



Imbalance Sheet:

Supply, Demand, and S&P 500[®] Financing

January 2025

The logo for DE Shaw & Co, featuring the company name in a blue serif font with a thin blue line above the letters 'E' and 'S'.

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The law of one price states that different instruments providing the same exposure should cost the same. If that weren't the case, market participants would be presented with an arbitrage opportunity that, when acted upon, would cause the prices to converge.

For most of 2024 and into 2025, we've seen a breakdown of this principle in instruments that track one of the world's most liquid and recognizable assets: the S&P 500®.

In particular, it has been meaningfully more expensive to own the S&P 500® via futures than to obtain the same exposure via cash (e.g., by buying an ETF or the index's underlying stocks). As we'll explain, this appears to stem from a financing spread for S&P 500® futures that's been as high as four times its recent average.

We believe that what seems to be a mispricing according to the law of one price is better understood as an effectively priced supply-demand imbalance for financing capital to support S&P 500® exposure—that is, the efficient pricing of scarce balance sheet. This would explain why the apparent anomaly has persisted and how it might ultimately be resolved.

Futures Pricing and Implied Financing

It's helpful to review how S&P 500® futures are priced. Futures are implicitly levered instruments, with a cost of leverage that can be expressed as the risk-free interest rate plus a spread.

Where does this implicit leverage come from? A market participant short an S&P 500® futures contract can hedge their exposure by borrowing the notional amount of the contract and using the proceeds to purchase an S&P 500® ETF.¹ As a result, the futures price must satisfy the following expression:

$$F = S \times (1 + r + s) - E[D]$$

where:

F = price of the futures contract

S = spot price of the index

r = risk-free interest rate

s = spread over (or under) the risk-free rate required to borrow against the index

$E[D]$ = expected value of dividends paid by the index

The inclusion of $(1 + r + s)$ in this expression means that it's more expensive to obtain long exposure to the S&P 500® when risk-free rates (r) are higher or when lenders demand a wider spread (s) to borrow against the index.

The spread term (s) is often overlooked and worth examining in more detail.

Lending against the S&P 500® carries risk, and lenders charge a financing spread as compensation for that risk. The spread charged by any individual lender can change based on its risk appetite generally or willingness to lend against the S&P 500® specifically, among other considerations. The spread (s) implied by the futures price represents the marginal cost of borrowing aggregated across all borrowers and lenders in the market.

¹ This hedge is imperfect because the futures price reflects the index's expected dividends. In practice, however, S&P 500® dividends are generally stable outside large risk events (such as the COVID-19 pandemic). The above equation also doesn't account for "mark-to-market" risks like moves in risk-free interest rates or changes in the implied financing spread.

An Unusual, and Unusually Persistent, Anomaly

The recent past stands out relative to a history of typically tight financing spreads for the S&P 500®.

The S&P 500® financing spread can't be directly observed, but it can be estimated by comparing the actual price of futures to the fair value implied by dividend forecasts, interest rates, and spot prices. *Figure 1* plots one such estimate since 2012.

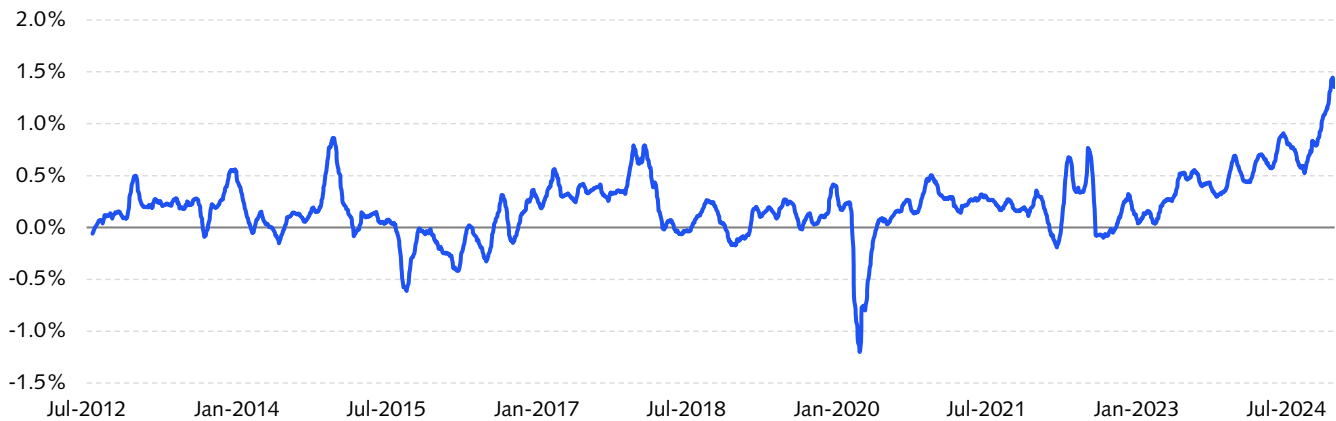
The series shows a significant runup starting in early 2024 that persisted throughout the year, which contrasts with a largely rangebound history. The series peaked at over 1.4% in December 2024, much higher than the average of 0.3% seen between 2021 and 2023. By the end of 2024, it had declined slightly but remained elevated.

Since the start of 2024, deploying cash to finance S&P 500®-backed borrowing has yielded more than other investments that can often be used for cash management. *Figure 2* shows that the S&P 500® financing spread is an outlier compared to the spread earned from 3-month Treasury bills, the credit spread on short-dated, high-quality corporate borrowing, the spread from lending U.S. Treasuries in the repo market, and the excess cost of borrowing U.S. dollars in the USD-JPY FX market.

This is unusual, since such a wide spread should theoretically present an opportunity for arbitrageurs.

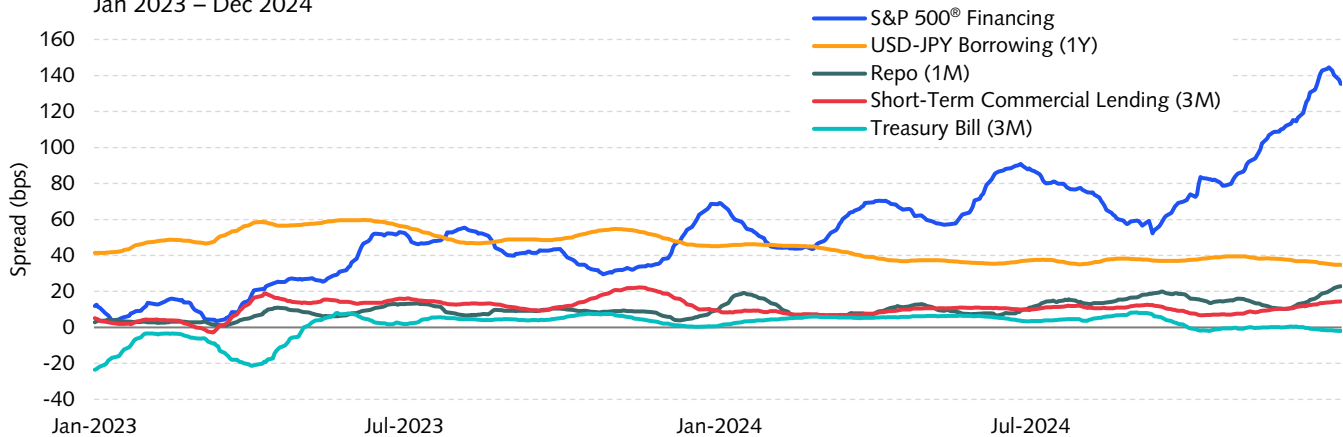
To illustrate, imagine if the spread were 10% and, for simplicity, risk-free borrowing costs and expected S&P 500® dividends were both zero. An investor with \$100 could sell \$95 of S&P 500® futures (depositing less than \$5 as margin) and buy \$95 of the underlying cash index (paying a small management fee to purchase an ETF). That trade would net

Figure 1: Implied S&P 500® Financing Spread (Rolling 20-Day Average)
Jul 2012 – Dec 2024



Sources: Bank of America Global Research; the D. E. Shaw group.

Figure 2: S&P 500® and Additional Financing Spreads (Rolling 20-Day Average)
Jan 2023 – Dec 2024



Sources: Chicago Mercantile Exchange; the D. E. Shaw group. Applicable data used with permission of Bloomberg.

9.5% per year with little risk if held to maturity, and the likely volume of similar trades would serve to narrow the financing spread in relatively short order.

In a frictionless market, we'd expect these dynamics to cause a financing spread as meaningful as the one in *Figure 2* to be quickly arbitrated away. But investors don't operate in a frictionless market, and this didn't happen. To understand why, we need to consider the relevant financing supply and demand dynamics.

Interpreting Recent Spread Widening

We suspect that a combination of demand- and supply-side factors are responsible for widening S&P 500[®] financing spreads.

On the demand side, we have seen unusually strong interest from asset managers in long S&P 500[®] futures exposure. *Figure 3* shows asset manager positioning in S&P 500[®] futures in both unit (*i.e.*, number of contracts; top) and notional value (*i.e.*, dollar value of exposure demanded; bottom) terms since 2010.

Both measures show multi-year highs, with notional demand reaching levels not seen previously in the data. We hypothesize that this increased demand stems from some combination of fundamental (*i.e.*, more bullish sentiment on U.S.

Figure 3: Asset Manager Net Positioning in S&P 500[®] E-Mini Futures
Jan 2010 – Dec 2024



Sources: Commodity Futures Trading Association; the D. E. Shaw group. Applicable data used with permission of Bloomberg.

equities relative to other regions) and technical factors (*i.e.*, large capital inflows). On top of that, the S&P 500® has rallied more than 20% since the beginning of 2022, which means the actual dollar value that needs to be financed has grown even more than the number of contracts.

On the supply side, dealers are an important source of financing for S&P 500® positions but face an important constraint: the aggregate size of the banking sector's balance sheet is relatively fixed over shorter horizons. This is because the aggregate size of that balance sheet is primarily determined by the amount of capital held by each bank, and building or raising new capital takes time. Banks can shift capital among business lines, but there are practical restrictions on doing so. As a result, banks may not have flexibility to respond to rapid changes in demand for leverage.

Moreover, in recent years banks have become more constrained in financing (especially directional) equity exposures. Among other considerations, that is because banks need to optimize their balance sheets given competing regulatory requirements and constraints. Equity financing tends to be balance sheet-intensive and thus can be unattractive for banks.

To the extent that 2024 featured an ongoing U.S. equity bull market and evidence of consensus asset manager demand for long equity exposure, already-constrained bank balance sheets faced additional concentration risk, something they typically seek to avoid.

Limits to Arbitrage

In short, we believe the elevated financing spread observed since early 2024 reflects abnormally large demand for financing capacity exceeding constrained supply. In market jargon, there has been a shortage of balance sheet.

When a market participant uses capital to sell futures and buy cash equities, they are supplying balance sheet to other market participants seeking leverage. The financing spread represents payment for this scarce capacity. So what appears at first to be a "mispricing" is instead the price of balance sheet capacity showing up in instruments with implicit leverage.

We believe this explains why levered market participants, which generally demand rather than supply balance sheet, have not yet arbitrated away this particular dislocation. If a levered player sought to profit from the elevated S&P 500® financing spread (*e.g.*, buying the stocks in the index or a related ETF and selling the futures), it would first need to borrow from a dealer to finance the long leg. Given the supply-demand imbalance discussed above, that borrowing cost would approximate the expected gross return of the trade, precluding arbitrage profits.

How Might the Distortion Revert?

We believe there are several potential paths by which the S&P 500® financing spread might narrow.

On the demand side, asset allocators could shift their preference away from U.S. stocks, reducing the concentration to which dealers are exposed. Outflows could cause asset allocator demand to decline. Or, perhaps, the U.S. equity market could draw down, reducing notional demand for S&P 500® futures without necessarily reducing unit demand.

On the supply side, banks could raise additional capital or allocate a larger fraction of their current capital to equity financing. Regulations could be loosened in ways that allow banks to deploy existing capital more aggressively. Alternately, supply could come from sources outside of dealer balance sheets—unlevered investors looking to deploy unencumbered cash might step in to finance equity exposures, given the attractiveness of the S&P 500® futures spread relative to other common uses of cash (*e.g.*, investment grade credit).

At some point, we believe one or more of these factors is likely to cause the supply-demand imbalance to normalize, and the financing spread for S&P 500® futures to compress. Still, this episode is instructive in thinking about how balance sheet capacity is priced, because similar constraints and imbalances may recur in the future.

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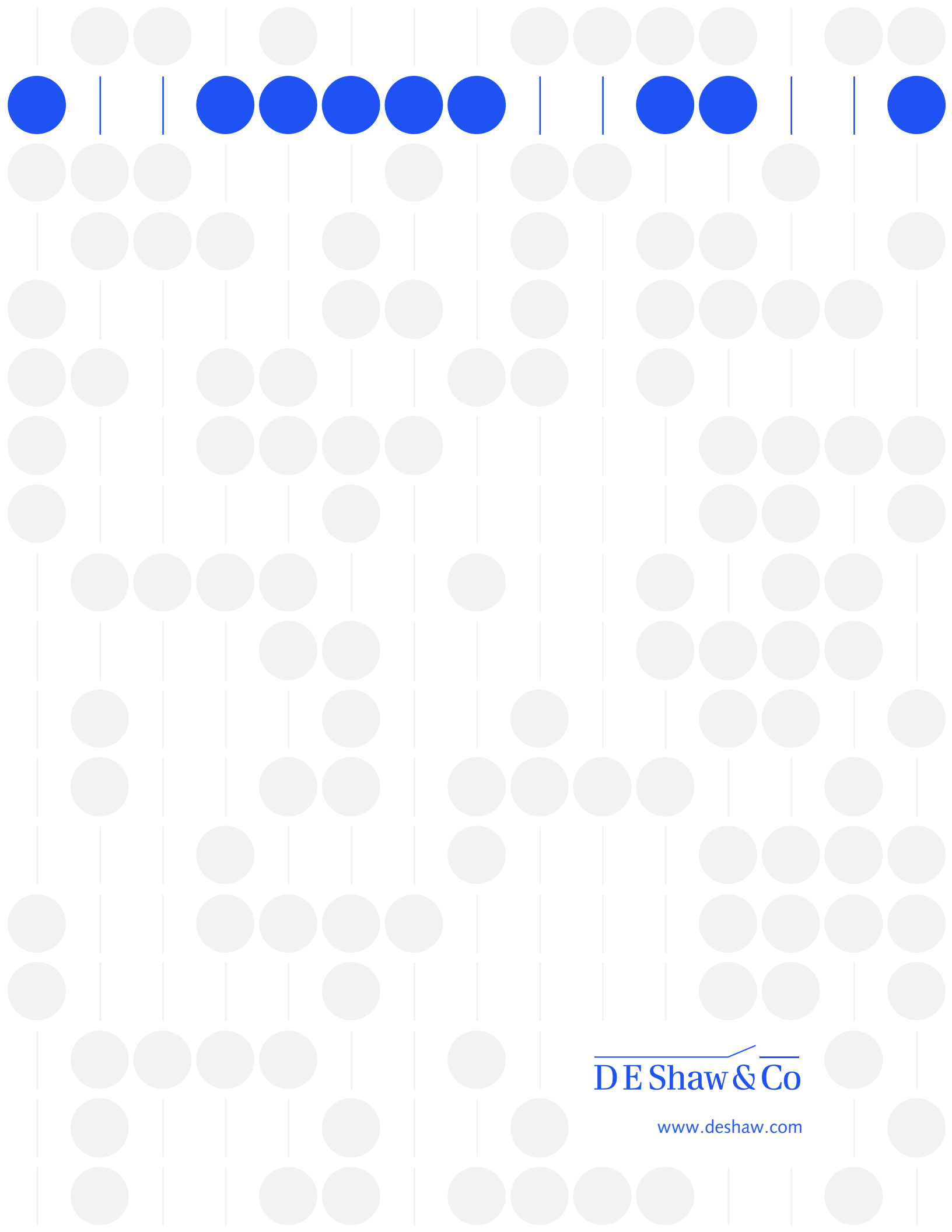
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