**🔹 3. Multi-day T-Cost Perspective**

**Block trading dynamics**

* For **non-US names** (thin liquidity), blocks are essential.
* Mechanisms: conditional venues (Liquidnet, Turquoise Plato) + block desks.
* Works when there’s **natural liquidity on the other side**.
* Risks: signalling, leakage. Solution: monitor **hit ratio and post-fill slippage**.

**Quarterly expirations/recons**

* Index/futures/ETF rebalances create **predictable crowding flows**.
* Example: MSCI/FTSE rebalances can drive **10–15% one-day volume spikes**.
* Best practice:
  + **Pre-hedge** to reduce stress at close.
  + Use **MOC algos** tactically.
  + Analyse **past rebal costs** to improve forecasting.

**Non-event trading**

* On normal days, liquidity is mean-reverting.
* Slicing too aggressively is unnecessary.
* VWAP or opportunistic algos are more efficient.

**Intraday liquidity & predictive models**

* Trend: **liquidity shifting to close**; intraday participation thinning.
* Predictive modelling (often ML-driven) now forecasts:
  + Volume curves intraday.
  + Spread & volatility evolution.
  + Imbalance probabilities.
* EU: more reliance on **auction participation**.
* US: **smile patterns** in spreads and depth (tight at open, widen midday, tighten at close).

**5. What should CalPERS focus on in equity markets?**

1. **Liquidity concentration risk** (too much at close).
2. **Venue quality monitoring** (especially SIs/ATSs).
3. **Passive crowding risk** in index flows.
4. **Multi-day execution optimisation** (avoid cramming into one session).
5. **Continuous review of algo wheels** to ensure alignment.

**🔹 Intraday Liquidity & Predictive Models**

**1. Liquidity distribution intraday (“U-shape” patterns)**

* Historically, equity markets show a **U-shape in volume**:
  + **High at open** → driven by overnight news, index futures hedges, market open auctions.
  + **Tapers mid-day** → spreads widen, volumes drop, book depth shallow.
  + **High at close** → due to MOC auction, passive/index trackers, mutual fund NAV pricing.
* Increasingly this **U-shape is deforming** into more of a **smile with an exaggerated close**.
  + In the US, ~15–20% of daily volume is in the close.
  + In Europe, it’s **40–50%** in some indices (e.g. CAC, DAX).
* Liquidity at open has also become more **fragmented** with SIs/ATSs competing with exchange auctions.

**Implication for asset owners:**

* Trading too much intraday risks interacting with **thin liquidity** (higher spreads, impact).
* Concentrating too much at close → **crowding risk** and higher volatility.
* Solution: dynamic models that **predict volume availability across the curve**.

**2. Intraday microstructure changes**

* **Spreads and depth** also follow a predictable curve:
  + **Wide spreads & shallow depth** at open (price discovery).
  + **Tight spreads** as market stabilises mid-morning.
  + **Depth improves** into the close but spreads can widen again due to imbalance volatility.
* **Volatility “smile”** intraday: high at open, lower mid-day, spikes at close.
* **Fragmentation differences**:
  + US: multiple ATS/dark pools operating all day.
  + EU: lit book liquidity shrinking intraday, auctions and SIs dominating.

**3. Predictive liquidity models**

* Goal: **forecast intraday volume, spread, volatility, and imbalance risk** → optimise algo slicing.
* Approaches:
  1. **Deterministic models**: fit historical volume curves (e.g. historical average % volume by 15-min bucket).
  2. **Stochastic models**: incorporate volatility, news flow, ETF activity to adapt curves dynamically.
  3. **Machine learning models**:
     + Features:
       - **Market state:** realised volatility, spread, order book depth, imbalance.
       - **Calendar:** day-of-week, month-end, rebalance days, earnings season.
       - **Cross-asset signals:** futures volumes, ETF flows, ADR activity.
     + Output: probability-adjusted forecast of **liquidity availability and expected cost**.

**4. Predictive signals in practice**

* **Volume forecasting:**
  + ML models can predict daily volume to **±5–10% accuracy by 10am** (especially for large caps).
  + Adjust algo POV accordingly (e.g. increase participation if expected end-of-day volume is high).
* **Spread & impact forecasting:**
  + Intraday regression on realised vol & depth can forecast expected spread trajectory.
* **Imbalance forecasting (close):**
  + Use historical imbalance profiles, ETF rebalance data, options open interest to **predict MOC demand**.
* **Liquidity shifts by venue:**
  + Some models predict which venues (lit vs SI vs dark) will be more active given market state.

**5. Case studies / examples**

* **Europe:** predictive models show that **30–40% of orders executed mid-day have higher IS slippage** vs pre- or post-midday slices.
* **US:** Nasdaq imbalance feeds + ETF flow models can predict **MOC imbalance direction ~70% accuracy** → lets traders tilt flow earlier.
* **Cross-asset:** ADR volumes overnight in US → can predict EU stock liquidity on open (useful for CalPERS if they trade globally).

**6. Why predictive models matter for CalPERS**

* CalPERS is **huge relative to daily volume** → can’t just “hide in the flow.”
* Predictive models let them:
  + **Avoid thin liquidity buckets** (e.g. 12–2pm EU where spreads widen, volumes low).
  + **Align with liquidity surges** (e.g. ETF rebalance, futures expiry, MOC).
  + **Customise algo urgency dynamically** → if model predicts a liquid close, trade lighter intraday.
  + **Monitor crowding risk** → predictive imbalance models help them judge how much of their order should go into MOC vs earlier.

**7. Risks & limitations**

* **Model error**: forecast uncertainty can mislead execution (e.g. predicted high volume fails to materialise after macro shock).
* **Overfitting**: ML models trained on stable regimes may fail in stress (COVID, Brexit votes, Fed shocks).
* **Data dependency**: requires rich tick-level & venue-level data.
* **Behavioural shifts**: if everyone uses predictive models, crowding may increase.

**8. Best practices for asset owners**

* Use predictive models in **advisory capacity** (guide urgency, venue mix), not as a blind driver.
* Combine **deterministic baselines** (historical curves) with **real-time adaptive models**.
* Build governance around **model explainability** → asset owners don’t like black boxes.
* Integrate predictive forecasts into **pre-trade tools** (expected cost heatmaps).
* Post-trade: compare **actual vs predicted liquidity** → feedback loop improves models.

✅ **Soundbite you can use in meeting:**  
“Liquidity is no longer evenly distributed during the day – we’re seeing concentration into the close and thinner intraday markets. Predictive models let us forecast when and where liquidity will emerge, allowing us to time CalPERS’ participation to minimise slippage. The key is balancing systematic curves with adaptive, data-driven forecasts – not just hiding in VWAP curves but actively avoiding thin buckets and crowded closes.”

**🔹 What is “Crowding Risk”?**

**Definition**

Crowding risk occurs when **many investors are trying to do the same thing at the same time** in the market (e.g., trade in the close, rebalance on the same day, sell the same stock on bad news). This concentration of activity reduces liquidity, pushes up costs, and increases slippage.

**Types of crowding risk**

1. **Benchmark crowding**
   * When most flows are benchmarked to the same point (e.g. **MOC auctions, VWAP curves**).
   * Example: If 50% of market participants are benchmarked to VWAP, everyone is buying in the morning and selling in the afternoon → pushing prices against themselves.
2. **Passive/index crowding**
   * **Index funds and ETFs** rebalance at predictable times (quarterly, month-end).
   * Active managers and hedge funds “pre-position” against these flows.
   * Asset owners like CalPERS get pulled into **liquidity crunches** if they rebalance at the same time.
3. **Event-driven crowding**
   * Earnings releases, rebalances, option expiries → attract large concentrated flows.
   * Can lead to **sharp spikes in spreads/impact** around the event.
4. **Strategy crowding (alpha decay)**
   * When many quants use the same alpha signals, trades get crowded → execution costs rise, alpha disappears.
   * More relevant to hedge funds, but asset owners can feel it indirectly via **higher execution costs**.

**Why it matters to CalPERS**

* CalPERS trades **very large size** relative to market volume.
* If they trade **where everyone else is**, their impact is magnified.
* Examples:
  + Closing auction in Europe: 40–50% of daily flow → if CalPERS also piles in, costs rise disproportionately.
  + MSCI rebalances: tens of billions of dollars shift → being part of that wave leads to higher market impact.

**How to measure crowding risk**

1. **TCA metrics:**
   * Compare CalPERS’ slippage vs peers across the same benchmark (e.g. VWAP, Close).
   * Persistent underperformance signals **overcrowded strategies**.
2. **Liquidity concentration analysis:**
   * % of daily volume in each bucket (open, mid-day, close).
   * High concentration at close = higher crowding risk.
3. **Market impact/reversal studies:**
   * If price moves sharply into the close and then **reverses next day**, that’s a crowding signature.

**How to mitigate crowding risk**

* **Diversify benchmarks:** Don’t always use VWAP or Close; sometimes use IS or POV.
* **Stagger execution:** Trade over multiple days instead of cramming into one session.
* **Pre-positioning:** Execute part of flow before crowded windows (e.g., do 30% before MOC, rest in the close).
* **Alternative liquidity:** Use **blocks, conditional venues, SIs** to reduce reliance on auctions.
* **Predictive modelling:** Forecast expected crowding (e.g., imbalance feeds, ETF flow models).

✅ **Soundbite you can use with CalPERS:**  
“Crowding risk is essentially the danger of trading in the same place, at the same time, in the same direction as everyone else. For asset owners like CalPERS, it can quietly eat into returns, because even if execution looks ‘cheap’ against a benchmark, you may actually be losing money in real terms if prices reverse afterwards. The key is to diversify benchmarks, manage participation around crowded events, and use predictive liquidity models to avoid the herd.”