

Operating Assets & Quality with LLM as Co-Pilot

Working Capital, Revenue Quality, and Capitalization Diagnostics

Miao Liu

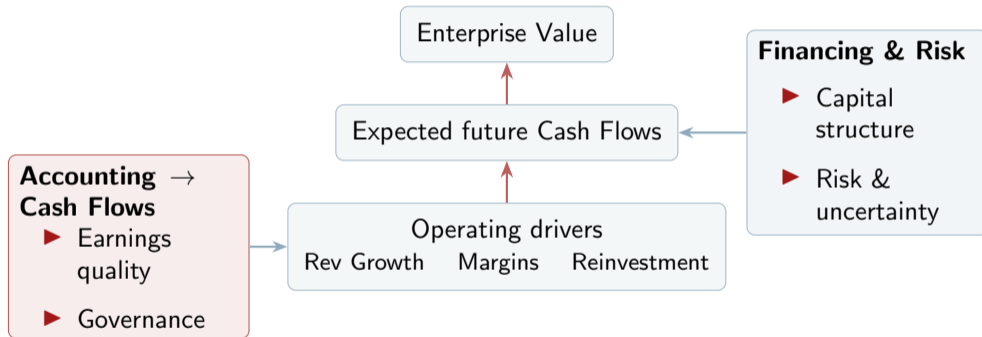
Boston College

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Overview

- 1 Big Picture: What We Are Diagnosing
- 2 Working Capital & Revenue Quality
- 3 Capitalization & Long-Lived Operating Assets
- 4 Case: Amazon

Mapping Drivers Data



The common failure mode: mechanism confusion

A typical “great quarter”: revenue up and margin up.

The miss arrives later when the **mechanism** was misunderstood:

Two breakdown channels

- ▶ **Timing (working capital):** Revenue jumps, but **AR jumps even more**. The firm “sold” growth on looser credit; cash didn’t arrive. Next quarter: collections slow, credits/returns rise, CFO collapses.
- ▶ **Measurement (long-lived assets):** EBIT “improves” because the firm **extends depreciation lives** for a major asset class. Cash and unit economics do not change. Later: the accounting tailwind fades (or reverses via impairment), and the margin story breaks.

The four value drivers

Growth

Margins

Reinvestment

Risk

Do the reported numbers faithfully represent the four drivers?

We test the operating-asset layer where *timing* and *measurement* distortions hide.

Working capital & revenue quality

Focus: timing

Objects: AR, inventory, AP, contract assets/liabilities, reserves

Question: do earnings convert to cash on credible terms?

Capitalization & long-lived assets

Focus: measurement

Objects: PP&E lives, impairment, leases, intangibles, quasi-capex

Question: do reported profits reflect economics—or accounting allocation and classification?

Why humans struggle here (and where LLMs help)

These failures persist because the evidence is fragmented and definition-sensitive.

Why analysis is high-friction for humans

- ▶ Evidence is scattered across statements, notes, and MD&A.
- ▶ Definitions drift (e.g., billings/bookings, capex vs quasi-capex).
- ▶ The same numbers can support multiple narratives (benign timing vs deteriorating economics).

Division of labor: LLM co-pilot vs analyst

- ▶ **LLM accelerates:** disclosure triage, excerpt extraction, structure, competing narratives, test design, red-teaming.
- ▶ **Human owns:** computations, tie-outs, verification, and judgment (audit trail).

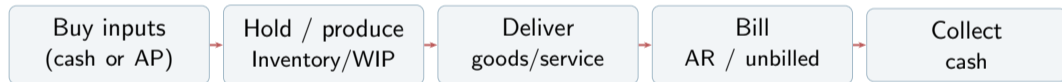
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Working capital: why it exists

Working capital exists because cash timing rarely matches revenue and cost timing: firms buy inputs, hold inventory (or incur labor/project costs), deliver, bill, and collect.

Operating cycle (goods/services flow)



Working capital: why it is “capital”

It is called *capital* because, net of operating liabilities, it represents the funds committed (invested) in the operating cycle—receivables and inventory tied up until they turn back into cash.

Operations view vs Finance view

Why AR and inventory are cash uses (finance intuition)

Accounts receivable (AR): you financed the customer

Sell on credit today → record Revenue + AR → cash arrives later.

If AR increases: you collected *less cash* than revenue recognized; cash is tied up in customer IOUs.

Inventory: you financed unsold goods

Buy/produce before selling → unsold portion sits as inventory.

If inventory increases: more resources are committed to stock that has not turned into cash yet; cash is tied up in inventory stock.

Cash view: “sales not collected” / “bought more than sold”

Accounting view: $\Delta AR > 0$ / $\Delta Inv > 0$

Same reality: **cash is tied up in the operating cycle, creating financing needs.**

The finance question: who funds working-capital growth?

When AR/Inventory rise, someone must fund it

Working-capital growth is a **funding requirement**. The gap can be financed by:

- ▶ **Cash on hand** (use liquidity buffers)
- ▶ **Operating liabilities** (AP/accruals up: suppliers/employees finance you)
- ▶ **Customer prepayments** (deferred revenue up: customers finance you)
- ▶ **External financing** (debt/equity: lenders/investors finance you)

Driver link (why finance cares)

Growth: sales expand but cash arrives later → funding need rises.

Reinvestment: ΔNOWC is reinvestment (cash use) alongside capex.

Risk: more external funding or tighter liquidity increases fragility if conditions tighten.

NOWC as reinvestment in the operating cycle

Δ **NOWC** measures how much **additional operating capital** the firm must commit (or release) as it runs and grows the business.

Two cases

- ▶ Δ **NOWC** > 0: **cash use** → AR/inventory/unbilled grow faster than AP/prepayments.
Interpretation: the firm must fund the operating cycle to support sales (cash-hungry growth).
- ▶ Δ **NOWC** < 0: **cash release** → collections catch up, inventory is run down, or AP/prepayments rise.
Interpretation: the cycle releases cash (often temporary).

Why it is called reinvestment

It is the **operational funding required** to maintain/grow revenue, analogous to capex.

A simple numeric example: computing ΔNOWC

Suppose operating accounts change during growth (in \$):

Inputs

$$\Delta AR = +40, \quad \Delta Inv = +30, \quad \Delta AP = +20$$

Compute the operating funding need (simplified)

$$\Delta\text{NOWC} \approx (\Delta AR + \Delta Inv) - (\Delta AP) = (40 + 30) - 20 = 50$$

The firm must provide **50 of cash/financing** (from cash sales, customer prepayment, debt, or equity) to carry receivables and inventory net of supplier financing. Economically, this is investment needed to support growth.

Summary: why Δ NOWC is reinvestment

Δ NOWC is reinvestment because it is the **incremental capital** the firm must commit to receivables and inventory (net of operating liabilities) to sustain and grow operations.

Analogy: two kinds of capacity investment

- ▶ Capex buys **physical/digital capacity**: factories, stores, servers, software, content libraries.
- ▶ Δ NOWC buys **operating capacity**: the ability to grant credit (AR), carry stock (inventory/WIP), and perform before billing (contract assets).

Mnemonic: Capex builds the **machine**; Δ NOWC fills the **pipeline**.

Working capital: definition discipline (NWC vs NOWC)

Definition discipline (liquidity vs operating convention)

$$\mathbf{NWC} = \text{Current Assets} - \text{Current Liabilities}$$

$$\begin{aligned} \mathbf{NOWC} = & (\text{Current Assets} - \text{Cash} - \text{Short-term Investments}) \\ & - (\text{Current Liabilities} - \text{Short-term Debt}) \end{aligned}$$

Interpretation: **NWC** is a broad liquidity snapshot (mixes operating items with cash and financing). **NOWC** isolates operating timing frictions (AR, inventory, AP, contract balances) and is the object that drives cash reinvestment through $-\Delta\mathbf{NOWC}$.

The CFO bridge (indirect method) and sign discipline

Most U.S. firms present CFO via the indirect method:

$$\text{CFO} = \text{Net Income} + \text{Noncash Charges} - \Delta(\text{Op. Curr. Assets}) + \Delta(\text{Op. Curr. Liab.})$$

Sign discipline (translate stock moves to cash implications)

- ▶ $\uparrow \text{AR} \Rightarrow \downarrow \text{CFO}$ (revenue not yet collected)
- ▶ $\uparrow \text{Inventory} \Rightarrow \downarrow \text{CFO}$ (cash tied up in stock/WIP)
- ▶ $\uparrow \text{AP} \Rightarrow \uparrow \text{CFO}$ (supplier financing)
- ▶ $\uparrow \text{Contract liabilities / deferred revenue} \Rightarrow \uparrow \text{CFO}$ (customer prepayment)

Rule of thumb: growth consumes cash unless paid in advance or financed by suppliers.

Cash conversion cycle (CCC): the speedometer

NOWC expresses the operating cycle in *dollars*.

CCC expresses the operating cycle in *days*: *how long between paying for inputs and collecting cash, net of supplier terms?*

Core metrics (use average balances)

$$\text{DSO} = \frac{\overline{AR}}{\text{Revenue}} \cdot 365, \quad \text{DIO} = \frac{\overline{Inv}}{\text{COGS}} \cdot 365, \quad \text{DPO} = \frac{\overline{AP}}{\text{COGS}} \cdot 365$$

$$\text{CCC} = \text{DSO} + \text{DIO} - \text{DPO}$$

Interpretation discipline

Low/negative CCC can be a structural advantage, but changes can reflect timing, mix shifts, or financing overlays.

Hypothetical example: “Great growth” can be cash-hungry (Orion Devices)

Orion Devices (hardware distributor) reports a strong Year 2: revenue up, margins up, earnings up.

	Year 1	Year 2	Change
Revenue	1,000	1,250	+250
Gross margin	30%	32%	+2pp
Net income	60	80	+20
Accounts receivable	120	220	+100
Inventories	180	320	+140
Accounts payable	160	210	+50

Headline story “Improving profitability” + “strong growth” \Rightarrow tempting to treat earnings as durable.

Mechanism: working-capital build absorbs cash

The operating cycle requires funding when AR and inventory rise faster than payables.

Compute the operating funding need (simplified)

$$\Delta \text{NOWC} \approx (\Delta \text{AR} + \Delta \text{Inv}) - (\Delta \text{AP}) = (100 + 140) - 50 = 190$$

Translate into cash (CFO bridge intuition) If noncash charges are small:

$$\text{CFO} \approx \text{NI} - \Delta \text{NOWC} = 80 - 190 = -110$$

Clear message

Earnings rose, but operating cash fell because cash collection lags (AR up) and cash is tied up in stock (Inv up).

What this changes for an analyst (tests, not stories)

Cash-hungry growth is not automatically bad, but it is **conditional** until you diagnose the mechanism.

Three discriminating questions (with filing tests)

- ▶ **Receivables:** expansion into longer terms vs weak collectibility?
Test: DSO trend, aging/allowance, customer concentration, ASC 606 timing.
- ▶ **Inventory:** strategic build vs slowing sell-through?
Test: DIO trend, reserve/markdown language, demand commentary, obsolescence signals.
- ▶ **Payables:** stable supplier financing vs stress/overlays?
Test: DPO trend, supplier finance disclosures, “liquidity” language, term changes.

Takeaway: “Even though earnings improved, Orion’s growth is **cash-hungry** because **receivables and inventory rose far faster than payables, creating a large NOWC build that absorbs operating cash.**”

Working capital analysis: why we do it

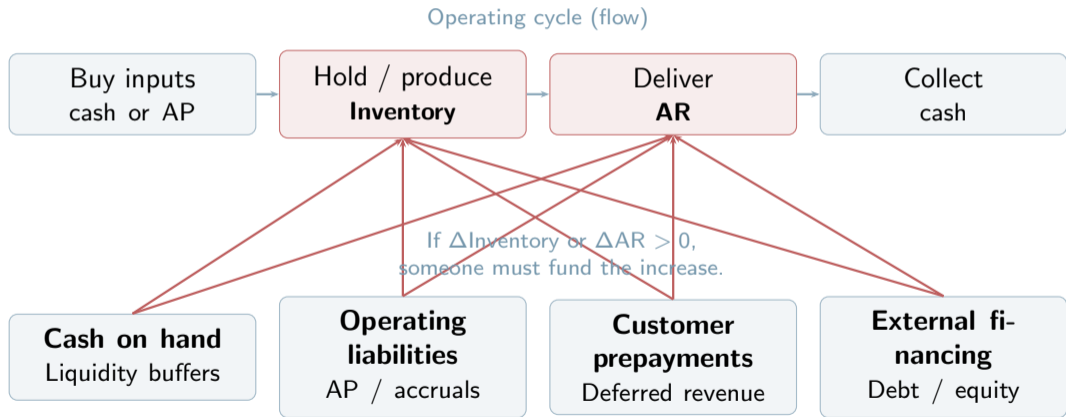
Valuation cares about **long-run cash flows**. Because forecasting them directly is hard, we start from **observable statements** as proxies.

Earnings are a useful starting point because accrual accounting separates operating performance from cash timing, though it introduces estimation risk.

Working capital analysis is a diagnostic of whether earnings are likely to persist and convert to cash.

Finance view vs operations view: framing working capital as “How much capital does the operating cycle absorb or release + who funds it” is exactly the bridge to growth/reinvestment/risk.

Operating cycle (the Finance View)



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Capitalization: the measurement layer

Working capital explains why **earnings and cash** diverge due to **timing**: collections, inventory build, payables, and customer prepayments.

The next step: capitalization

Capitalization explains why **earnings and cash** can diverge due to **measurement choices**: expense now vs capitalize and amortize later.

Why this matters

A firm can look “more profitable” or “more cash generative” without better economics. Your task is to separate **economics** from **accounting allocation**.

Capitalization: Economics vs. Reporting

Economics:

Capitalize a cost when it is primarily an **investment** that produces future benefits.

Expense a cost when it is primarily a **period cost** whose benefits are mostly current.

Reporting constraint:

Accounting adds a practical filter: **are future benefits measurable and verifiable?**

If not, U.S. GAAP often requires **expensing** even when the cost is investment-like economically (e.g., most **R&D**).

Implication (modern economy)

Intangible investment is large, but often **not capitalized**.

Result: reported assets can understate economic capital, and reported margins/reinvestment can be hard to compare across firms.

Where capitalization shows up (our roadmap)

Capitalization choices concentrate in a few recurring balance-sheet domains.

1. **PP&E:** useful lives, depreciation, and impairment (allocation over time).
2. **Leases:** fixed claims embedded in operations (“asset-light” can be levered).
3. **Intangibles & goodwill:** acquisition accounting, amortization, and impairment discretion.
4. **Quasi-capex:** investment-like spending outside PP&E (R&D, software, content).

For each: identify the policy, locate where judgment enters, run tie-outs, and document an adjustment ledger.

PP&E: why it matters for valuation

Two reasons PP&E is a core measurement object

- ▶ **Margins (measurement):** Depreciation is a recurring expense that can move reported **EBIT** even when cash and unit economics are unchanged.
- ▶ **Reinvestment (economics):** Capital-intensive models require ongoing **maintenance + growth capex**. The capex–depreciation relationship is a fast check on whether growth and margin are supported by sustained investment.

Takeaway

Do not interpret margin trends without checking: **(i)** depreciation method/lives and **(ii)** capex intensity relative to depreciation.

Where judgment enters: useful lives

Depreciation allocates past investment across time, depending on **estimated useful lives**.

Mechanics

- ▶ **Longer lives** → lower current depreciation → **higher current EBIT**.
- ▶ **Shorter lives** → higher current depreciation → **lower current EBIT**.

Result

Reported earnings can move materially even when **cash and operations do not**.

Analyst discipline

Treat a life change as a **measurement event**: quantify the EBIT impact and ask whether the rationale is operational or optimistic allocation.

In-class mini-case: useful-life extension (set-up)

Asset facts

- ▶ Cost = \$1,100, salvage = 0
- ▶ Depreciated for 2 years on a 4-year straight-line schedule
- ▶ Starting year 3, management revises **total useful life** to 5.5 years

Tasks

1. Compute accumulated depreciation after 2 years and net book value (NBV).
2. Compute annual depreciation going forward under the old life (D_{old}).
3. Compute annual depreciation going forward under the new life (D_{new}).
4. Compute the annual Δ depreciation and the mechanical impact on EBIT.

Solution: useful-life extension

Step 1: book value after 2 years (old 4-year life)

$$\text{Accumulated depreciation} = 1,100 \times \frac{2}{4} = 550 \quad \Rightarrow \quad \text{NBV} = 1,100 - 550 = 550$$

Step 2: depreciation going forward

Old remaining life = 2 years:

$$D_{\text{old}} = \frac{550}{2} = 275$$

New remaining life = 5.5 - 2 = 3.5 years:

$$D_{\text{new}} = \frac{550}{3.5} \approx 157.1$$

Solution: useful-life extension

Step 3: EBIT impact (mechanical)

$$\Delta D = 275 - 157.1 \approx 117.9 \Rightarrow \text{EBIT rises by } \approx \$117.9 \text{ (all else equal).}$$

Takeaway

A useful-life extension can create a **margin tailwind without better economics**.

Treat it as a **measurement event**: document the estimate change, quantify the effect, and test whether peers and operating evidence support the new life.

Useful-life change: what to verify before calling it “economic”

Verification checklist

1. **Disclosure & scope:** where disclosed; which asset classes; prospective estimate change (no restatement).
2. **Magnitude & mechanics:** quantified D&A/EBIT impact; does it explain most of the margin move? PP&E roll-forward consistency.
3. **Operational rationale:** stated reason (engineering/usage/refresh); corroborating evidence (utilization, refresh cadence, reliability).
4. **Peer comparability:** are the new lives within peer ranges for similar assets and usage?

Leases: capacity without ownership

PP&E is **owned** productive capacity.
Many firms access the same capacity by **leasing** it instead.

Leasing and owning can be close substitutes:

- ▶ Retail: own stores *or* lease stores
- ▶ Airlines: own aircraft *or* lease aircraft
- ▶ Logistics: own warehouses *or* rent warehouses
- ▶ Tech: own data centers *or* lease facilities

Accounting can make leased strategies look **asset-light** and **low-debt** even when the firm has large **fixed payment obligations** that behave like debt.

Why leases matter for the value drivers

Two primary channels

- ▶ **Risk (fixed claims):** lease liabilities are obligations to pay. Payments don't fall when demand falls → higher downside fragility.
- ▶ **Reinvestment / asset intensity:** leased capacity can make PP&E look small even when the operating footprint is large.

Secondary channel: margins

Lease strategy affects how costs appear in inc statement (rent-heavy vs depreciation-heavy).

Rule: don't compare firms without checking **owned vs leased** capacity.

Always read the lease note for **(i)** liability level and **(ii)** maturity structure.

In-class mini-case: Lease liabilities as fixed claims (set-up)

Firm A (lease-heavy)

Debt = 40, Cash = 10, **Operating lease liability** = 50, EBITDA = 20.

Lease payments (undiscounted): Y1 18, Y2 13, Y3 10, Y4 8, Y5+ 6.

\sum payments = 55; imputed interest = 5; reported liability = 50.

Firm B (PPE-heavy)

Same EBITDA = 20, same Debt = 40, Cash = 10, but **Operating lease liability** = 10.

Payments: Y1 3, Y2 3, Y3 2, Y4 1, Y5+ 2.

\sum payments = 11; imputed interest = 1; reported liability = 10.

Tasks: Compute

1. net debt/EBITDA for both,
2. lease-adjusted fixed-claim base/EBITDA for both,
3. near-term lease payments (Years 1–2) as a multiple of EBITDA for both.

Mini-case solution: debt-only vs lease-adjusted risk

Step 1: debt-only leverage (misleading similarity)

$$\text{Net debt} = 40 - 10 = 30 \quad \Rightarrow \quad \frac{\text{Net debt}}{\text{EBITDA}} = \frac{30}{20} = 1.5\times$$

Same for Firm A and Firm B.

Step 2: lease-adjusted fixed-claim base (economic difference)

$$\text{Fixed-claim base}_A = (40 - 10) + 50 = 80 \quad \Rightarrow \quad \frac{80}{20} = 4.0\times$$

$$\text{Fixed-claim base}_B = (40 - 10) + 10 = 40 \quad \Rightarrow \quad \frac{40}{20} = 2.0\times$$

Firm A carries roughly **double** the fixed-claim burden.

Mini-case solution: maturity structure (rigidity) + takeaway

Step 3: near-term rigidity (Years 1–2)

$$\text{A: } 18 + 13 = 31 \Rightarrow \frac{31}{20} = 1.55 \times \quad \text{B: } 3 + 3 = 6 \Rightarrow \frac{6}{20} = 0.30 \times$$

Firm A has far less flexibility if conditions tighten.

Takeaways

- ▶ Debt-only screens can miss lease-driven fixed claims (“asset-light” \neq low risk).
- ▶ Leases embed obligations competing for future cash flows; **level + maturity** determine fragility.
- ▶ Practical rule: treat operating leases as debt-like for fixed-claim risk assessment and always read the maturity schedule and reconciliation.

Intangibles: economic capital, unevenly reported

Economics -Modern firms compete with **intangible capital**: technology, customer relationships, brands, data, know-how, and organizational capability.

Reporting asymmetry

- ▶ **Acquired** intangibles → recognized on the balance sheet (fair value in business combinations); many are **amortized** if finite-lived.
- ▶ **Internally built** intangibles → mostly **expensed** (brand building, most R&D, etc.) and therefore **invisible** as assets.

Takeaway

Balance sheets often show **how intangibles were acquired**, not how economically important they are.

Valuation implications of the asymmetry

1) Comparability breaks

Acquisitive firms mechanically report **more amortization expense** than otherwise similar organic peers.

Result: GAAP operating profit can look lower even if underlying operations are similar.

2) Measurement gaps distort profitability narratives

Book assets can **understate economic capital employed** in intangible-intensive firms.

Result: asset-based metrics (capital intensity) can mislead without an intangible reinvestment map.

Before comparing firms, ask: **Is the difference economics—or acquisition accounting and capitalization?**

Goodwill: what it is (and what it is not)

Acquisition mechanics

Goodwill = Purchase price – Fair value of identifiable net assets acquired

Interpretation

- ▶ Goodwill is **not** a stand-alone operating asset that produces cash flows by itself.
- ▶ It is an accounting record of the **premium paid** (e.g., synergies).

GAAP vs non-GAAP: amortization add-backs (discipline)

GAAP numbers are standardized, audited statement figures.

Non-GAAP measures are management-defined “adjusted” metrics by applying **add-backs**.

Common acquisitive-firm add-back

Amortization of purchased intangibles is often added back to portray “operating” performance. This can be informative *after* the acquisition, but it is definition-sensitive.

Two disciplined questions

- ▶ **Comparability:** does the add-back improve apples-to-apples vs organic peers?
- ▶ **Recurrence:** are acquisitions occasional (maybe ok) or structural (then “buying growth” is part of reinvestment)?

Quasi-capex: investment that hides in operating expenses

Valuation-relevant **reinvestment** is broader than “capex”.

Where the investment hides

Intangible investment (R&D knowledge, code, content libraries, customer acquisition capability, scalable operating systems) may:

- ▶ sit in **operating expenses** (reducing current margins), or
- ▶ be **capitalized** into specialized assets (software, content, deferred commissions) that you will miss if you only scan PP&E.

Predictable pitfall

A firm can look **high margin** or **asset-light** while still consuming substantial resources to sustain growth.

Discipline: rebuild the reinvestment map (capex + quasi-capex + Δ NOWC).

Quasi-capex categories

Four recurring categories

- ▶ **R&D:** investment-like spending expensed under GAAP; can understate economic capital and distort profitability comparisons.
- ▶ **Capitalized software:** development costs may be capitalized after a policy threshold; shifts cost from opex to amortization.
- ▶ **Capitalized contract acquisition costs:** “deferred commissions” treat customer acquisition as an amortizing asset.
- ▶ **Content assets:** content libraries are capitalized and amortized, profit can look smooth while reinvestment is heavy.

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Amazon: The Depreciation Dial in the AI Capex Race

Case setup (imagine you are the analyst -) covering Amazon at the start of an AI capex supercycle. The market is watching AWS profitability, capital intensity, and the pace of hardware refresh.

In FY2024 disclosures, Amazon reports a major **depreciation dial move**: changes in estimated useful lives for long-lived assets (especially servers and networking equipment) and **accelerated depreciation** tied to early retirements.

Your job: assess **earnings quality and comparability** with an evidence-first approach:

- ▶ **Quantify** how much operating income and net income were affected.
- ▶ Build a simple **reported vs. normalized** bridge.
- ▶ Explain how the adjustment changes interpretation of common **valuation multiples** (and what you would monitor next).

Lab Assignment 3

- ▶ Assigned Reading: Chapter 4.1-4.6.
- ▶ Assigned Reading: Chapter 5.1-5.8.
- ▶ Lab Assignment 3 (due Feb 5).