

SOFR PRODUCTS INPUTS AND DECOMPOSITION GUIDE

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Introduction

This document provides a comprehensive explanation of the input data required to price, risk-manage, and decompose four major SOFR-linked instruments: (1) SOFR Futures, (2) SOFR Futures Options, (3) OIS Swaps, and (4) Caps/Floors. It also highlights relevant tenors, day count conventions, market quotes, and decomposition metrics (Greeks, DV01s, carry, and roll-down). The intent is to guide analysts and developers in preparing the correct columns and formats in their CSVs or data pipelines to ensure accurate and consistent modeling across products.

1. SOFR Futures

SOFR futures are standardized contracts traded on CME. They reference the compounded SOFR rate over a 3-month accrual period starting on an IMM date. The following inputs are essential:

- **Contract ID / IMM Code:** Identifies the contract (e.g., SR3H25).
- **IMM Start Date:** Third Wednesday of the contract month.
- **IMM End Date:** Third Wednesday of the following IMM quarter.
- **Tenor:** Always 3 months.
- **Quote:** Futures price quoted as 100 – implied SOFR (%).
- **Forward Rate:** Derived from the discount curve, used for pricing.
- **Day Count:** ACT/360 for accrual calculations.
- **Curve Inputs:** Zero rates or discount factors used to back out implied forward rates.

Decomposition: For risk, futures exposures are mapped to IMM buckets. Sensitivities are computed as DV01s with respect to curve nodes. Carry and roll-down require knowledge of today's forward and how it evolves under a frozen curve assumption.

2. SOFR Futures Options

Options on SOFR futures are European-style with expiration on the IMM start date. Inputs required include:

- **Underlying Future:** The IMM code and forward rate from the curve.
- **Strike Price:** Expressed as a futures price (e.g., 95.50).
- **Option Type:** Call or Put.
- **Volatility:** Quoted in basis points or decimal, typically Black implied vols.
- **Time to Expiry:** Year fraction between valuation date and expiry (ACT/365F).
- **Discount Factor:** Settlement discount factor at expiry date.
- **Market Quote Data:** Volatility surface by strike and expiry tenors.

Decomposition: Risk decomposition requires Delta, Gamma, Vega. Delta links option price changes to forward changes. Gamma captures convexity. Vega links price changes to volatility. Roll-down refers to how an ATM strike migrates across the vol surface as expiry shortens. Carry includes daily theta under frozen curves and static vol surfaces.

3. OIS (SOFR) Swaps

SOFR swaps exchange fixed vs. compounded SOFR over the life of the trade. Inputs required:

- **Trade ID:** Identifier for the swap.
- **Effective Date:** Start of accruals.
- **Termination Date:** End date of the swap.
- **Fixed Rate:** Quoted par rate at trade inception.
- **Fixed Leg Details:** Frequency (annual, semi-annual, quarterly), day count convention (30/360, ACT/365F).
- **Floating Leg:** SOFR compounded daily, reset frequency (usually daily).
- **Discount Curve:** OIS discount factors bootstrapped from OIS par quotes.
- **Payment Schedule:** Cash flow dates and accrual factors.
- **Notional:** Principal amount of the swap.

Decomposition: The primary risk metric is DV01, either parallel or key-rate by tenor. Carry consists of fixed leg accrual minus float accrual plus roll-down effect as maturity shortens. Roll-down captures changes in PV as the swap moves closer to maturity under a static curve. For Greeks, sensitivity to curve bumps (delta), convexity (gamma of PV), and cross-tenor effects are considered.

4. Caps and Floors

Caps and floors are portfolios of caplets/floorlets. Each caplet is an option on a forward SOFR rate over a specific accrual period. Inputs required:

- **Contract ID:** Identifier for the cap/floor.
- **Strike:** Quoted in rate terms (e.g., 3%).
- **Schedule:** Reset dates and accrual periods (quarterly/annual).
- **Volatility Surface:** Black implied vols by maturity and strike.
- **Discount Factors:** From OIS curve for PV of payoffs.
- **Forward Rates:** Implied from the discount curve for each reset period.
- **Day Count:** ACT/360 or ACT/365F for accrual.
- **Notional:** Amount on which payoff is based.

Decomposition: Greeks are computed per caplet: Delta, Gamma, Vega. Vega is often bucketed by expiry to manage vol risk. Roll-down refers to how a cap's expiries migrate along the vol surface. Carry incorporates time decay (theta) and changes in forward rates under frozen curve assumptions.

5. Context and Commentary

To successfully price and decompose SOFR products, inputs must be harmonized across instruments. Swaps and futures are linked through the discount curve, while options and caps/floors depend on both the forward curve and volatility surfaces. Ensuring data quality (accurate day counts, IMM dates, par quotes, and vol calibrations) is critical. In practice, trading desks align exposures by mapping everything back to IMM futures, OIS tenors, and vol buckets, allowing a common risk language across products.

Best practice includes generating daily reports showing Delta/DV01 by tenor, Vega by bucket, carry and roll-down by product, and reconciling with PnL explains. Automation of CSV ingestion and curve/vol calibration is highly recommended to reduce operational risk.

