

"Volume Scales Computation"

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For futures products with a range of active maturities, traded volume and price variance can have complex patterns across the range. For example, Figure 1 shows the CME Soybean futures contract ZS on June 25, 2025. The upper panel shows the volume traded on that day in each maturity as a fraction of the total volume traded across the entire spectrum. The most active maturity is the Nov 2025 contract X5, with about 50% of the total volume; the remaining volume is spread across the rest of the complex. The horizontal axis in these figures is trading days before “first intention date” when long positions may be obligated to take delivery. This date is generally earlier than the contract expiration, and is a more stable reference point.

The lower panel of Figure 1 shows the total realized variance for each maturity, relative to the volume-weighted average of all variances: the mean of these quantities weighted by the values in the upper panel is equal to 1. (Note that volatility is the square root of variance.) The most active contract X5 (Nov 2025) carries most of the trading activity and thus has variance fraction nearly exactly equal to 1. Contracts closer to expiration generally have higher variance; contracts further from expiration generally have lower variance.

The upper panel of Figure 2 shows the same volume fractions (variance will be considered separately) as in the upper panel of Figure 1, plotted across dates. On any particular date, there is generally one contract that carries most of the volume.

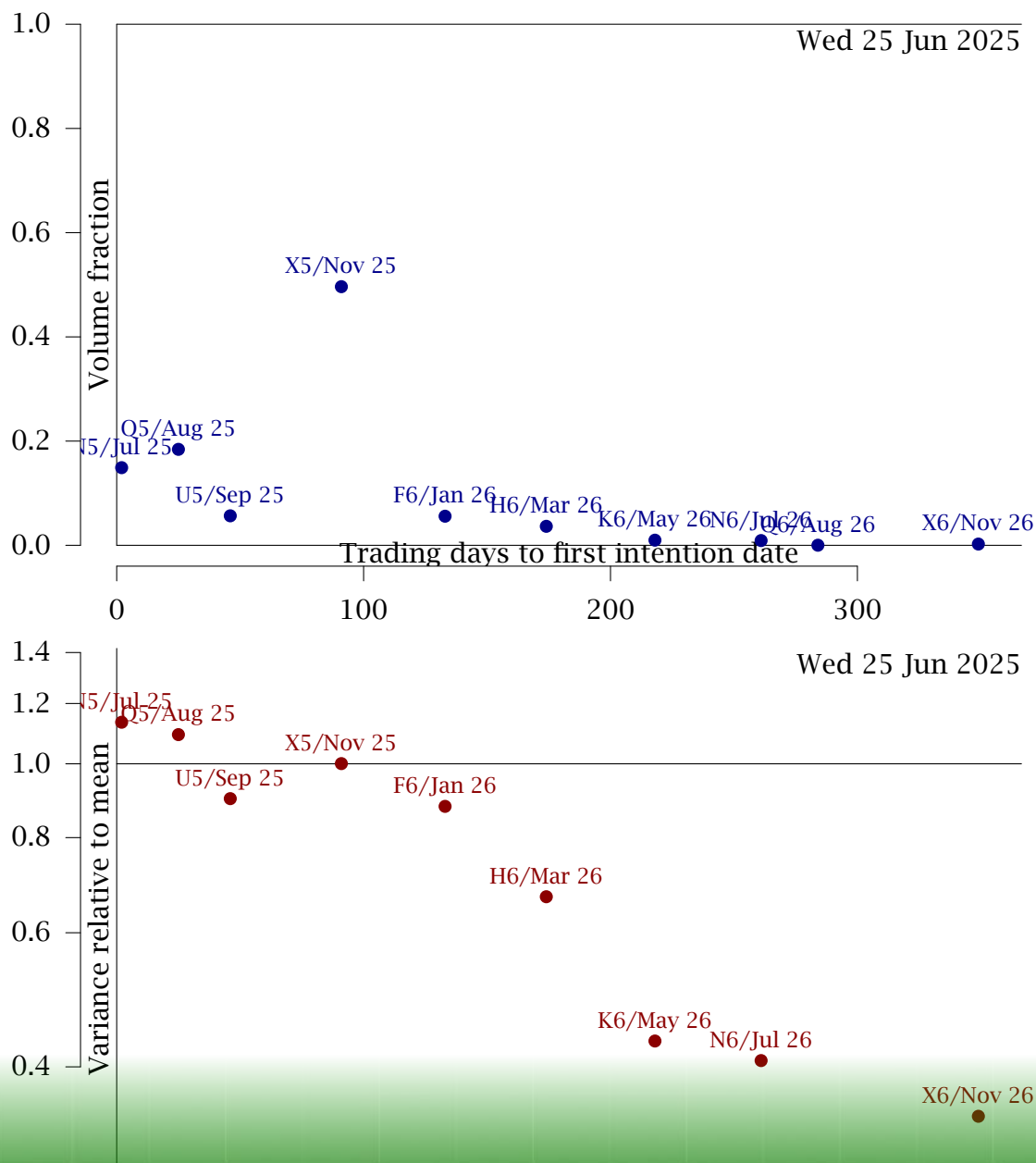
The purpose of this note is to estimate and predict the patterns in Figures 1 and 2. A separate calculation forecasts the total volume and variance for any given date, as well as the intraday profile including contributions from information events. Here we discuss only the “scale factors” by which we multiply the overall daily values to determine volume and variance for a particular maturity. This decomposition yields more accurate predictions than making a forecast for each maturity independently.

1 Formulation

We use d to denote trading days, and $m = 1, \dots, M$ for futures maturities. Let

$$\begin{aligned} \text{vol}_{dm} &= \text{total traded volume for futures maturity } m \text{ on trading day } d, \text{ and} \\ \text{var}_{dm} &= \text{total integrated variance for futures maturity } m \text{ on trading day } d. \end{aligned} \quad (1)$$

Volume is the total number of lots traded on the entire day. For variance, we use an estimator that aggregates sums of squared price changes at suitable sample times.



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