**Prediction Math Specification — Selling-Options (Volume/OI Weighting)**

**Purpose**

This captures the **exact** math we agreed on to compute a predicted stock price from an options chain. It mirrors your Excel sheet and the live API logic so a future session can continue without re-deriving the rules.

**Scope**

* Applies to a **single underlying** and a **single expiration date** at a time.
* **Calls and puts are pooled** into one set of rows for weighting.

**Data fields used (per option row *i*)**

* Type: “Call” or “Put”
* Strike: SiS\_iSi​
* Premium: pi=p\_i =pi​= **lastPrice** (not bid/ask/mid)
* Volume: ViV\_iVi​
* Open Interest: OIiOI\_iOIi​

**Breakeven (BE)**

Use premium pip\_ipi​ = **lastPrice**:

* **Calls:** BEi=Si+piBE\_i = S\_i + p\_iBEi​=Si​+pi​
* **Puts:** BEi=Si−piBE\_i = S\_i - p\_iBEi​=Si​−pi​

**Contributing rows (filters)**

Include a row *i* if:

* **Volume mode:** pi>0p\_i > 0pi​>0 **and** Vi>0V\_i > 0Vi​>0
* **OI mode:** pi>0p\_i > 0pi​>0 **and** OIi>0OI\_i > 0OIi​>0

Compute everything in full-precision floats; only round when displaying or serializing.

**Weights**

Define per-row weights as **premium × market depth**:

* **Volume weight:** wi(vol)=pi×Viw\_i^{(vol)} = p\_i \times V\_iwi(vol)​=pi​×Vi​
* **OI weight:** wi(oi)=pi×OIiw\_i^{(oi)} = p\_i \times OI\_iwi(oi)​=pi​×OIi​

**Core formulas (single expiration)**

Let C\mathcal{C}C be the set of contributing rows after filtering.

**Denominators**

* Dvol=∑i∈Cwi(vol)D\_{vol} = \sum\_{i\in \mathcal{C}} w\_i^{(vol)}Dvol​=∑i∈C​wi(vol)​
* Doi=∑i∈Cwi(oi)D\_{oi} = \sum\_{i\in \mathcal{C}} w\_i^{(oi)}Doi​=∑i∈C​wi(oi)​

**Numerators**

* Nvol=∑i∈CBEi⋅wi(vol)N\_{vol} = \sum\_{i\in \mathcal{C}} BE\_i \cdot w\_i^{(vol)}Nvol​=∑i∈C​BEi​⋅wi(vol)​
* Noi=∑i∈CBEi⋅wi(oi)N\_{oi} = \sum\_{i\in \mathcal{C}} BE\_i \cdot w\_i^{(oi)}Noi​=∑i∈C​BEi​⋅wi(oi)​

**Predictions**

* **Volume-weighted:** Pvol=Nvol/DvolP\_{vol} = N\_{vol}/D\_{vol}Pvol​=Nvol​/Dvol​
* **OI-weighted:** Poi=Noi/DoiP\_{oi} = N\_{oi}/D\_{oi}Poi​=Noi​/Doi​
* **Average:** Pavg=(Pvol+Poi)/2P\_{avg} = \big(P\_{vol} + P\_{oi}\big)/2Pavg​=(Pvol​+Poi​)/2
* **Blend (α∈[0,1]\alpha\in[0,1]α∈[0,1]):** Pblend(α)=α⋅Poi+(1−α)⋅PvolP\_{blend}(\alpha) = \alpha\cdot P\_{oi} + (1-\alpha)\cdot P\_{vol}Pblend​(α)=α⋅Poi​+(1−α)⋅Pvol​

**Excel equivalence (volume mode)**

Let wi(vol)=pi⋅Viw^{(vol)}\_i = p\_i \cdot V\_iwi(vol)​=pi​⋅Vi​.

* **Percent of Volume:** PctVoli=wi(vol)∑wj(vol)\text{PctVol}\_i = \dfrac{w^{(vol)}\_i}{\sum w^{(vol)}\_j}PctVoli​=∑wj(vol)​wi(vol)​​
* **Predicted Part:** PredParti=BEi⋅PctVoli\text{PredPart}\_i = BE\_i \cdot \text{PctVol}\_iPredParti​=BEi​⋅PctVoli​
* **Final prediction:**

Pvol=∑PredParti=∑BEi⋅wi(vol)∑wi(vol)P\_{vol} = \sum \text{PredPart}\_i = \frac{\sum BE\_i \cdot w^{(vol)}\_i}{\sum w^{(vol)}\_i}Pvol​=∑PredParti​=∑wi(vol)​∑BEi​⋅wi(vol)​​

**Derived metric: pctChange**

Given currentPrice CCC (from fast\_info.last\_price with fallback to recent close),

pctChange=P(mode)−CC\text{pctChange} = \frac{P(\text{mode}) - C}{C}pctChange=CP(mode)−C​

**Implementation notes**

* Compute in float; **do not round** intermediate values.
* Pool **calls + puts** together before filtering/weighting.
* The premium field is **lastPrice** in **both** BE and weight calculations.
* In debug=1, include at least: **sum of weights** and **contributing row count**.

**Worked example (NVDA, 2025-09-05 snapshot)**

* ∑wvol=2,162,826.65\sum w\_{vol} = 2{,}162{,}826.65∑wvol​=2,162,826.65 across **141** contributing rows
* Pvol=169.464602P\_{vol} = 169.464602Pvol​=169.464602

A smaller subset from a spreadsheet yielded ∑wvol=2,086,047.64\sum w\_{vol} = 2{,}086{,}047.64∑wvol​=2,086,047.64 and Pvol=169.411205P\_{vol} = 169.411205Pvol​=169.411205; the difference is solely “subset vs full chain”.

**Verification checklist**

* ✅ Filters: lastPrice > 0 **and** (Volume > 0 for volume | OI > 0 for OI)
* ✅ Spot-check rows:
  + BE (Call = strike+premium, Put = strike−premium)
  + Weights: w\_vol = premium×Volume or w\_oi = premium×OI
* ✅ Consistency checks:
  + Pavg=(Poi+Pvol)/2P\_{avg} = (P\_{oi}+P\_{vol})/2Pavg​=(Poi​+Pvol​)/2
  + Pblend(α)=α⋅Poi+(1−α)⋅PvolP\_{blend}(\alpha) = \alpha\cdot P\_{oi} + (1-\alpha)\cdot P\_{vol}Pblend​(α)=α⋅Poi​+(1−α)⋅Pvol​