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Temporal Robustness and Valuation Closure in Corporate Finance: A Closed-Loop Test of Broken-Date Floating-WACC and Full-Year Fixed-WACC Regimes

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Abstract

This paper studies whether a closed-loop corporate-finance valuation system preserves its core economic identities when the valuation regime changes from a broken-date, floating-WACC structure to a full-year, fixed-WACC structure. The two scenarios are deliberately not treated as a clean one-factor experiment. Scenario A is valued on 14 September 2005, uses a 108/365 first-period fraction and maturity-specific floating WACC inputs, and follows the baseline operating path. Scenario C begins at a full-year boundary, uses a fixed WACC of 17.6754%, and embeds a 5% higher sales path that propagates into NOPLAT, ROIC, economic profit, FCFF, and value. The research therefore separates within-regime identity tests from cross-regime descriptive comparisons. Four findings are central. First, both scenarios satisfy exact cash-flow conservation across the active 2005-2009 forecast horizon: FCFF equals NOPLAT less net investment, gross cash flow less gross investment, and the financing flow serving investors. Second, claim-level conservation holds year by year: FCFF equals FCFE/quasi-equity cash flow plus debt movements plus after-tax interest. Third, Scenario C produces exact DCF-residual-income closure at operating value 74,268.4586, equity value 73,718.4586, and model per-share value 335.0839. Scenario A produces near, but not exact, closure. On a single schedule-consistent analytical basis, the DCF operating value is 71,169.1793 and the residual-income operating value is 71,327.6925, a residual of 158.5132 model units, or approximately 0.2225% on a symmetric valuation-error basis. Fourth, the paper derives a general discount-factor closure condition. If D_t is the discount factor for period t and k_t is the capital-charge rate used in residual income, DCF and residual-income valuation close exactly when $D_{t-1} = (1 + k_t)D_t$; equivalently, $k_t^* = D_{t-1}/D_t - 1$. The fixed-WACC full-year case satisfies this recursion exactly, whereas the broken-date floating-WACC case does not when maturity-specific direct-power discount factors are paired with a different capital-charge timing convention. Replacing the capital-charge sequence with the implied forward sequence restores closure to machine precision. A date-normalized diagnostic bridge also shows why the raw values near 321 and 335 per share cannot be interpreted as a simple fixed-versus-floating WACC effect. Holding Scenario A operations constant, moving from the broken date to a full-year basis lowers operating value from 71,169.18 to 63,504.84; changing only the full-year discount architecture to Scenario C's fixed WACC lowers value by a further 19.33; replacing Scenario A operations with Scenario C operations then raises value by 10,782.95 to 74,268.46. Valuation convergence is therefore treated as a structural property governed by capital continuity, claim conservation, discount-factor recursion, and temporal alignment rather than as a coincidence of headline values.

Keywords: Closed-Loop Valuation, Broken-Date Valuation, WACC, ROIC, NOPLAT, EVA, Residual Income, FCFF, FCFE, Valuation Closure, Capital Continuity, Discount-Factor Recursion, Temporal Robustness, Corporate Finance

JEL Classification: G12; G31; G32; G34; M41.

Introduction

A valuation model is most informative when it can do more than generate a plausible number. It should also reveal whether the number is internally supported by the capital, return, income, cash-flow, financing, and discounting relations that produced it. This is the motivation behind closed-loop valuation: a valuation is treated as an internally testable system rather than a single forward estimate. Earlier work in this research program formalized capital continuity, multi-path convergence, temporal discipline, and the possibility that a model should refuse an output when its structural identities do not reconcile [1]. The present paper moves that program from conceptual architecture into a stricter computational stress test.

The stress test is especially demanding because the two model scenarios are not synchronized. Scenario A is a broken-date valuation beginning on 14 September 2005. Only 108 days remain to the first year-end. The workbook applies floating WACC inputs across forecast maturities and discounts the first explicit cash flow over 108/365 of a year. Scenario C begins at a full-year boundary, uses a fixed WACC throughout the forecast, and simultaneously assumes a stronger operating path. Comparing their raw values as if they were identical-date observations would therefore confound timing, discount-rate structure, and operating performance. The methodological task is not to force the scenarios into a false apples-to-apples comparison, but to identify which structural relations survive the regime change and to normalize the comparisons that genuinely require a common temporal basis.

This distinction matters because the model produces visually similar headline per-share values: approximately 321 under Scenario A and 335.08 under Scenario C. The superficial reading is that the full-year fixed-WACC case is worth about 4.4% more. The deeper reading is different. Scenario A is valued substantially later in calendar time, giving its forecast cash flows a shorter discount horizon. Scenario C has higher sales and NOPLAT, so its operating engine is stronger. The fixed and floating WACC levels, meanwhile, are numerically close over much of the horizon. Once these channels are separated, the apparent 14-point per-share gap can be decomposed into a large positive operating effect and a large negative timing-normalization effect, with the fixed-versus-floating rate architecture contributing relatively little in this particular calibrated pair.

The most important contribution, however, is not the decomposition of the two headline values. It is the derivation of an operational closure condition linking discount factors and residual-income capital charges. The accounting valuation literature establishes that properly implemented cash-flow and residual-income models are theoretically equivalent under coherent assumptions [2-4]. The computational evidence here identifies how that equivalence can fail in the present broken-date, time-varying-rate implementation even when the underlying operating identities are otherwise correct. The failure is not treated as a reason to discard the model. It becomes a diagnostic residual that can be located, decomposed, and eliminated by enforcing discount-factor recursion.

Literature Positioning

Residual-income valuation rests on the idea that value can be represented as book capital plus the present value of abnormal or residual earnings, provided the accounting and discounting relations are internally consistent. Ohlson (1995) and Feltham and Ohlson (1995) formalize the role of book value, earnings, dividends, operating activities, and clean-surplus accounting in this representation [2,3]. Penman and Sougiannis (1998) compare dividend, cash-flow, and earnings-based valuation approaches over finite forecast horizons, while Lundholm and O'Keefe (2001) emphasize a critical practical point: cash-flow and residual-income models should yield identical value estimates when implemented consistently [4,5]. Plenborg (2002) shows that simplifying assumptions can create valuation biases even when the underlying approaches are theoretically equivalent, and Heinrichs et al. (2013) examine extended dividend, cash-flow, and residual-income models when ideal valuation conditions are relaxed [6,7].

A second strand of literature concerns discount-rate structure. The standard WACC framework aggregates the required returns of debt and equity into a discount rate for operating cash flow. Classic work on capital structure and taxes provides the theoretical foundation for this structure, while Miles and Ezzell (1980) show that the appropriate WACC treatment depends on the assumed financing and project-life structure [8-10]. When expected returns vary through time, a single constant rate need not represent the correct horizon-specific discounting process. Ang and Liu (2004) develop a term-structure approach in which expected cash flows at different horizons are discounted with horizon-consistent expected returns [11]. This literature is directly relevant to the present paper because Scenario A combines a broken date with maturity-specific WACC inputs.

A third strand connects financial-statement analysis with valuation. Nissim and Penman (2001) demonstrate how operating profitability, asset turnover, financing, and other accounting ratios can be organized into a coherent equity-valuation analysis [12]. Practical valuation frameworks likewise emphasize the joint roles of invested capital, operating returns, reinvestment, growth, and discount rates in enterprise value. Stewart (1991) develops the EVA/economic-profit capital-charge perspective used here as one valuation path [13-15]. This paper uses that literature as a foundation but focuses on computational conservation and closure. ROIC, economic spread, FCFF, FCFE, debt movements, and residual income are not treated as independent indicators. They are alternative representations of the same operating-capital and claim-allocation system. The empirical object is therefore not a market sample; it is a fully articulated computational laboratory in which every result can be traced back to its originating income-statement and balance-sheet relations.

The paper also extends the author's prior closed-loop work. Badr (2026a) develops a valuation system in which DCF, ROIC, WACC, and EVA are evaluated under capital-continuity and temporal-discipline constraints [1]. Badr (2026b) applies closed-loop logic to structural peer ranking [16]. The present manuscript is narrower and more technical: it asks what happens to valuation closure when the timing grid and discount-rate regime change, and it derives a precise algebraic condition under which residual-income and DCF paths must converge.

Research Design, Evidence Boundary, and Source Hierarchy

The evidence consists of two linked corporate-finance workbooks, each containing 28 analytical sheets, and a comprehensive computational visual atlas derived from the same model architecture. The workbooks span the income statement, balance sheet, NOPLAT, WACC, invested capital, ROIC, economic profit, free cash flow, discounted free cash flow, FCFE/FCFF reconciliation, finance analysis, ROIC trees, year-by-year summaries, DCF, economic value, growth/reinvestment, and IRR. The computational visual atlas is not used as the controlling numerical source; it documents model intent and provides selected evidence plates preserving the complete informational content of the source exhibit. Blank outer margins may be removed solely to improve legibility; no analytical region is omitted. All headline calculations in this paper are reconstructed from the workbook schedules.

Evidence layer	Role in this paper	Controlling treatment
Income statement / balance sheet	Origin of operating and financing data	Primary source
NOPLAT / invested-capital schedules	Operating earnings and capital continuity	Primary source
Free CFF / financing-flow schedules	Cash-flow conservation	Primary source
Discount Free CFF / DCF	Discounting and operating value	Primary; values are reported from the DCF path being analyzed, with schedule-consistent analytical reconstruction used only when explicitly identified
Economic Value / Economic Profit	Residual-income path and closure	Primary, with timing conventions made explicit
Computational visual atlas	Model intent, complete-page screenshots, explanatory diagrams	Corroborating visual evidence only

Table 1: Evidence Hierarchy and Controlling Treatment

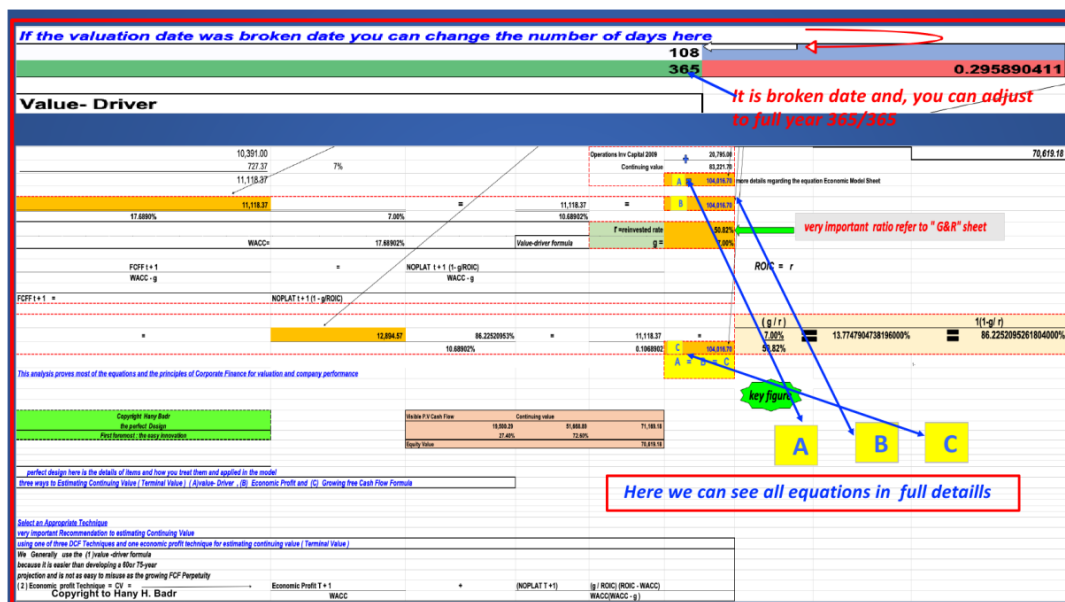
The quantitative evidence is restricted to the 2005-2009 explicit forecast horizon and the T+1 continuing-value layer. Every reported number is tied to the calculation path being analyzed. The workbooks contain parallel schedules that may aggregate or display whole-unit values differently; the paper does not force those parallel displays into artificial numerical identity and does not interpret presentation-level rounding as an economic discrepancy. For formal closure tests, DCF and residual-income inputs are reconstructed on one internally consistent schedule basis, stated explicitly in the relevant section. Workbook display values are reproduced only when the purpose is to document the model's displayed output.

The Two Valuation Regimes

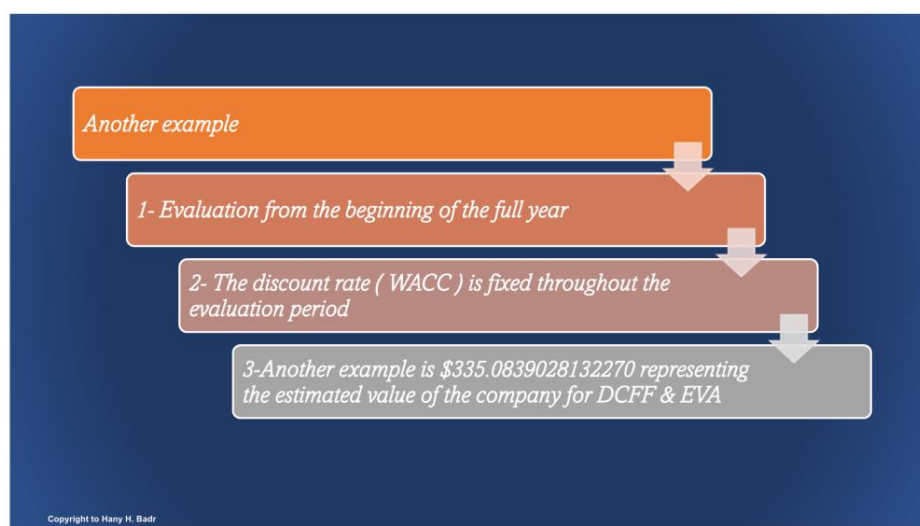
Dimension	Scenario A	Scenario C
Valuation date	14 September 2005	31 December 2004 / beginning of full year
First-period fraction	$108/365 = 0.29589041$	$365/365 = 1.00000000$
Discount-rate structure	Floating maturity-specific WACC	Fixed WACC = 17.675365%
2005 annual WACC	15.782213%	17.675365%
Terminal WACC	17.689024%	17.675365%
Sales path	Baseline	Exactly 5% above A in each explicit year
Beginning operating capital	Same structural path	Same structural path
Interpretation	Broken-date timing experiment plus baseline operations	Full-year timing plus stronger operating case

Table 2: Structural Definition of the Two Valuation Regimes

Scenario A therefore tests temporal flexibility. The model does not wait for a fiscal year boundary; it values the remaining portion of the first year from a 14 September date. The first DCF discount factor is 0.95756660. Scenario C uses full-year discount factors of 0.84979554, 0.72215245, 0.61368193, 0.52150416, and 0.44317191. The visual atlas states explicitly that the broken date can be adjusted to a 365/365 full-year convention, while the full-year example states that WACC is fixed throughout the evaluation period. Those statements are consistent with the workbook cells and are reproduced in the evidence appendix.



Evidence Plate 1: Purpose: Establish that the Model is Intentionally Date-Flexible Rather than Restricted to a Fiscal-Year Boundary. The Complete Atlas Exhibit Shows the Broken-Date Setting and the Day-Count Control Used to Move Between a Partial First Period and a 365/365 Convention. Its Evidentiary Role is to Document Model Design; it does not by Itself Justify a Level Comparison Between Scenarios A and C



Evidence Plate 2: Purpose: Define Scenario C Independently of Scenario A. The Complete Atlas Page States that Evaluation Begins from the Full-Year Boundary, WACC is Fixed Throughout the Evaluation Period, and the Displayed Model Value is 335.0839. The Plate Therefore Documents C as a Distinct Timing-And-Discount Regime Rather than a Synchronized Version of A

Capital, Return, and Cash-Flow Architecture

In the controlling invested-capital schedules, the operating-capital path is common to the two scenarios: beginning operating invested capital is 6,756 in 2005, 9,804 in 2006, 14,098 in 2007, 17,286 in 2008, 19,134 in 2009, and 20,794 in the continuation layer. The operating difference comes from the income statement. Scenario C raises explicit-period net sales by exactly 5% while several nominal operating-cost lines remain unchanged. The resulting NOPLAT path is higher in every year, so ROIC increases without requiring a different controlling capital denominator.

Year	A Sales	C Sales	A NOPLAT	C NOPLAT	A ROIC	C ROIC
2005	21,804.00	22,894.20	5,549.00	6,300.59	82.13%	93.26%
2006	27,996.00	29,395.80	7,851.00	8,916.75	80.08%	90.95%
2007	32,918.00	34,563.90	9,220.00	10,472.71	65.40%	74.29%
2008	36,258.00	38,070.90	10,148.00	11,565.63	58.71%	66.91%
2009	40,549.00	42,576.45	12,051.00	13,661.31	62.98%	71.40%

Table 3: Operating Propagation Under Scenarios A and C

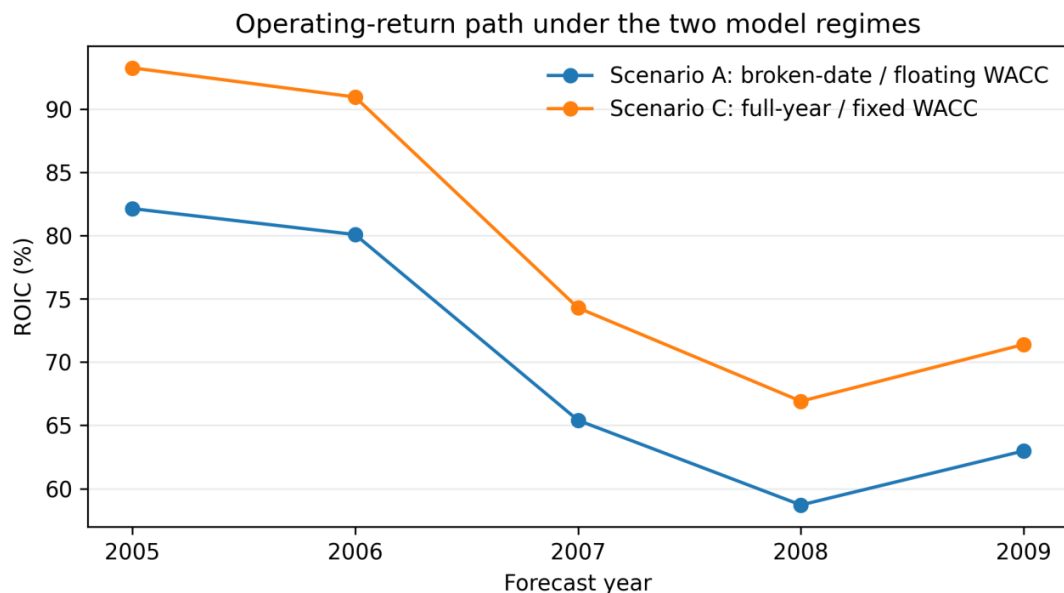


Figure 1: ROIC Paths Under the Two Model Regimes. The Figure is Descriptive Rather Than Causal: The Controlling Invested-Capital Path is Held Structurally Constant While Scenario C's Higher Sales and NOPLAT Raise ROIC Across the Explicit Forecast Years

This operating propagation is important for interpreting the valuation difference. A higher C valuation cannot be attributed to fixed WACC alone. The operating engine is materially stronger. Consequently, cross-regime headline comparisons are descriptive until the date and discount-rate basis is normalized.

Exact Cash-Flow Conservation Within Each Regime

A central validation layer in the workbooks is a set of cash-flow identities rather than a single valuation number. In each explicit year, FCFF is reconciled through three equivalent representations: NOPLAT less net investment; gross cash flow less gross investment; and the financing flow available to all investors. These representations close exactly in the active source schedules.

$$\text{FCFF}_t = \text{NOPLAT}_t - \text{NetInvestment}_t \quad (1)$$

$$\text{FCFF}_t = \text{GrossCashFlow}_t - \text{GrossInvestment}_t \quad (2)$$

$$\text{FCFF}_t = \text{FinancingFlow}_t \quad (3)$$

Year	Scenario A FCFF	A Financing Flow	Scenario C FCFF	C Financing Flow
2005	2,501.00	2,501.00	3,252.59	3,252.59
2006	3,557.00	3,557.00	4,622.75	4,622.75
2007	6,032.00	6,032.00	7,284.71	7,284.71
2008	8,300.00	8,300.00	9,717.63	9,717.63
2009	10,391.00	10,391.00	12,001.31	12,001.31

Table 4: Exact FCFF-Financing-Flow Conservation in the Active Forecast Horizon

A Cash-Flow Conservation Error can be defined as $\text{CFCE}_t = |\text{FCFF}_t - \text{FinancingFlow}_t|$ divided by the average absolute magnitude of the two quantities. CFCE equals zero for all ten active scenario-year observations. This result is robust to the broken date because the conservation identity is established before discounting. Timing changes present value, not the underlying accounting flow identity.

Claim-Level Conservation: FCFE, Debt, Interest, and FCFF

The next layer decomposes the same firm cash flow by claimant. The model starts from FCFE/quasi-equity cash flow, adds the change in debt financing, and adds after-tax interest expense. The sum reproduces FCFF year by year.

$$\text{FCFF}_t = \text{FCFE}_t + \text{DebtMovement}_t + \text{AfterTaxInterest}_t \quad (4)$$

Year	A FCFE	A debt move	A after-tax interest	A FCFF	C claim components	C FCFF
2005	2,039.00	-57.00	519.00	2,501.00	2,790.59 - 57.00 + 519.00	3,252.59
2006	93.00	3,055.00	409.00	3,557.00	1,158.75 + 3,055.00 + 409.00	4,622.75

2007	4,289.00	1,445.00	298.00	6,032.00	5,541.71 + 1,445.00 + 298.00	7,284.71
2008	7,151.00	978.00	171.00	8,300.00	8,568.63 + 978.00 + 171.00	9,717.63
2009	10,280.00	0.00	111.00	10,391.00	11,890.31 + 0.00 + 111.00	12,001.31

Table 5: Claim-Level Reconstruction of FCFF from FCFE, Debt Movements, and After-Tax Interest

This claim-level identity is particularly useful because it prevents a common valuation error: mixing a firm cash-flow numerator with an equity discount rate, or an equity cash flow with a firm discount rate, without reconstructing the financing bridge. In the present system, the operating cash-flow route and the claim route reconcile before present value is taken. Thus the valuation layer inherits a cash-flow base that has already passed a conservation test.

DCF-EVA Equivalence and the General Closure Condition

The theoretical center of the paper is the relation between discounted FCFF and residual-income/EVA valuation. Let IC_t denote operating invested capital at the end of period t , N_t denote NOPLAT, D_t denote the discount factor to the valuation date, and k_t denote the capital-charge rate used to construct economic profit. Define $D_0=1$. Free cash flow and economic profit are

$$FCFF_t = N_t - (IC_t - IC_{t-1}) \quad (5)$$

$$EP_t = N_t - k_t IC_{t-1} \quad (6)$$

Assume the continuing-value relation is internally consistent so that the DCF terminal value can be decomposed into capital in place plus the continuing residual-income value. Then the two operating valuations are

$$V_{DCF} = \sum [FCFF_t D_t] + TV_T D_T \quad (7)$$

$$V_{RI} = IC_0 + \sum [EP_t D_t] + (TV_T - IC_T) D_T \quad (8)$$

Subtracting equation (7) from equation (8) and collecting the invested-capital terms yields the closure residual

$$R = V_{RI} - V_{DCF} = \sum IC_{t-1} [D_{t-1} - (1+k_t)D_t] \quad (9)$$

Equation (9) provides a direct diagnostic. Exact closure for arbitrary capital paths is obtained when each period satisfies the recursive discount condition

$$D_{t-1} = (1+k_t)D_t \quad (10)$$

Equivalently, the capital-charge rate that is consistent with an observed discount-factor sequence is

$$k_t^* = D_{t-1}/D_t - 1 \quad (11)$$

This condition is familiar in economic meaning even if rarely stated as an implementation audit rule: residual income must use the same effective period return that links adjacent discount factors. Under a full-year constant WACC, $D_t = (1+WACC)^{-t}$, so $k_t^* = WACC$ in every period. Under a broken-date term structure, however, a maturity-specific rate and a period-forward rate are not generally identical. This distinction becomes the source of the Scenario A closure residual.

Scenario C: Exact Closure Under Synchronous Full-Year Timing

Scenario C is the clean benchmark. The fixed WACC is 17.675365%. Discount factors satisfy the recursive relation exactly, up to floating-point precision. The DCF operating value is 74,268.4586. The residual-income path starts from operating invested capital of 6,756, adds 67,512.4586 of present-value economic profit, and arrives at the same operating value. The bridge to equity is also identical in both methods.

Measure	DCF	EVA / Residual Income	Difference
Operating value	74,268.4586	74,268.4586	0.0000
Equity value	73,718.4586	73,718.4586	0.0000
Per-share value	335.0839	335.0839	0.0000
Valuation Closure Error	0.0000%	0.0000%	0.0000%

Table 6: Scenario C DCF-Residual-Income Valuation Closure

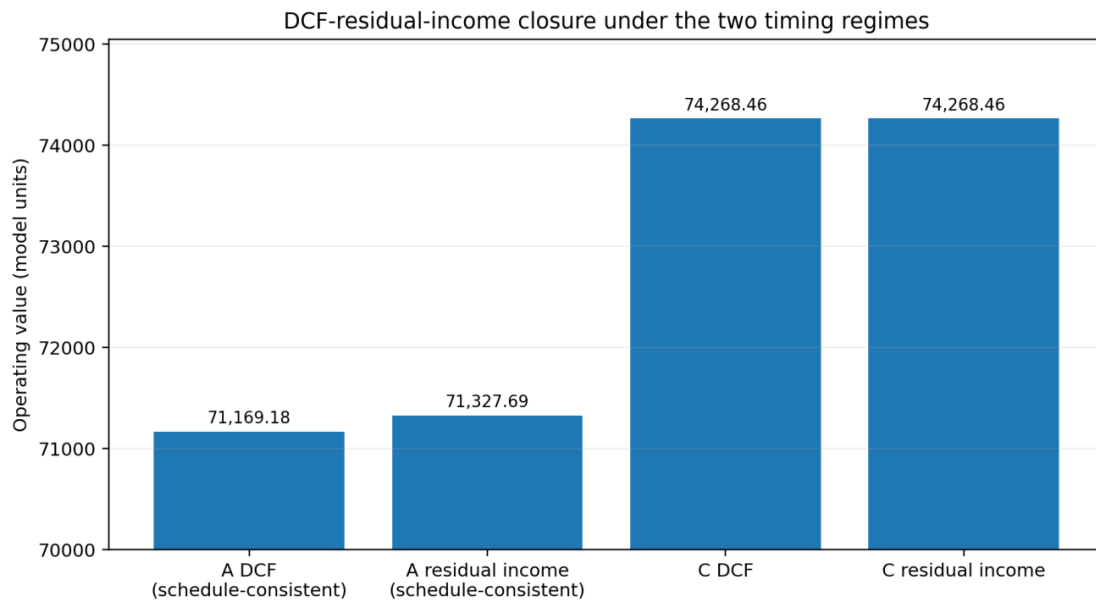
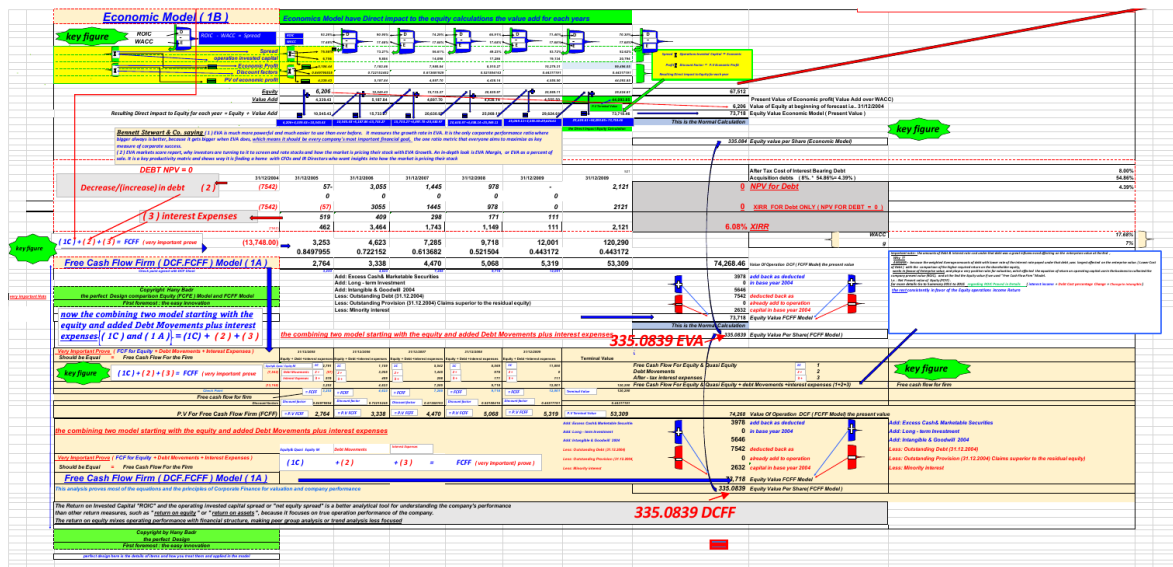


Figure 2: DCF-Residual-Income Closure Comparison on a Schedule-Consistent Analytical Basis. Scenario C Closes Exactly; Scenario A Retains A Small Residual Under its Broken-Date Floating-Rate Timing Convention



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Evidence Plate 3: Purpose: Visually Corroborate Scenario C's Cross-Method Closure. The Source Exhibit Displays the Fixed-WACC ECONOMIC-PROfit Path and the DCF/Economic Value Outputs that Converge to Approximately 335.0839 Per Share. Complete Analytical Content is Retained; Only Blank Outer Margins are Removed for Legibility. The Excel Schedules Remain the Controlling Numerical Source

Scenario A: The Temporal Closure Residual

Scenario A is more revealing because it breaks the synchronous annual structure. The first explicit discount factor is based on $108/365$ of a year. The workbook's residual-income layer prorates the 2005 annual WACC arithmetically, using $15.7822\% \times 108/365 = 4.6698\%$ as the first capital charge. At the same time, the DCF discount factor is compounded: $D_1 = (1 + 15.7822\%)^{-(108/365)} = 0.95756660$. These two treatments imply different effective period rates. The closure-preserving first-period rate implied by the discount factor is $1/D_1 - 1 = 4.4314\%$, not 4.6698% .

The mismatch continues after the first period because Scenario A applies maturity-specific annual WACC values to direct-power discount factors. Adjacent discount factors therefore imply forward period charges that differ from the capital-charge sequence used in the residual-income calculation. Table 7 reports the implied forward rates, defines the basis-point gap as $k_{t-1} - k_t$, and shows the period-by-period contributions to the analytical closure residual.

Year	Beginning IC	Economic-profit charge k_t	Closure rate k^*_t	Gap: $k_t - k^*_t$ (bp)	Residual contribution
2005	6,756	4.6698%	4.4314%	+23.84	-15.42
2006	9,804	16.8270%	17.1379%	-31.09	+24.92
2007	14,098	17.3540%	18.0405%	-68.65	+67.02
2008	17,286	17.6412%	18.3032%	-66.20	+66.99
2009	19,134	17.6890%	17.8469%	-15.79	+15.00
Total					158.51

Table 7: Scenario A Discount-Factor Recursion Mismatch and Closure-Residual Contributions

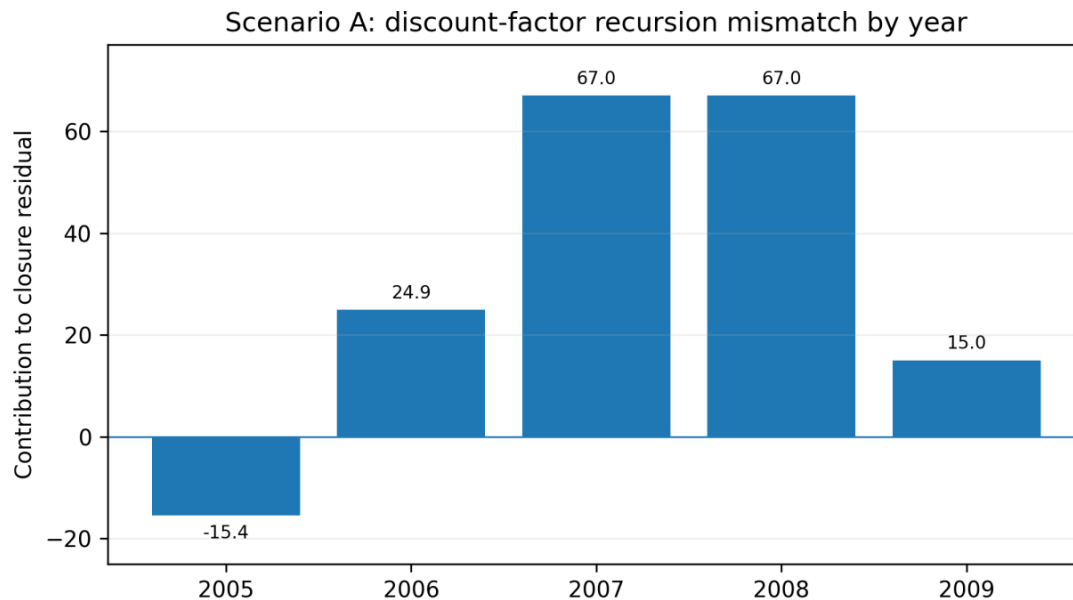


Figure 3: Scenario A Analytical Closure-Residual Contributions Implied by Equation (9). The Largest Contributions Occur in 2007-2008, when the Period-Forward Rate Implied by Adjacent Discount Factors Differs Most from the Capital-Charge Rate Used in Residual Income

For the formal closure test, Scenario A is reconstructed on one schedule-consistent basis: FCFF is taken from the Free CFF schedule, operating invested capital from the Invested Capital Calculation schedule, and the residual-income capital-charge timing follows the Economic Value convention for the broken first period and the annual economic-profit charge sequence thereafter. On that basis, the DCF operating value is 71,169.1793 and the residual-income operating value is 71,327.6925. The Temporal Closure Residual is 158.5132, corresponding to a symmetric Valuation Closure Error of 0.2225%. This is the residual explained exactly by equation (9). The workbook's displayed DCF and Economic Value outputs remain useful visual evidence, but they are not mixed with the analytical reconstruction when the formal residual is calculated.

A decisive falsification test is then available. Replace the residual-income capital-charge sequence with $k_t^* = D_{t-1} / D_t - 1$ while keeping the source capital and DCF discount factors unchanged. The recalculated residual-income operating value becomes 71,169.1793, equal to the DCF value to machine precision. The broken date therefore does not prevent closure. What matters is whether the capital charge and discount-factor sequence are recursively aligned.

Comparison of two methodology 2005

DCFF

1- free cash flow =
The finance flow
2- the present value
of the free cash
flow for firm

2 A & B
value

DCFF

2 A
Value DCFF

Economic value -
added EVA you will
note the performance
and their
measurement in
yearly basis
And how much value
i.e. the amount of
economic value-
added in any year
and performance
ranks for the year

EVA

2 B
Value, Economic
value added EVA

open the company's black box.

floating WACC $15.78\% \times 108/365 = 4.670\%$ Broken Date

The free cash flow will be
correctly by 100%

if the Free Cash Flow For Firm
equal the Financial Flow

Excel (A) for PPT

The
company
year 2005

Each number and any expression and points here and there under this work meant that was tremendous work behind a very new result and huge new methodology with foundation of the new technique.

Evidence Plate 4: Purpose: Expose the First-Period Mechanics of Scenario A. The Source Exhibit Links the 14/09/2005 Valuation Date, the 108/365 Broken-Period Treatment, FCFF and Financing-Flow Reconciliation, the First Discount Factor of 0.9575666, and the First-Period Economic Value Capital Charge. Complete Analytical Content is Retained; Only Blank Outer Margins are Removed. The Exhibit Supports the Claim that Temporal Flexibility is Deliberate and that Valuation-Date Timing Must be Distinguished from Annual Performance Measures

The 321-versus-335 Question: A Date-Normalized Diagnostic Bridge

The model's visual materials repeatedly contrast a per-share value near 321 in Scenario A with 335.0839 in Scenario C. Those numbers are useful only if the date problem is made explicit. Scenario A is valued on 14 September 2005, whereas Scenario C is valued at the beginning of the full year. The later Scenario A valuation date shortens the discount horizon and mechanically raises present value relative to an otherwise identical full-year valuation. A raw comparison therefore understates the operating improvement embedded in Scenario C.

A transparent ordered diagnostic bridge can be constructed without pretending that it is a causal experiment. First, keep Scenario A cash flows and terminal operating assumptions but change only the timing grid from broken-date to full-year while retaining the floating maturity-specific WACC structure. Operating value falls from 71,169.18 to 63,504.84. Second, keep Scenario A operations and the full-year date but replace the floating WACC structure with Scenario C's fixed 17.6754% WACC. Value changes only to 63,485.51. Third, retain the full-year fixed-WACC structure and replace Scenario A operations with Scenario C operations. Value rises to 74,268.46.

Stage	Operating value	Equity value	Per-share value	Incremental change in operating value
A: broken-date, floating WACC	71,169.18	70,619.18	320.9963	-
A operations: full-year, floating WACC	63,504.84	62,954.84	286.1584	-7,664.34
A operations: full-year, fixed WACC	63,485.51	62,935.51	286.0705	-19.33
C operations: full-year, fixed WACC	74,268.46	73,718.46	335.0839	+10,782.95

Table 8: Ordered Date-Normalized Diagnostic Bridge from Scenario A to Scenario C

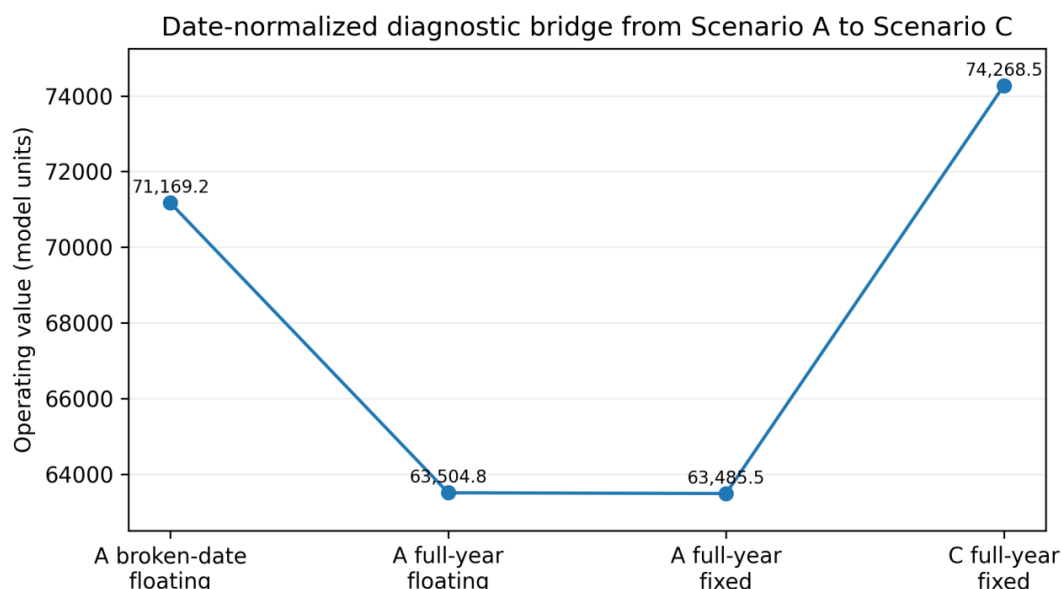


Figure 4: Ordered Date-Normalized Diagnostic Bridge. The Raw A-to-C Value Gap is the Net Result of a Large Negative Timing-Normalization Effect, a Small Additional Effect from the Full-Year Fixed-Versus-Floating WACC Switch in this Calibration, and a Larger Positive Operating-Path Effect

The corresponding per-share increments are -34.8379 for date normalization, -0.0879 for the full-year rate-architecture switch, and +49.0134 for the operating-path change, producing a net increase of 14.0876 from 320.9963 to 335.0839. Because the ordering of counterfactual switches can affect attribution, the paper does not label these increments causal. As a robustness check, a two-factor Shapley decomposition that averages the order of switching operating and discount/timing regimes attributes +11,439.19 model units to the operating change and -8,339.91 to the combined discount/timing change, summing exactly to the observed +3,099.28 operating-value difference [17].

Enterprise Value, Equity Value, and the Invariant Claim Bridge

The operating-to-equity bridge is structurally identical in both scenarios. The model adds excess cash of 3,978 and goodwill/intangibles of 5,646, then subtracts debt of 7,542 and minority interest of 2,632. The net bridge is -550. Thus the transformation from operating value to equity value is invariant across the two scenarios even though operating value changes.

$$\text{EquityValue} = \text{OperatingValue} + 3,978 + 5,646 - 7,542 - 2,632 = \text{OperatingValue} - 550 \quad (12)$$

Scenario	Operating value	Net claim bridge	Equity value	Per-share convention	Per-share value
A schedule-consistent DCF (Free CFF source path)	71,169.18	-550.00	70,619.18	Equity Value / 22,000 × 100	320.9963
A Economic Value display	71,327.42	-550.00	70,777.42	Equity Value / 22,000 × 100	321.7155
C DCF / Economic Value	74,268.46	-550.00	73,718.46	Equity Value / 22,000 × 100	335.0839

Table 9: Operating-Value to Equity-Value Claim Bridge and Per-Share Scaling

The per-share scaling convention also requires explicit disclosure. The workbooks use a model-specific displayed formula of $\text{Equity Value} / 22,000 \times 100$. The paper reproduces that convention exactly and labels the result a model per-share value; it does not impose a separate interpretation of the underlying share-unit scale. Table 9 deliberately labels Scenario A's Economic Value row as a workbook display output; the formal closure test in Section 10 instead uses the schedule-consistent residual-income reconstruction reported there. The two are not interchanged.

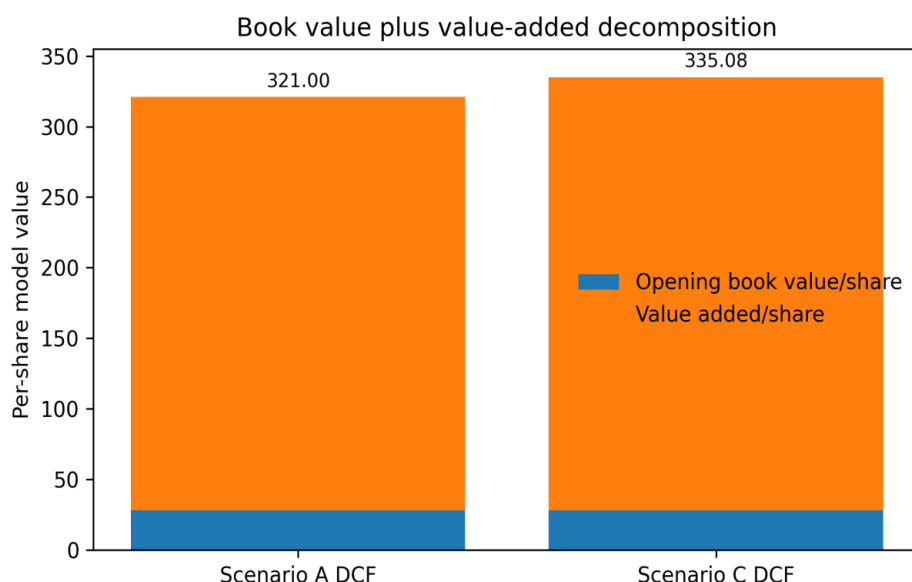


Figure 5: Model Per-Share Decomposition Using the Common Opening Book-Value Component and the Scenario-Specific Value-Added Component. The Figure Reproduces the Workbook's Displayed Per-Share Scaling Convention

Shareholder Equity year 2005 = LE8853 /22000=40.24		
Book value of share=6206/22000=28.21year 2004	28.21	Book value 2004
Equity value per share (Present value) DCF VALUATION	321.00	share value at End of the forecasting
Shareholder value Add per Share (Intrinsic value) =	292.79	Intrinsic value
(1) Shareholder value Add =	64413.38	shareholders value Added
(2) Shareholder Equity At Year End 2004	6206.00	
(1) + (2) Present Value of Equity (DCF VALUATION)	70619.38	value of the company at End of forecasting

The reader should be always keeping in hies mind the book value 2004 = 28.21 and share value at forecasting period i.e. 321.00 because we will be used its in many next slides

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Evidence Plate 5: Purpose: Connect Enterprise/Equity Valuation to the Shareholder-Facing Model Output. The Source Exhibit Decomposes Scenario A's DCF Per-Share Value Near 321 Into an Opening Book-Value Component of about 28.21 and a Value-Added Component of about 292.79. Complete Analytical Content is Retained; Only Blank Outer Margins are Removed. The Exhibit Demonstrates the Per-Share Bridge Rather than Serving as an Independent Input

Continuing Value, Reinvestment, and Terminal Claim Reconciliation

The continuation layer provides another opportunity for a closed-loop test. Both scenarios use a 7% long-run growth rate, but the stable incremental return on new operating investment differs from the periodic T+1 ROIC. This distinction is essential. In Scenario A the stable incremental return used in the value-driver formula is 50.8175%; in Scenario C it is 57.6079%. These rates are inferred from the relationship between long-run growth, NOPLAT, and net investment and should not be conflated with the T+1 periodic ROIC reported elsewhere in the workbook.

$$FCFF_{\{T+1\}} = NOPLAT_{\{T+1\}}(1 - g/r) \quad (13)$$

$$TV_T = FCFF_{\{T+1\}}/(WACC_{\{T+1\}}-g) \quad (14)$$

Measure	Scenario A	Scenario C
Long-run growth g	7.00%	7.00%
Stable incremental return r	50.8175%	57.6079%

NOPLAT T+1	12,894.57	14,617.60
Terminal FCFF / value-driver numerator	11,118.37	12,841.40
Terminal value	104,016.70	120,290.05

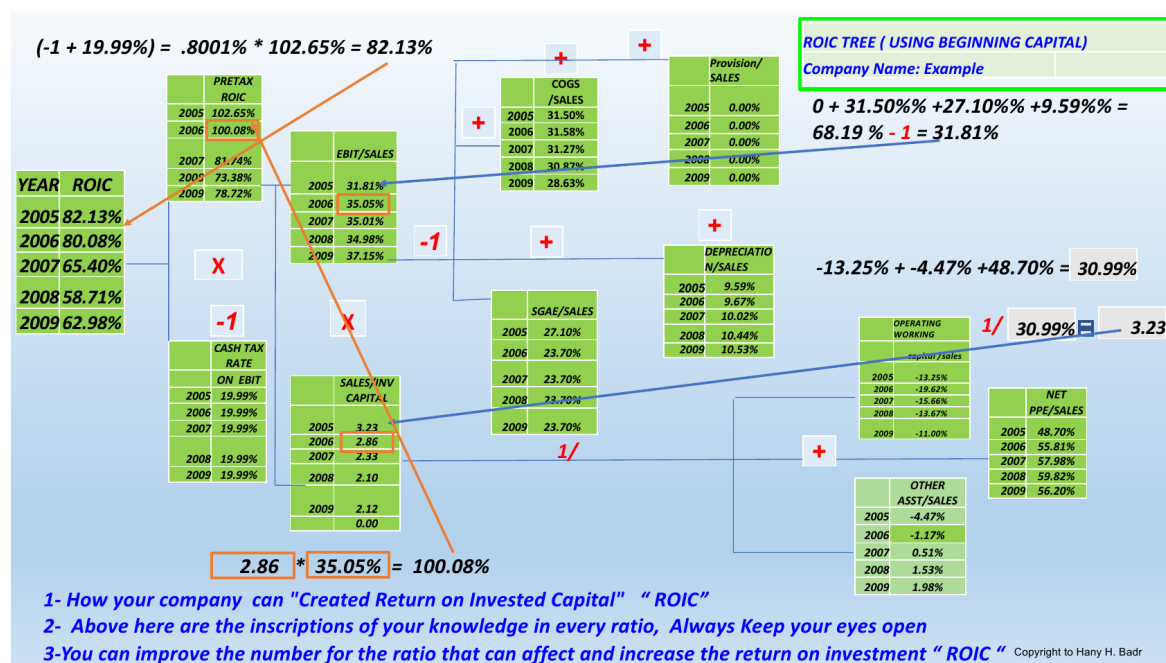
Table 10: Continuing-Value and Reinvestment Inputs Under Both Scenarios

Scenario C goes further by reconciling terminal firm value through the claim structure. Its FCFE/quasi-equity terminal amount is 108,791.1362; terminal debt movement is 2,121; and the continuing tax-shield/after-tax interest component is 9,377.9090. Their sum is 120,290.0452, exactly the FCFF terminal value. This is a terminal analogue of the annual claim-conservation identity.

$$108,791.1362 + 2,121.0000 + 9,377.9090 = 120,290.0452 \quad (15)$$

ROIC Tree and Operating Diagnostics

The model's ROIC tree provides the bridge between accounting detail and valuation. Rather than treating ROIC as a terminal ratio, the tree decomposes it into operating margins, sales-to-invested-capital efficiency, taxes, working-capital intensity, fixed-asset intensity, and other operating-asset relations. This matters for the 5% higher-sales scenario in Scenario C. Because the operating-capital path is held constant while sales increase and several nominal cost lines do not increase proportionally, the improvement appears first in operating margin and NOPLAT, then in ROIC, economic spread, economic profit, FCFF, and value.



Evidence Plate 6: Purpose: Show how Operating Information Propagates Into ROIC Before Valuation is Applied. The Complete ROIC Tree Traces Operating Margin, Sales-To-Invested-Capital Efficiency, Tax Effects, Working-Capital Intensity, Fixed Assets, and Other Operating Items Into ROIC. It Supports the Interpretation that Scenario C's Higher Value is Driven Materially by the Operating Path, Not by the Discount-Rate Switch Alone

The tree also helps distinguish structural from accounting amplification. A high return ratio is not, by itself, evidence of superior economics. The relevant question is whether the return can be reconciled with the capital boundary, the income statement, the reinvestment requirement, the financing flows, and the final valuation. This is consistent with the broader capital-return conservation principle in Badr (2026b), but the present paper gives the principle an explicit valuation-timing test [16].

Falsification Tests and Robustness Protocol

A closed-loop framework is only useful if it can fail. The following tests are therefore part of the research design rather than optional sensitivity analysis.

- Cash-flow conservation test: FCFF must equal both NOPLAT less net investment and financing flow for every active year.
- Claim reconciliation test: FCFE/quasi-equity plus debt movements plus after-tax interest must reproduce FCFF before discounting.
- Claim-bridge test: operating value must reconcile to equity value through identifiable non-operating assets and

superior claims; unexplained balancing items are not permitted.

- Discount-recursion test: the economic-profit capital charge must equal $D_{t-1}/D_t - 1$ if exact DCF-residual-income closure is claimed.
- Terminal decomposition test: DCF continuing value must equal capital in place plus continuing residual-income value under the same terminal assumptions.
- Date-normalization test: values from different valuation dates cannot be compared as levels until their time basis is aligned or explicitly retained as part of the regime difference.
- Schedule-consistency test: a closure residual must be calculated from one internally consistent capital, cash-flow, and discounting schedule; values from parallel display paths are not mixed merely to force or reject convergence.
- Operating-regime test: changes in sales, margins, or NOPLAT must be separated from discount-rate changes before causal language is used.

Applying these tests materially changes the interpretation of Scenario A. The broken-date model is not rejected because DCF and residual income differ by approximately 0.223%. Instead, equation (9) locates the analytical residual in discount-factor/capital-charge recursion. When the implied forward capital-charge sequence $k_t^* = D_{t-1}/D_t - 1$ is used on the same capital and discount-factor basis, closure is restored to machine precision. This is the behavior expected from a diagnostic valuation system: the residual is exposed, located, and resolved by a falsifiable structural condition rather than concealed by a balancing adjustment.

Limitations

The evidence is computational rather than cross-sectional. The scenarios are controlled model environments, not a sample of listed firms. The paper therefore establishes algebraic consistency, timing sensitivity, and model diagnostics; it does not establish that the framework predicts stock returns, market mispricing, or future accounting performance. Any market-predictive claim would require an external panel of firms, historical prices, realized returns, and out-of-sample testing.

The two scenarios are intentionally non-identical. Scenario C changes both operating assumptions and the discounting regime. Consequently, the raw difference between 321 and 335 is not a treatment effect. The counterfactual bridge and Shapley decomposition are diagnostic devices that separate channels within the calibrated model; they are not estimates of causal economic parameters.

The broken-date floating-WACC schedule uses a particular maturity-specific direct-power convention. Alternative term-structure implementations, including sequential chaining of period-specific rates, are possible. The paper does not assert that one convention is universally correct for every valuation setting. Its narrower claim is that DCF and residual-income paths must use mutually consistent discount factors and capital charges if exact closure is expected.

The computational files contain multiple parallel analytical and presentation schedules. The paper therefore restricts inference to identified active-horizon calculation paths and reports the source basis for each closure test. Presentation-level rounding or aggregation differences are treated as display conventions unless they alter an economic identity or a reported valuation result.

Implications for Valuation Practice, Banking, and Governance

For valuation practice, the principal implication is that model convergence should be tested as a structural condition rather than celebrated as a coincidental agreement of final numbers. A DCF/EVA match is meaningful only when capital definitions, timing, discount rates, reinvestment, and terminal assumptions are aligned. Conversely, a small divergence can be informative if it can be traced to a specific timing or rate-recursion inconsistency.

For banking and credit analysis, claim conservation is particularly relevant. FCFF is the common pool that ultimately supports debt service and equity claims. Reconstructing FCFF from both operating sources and financing uses allows the analyst to test whether projected cash generation is internally compatible with the proposed capital structure. The Scenario C terminal reconciliation illustrates how debt movement and continuing interest/tax-shield effects can be explicitly mapped into firm cash flow rather than buried inside a discount rate.

For boards and governance, the framework encourages a distinction between operating-value creation and financing representation. ROIC and economic spread diagnose the operating engine; the claim bridge shows how operating value is allocated across cash, debt, minority interests, and equity; the per-share layer translates the result into a shareholder-facing metric. The entire sequence can be audited without changing the economic boundary midstream.

Conclusion

This paper began with a simple but consequential problem: two scenarios generate headline model per-share values near 321 and 335 even though one is a broken-date, floating-WACC valuation and the other is a full-year, fixed-WACC valuation with a stronger operating path. A direct level comparison would therefore be methodologically weak. Once the workbooks are read as complete systems, however, the contrast becomes analytically informative.

Both regimes preserve exact operating cash-flow conservation over the active forecast horizon. FCFF can be reconstructed from NOPLAT less net investment, from gross cash flow less gross investment, and from financing flow. Claim-level conservation also holds: FCFE/quasi-equity cash flow, debt movements, and after-tax interest reconstruct FCFF year by year. The operating-to-equity claim bridge remains -550 in both scenarios. These relations are structural invariants of the model rather than consequences of a particular discount-rate regime.

Valuation closure, by contrast, is conditional rather than automatic. Scenario C closes exactly because its full-year fixed-WACC discount factors satisfy the adjacent-period recursion used by the residual-income capital charge. Scenario A is more revealing: maturity-specific direct-power discount factors are combined with a capital-charge timing convention that implies different effective period rates. On the schedule-consistent analytical basis, the resulting closure residual is 158.5132 model units, or 0.2225% on the symmetric valuation-error measure. Equation (9) accounts for this residual period by period, and the derived sequence $k_{t^*} = D_{\{t-1\}}/D_{t-1}$ restores DCF-residual-income equivalence to machine precision.

The date-normalized bridge further shows that the raw 321-versus-335 difference cannot be interpreted as a fixed-versus-floating WACC effect. In this calibration, the operating-path improvement is large and positive, date normalization is large and negative, and the incremental full-year rate-architecture effect is comparatively small. The broader conclusion is therefore that temporal flexibility and valuation closure are compatible only when discount architecture and capital charges are expressed on the same temporal basis. A closed-loop valuation system should be judged by its ability to preserve identities, expose residuals, locate the source of non-closure, and reject comparisons that mix valuation dates or capital boundaries. Under that standard, a broken date is not a nuisance; it is a useful stress test of whether the valuation architecture is genuinely closed.

Appendix A. Core Computational Audit Tables

Scenario A annual WACC and operating spread

Year	ROIC	Annual WACC	Annual spread	Annual economic profit
2005	82.1344%	15.7822%	66.3522%	4,482.75
2006	80.0796%	16.8270%	63.2526%	6,201.28
2007	65.3993%	17.3540%	48.0454%	6,773.44
2008	58.7065%	17.6412%	41.0653%	7,098.55
2009	62.9821%	17.6890%	45.2931%	8,666.38

Note: These are annual performance measures. They must not be confused with Scenario A's valuation-date first-period capital charge of 4.6698%, which is the annual 2005 WACC multiplied by 108/365 in the Economic Value sheet.

Scenario C fixed-WACC economic-profit path

Year	ROIC	Fixed WACC	Spread	Economic profit	PV economic profit
2005	93.2592%	17.6754%	75.5838%	5,106.44	4,339.43
2006	90.9501%	17.6754%	73.2748%	7,183.86	5,187.84
2007	74.2851%	17.6754%	56.6097%	7,980.84	4,897.70
2008	66.9075%	17.6754%	49.2321%	8,510.27	4,438.14
2009	71.3981%	17.6754%	53.7227%	10,279.31	4,555.50

Closure metrics

Metric	Scenario A	Scenario C
Cash-flow conservation error (active years)	0	0
Claim reconciliation error (active years)	0	0
Operating-to-equity bridge residual	0	0
DCF-residual-income analytical closure residual (schedule-consistent)	158.51	0
Symmetric valuation closure error	0.2225%	0.0000%
Terminal claim reconciliation error	Not separately expanded in A	≈0 (floating-point only)

Appendix B retains one nonredundant full-context source exhibit from the author's computational visual atlas. The plate preserves the complete analytical content of the source exhibit; only blank outer margins are removed for legibility. No analytical region is omitted. Other visual proofs are embedded beside the relevant arguments in the main text, avoiding repetitive screenshots. All numerical claims remain controlled by the Excel schedules.

Evidence Plate B1: Scenario A DCF Source Exhibit. Purpose: Document the 14/09/2005 Valuation Date, the FCFF Sequence, Broken-Date Discount Factors, Continuing Value, Operating Value Near 71,169.18, Equity Value Near 70,619.18, and the Model Per-Share Value Near 321 in a Single Visual Audit Trail. The Plate Supports the Timing and DCF Bridge; the Excel Schedules Remain the Numerical Authority

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