

AI for Business: Insights from Corporate Data

Topic 2: Financial Statements, Linkages, Ratios, DuPont, and LLM-Aided Interpretation

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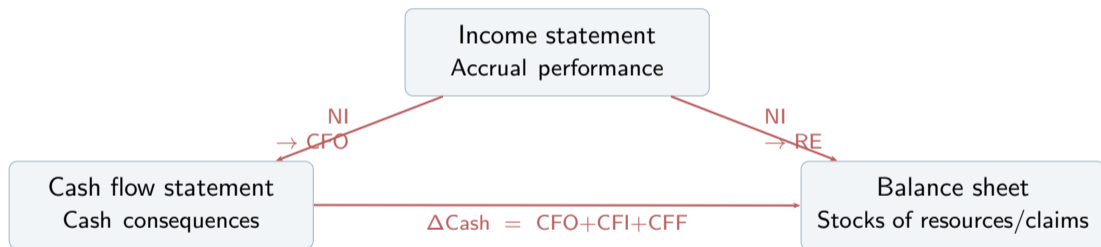
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Overview

- 1 Financial Statements as a System
- 2 Integrated Example
- 3 Ratio Analysis as a Diagnostic System
- 4 DuPont Decomposition
- 5 Pitfalls
- 6 Mini-Case: Apple

Three statements: the articulation links



Articulation mindset

Articulation mindset

- ▶ Read statements as a **single mechanical system**.
- ▶ Treat non-obvious ties as **research tasks**: what transaction explains it, and where is it disclosed?
- ▶ **Mechanical and Interpretive**: mechanics without interpretation becomes bookkeeping; interpretation without mechanics becomes storytelling.

Stocks vs flows

Stock vs. Flow:

Stock: measured at a point in time (cash, AR, inventory, PP&E, debt, equity).

Flow: measured over a period (revenue, depreciation, net income, CFO/CFI/CFF).

When you divide a flow by a stock, you are asking: *how much activity was generated per dollar of resources deployed during the period?*

Ending balance-sheet values can bias ratios when the firm is growing, shrinking, or seasonal.

Averaging convention

$$\text{Avg. Assets} = \frac{\text{Assets}_t + \text{Assets}_{t-1}}{2}, \quad \text{Avg. Equity} = \frac{\text{Equity}_t + \text{Equity}_{t-1}}{2}.$$

Core identities: the mechanical spine

Identity 1: Balance sheet

$$\text{Assets} = \text{Liabilities} + \text{Equity}.$$

- ▶ Capital intensity: asset base required to produce revenue/earnings.
- ▶ Financing risk: fixed claims vs equity cushion.

Core identities: the mechanical spine

Identity 2: Cash roll-forward (BS \leftrightarrow CFS)

$$\Delta\text{Cash} = \text{CFO} + \text{CFI} + \text{CFF}.$$

- ▶ CFO: operations + working capital timing.
- ▶ CFI: long-lived investment (capex, acquisitions, securities).
- ▶ CFF: debt/equity raised or returned (dividends, buybacks).

Core identities: retained earnings roll-forwards

Identity 3: Retained earnings roll-forward

$$RE_t = RE_{t-1} + \text{Net Income}_t - \text{Dividends}_t.$$

- ▶ RE accumulates profits retained in the business.
- ▶ Buybacks usually reduce **treasury stock** (contra-equity), not RE.
- ▶ Equity can fall even with rising RE if repurchases dominate.

Core identities: PP&E roll-forwards

Identity 4: PP&E roll-forward

$$PP\&E_t = PP\&E_{t-1} + Capex_t - Depreciation_t (\pm disposals/FX/M\&A).$$

- ▶ Capex increases productive assets (typically cash outflow in CFI).
- ▶ Depreciation reduces book PP&E (non-cash; added back in CFO).
- ▶ Adjustments often matter: disposals, acquisitions, FX.

Income statement: accrual performance

Question answered

What did the firm earn during the period under GAAP? Accrual accounting recognizes revenue when earned and matches expenses to the period's activity (not cash timing).

Why it matters for valuation

- ▶ scalable measures: growth, margins
- ▶ numerators for equity multiples (P/E) and inputs for forecasts

Balance sheet: resources, financing, constraints

Question answered

What resources does the firm control today, and how are they financed?

Why it matters for valuation

1. **Capital intensity:** asset base required to support revenue. Growth can destroy value if incremental assets (working capital + capex) rise disproportionately and drive returns below the cost of capital.
2. **Liquidity + leverage:** near-term feasibility and long-run fragility.
3. **Comparability:** capital structure affects whether P/E vs EV-based multiples are informative.

Cash flow statement: feasibility and discipline

Question answered

Where did cash come from and where did it go?

Valuation insight: CFO is not automatically “more truthful” than earnings

- ▶ CFO can be boosted by timing: stretch payables, pull forward collections, run down inventory, increase contract liabilities (deferred rev).
- ▶ Objective here: learn the linkage—**what mechanically causes CFO to diverge from net income**, and where it lives on the balance sheet.

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Why a mini-filing? (Orion Tools)

Purpose

Orion is internally consistent and includes features that often drive misinterpretation.

Included features (why they matter)

- ▶ Deferred revenue: CFO and working capital mechanics
- ▶ Stock-based compensation (SBC): non-cash expense; equity effects; CFO add-back; dilution/repurchase implications
- ▶ Treasury stock buybacks: shrink equity; can mechanically raise ROE

Orion income statement (\$mm)

	Year 2	Year 1
Revenue	1,000	900
Cost of goods sold	(600)	(540)
Gross profit	400	360
Cash SG&A (cash operating costs)	(190)	(170)
Stock-based compensation (non-cash)	(10)	(8)
Depreciation & amortization (non-cash)	(50)	(45)
Restructuring charge (non-recurring)	0	(2)
Operating income (EBIT)	150	135
Interest expense	(30)	(28)
Pre-tax income	120	107
Income tax expense	(30)	(27)
Net income	90	80

Reading note: Non-cash charges (D&A, SBC) will reappear as CFO add-backs under the indirect method.

Orion balance sheet (\$mm)

	Y2	Y1
Assets		
Cash	90	50
A/R	95	80
Inventory	130	120
PP&E (net)	305	250
Total assets	620	500
Liabilities		
A/P	85	70
Accrued exp.	35	30
Deferred rev.	30	20
LT debt	150	130
Total liabilities	300	250
Equity		
CS + APIC	155	140
Ret. earnings	192	120
AOCI	(2)	0
Treasury stock	(25)	(10)
Total equity	320	250
Total L+E	620	500

Orion cash flow statement (Year 2, \$mm)

Cash flows from Operation (CFO)	
Net income	90
+ D&A	50
+ SBC	10
Working capital	
$\Delta A/R$	(15)
$\Delta Inv.$	(10)
$\Delta A/P$	15
$\Delta Accrued$	5
$\Delta Def. rev.$	10
Net cash from ops (CFO)	155

Cash flows from Investing (CFI)	
Capex	(105)
Net cash used in CFI	(105)
Cash flows from Financing (CFF)	
Net debt issued	20
Dividends	(18)
Repurchases	(15)
Share issuance	3
Net cash from CFF	(10)
Net change in cash	40
Cash, beg.	50
Cash, end	90

Statement-linkage walkthrough

Step 1: Cash roll-forward: Net change in cash = 40 \Rightarrow cash goes 50 \rightarrow 90 (matches balance sheet).

Step 2: Net income \rightarrow CFO

- ▶ Non-cash add-backs: D&A, SBC.
- ▶ Working capital: Δ AR and Δ Inv use cash; Δ AP, Δ Accrued, Δ Deferred Revenue provide cash.

Deferred revenue intuition: Cash collected before revenue recognition. When it increases, CFO rises even if earnings do not; interpret via business model.

Statement-linkage walkthrough (continued)

Step 3: PP&E roll-forward: PP&E increases 250 \rightarrow 305 (+55). With D&A=50 and capex=105:

$$\Delta\text{PP\&E} \approx \text{Capex} - \text{Depreciation} = 55.$$

Step 4: Retained Earnings roll-forward: RE increases by 192 $-$ 120 = 72, which is equal to NI - dividends

Statement-linkage walkthrough (continued)

Minimum-viable articulation checklist

1. Cash ties: $\Delta\text{Cash} = \text{CFO} + \text{CFI} + \text{CFF}$.
2. Long-lived assets: $\Delta\text{PP\&E} \approx \text{capex} - \text{depreciation}$ (plus adjustments).
3. Retained earnings:

$$\text{RE}_t = \text{RE}_{t-1} + \text{Net Income}_t - \text{Dividends}_t.$$

4. Working-capital deltas align between BS and CFO reconciliation.

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Why ratios matter (and how they mislead)

Ratios as a diagnostic system (not a checklist)

- ▶ **Scale:** convert levels into intensity (profit per dollar of sales/assets/equity).
- ▶ **Compare:** across time and peers (requires consistent definitions and averaging).
- ▶ **Diagnose:** separate margin vs turnover vs leverage vs cash timing.

Why ratios mislead

Business models differ; definitions differ

Ratio workflow (after articulation)

A practical sequence

1. Profitability: margins, ROA/ROE (Is it earning?)
2. Efficiency/capital intensity: turnover, WC days (What resources does it require?)
3. Leverage/coverage: debt ratios, interest coverage (How fragile is equity?)
4. Cash conversion: CFO/NI, CCC (Do cash mechanics support earnings?)

Profitability ratios (what is the profit engine?)

Profitability: convert activity/resources into profit

- ▶ **Gross margin** = $(Revenue - COGS) / Revenue$
Unit economics + mix; sensitive to input costs and pricing power.
- ▶ **Operating margin** = $EBIT / Revenue$
Operating discipline + leverage; closer to core operations than net margin.
- ▶ **Net margin** = $NI / Revenue$
Includes tax + financing + "other"; can move without operating change.
- ▶ **ROA** = NI / \bar{A}
Profit per dollar of assets deployed; first-pass capital-intensity signal.
- ▶ **ROE** = NI / \bar{E}
Equity-holder return; can be mechanically amplified by leverage/buybacks.

Efficiency & capital intensity (how much asset base is required?)

Efficiency: connect growth to reinvestment needs

▶ **Asset turnover** = $Revenue/\bar{A}$

Revenue per dollar of assets; high turnover \Rightarrow asset-light/efficient use; low turnover \Rightarrow asset-heavy or capacity build.

▶ **Working capital days**

$$DSO = \frac{\bar{AR}}{Revenue} \times 365, \quad DIO = \frac{\bar{Inv}}{COGS} \times 365, \quad DPO = \frac{\bar{AP}}{COGS} \times 365.$$

▶ **Cash conversion cycle (CCC)** = $DSO + DIO - DPO$

Net days cash is tied up; long CCC \Rightarrow growth needs cash; negative CCC \Rightarrow operating cycle finances the firm.

DSO intuition (collection time): DSO is receivables measured in “days of sales.” If \bar{AR} equals about 30 days of sales, the firm typically waits roughly a month between recognizing revenue and collecting cash.

Liquidity (near-term constraint)

Liquidity ratios: can the firm meet near-term obligations?

- ▶ **Current ratio** = CA/CL
Broad coverage of obligations due within a year.
- ▶ **Quick ratio** = $(Cash + AR)/CL$
Stress-test liquidity excluding inventory; more informative when inventory is illiquid, slow-moving, or obsolescence-prone.

Interpretation habit: A low liquidity ratio can be *structural* (fast cash collection, supplier financing) or *fragile* (stretched payables, shrinking cash). Pair with working-capital days and credit-line/maturity disclosures.

Leverage & coverage (long-run fragility)

Leverage/coverage: how thin is the equity cushion?

▶ **Debt-to-equity** = $Debt/Equity$

Capital structure intensity; definition-sensitive (what counts as debt). Can be unstable if equity is small/negative.

▶ **Interest coverage** = $EBIT/Interest$

Debt-service buffer; often remains interpretable when equity ratios break. Read alongside covenants and refinancing timing (maturity wall).

Valuation link: Same margin \neq same value: leverage and refinancing risk change the required return.

When ratios break: Retailers & Platforms (negative working capital)

Why current ratio < 1 can be normal (even good)

- ▶ **Operating-cycle mechanics:** customers pay immediately; suppliers are paid later \Rightarrow current liabilities (A/P) can exceed current assets.
- ▶ **Working-capital-days signature:** high DPO relative to (DSO+DIO) \Rightarrow short or **negative** cash conversion cycle (CCC).
- ▶ **Economic interpretation:** the operating cycle *finances the business* (supplier terms + customer cash timing), reducing reinvestment needs and supporting FCF even at modest margins.
- ▶ **Examples:** Walmart and Costco have historically operated with working-capital deficits; many platforms that collect customer cash early and pay counterparties later can exhibit similar mechanics.

When ratios break: Intangible-intensive firms (assets understated)

Why turnover and ROA can be inflated mechanically

- ▶ **Economic reality:** major investment is intangible (R&D, product development, data, organizational capital).
- ▶ **Accounting wedge:** much intangible investment is **expensed** (not capitalized) under GAAP \Rightarrow book assets understate invested capital.
- ▶ **Mechanical consequence:** asset turnover and ROA can look artificially high relative to asset-heavy peers.
- ▶ **What to do:** treat turnover/ROA comparisons with care; in deeper work, use “economic capitalization” (e.g., capitalize a portion of R&D) for comparability.
- ▶ **Examples:** software, biotech, and advertising platforms often look “asset-light” on the balance sheet while reinvesting heavily through the income statement.

Orion ratio dashboard (Year 2)

Ratio	Value	Interpretation anchor
Gross margin	40.0%	Pricing power / cost structure
Operating margin (EBIT/Sales)	15.0%	Operating discipline
Net margin	9.0%	Includes financing + taxes
Asset turnover (Sales/Avg Assets)	1.79	Asset intensity
ROA (NI/Avg Assets)	16.1%	Profitability on asset base
ROE (NI/Avg Equity)	31.6%	Profitability to equity holders
Current ratio	2.10	Short-term coverage
Quick ratio	1.23	Liquidity ex inventory
Debt-to-equity (EOY)	0.47	Financing intensity
Interest coverage (EBIT/Interest)	5.0x	Debt-service buffer
CFO / Net income	1.72x	Cash support for earnings
DSO	31.9 days	Collection speed
DIO	76.0 days	Inventory velocity
DPO	47.1 days	Supplier financing
Cash conversion cycle	60.8 days	Cash tied up in ops

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Why DuPont (capstone of ratio workflow)

ROE is powerful and dangerous

ROE answers: *profit per dollar of shareholder capital*. But it mixes operating performance, capital intensity, and capital structure/equity base management.

DuPont separates three stories

- ▶ margin: operating + below-the-line effects
- ▶ turnover: capital intensity/efficiency
- ▶ equity multiplier: leverage + equity base (including buybacks)

Three-step DuPont

Identity

$$\text{ROE} = \underbrace{\frac{\text{Net Income}}{\text{Sales}}}_{\text{net margin}} \times \underbrace{\frac{\text{Sales}}{\text{Avg. Assets}}}_{\text{asset turnover}} \times \underbrace{\frac{\text{Avg. Assets}}{\text{Avg. Equity}}}_{\text{equity multiplier}}.$$

Diagnostic rule

When ROE is high (or moves), ask: **which component is doing the work?** Only then talk valuation.

Orion DuPont (worked example)

Compute (Year 2)

$$\text{Net margin} = 90/1000 = 9.0\%,$$

$$\text{Asset turnover} = 1000/560 \approx 1.79,$$

$$\text{Equity multiplier} = 560/285 \approx 1.97,$$

$$\Rightarrow \text{ROE} \approx 0.09 \times 1.79 \times 1.97 \approx 31.6\%.$$

Interpretation pattern: High ROE can mean: (i) high margin (pricing/cost advantage), (ii) high turnover (asset-light or operational excellence), and/or (iii) high multiplier (leverage or buyback-shrunk equity). DuPont tells you which.

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Pitfall 1: “High ROE = great operations” (buybacks can dominate)

Apple evidence (FY2024)

- ▶ Repurchases: “repurchased . . . for \$95.0 billion.”
- ▶ Common stock repurchased shown as \$(95,846) mm in equity statement.

Source: Apple Inc. Form 10-K (FY ended Sep. 28, 2024), Note 10 and Statement of Shareholders' Equity.

Lesson: ROE can be a **capital return strategy** as much as an operating outcome. Use DuPont to separate denominator mechanics from operating drivers.

Pitfall 2: “Current ratio < 1 = distress” (negative working capital can be normal)

Walmart disclosure (FY ended Jan. 31, 2025): Walmart explains it “generally operate[s] with a working capital deficit” due to efficient cash use and shareholder returns. Source: Walmart Inc. Form 10-K, Liquidity and Capital Resources.

Two structural reasons in retail/platform models

- ▶ Operating-cycle mechanics: customers pay immediately; suppliers are paid later (higher AP). Current liabilities rise relative to current assets; can reflect efficient supplier financing.
- ▶ Shareholder returns: dividends/buybacks reduce cash (a current asset) while payables/accruals remain; mechanically lowers the current ratio even if operations are healthy.

Pitfall 3: ROE can be uninterpretable (equity tiny or negative)

McDonald's evidence (FY2024): McDonald's reports total shareholders' equity (deficit) of \$(3,797) mm.

Source: McDonald's Corporation Form 10-K (FY ended Dec. 31, 2024), Balance Sheet.

What to do instead

- ▶ Use ROA/ROIC-style measures (operating profit on operating assets).
- ▶ Emphasize cash-based metrics and coverage/leverage feasibility.
- ▶ Treat book-based ratios as mechanically unstable when equity is very small/negative.

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Case objective and deliverables

Apple combines: (i) very strong operating profitability, (ii) persistent large buybacks that shrink equity, and (iii) liquidity ratios that require business-model interpretation.

Workflow

1. Extract minimal inputs from the filing (source of truth).
2. Compute DuPont with correct stock-flow conventions.
3. Interpret ROE as diagnosis (margin vs turnover vs equity multiplier).
4. Add a second diagnostic layer (liquidity + cash support).
5. Present competing narratives + discriminating tests.

Step 1: minimal data extraction (FY2024 10-K)

DuPont inputs

- ▶ Sales: 391,035; Net income: 93,736; EBIT: 123,216.
- ▶ Total assets: 364,980 (2024) and 352,583 (2023).
- ▶ Total equity: 56,950 (2024) and 62,146 (2023).
- ▶ Repurchases/dividends (equity roll-forward and notes).
- ▶ FY2023 spanned 53 weeks (comparability note).

Source: Apple Inc. Form 10-K (FY ended Sep. 28, 2024).

Step 2: three-step DuPont (FY2024 vs FY2023)

	FY2024	FY2023
Net margin (NI / Sales)	24.0%	25.3%
Asset turnover (Sales / Avg Assets)	1.09	1.09
Equity multiplier (Avg Assets / Avg Equity)	6.03	6.25
ROE (NI / Avg Equity)	157.4%	171.9%

First-pass diagnosis

Extremely high ROE is driven heavily by a **large equity multiplier** (small equity base). Net margin is also high (economic strength), but DuPont shows magnitude is not purely “operating excellence.”

Step 3: second diagnostic layer (liquidity + cash support)

Liquidity

Current assets 152,987 vs current liabilities 176,392 (current ratio ≈ 0.87). Not automatically distress; interpret with working-capital structure and access to liquidity.

Cash support

CFO 118,254 vs net income 93,736 (CFO/NI ≈ 1.26). Use as a prompt: which non-cash items and working-capital movements explain the gap, and are they structural?

Source: Apple Inc. Form 10-K (FY ended Sep. 28, 2024), Balance Sheet and Cash Flow.

Step 4A: narrative + test (premium-multiple story)

Narrative 1: premium-multiple story (operating strength)

- ▶ **Operating margin strong** \Rightarrow stronger unit economics / pricing / cost discipline.
- ▶ **Turnover stable** \Rightarrow not driven by shrinking the asset base.
- ▶ **CFO > NI** \Rightarrow earnings appear cash-supported (identify the driver).

Test:

- ▶ **Margin test:** check whether the margin gain is broad-based vs. mix/one-time (segment results + MD&A cost drivers + any unusual-item footnotes).
- ▶ **Cash test:** decompose CFO–NI into non-cash add-backs vs. working-capital; verify it is not a temporary working-capital release.

Step 4B: narrative + test (be-careful story)

Narrative 2: be-careful story (capital structure + equity base)

- ▶ **ROE magnitude** largely reflects a **small equity base** (multiplier ≈ 6).
- ▶ **Buybacks shrink equity**, keeping ROE high even if operations are flat.
- ▶ **Equity-based ratios** (ROE, P/B) can become mechanically unstable when equity is thin.

Test:

- ▶ **Denominator test:** reconcile the equity roll-forward and quantify how much equity shrinkage is buyback-driven.
- ▶ **Robustness test:** re-evaluate using **EV-based** framing (operating margin; EV/EBIT-style) to remove equity-base mechanics.

Lab Assignment 2

- ▶ Assigned Reading: Chapter 3.1-3.9.
- ▶ Lab Assignment 2 (due Jan 29).