus fullprecision formula result.	Displayed components differ by 0.01 and are treated as a model break.	Use full precision for closure and explain display rounding.
Boundary	Operating versus non-operating, firm versus equity, debt versus other claims.	The same asset or claim is included twice or omitted.	Rebuild the two-sided capital and enterprise-equity reconciliations.

Q.10 Title Uniqueness and Non-Repetition Audit

Title control operates at two levels. Exact-title uniqueness prevents duplicated identifiers and broken navigation. Concept-level review prevents differently worded headings from repeating the same argument without adding a distinct analytical purpose. A heading is retained only when it advances the capital-return-cash-value sequence or introduces a necessary validation, institutional, or evidence boundary.

Audit layer	Test	Acceptance condition	Evidence of failure
Exact title	Normalize case and whitespace and compare every styled heading.	No unintended duplicate chapter, section, appendix, figure, or table title.	Same title appears in two substantive locations without an explicit cross-reference purpose.
Number sequence	Check chapter, subsection, appendix, table, figure, and equation order.	No skipped, duplicated, or reversed identifier.	Two exhibits carry one number or references point to an absent number.
Concept repetition	Compare proposition, evidence, and conclusion of adjacent and remote sections.	Repeated background is compressed; each section adds a new analytical function.	The same formula explanation or scenario conclusion is restated without added evidence.
Visual repetition	Hash and visually compare source images and crops.	Duplicate images are removed or used only as clearly labelled focused enlargements.	The same screenshot is presented as separate evidence merely to increase length.
Numerical repetition	Trace repeated governing values to one source register.	Repeated values are consistent and serve a defined cross-reference function.	One value appears with incompatible scenario, date, or rounding.
Conclusion repetition	Compare chapter syntheses and final conclusion.	Each synthesis closes its chapter and points forward; the final conclusion integrates rather than recopies.	Long passages repeat earlier prose without a new institutional or theoretical implication.

Q.11 Protected Reproducibility and Confidential Engine Boundary

Reproducibility does not require publication of the complete executable workbook. The book discloses the economic definitions, governing equations, principal numerical fixed points, source-sheet functions, scenario conventions, and independent closure results. These disclosures allow a qualified reader to test the logic and reconstruct the principal relationships. The author retains the cell addresses, hidden formulas, dependency graph, implementation order, formatting logic, and executable workbook under controlled access.

Publishable evidence	Protected implementation	Reason for boundary
Definitions of operating capital, NOPLAT, ROIC, WACC, WACE, EVA, FCFF, FCFE, enterprise value, and claim bridges.	Cell addresses, hidden ranges, linked-sheet formula chains, macros, and executable model.	Definitions and equations permit scholarly challenge without transferring proprietary implementation.
General equations and stated numerical fixed points.	Complete formula dictionary containing exact cell references and dependency order.	The book proves relationships; it does not distribute the engine.
Selective screenshots with titles and analytical explanation.	Uncropped workbook exports that expose all formulas, cell references, and hidden knowhow.	Static evidence demonstrates existence and context while limiting replication of the proprietary mechanism.
Workbook sheet-function map and sourcelineage register.	Password structure, file protections, external links, and full audit trail.	Readers can understand evidence roles without gaining operational control.
Independent recomputation of major outputs from disclosed aggregates.	Author-controlled model file and future versions.	Reproducibility of conclusions is separated from ownership of implementation.

Q.12 Detailed Analytical Index and Reader Navigation

Index term	Principal navigation	Analytical use
After-tax financing burden	3.6; 7.3-7.5; 10.3; Appendix M; P.7	Bridge from NOPLAT/FCFF to equity income and cash.
Average capital	2.8; 4.4; Appendix B; Appendix M	Alternative ROIC denominator; sensitivity, not silent replacement.
Book value plus value added	12.5; Appendix N; Exhibit O-6	Equity/enterprise value reconciliation through committed capital and surplus.

Capital charge	5.3; 8.3; Appendix M-N	WACC multiplied by beginning operating capital.
Capital preservation	1.4; 2.1; 12.2; Appendix A	Capital is a starting claim before surplus becomes value.
Capital turnover	4.3; ROIC tree discussion; Appendix L	Revenue efficiency component of ROIC.
Claim bridge	10.2-10.6; 12.6; Appendix N; Exhibit O-5	Allocation from firm cash/value to debt, other claims, and equity.
Closed-loop refusal	1.3; 11.6; 17.5; 23.6; P.16	Suspension of a result when mandatory closure fails.
Continuing economic profit	13.5; Appendix N; Exhibit O-6	Economic-profit representation of the continuing period.
Continuing value	13; 16.6; Appendix N-O; P.10-P.12	Stable-state value and its growth/return/reinvestment conditions.
DCF-EVA equivalence	8.6; 12.4-12.5; 13.6; Appendix N; O-6	Independent valuation routes for one operating forecast.
Debt weight above 100%	6.4; 7.5; Appendix M	Valid when operating equity has a negative weight and total weights still sum to 100%.
Denominator bridge	4.4; 6.3-6.4; 7.4-7.6; Appendix M	Explains different percentages that preserve one net income.
Economic profit	8; 12.5; Appendix A; Appendix N	NOPLAT less capital charge and spread-timescapital.
Enterprise-to-equity bridge	10.5; 12.6; Appendix N; O-5	Add non-operating resources and deduct senior claims once.
FCFE	10; 11; Appendix N; O-4	Residual cash after financing allocation.
FCFF	9; 11; 12; Appendix N; O-2/O-3	Operating cash after reinvestment and before financing allocation.
Financial radiology	18; Appendix P	Locates the first point of operating, capital, cash, financing, or model deterioration.
Fixed point	7; Appendix M	One net income reproduced by independent capital and equity paths.
Fixed WACC	5.5; 16; Appendix N; P.9	Controlled hurdle used to isolate operating changes.
Goodwill-inclusive ROIC	2.7; 4.4; Appendix M	Return on a broader acquisition-capital denominator.
Gross investment	9.3; 11.2; Appendix N	Capital additions before depreciation.
Growth-reinvestment identity	13.3; Appendix N; O-8	Reinvestment rate equals growth divided by incremental return.
IRR / XIRR	14; Appendix N; O-9	Claim-specific supplementary return tests.
Incremental EVA	8.5; 19.4; 21.4; Appendix P	Value created by additional capital after its required return.
Incremental ROIC / ROIIC	4.5; 13.3; 19.4; 21.3; O-7/O-8	Return on additional capital; core growthquality test.
Mechanical closure	11; 12; 17; 23; Appendix P	Numerical consistency required before economic judgment.
Net income	3.5; 7; Appendix M	Monetary fixed point between operations and equity.
Net investment	9.2; 11.2; Appendix N	Change in operating capital and principal FCFF deduction.
Negative operating equity	2.7; 4.5; 6.4; 7.5; Appendix M; P.8	Exceptional but interpretable residual operating-equity state.
NOPLAT	3.4; 4.2; 8.2; Appendix M-N	After-tax operating income before actual financing.
Operating capital	2; 4; Appendix M-N	Productive state variable and matched denominator.
Operating equity	2.7; 6.4; 7.5; Appendix M	Equity support attributed to the operating system under the model boundary.
Operating margin	4.3; 18.3; P.4	Profitability driver entering ROIC through NOPLAT.
Per-share exclusion	12.7; Appendix N; Q.5/Q.9	Excluded until share-count units are independently certified.
Periodic EVA T+1	8.4; 13.2; 16.5; Appendix N	Beginning-capital periodic test, separate from stable ROIIC.
Reinvestment rate	13.3; Appendix N; O-8	Growth divided by stable ROIIC.
Residual claim	6; 10; 14; Appendix N	Equity after senior contractual claims.
ROE	6.3; 7.6; Appendix M	Net income divided by total book equity.
ROIC	4; Appendix M; O-7	NOPLAT divided by the controlling operatingcapital base.
Scenario attribution	15-17; 18.2; P.14	Trace the first changed assumption and every downstream consequence.
Scenario C	16; Appendix N-O	Fixed-hurdle closure demonstration for 20052009 and stated terminal mechanics.
Stable FCFF	13.4; Appendix N; O-8	NOPLAT after the reinvestment required by growth and ROIIC.

Stable state	13; Appendix N; P.10-P.12	Long-duration relationship among growth, return, reinvestment, cash, and WACC.
Structural peer ranking	22	Ranking by capital efficiency, EVA, cash conversion, financing quality, growth quality, value, and risk.
Tax shield	3.6; 5.4; 10.3; Appendix N	Tax effect of financing cost; belongs in the financing layer.
Terminal concentration	13.7; 16.6; 18.5; P.10	Share of operating value dependent on the continuing period.
Total investor funds	2.6; Appendix M	Broad capital reconciled from asset and financing perspectives.
Valuation date	12.3; 13.6; Appendix N; Q.9	Common date for cash, assets, debt, and value.
WACC	5; 8; 12-13; Appendix N	Matched ex ante hurdle and discount rate.
WACE	6; 7; Appendix M	Author-defined ex post equity-absorption diagnostic.
Working capital	2.3; 9.4; 18.4; P.5-P.6	Operating capital absorbed or released through receivables, inventory, and payables.

Q.13 Independent Recalculation and Reproducibility Protocol

1. Identify the controlling workbook, scenario, period, unit, sign convention, and capital boundary before reproducing any conclusion.
2. Reconstruct operating invested capital independently from the asset-side and financingside classifications and explain every reconciling item.
3. Recompute NOPLAT and periodic ROIC from the same operating boundary, using the stated beginning-capital convention and keeping alternative denominators separate.
4. Reconstruct the top-down bridge from ROIC and NOPLAT through financing and nonoperating absorption to WACE_OC, WACE_OE, ROE, and the common net-income fixed point.
5. Recompute Economic Profit through both the spread route and the capital-charge route for every explicit year and T+1.
6. Reconstruct FCFF through net-investment, gross-investment, and financing-flow routes; investigate every non-zero residual rather than inserting a balancing plug.
7. Reproduce operating enterprise value independently through discounted FCFF and discounted economic profit under identical timing and discount-rate assumptions.
8. Rebuild continuing value from growth, stable incremental ROIC, implied reinvestment, T+1 FCFF, and the fixed operating-capital WACC without substituting stable ROIIC into periodic ROIC.
9. Reconstruct claim-specific IRR and XIRR series from their named cash-flow boundaries and reject any unlabeled aggregate return.
10. Use screenshots only after workbook-first verification, with a title, reading guide, academic significance, closure test, governance implication, and transition to the next exhibit.

Q.14 Final Analytical Acceptance Matrix

Analytical domain	Acceptance condition	Rejection or escalation condition
Source identity	Pass only if both papers, both workbook roles, image role, and excluded editions are stated correctly.	Fail if an earlier book or screenshot becomes numerical authority.
Chapter completeness	Pass only if Chapters 1-24 and the full appendix sequence are present in order.	Fail if a chapter is omitted, duplicated, or replaced by a drafting summary.
Title uniqueness	Pass only if headings, tables, figures, and appendices have unique identifiers and intended titles.	Fail on duplicate titles or inconsistent TOC text.
ROIC-WACE-ROE proof	Pass only if OC x WACE_OC = OE x r_OE = E x ROE = NI is explained with signs and denominators.	Fail if WACE is confused with CAPM or if negative OE is suppressed.

Periodic EVA	Pass only if both EVA routes close for the explicit years and T+1, while stable ROIIC remains separately stated.	Fail if stable ROIIC is inserted into the periodic EVA schedule.
FCFF closure	Pass only if direct, gross, and financing-flow routes reconcile under one boundary.	Fail if cash is plugged or investment is omitted.
DCF-EVA value	Pass only if operating enterprise value is 74,268.46 under the governing workbook and both value routes close.	Fail if terminal or discount timing differs across routes.
Equity bridge	Pass only if common-equity value is 73,718.46 under the stated claims and non-operating assets.	Fail if a claim or non-operating asset is added/subtracted twice.
Continuing value	Pass only if growth, ROIIC, reinvestment, FCFF, WACC, and terminal value form one mechanism.	Fail if terminal value is an unexplained residual.
Return labels	Pass only if IRR/XIRR percentages are attached to named claims and cash-flow series.	Fail if one "company IRR" is presented as universal.
Figures	Pass only if each image has a title above it, readable scale, source, purpose, reading guide, significance, control, and transition.	Fail if images are decorative, duplicated, cropped materially, or unexplained.
Confidentiality	Pass only if the protected engine remains protected while conclusions remain testable.	Fail if cells, hidden formulas, or executable mechanics are disclosed.
Cross-route consistency	Accept only when operating capital, net income, cash flow, value, and claim-return routes reproduce their governing fixed points within stated rounding tolerance.	Reject any unexplained residual, timing mismatch, denominator drift, or duplicate claim adjustment.
Independent reproducibility	Accept only when a qualified reviewer can reproduce the stated conclusions from disclosed definitions, assumptions, native tables, equations, and protected source extracts.	Narrow or reject a claim that depends on inaccessible intuition, an unexplained screenshot, or undisclosed executable mechanics.

Q.15 Exclusions, Limitations, and Statements That Must Not Be Made

- The book must not claim that mechanical closure proves the economic forecasts will occur.
- The book must not present WACE as a market-required return, CAPM replacement, or discount rate.
- The book must not treat the negative raw return on operating equity as a stand-alone performance ranking.
- The book must not claim that one IRR represents operations, debt, equity, and total investor funds simultaneously.
- The book must not publish a per-share value until the share-count scale is independently certified.
- The book must not imply that Scenario C is the only economically correct scenario; it is a controlled fixed-hurdle demonstration.
- The book must not substitute the long-run stable ROIIC assumption into the periodic-EVA schedule.
- The book must not disclose the complete Excel model, cell references, hidden formula logic, or executable dependencies.
- The book must not use page count, repeated screenshots, or duplicated prose as a substitute for academic depth.
- The book must not treat a single valuation route, an unexplained screenshot, or an unlabelled percentage as sufficient evidence of structural validity.

Q.16 Independent Validation Checklist

The checklist below consolidates the conditions required for an independent reader to distinguish conceptual propositions, workbook-derived numerical results, visual evidence, and institutional interpretations. It is an analytical boundary statement rather than a substitute for recalculation.

Validation statement	Supporting evidence	Analytical status
The manuscript is the current authorcontrolled project and not a superseded edition.	Source-control register and unique Chapter 1 title.	Pass / Hold
The two papers perform distinct conceptual and methodological roles.	Q.1-Q.4 source hierarchy.	Pass / Hold
The Excel workbooks are the numerical authority.	Q.2-Q.6 workbook and equation lineage.	Pass / Hold
The ROIC-WACE-ROE-net-income proof is complete and sign-aware.	Chapters 4-7 and Appendix M.	Pass / Hold
Cash, financing, DCF, EVA, continuing value, and claims close through independent paths.	Chapters 9-14 and Appendix N.	Pass / Hold
Images are subordinate to Excel and fully explained.	Appendix O and Q.8.	Pass / Hold
Stress, falsification, and adoption protocols are included.	Appendix P.	Pass / Hold
No unintended duplicate titles or concepts remain.	Q.10 plus final automated/manual audit.	Pass / Hold
All governing numbers match the source register.	Q.5 plus final numerical audit.	Pass / Hold
All governing results are traceable from source definition to equation, native table, and conclusion.	Q.2-Q.6 source, value, and equation lineage.	Documented
Every visual exhibit remains subordinate to the controlling workbook and is explained in sequence.	Appendix O, Q.8, and Q.20 evidence standards.	Documented
Claim boundaries, scenarios, timing conventions, units, and signs are explicit.	Q.5, Q.9, Appendices M-N, and chapter definitions.	Documented
A qualified reviewer can challenge and reproduce the principal fixed points without receiving the protected executable engine.	Appendices A, C, D, E, I, M, N, P, and Q.13-Q.19.	Reproducible under the stated confidentiality boundary

Q.17 Source-Lineage Synthesis

The source-lineage register closes the evidentiary loop of the book. Theory originates in the two papers, numerical proof originates in the author-controlled Excel workbooks, images communicate selected discoveries, and the manuscript integrates them under explicit definitions, timing, signs, units, claim boundaries, and validation controls. No part is permitted to substitute for another. The papers do not certify a spreadsheet number; screenshots do not define formulas; narrative persuasion cannot replace a failed identity; and institutional interpretation remains subordinate to the verified economic chain.

Conceptual proposition + workbook formula lineage + independent closure + explained visual evidence + institutional interpretation = structural proof

The resulting architecture does not claim that closure guarantees future outcomes. It establishes that every accepted result describes the same capital, return, income, cash-flow, risk, and claim system under the stated assumptions. Economic judgement begins from this coherent base rather than attempting to repair inconsistencies after valuation.

Q.18 Model-Wide Numerical and Structural Regression Suite

A regression suite protects the analytical system against a local assumption, classification, or formula change that leaves one output looking plausible while breaking a linked conclusion elsewhere. Each test begins from a governing monetary amount or identity and verifies that every dependent result changes only where economic causality requires it.

Test	Fixed point / identity	Governing result	Regression procedure	Failure response
R1	2005 operating state	OC = 6,756; NOPLAT = 6,300.59; ROIC = 93.2592%.	Recompute ROIC and verify every narrative/table/caption occurrence.	Hold if any denominator or year label differs.
R2	2005 net-income fixed point	OC x WACE_OC = OE x r_OE = E x ROE = 4,887.59.	Recompute the three percentage paths with signs.	Reject if one path produces a different monetary NI.
R3	Negative operating equity	OE = -786; debt weight 111.63%; OE weight -11.63%; weights sum to 100%.	Check classification and signaware weighting.	Reject any "normalisation" that hides the negative layer.
R4	Periodic EVA 2005	EVA = 5,106.44 through both periodic routes.	Recompute spread route and capital-charge route.	Hold if the two results differ beyond rounding.
R5	Five-year periodic EVA	Both routes agree for 20052009.	Compare annual rows and cumulative values.	Hold on any silent formula drift.
R6	T+1 periodic EVA	Beginning-capital formula is used consistently; stable ROIIC is separate.	Verify T+1 numerator, capital, WACC, and both EVA routes.	Reject if stable-return mechanics are substituted.
R7	Operating-capital rollforward	Beginning OC + net investment = ending OC for every year.	Recalculate annual state transitions.	Hold if the closing state does not become the next opening state.
R8	Dual FCFF	NOPLAT - net investment = NOPLAT + depreciation - gross investment.	Compare annual and cumulative FCFF.	Hold on an unexplained cash residual.
R9	Financing-flow closure	Annual financing allocation reproduces the same cash generated by operations.	Rebuild debt, interest, asset movement, provisions, minority, distributions, and residual.	Reject if financing items are reclassified as operating cash merely to close.
R10	Explicit DCF	PV of five FCFFs = 20,959.29.	Recalculate discount factors and valuation date.	Hold if cash dates or exponents change.
R11	Stable-state engine	g = 7%; ROIIC = 57.6079%; reinvestment = 12.1511%; stable FCFF = 12,841.40.	Recalculate g/ROIIC and cashconversion factor.	Reject if growth is increased without corresponding reinvestment.
R12	Continuing-value equality	Growing-FCFF and closingcapital-plus-continuing-EVA both equal 120,290.05.	Recompute both fullprecision routes.	Hold if equality is achieved through a plug.
R13	Operating enterprise value	20,959.29 + 53,309.17 = 74,268.46.	Reconcile explicit and continuing PVs.	Hold if displayed rounding is confused with governing precision.
R14	Enterprise-equity bridge	Operating EV plus stated net non-operating assets less senior claims = 73,718.46.	Apply every bridge item once at one date.	Reject double counting or omitted claim.
R15	Claim-specific returns	Each IRR/XIRR is tied to one opening claim and one cashflow series.	Recalculate NPV at the stated rate within each path.	Reject a universal "company IRR" statement.
R16	Per-share exclusion	No accepted per-share output appears.	Search every narrative, table, caption, abstract, and conclusion occurrence.	Hold until share-count scale is independently certified.

Regression principle. A successful regression test does not merely confirm that a number still appears. It confirms that the number is produced by the same source, boundary, timing, sign, unit, and formula route after the manuscript change.

Q.19 Reviewer Challenge Matrix and Required Evidence

The following matrix anticipates the most demanding academic, practitioner, audit, and institutional questions. The purpose is not to script a favourable answer. It identifies what evidence must exist for the claim to survive and what finding would require narrowing or rejecting it.

Challenge	Book response	Required evidence	Finding that invalidates or narrows the claim
"Is ROIC merely a ratio relabelled as a theory?"	ROIC is used as the transformation coefficient linking a defined opening operating state to NOPLAT, then traced into cash, claims, and value.	Capital definition, NOPLAT construction, ROIC identity, multiyear state roll-forward.	Reject the causal interpretation if the numerator and denominator do not describe the same operating object.
"Is WACE just ROE under another name?"	No. WACE_OC, raw operatingequity return, and ROE use different denominators while preserving one net income.	2005 and 2005-2009 Focus Operation Equity& Capital schedules.	Narrow the claim if the defined equity layer or weights cannot be independently reconciled.
"How can an equity weight be negative and a debt weight exceed 100%?"	Operating debt exceeds operating capital, producing negative operating equity; the two weights still sum to 100%.	Inv Capital Calculation and Summary 2005 two-sided reconciliation.	Reject if the negative operatingequity layer results from an inconsistent boundary.
"Does mechanical equality prove economic truth?"	No. Closure removes avoidable inconsistency; assumptions still require external economic challenge.	Scenario, stress, reverse-stress, and falsification protocols.	Reject any statement claiming certainty from algebra alone.
"Are DCF and EVA forced to agree by construction?"	They are theoretically equivalent only under matched forecasts, capital continuity, timing, and required returns; independent implementation makes divergence diagnostic.	Separate FCFF, capital, EVA, DCF, and continuing-value schedules.	Narrow "independence" if routes share the same incorrect source or plug.
"Is terminal value doing too much work?"	Approximately 71.78% of operating value is continuing value, disclosed as a governance concentration.	Explicit PV, continuing PV, stable ROIIC, reinvestment, and reversestress evidence.	Reject the valuation if stable-state evidence is insufficient for the decision.
"Why is a single illustrative company enough?"	The core claims are structural identities demonstrated in a linked engine; empirical generalisation remains a separate research agenda.	Formal proof, computational closure, scenario invariance, and falsification cases.	Do not claim cross-sectional predictive validity without empirical testing.
"Could screenshots be curated to support the story?"	Images are subordinate to workbook-first verification and are selected only after formula lineage is established.	Appendices M-N source analysis, O visual protocol, Q lineage register.	Reject any image whose underlying workbook path cannot be reproduced.
"Does WACE replace CAPM?"	No. WACE is an author-defined ex post structural diagnostic; CAPM is an ex ante market-pricing model.	Chapter 6, Paper 2, Appendix M, terminology controls.	Correct any wording that describes WACE as a discount rate or market expectation.
"What happens under negative or near-zero equity?"	Raw denominator returns become extreme, but monetary income and matched weighted contributions remain interpretable if the boundary is valid.	Negative-OE stress and denominator-location tests.	Suspend percentage ranking where denominator instability dominates interpretation.
"Are financing and nonoperating items mixed into operations?"	NOPLAT and operating capital are separated first; financing and nonoperating absorption are bridged explicitly.	NOPLAT, Finance Analysis, Focus, and enterprise-equity schedules.	Reject a result if an item enters both operating and financing paths.
"Can management game the system?"	The architecture reduces discretion through source certification, independent paths, version control, overrides, and postdecision review.	Chapters 20 and 23; Appendices I, P, Q.	Escalate any manual override without impact analysis and independent revalidation.

Q.20 Figure, Table, and Caption Evidence Standard

Every figure and table is treated as an argument component. The register below assigns minimum evidentiary requirements by class. The standard is deliberately stricter than ordinary captioning because the source images contain dense formulas, arrows, coloured boxes, and multiple analytical layers that can become misleading when reduced or detached from their explanation.

Evidence class	Purpose	Presentation requirement	Mandatory explanation	Repetition / failure control
Master-map screenshots	Whole-company or whole-valuation architecture.	Full-width or landscape; no material crop; readable at normal page scale.	Title above; source; purpose; reading direction; major fixed points; academic significance; limits.	Use once as orientation, then refer to focused panels.
Focused algebraic panels	One denominator bridge, equation cluster, or reconciliation.	Crop only after verifying that all inputs, signs, and result are visible.	State numerator, denominator, weights, timing, equation, and monetary fixed point.	May repeat a region from a master map only when labelled as an enlargement.
Workbook output tables	Annual or multi-year values extracted into manuscript tables.	Recreated as native Word tables; scenario, years, units, and source stated.	Explain why the table appears, what it proves, and what it does not prove.	Do not use an image when a native table is clearer.
Closure tables	Two or more theoretically equivalent routes.	Place routes side by side with explicit difference/zero check.	Define each route and explain any rounding difference.	Any non-zero unexplained residual is a hold condition.
Scenario comparisons	A/B/C or fixed/floating changes.	Same definitions, dates, units, and output order across cases.	Identify exactly which input changed and which remained fixed.	Do not compare unlabeled workbook extracts.
Stress tables	Controlled changes to one economic mechanism.	Baseline and stressed values; assumption scope; linked variables identified.	Separate economic sensitivity from model failure.	Do not call a partial sensitivity a full forecast.
Institutional protocols	Board, credit, risk, investor, and modelgovernance matrices.	Native tables with owners, evidence, decision gate, escalation, and monitoring.	Connect the protocol to the capital-return-cashvalue chain.	Avoid generic governance lists unrelated to the workbook evidence.
Equation displays	Central identities and transformations.	Native equation text with defined symbols and matched notation.	State whether identity is definitional, derived, assumed, or a control.	Reject malformed symbols, missing parentheses, or mixed conventions.

Q.20.1 Caption completeness test

1. The title above the image identifies the economic relationship, scenario, and period rather than merely repeating the worksheet name.
2. The source note identifies the controlling workbook and worksheet function without disclosing protected cell references.
3. The purpose states why the evidence is necessary at this exact point in the argument.
4. The reading guide tells the reader where to begin, which arrows or boxes to follow, and which signs or denominators require care.
5. The analytical finding is derived from Excel and does not rely on visual estimation from the screenshot.
6. The academic significance states what the evidence adds to theory or method.
7. The closure test states the equation or zero check and the consequence of failure.
8. The governance implication states how the result changes a board, bank, investor, management, audit, or risk decision.
9. The transition states why the next exhibit follows and prevents the atlas from becoming a disconnected album.

Q.21 Evidence Change-Control and Revalidation Protocol

Because the system is closed, a change in one definition or assumption may propagate through operating return, income attribution, cash flow, value, and claim returns. The protocol below requires every change to be classified, traced through its dependencies, and independently revalidated before the affected conclusion is accepted.

Change class	Examples	Required revalidation	Acceptance gate
Definition / boundary	Operating capital, NOPLAT, debt, non-operating assets, operating equity, or claim classification.	Rebuild source mapping, denominators, signs, and every dependent closure route.	Independent boundary agreement and zero unexplained residual.
Scenario / assumption	WACC, growth, stable ROIIC, margin, capital intensity, debt path, or terminal mechanism.	Update the scenario register, reinvestment, cash flows, value routes, sensitivities, and institutional implications.	Changed outputs follow economic causality; invariant identities remain closed.
Formula / timing	Beginning versus average capital, discount dates, tax timing, reinvestment timing, or bridge equation.	Recompute all linked years and both sides of each equivalent identity.	No unexplained timing or formula residual.
Visual evidence	Image selection, crop, enlargement, title, source note, or explanatory sequence.	Verify the underlying workbook path first; then confirm readability, lineage, equation, significance, and transition.	The exhibit clarifies a verified result without becoming calculation authority.
Narrative interpretation	Academic claim, governance conclusion, risk diagnosis, or management-quality inference.	Compare wording with the evidence boundary, limitations, and alternative explanations.	The claim is no broader than the verified source and model scope.
Confidentiality boundary	Disclosure of workbook mechanics, hidden formulas, cell addresses, or executable dependencies.	Confirm that results remain independently testable while the protected engine is not disclosed.	Reproducibility is preserved without exposing proprietary implementation.

No-repeat analytical principle. A reviewer should encounter a source-controlled and already-reconciled argument, not be required to discover duplicated definitions, unexplained screenshots, broken identities, or inconsistent governing numbers through repeated full rereading.

Q.22 Independent Validation Synthesis

Appendix Q completes the validation architecture by converting the argument into an auditable chain. The book has a source hierarchy, a workbook function map, a chapter lineage register, a numerical fixed-point register, an equation concordance, visual-evidence rules, scenario and unit controls, an analytical index, a regression suite, a reviewer challenge matrix, an evidence standard, and a revalidation protocol. These controls are methodological rather than administrative: they make clear what is defined, what is calculated, what is inferred, and what remains outside the evidence boundary.

Verified source -> controlled derivation -> independent closure -> explained evidence -> bounded conclusion Independent

validation requires the principal fixed points to be recalculated, equivalent routes to converge, scenario and claim boundaries to remain explicit, and every visual exhibit to be traceable to the controlling workbook. A conclusion is accepted only to the extent that it survives these tests and remains within the stated limitations.

Q.23 T+1 Periodic ROIC and Economic-Profit Closure from the Controlling Workbook

The controlling workbook contains the complete T+1 periodic closure. The ROIC schedule carries NOPLAT of approximately 14,618 against beginning operating invested capital of 20,794, producing 70.30%. The Economic Profit schedule applies the same periodic ROIC, the fixed operating-capital WACC, and the same beginning-capital base to produce economic profit of approximately 10,942 through two equivalent routes. The images below make this verified structure visible and readable in the manuscript.

Computational Evidence Exhibit Q-1: T+1 Periodic ROIC Closure from NOPLAT and Beginning Operating Invested Capital

Company Name: Example
ROIC CALCULATION, 000

	1	2	3	4	5	
Years	Dec2005	31/12/2006	31/12/2007	31/12/2008	31/12/2009	t + 1
NOPLAT	6,301	8,917	10,473	11,566	13,661	14,618
Operating Invested Capital (beginning of year)	6,756	9,804	14,098	17,286	19,134	20,794
Operating Invested Capital (Average)	8,280	11,951	15,692	18,210	19,964	10,397
ROIC = NOPLAT / Operation invested capital	93.26%	90.95%	74.29%	66.91%	71.40%	70.3%
ROIC (using average capital)	76.09%	74.61%	66.74%	63.51%	68.43%	140.59%
ROIC (including goodwill)	50.80%	57.71%	53.04%	50.43%	55.13%	70.30%

A
B

Source and evidence identification. Author-supplied extract from the controlling ROIC calculation worksheet. The exhibit reports 2005–2009 and T+1 NOPLAT, beginning operating invested capital, alternative average-capital and goodwillinclusive views, and the governing beginning-capital ROIC row.

Purpose of inclusion. To demonstrate that T+1 is the normal continuation of the periodic operating-return schedule and preserves the same beginning-capital convention used throughout the explicit period.

How to read the exhibit. Read vertically in the T+1 column: NOPLAT is approximately 14,618 and beginning operating invested capital is 20,794. Their quotient is 70.30%. The separate average-capital and goodwill-inclusive rows answer different denominator questions and do not replace the governing periodic beginning-capital calculation.

$$ROIC\_T+1 = NOPLAT\_T+1 / \text{Beginning Operating Invested Capital}\_T+1$$

$$ROIC\_T+1 = 14{,}617.60 / 20{,}794.00 = 70.2972\% \approx 70.30\%$$

Academic significance. The exhibit preserves denominator discipline. Periodic ROIC measures the return generated by the full operating-capital stock inherited at the start of T+1. It must remain distinct from the stable incremental return used to determine reinvestment in continuing-value mechanics.

Control and transition. The 70.30% periodic ROIC becomes the operating return input to the fixed-hurdle Economic Profit schedule shown next.

Computational Evidence Exhibit Q-2: T+1 Economic-Profit Closure under the Fixed Operating-Capital WACC

Company Name: Example
ECONOMIC PROFIT CALCULATION, 000

		1	2	3	4	5		
Years		Dec2005	31/12/2006	31/12/2007	31/12/2008	31/12/2009	T + 1	
Return on Invested Capital	A	93.26%	90.95%	74.29%	66.91%	$	70.3%	
WACC	B	17.68%	17.6754%	17.6754%	17.6754%	17.6754%	17.6754%	FIXED WACC
Spread		75.58%	73.27%	56.61%	49.23%	#VALUE!	52.6%	
Invested Capital (beginning of year)		6,756	9,804	14,098	17,286	19,134	20,794	
Economic profit = Spread * Invested Capital		5,106	7,184	7,981	8,510	#VALUE!	10,942	
NOPLAT		6,301	8,917	10,473	11,566	13,661	14,618	
Capital charge		1,194	1,733	2,492	3,055	3,382	3,675	
Economic profit = NOPLAT- Capital Charge		5,106	7,184	7,981	8,510	10,279	10,942	

Source and evidence identification. Author-supplied extract from the controlling Economic Profit worksheet under the fixedWACC scenario. The exhibit displays periodic ROIC, fixed WACC, spread, beginning invested capital, NOPLAT, capital charge, and the two economic-profit constructions.

Purpose of inclusion. To prove that the T+1 economic-profit amount is generated directly by the workbook and closes through both the spread route and the amount route.

How to read the exhibit. In the T+1 column, periodic ROIC is 70.30% and fixed WACC is approximately 17.6754%, giving a spread of approximately 52.62%. Applying that spread to beginning operating invested capital of 20,794 produces approximately 10,942. Independently, subtracting the capital charge of approximately 3,675 from NOPLAT of approximately 14,618 produces the same amount.

Economic Profit_T+1 = (ROIC_T+1 - WACC_T+1) x Beginning Operating Capital_T+1

Economic Profit_T+1 = (70.2972% - 17.6754%) x 20,794.00 = 10,942.19

Economic Profit_T+1 = NOPLAT_T+1 - Capital Charge_T+1

Economic Profit_T+1 = 14,617.60 - (17.6754% x 20,794.00) = 10,942.19

Academic significance. The dual equality demonstrates amount-level closure between return, hurdle, capital, and operating surplus. It shows that economic profit is not a free-standing valuation estimate: it is the exact residual after the productive state has earned ROIC and paid the required operating-capital charge.

Boundary statement. Stable ROIIC of approximately 57.6079% remains a separate marginal return assumption used to derive continuing-state reinvestment. It is not the T+1 periodic ROIC and is not inserted into this annual Economic Profit schedule.

Decision and governance implication. A board or model validator can reproduce the T+1 result from either formula. Failure of either route to return the same amount would identify a denominator, timing, WACC, or source-link problem before valuation approval.

Q.24 Final Appendix Conclusion

The final control record distinguishes two valid but different analytical layers. The workbook's T+1 periodic ROIC and Economic Profit schedules measure the return earned on the full operating-capital stock under the fixed hurdle. The separate stable ROIIC assumption measures the return expected on incremental capital in the continuing state and determines the reinvestment required to support long-run

growth. Preserving this distinction strengthens the manuscript's central claim that performance measurement and valuation must remain linked without being conceptually collapsed.

Verified workbook source + denominator-consistent derivation + dual-form closure + explained visual evidence = controlled analytical result

The T+1 evidence completes the appendix by demonstrating that periodic performance measurement and continuing-value mechanics can remain linked within one model while preserving their distinct denominators, return concepts, and decision purposes.