S&P 500 Futures Excess Return Index (SPXFP) Methodology and Term Structure Impact

1. Index Overview

The S&P 500 Futures Excess Return Index (**SPXFP**) is calculated by S&P Dow Jones Indices to track the continuous holding performance of the front-month E-mini S&P 500 futures contract traded on the Chicago Mercantile Exchange (CME).

It is an **Excess Return** index, reflecting **futures price changes and roll costs/benefits** but **excluding collateral interest on risk-free rates**. This differentiates it from a Total Return Index:

- **Total Return = Futures price change + roll yield/cost + collateral interest**
- **Excess Return = Futures price change + roll yield/cost**

SPXFP is widely used as a benchmark for futures-based ETFs, derivatives, and systematic strategies. It is also relevant for analyzing long-term performance differentials between spot and futures markets, as well as the impact of market term structures.

2. Daily Return Calculation Framework

SPXFP is calculated on a chained daily return basis. On trading day t, the index level is derived from the previous day’s level multiplied by the contract daily return:

$$\mathrm{IndexER}_t = \mathrm{IndexER}_{t-1} \times \left(1 + CDR_t\right)$$

Where **CDR_t (Contract Daily Return)** represents the daily return of the underlying futures contract portfolio:

$$CDR_t = \frac{\mathrm{TDW}_t}{\mathrm{TDW}_{t-1}} - 1$$

TDW_t (Theoretical Daily Weight) is the daily theoretical weighted price:

$$\mathrm{TDW}_t = \sum_{i \in \{\mathrm{near},\mathrm{far}\}} CRW_{i,t-1} \times DCRP_{i,t}$$

- **CRW** = Contract Roll Weight, the weight assigned to the near and far contracts during roll.
- **DCRP** = Daily Contract Reference Price, the settlement price of the corresponding futures contract.

Outside the roll window, CRW assigns 100% weight to the front-month contract, and the daily index return equals the price return of that single futures contract.

3. Quarterly Roll Mechanism

Because futures contracts have fixed expiry dates, SPXFP must roll from the expiring contract to the next quarterly contract. The roll process is conducted over **five trading days prior to expiry**, known as the **roll window**, with **linear weight shifts**:

Roll Day	Near-Month Weight	Next-Month Weight
Day 1	80%	20%
Day 2	60%	40%
Day 3	40%	60%
Day 4	20%	80%
Day 5	0%	100%

During the roll window, the index represents a **weighted portfolio** of near and next-month contracts, avoiding sudden price jumps on a single roll date and embedding the term structure price differential into the daily returns.

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4. Term Structure and Roll Yield

The price relationship between different maturities is governed by the theoretical futures pricing model:

$$F(T) = S \times e^{(r-q)T}$$

- **S** = spot price
- **r** = risk-free rate
- **q** = dividend yield
- **T** = time to maturity

From this, the market can exhibit:

- **Contango (upward-sloping term structure)**: r > q → next-month > front-month.
- **Backwardation (downward-sloping term structure)**: q > r or high risk premium → next-month < front-month.

When SPXFP rolls: - **Contango** → sells cheaper near-month, buys more expensive next-month → future convergence leads to **negative roll yield**. - **Backwardation** → sells more expensive near-month, buys cheaper next-month → future convergence leads to **positive roll yield**.

Key Point: Roll yield is not added as a separate adjustment; it is **endogenously captured in daily returns via TDW_t** during the roll window.

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5. Numerical Example: Contango Roll Process

Assume: - Near-month (Sep) = **5000** - Next-month (Dec) = **5050** (Contango, +50 pts) - Spot remains unchanged, so Dec converges back to 5000 at expiry.

Trading Day	Near Weight	Far Weight	Sep Price	Dec Price	Portfolio Price (TDW)	Daily Return	Note
Day 0	100%	0%	5000	–	**5000**	–	Pre-roll
Day 1	80%	20%	5000	5050	**5020**	+0.40%	Buy more expensive far-month
Day 2	60%	40%	5000	5050	**5040**	+0.40%	Weight shift continues
Day 3	40%	60%	5000	5050	**5060**	+0.40%	
Day 4	20%	80%	5000	5050	**5080**	+0.40%	
Day 5	0%	100%	–	5050	**5050**	+0.40%	Roll complete
Expiry	–	–	–	**5000**	**5000**	–1.00%	Negative roll yield

After the roll, the index holds Dec at 5050, but Dec converges to spot 5000 → **loss of 50 pts (-1%)**.

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6. Contango vs Backwardation Comparison

If next-month price is cheaper (Backwardation = 4950), the effect is reversed:

Day	Near Weight	Far Weight	Far Price Contango	Portfolio Contango	Far Price Backwardation	Portfolio Backwardation
Day 0	100%	0%	–	5000	–	5000
Day 1	80%	20%	5050	5020 (+0.4%)	4950	4980 (-0.4%)
Day 2	60%	40%	5050	5040 (+0.4%)	4950	4960 (-0.4%)
Day 3	40%	60%	5050	5060 (+0.4%)	4950	4940 (-0.4%)
Day 4	20%	80%	5050	5080 (+0.4%)	4950	4920 (-0.4%)
Day 5	0%	100%	5050	5050 (+0.4%)	4950	4950 (-0.4%)
Expiry	–	–	Converge to 5000 → lose 50	Negative roll	Converge to 5000 → gain 50	Positive roll

Key differences: - **Contango:** Roll appears as incremental gains during the roll window but results in a future loss as the more expensive next-month converges down. - **Backwardation:** Roll appears as

incremental losses during the roll window but results in a future gain as the cheaper next-month converges up.

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7. FAQ: Addressing Key Questions

Q1: Does SPXFP simply follow futures price, or does it subtract the risk-free rate? - SPXFP follows the front-month futures price plus the effect of quarterly rolls. It does **not** explicitly subtract the risk-free rate; it simply omits collateral interest. Thus, it reflects futures price returns + roll yield/cost.

Q2: How are roll weights and mechanics included in daily returns? - During the 5-day roll window, the index gradually shifts weights linearly between the near and next-month contracts. The daily return (CDR_t) is the weighted change of both contracts' settlement prices. Term structure price differences are automatically embedded into daily returns.

Q3: Why does Contango/Backwardation affect SPXFP? - In Contango (r > q), the next-month contract trades at a premium due to cost-of-carry ($F = S \cdot e^{(r-q)T}$). Rolling means selling cheaper near-month and buying more expensive next-month, which later converges down to spot → negative roll yield. - In Backwardation, the opposite holds: the next-month is cheaper, converges upward to spot → positive roll yield.

Key takeaway: Roll yield is **endogenously captured** by the index during the roll window through weighted prices, not as an extra add-on. Contango/backwardation directly drive the embedded roll cost/benefit in SPXFP.

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8. Conclusion

- SPXFP continuously tracks the performance of holding the nearest S&P 500 futures contract by rolling quarterly.
- The roll process linearly shifts weights between near and next-month contracts over five days, embedding the futures term structure spread into daily returns.
- **Contango → Sell low, buy high → Negative roll yield → Long-term drag on SPXFP relative to spot.**
- **Backwardation → Sell high, buy low → Positive roll yield → Potential long-term outperformance.**

Thus, SPXFP performance is driven not only by the S&P 500 spot direction but also by the prevailing futures term structure.