Vol Vitals

Fading VIX Is Still Not Low

After hitting a level rarely seen outside major crises, SPX realized volatility has fallen materially in July. Interest rate volatility has similarly fallen from its peak level, as has credit volatility. On the other hand, FX volatility has stayed high and commodity volatility has surged. The return to somewhat lower (though not low) SPX realized volatility has been consistent with derivative market expectations that extreme realized vol would be unsustainable. We expect realized volatility to stay well below May/June levels - an outcome that would not be inconsistent with a recession - and like strategies that sell volatility.

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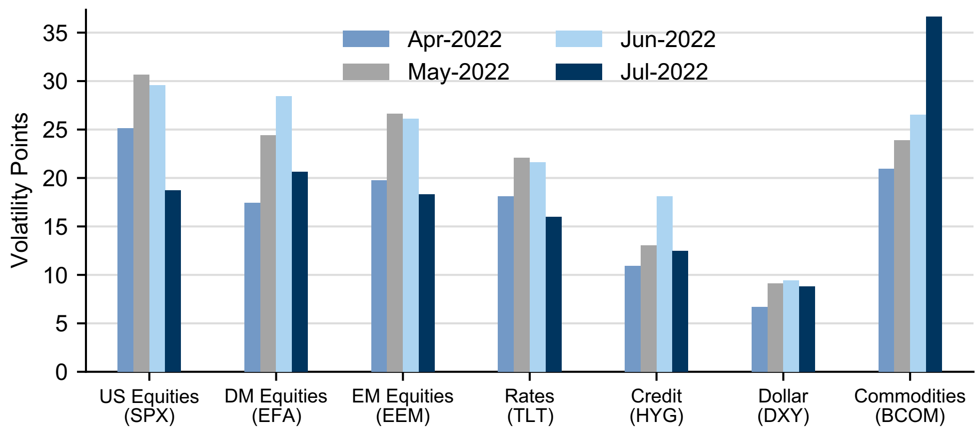
Exhibit 1: Realized volatility has been materially lower in July than it was in May/June for equities, rates, and credit; FX volatility has stayed elevated and commodity volatility has spiked
Monthly realized volatility

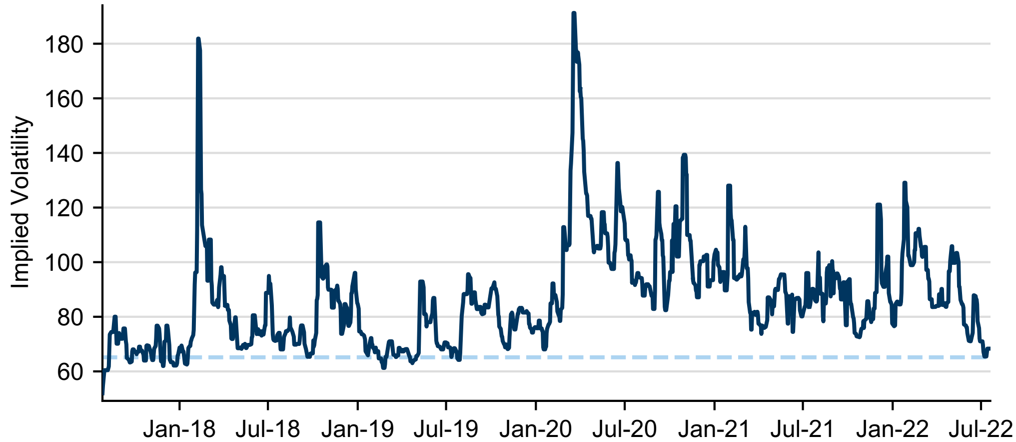


Source: Goldman Sachs Global Investment Research, Bloomberg

Volatility Views

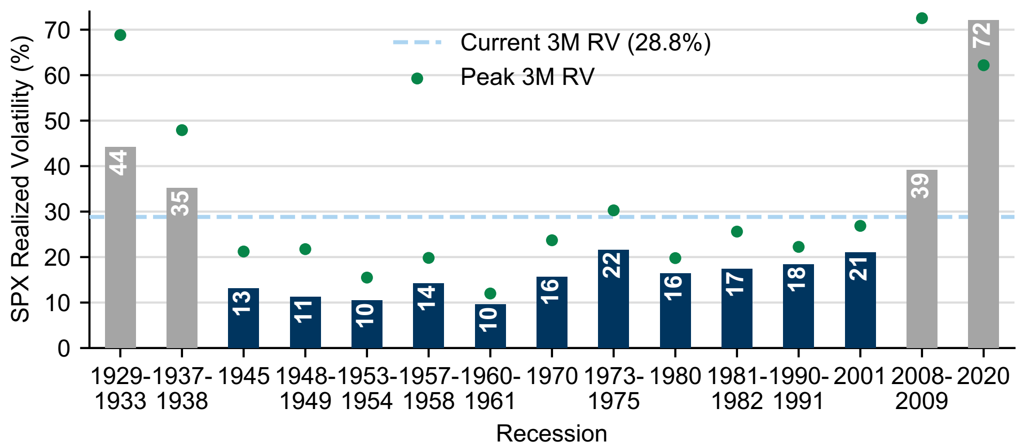
- **We expect implied and realized volatility to remain above-average but far from extreme.** Investors' perception that the VIX should be much higher than its current 24 level is driven by the comparison to its strong reaction to the early stages of this selloff and the magnitude of volatility in the two most recent recessions. However, there is plenty of precedent for realized vol well below 30 and even below 20 in strong SPX selloffs and even in recessions, so a low-20's VIX would not be unusual. In our view, the recent level of realized volatility (SPX realized vol has been 19% in July) is sustainable, and could fall further. We see falling realized vol as the primary driver of a return to positive volatility risk premium. With VIX option prices down substantially and the VIX futures curve well upward-sloping, we like VIX put options: **Buy 17-Aug VIX 22-strike put for $0.30 (indic. mid. ref. fut. 26.3).** Ongoing high rates volatility, driven in part by poor liquidity, should keep a floor on equity volatility, though, especially given how closely equity prices have been associated with cost of capital changes this year.
- **Realized vol has reached a level generally not even seen in recessions.** The current level of 3-month realized vol (29%) is not only well above the level of realized vol seen in each of the eleven recessions from 1945 to 2001, but it's higher than the peak level of 3-month vol seen in or around each of those recessions (tied with the peak in the 1973-75 recession). The Great Depression, the GFC, and COVID are outliers compared with this larger sample. With plenty of room for realized volatility to fall, even if there is a recession, we like strategies that benefit from realized volatility falling well below implied vol, including timer puts.
- **Longer-term option prices continue to show excessive risk aversion.** Despite falling short-dated implied volatility and low skew, longer-term option markets continue to exhibit strong risk aversion. VIX futures expiring in early 2023 are around 29, 90th percentile historically, and there continues to be a strong premium of variance swap risk to at-the-money options for longer-dated tenors. We see this as a dislocation driven by the level of volatility seen in early 2020, that will only dissipate slowly as time passes. In the meantime, strategies that sell longer-dated options, including call-selling (which also benefits from the elevated forward) continue to be attractive.

Exhibit 2: VIX puts' implied volatility is at a 3-year low
VIX: 1-month 25-delta put implied volatility



Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

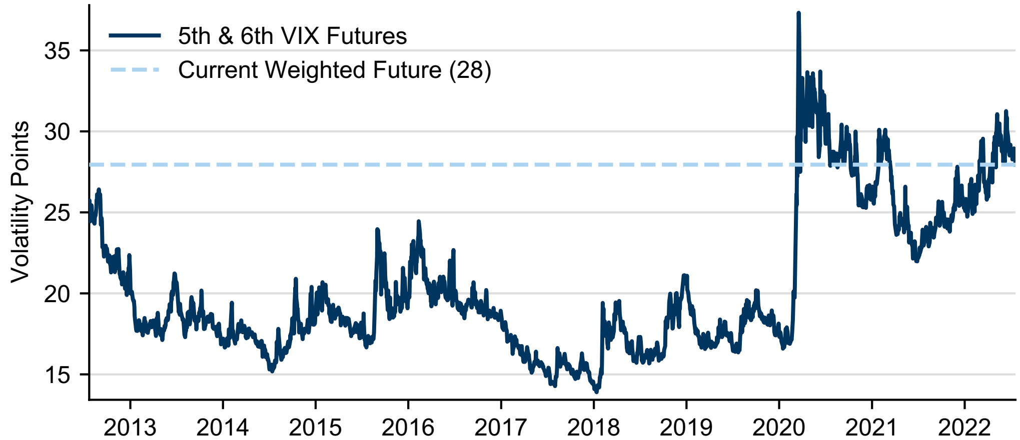
Exhibit 3: In most recessions, 3M SPX realized vol peaked below current realized vol
SPX realized volatility (%) during US recessions, and the peak level of 3-month realized volatility in the period beginning 6 months before each recession and ending 6 months after the recession



Source: Goldman Sachs Global Investment Research, Bloomberg, NBER

Exhibit 4: Longer-dated VIX futures are well above their pre-COVID range, reflecting persistent risk aversion

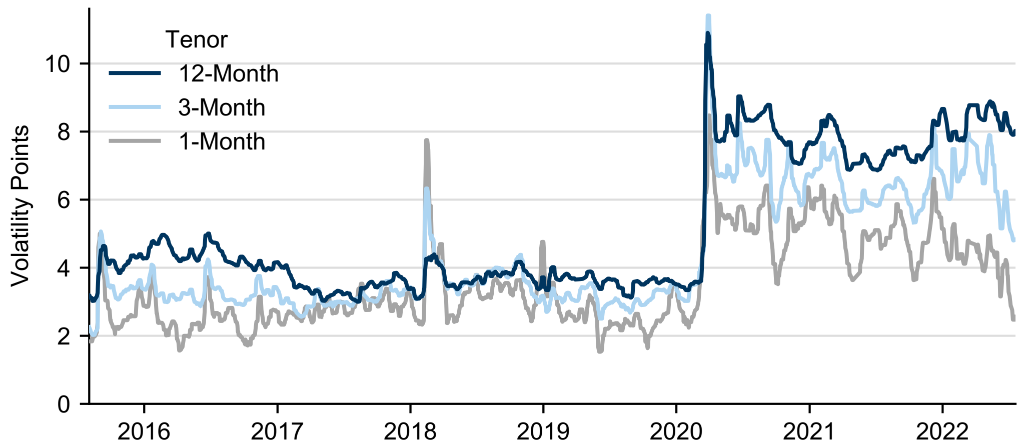
Day count-weighted average of the 5th & 6th VIX futures



Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 5: Longer-dated convexity remains extreme - reflecting investors' aversion to sell variance risk in the aftermath of the COVID volatility spike

S&P 500: difference between variance swap rate and 50-delta implied vol, 10-day median



Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

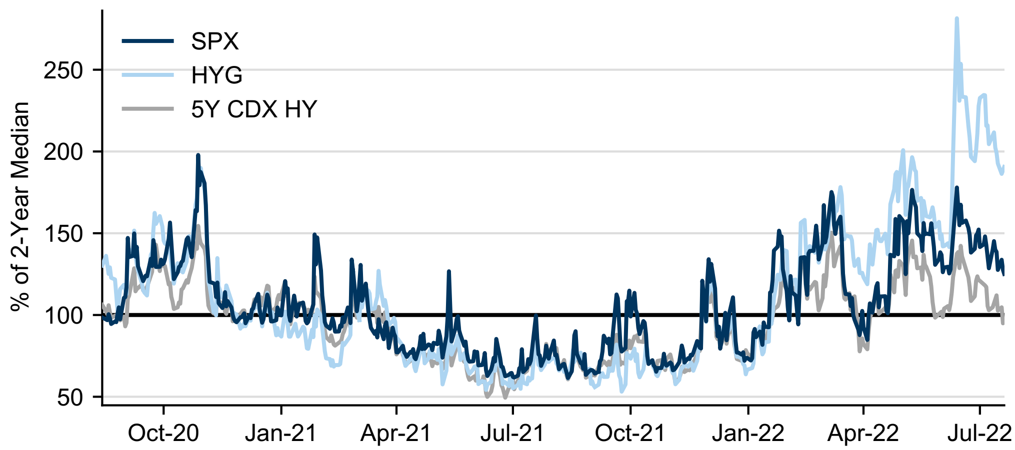
Charts We Are Watching

High interest rate volatility has pushed HYG implied vol to react more strongly than SPX or CDX HY

Although implied vol has fallen materially for both rates and credit markets since recent peak levels, the HYG's implied vol has separated from both the SPX and the CDX HY. The key driver of this change is that the HYG is a total return product, and is therefore driven by extremely high interest rate volatility. As has been the case for months, we prefer SPX options and especially CDX HY swaptions over HYG options as hedges against pure risk aversion.

Exhibit 6: HYG implied vol is farther above its historical range than SPX or CDX HY because as a total return product it is partially driven by rates volatility

SPX, HYG, and CDX HY swaption one-month 50-delta implied volatility, as a % of each underlying's 2-year median



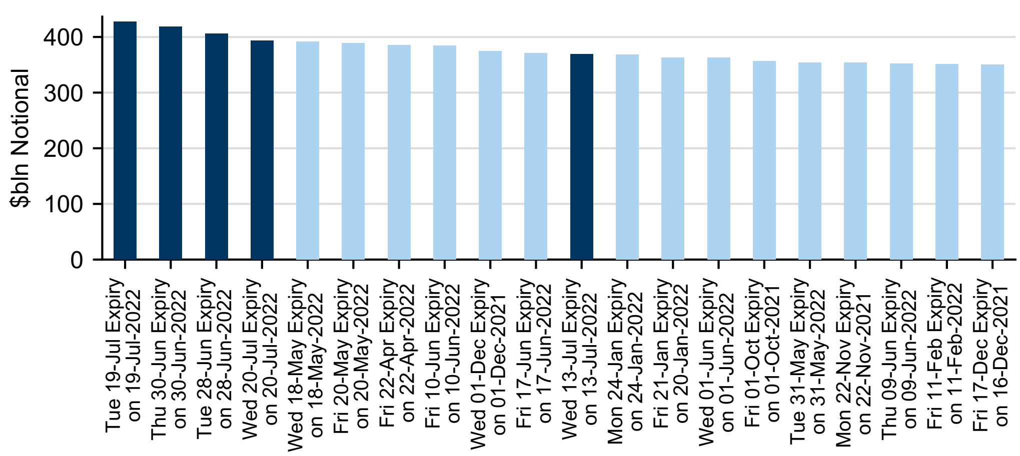
Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Ultra-short-dated SPX option markets continue to thrive

The $425bln of soon-to-expire SPX option notional that traded on Tuesday (19-Jul) expiring the same day marked a new record for SPX notional traded on one expiration in one day. The four highest single-expiration volume days have all been in the past month, including two Tuesday expirations that would not have existed prior to April. With the activity scattered across strikes throughout the day, we see the volume as largely algorithmic rather than reflecting strong investor views. The deep liquidity in ultra-short-dated SPX options expiring daily facilitates increasingly tailored tactical trading around events.

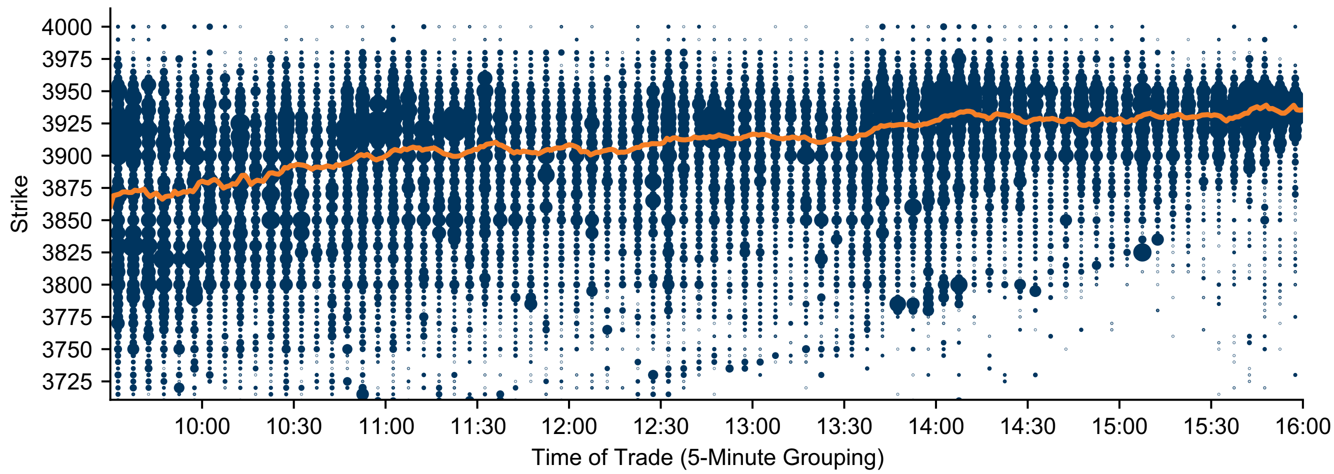
Exhibit 7: Tuesday (19-Jul) set a new record for SPX option notional traded for one expiration on one day

Largest notional SPX option volumes traded for an individual expiry on a single trading day (last 1M in dark blue)



Source: Goldman Sachs Global Investment Research, OptionMetrics

Exhibit 8: Tuesday's (19-Jul) record ultra-short-dated SPX option volume was broadly scattered across strikes and times of day
Volume in SPX 19-Jul options on 19-Jul, in 5-minute buckets; orange line is spot; markers proportional to volume (largest is 5k contracts, total daily volume 1.1mm contracts)

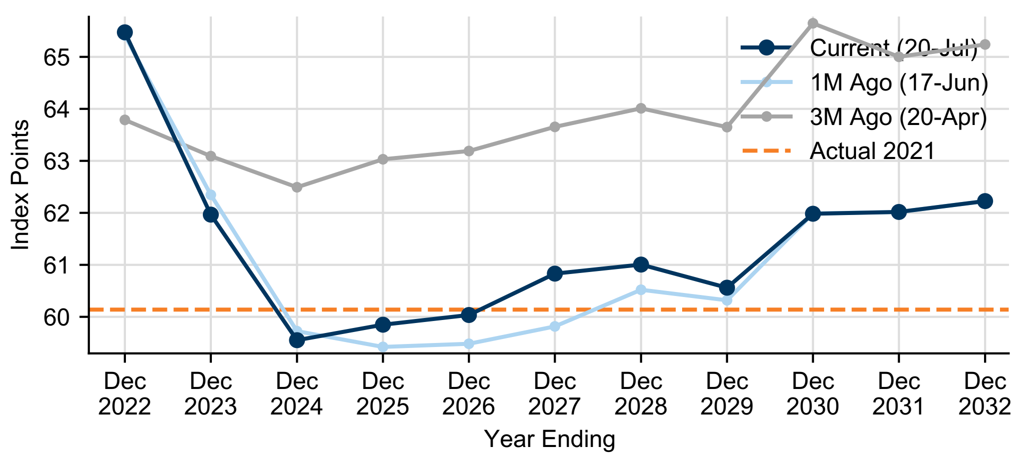


Source: Goldman Sachs Global Investment Research, Bloomberg, OptionMetrics

Dividend markets are pricing in a recession-like scenario

Dividend markets are pricing in near-zero dividend growth for the next decade. With historical recessions averaging 1% dividend cuts and markets already pricing in more cuts than that vs. 2022 dividends (the majority of which have already been paid), long dividend strategies look asymmetrically favorable. Low implied dividends also push up the SPX forward; we continue to like strategies that are short the forward, including selling long-dated call options.

Exhibit 9: SPX dividend markets are pricing in a very bearish scenario
S&P 500 implied dividends now vs. two previous dates; dotted line indicates actual dividends paid in 2021



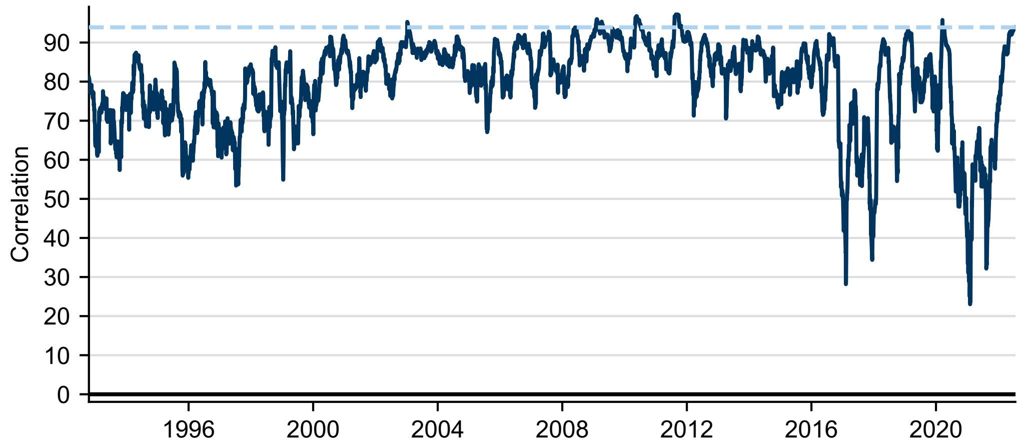
Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Cross-index correlation has been rising in a macro-led market

Less than 18 months after hitting an all-time low of 23%, the 3-month correlation between the Russell 2000 and NDX indices has approached its all-time high at 94%. Similarly, other index pairs within the US equity market, including the Russell 1000 Growth and Value, have also seen a dramatic increase in correlation. We see potential for sector dispersion ahead, and like strategies that economically sell index-pair correlation.

Exhibit 10: Russell 2000-NDX correlation has surged from an all-time low 18 months ago to nearly an all-time high in the current macro-led market

3M rolling correlation between Russell 2000 and NDX indices

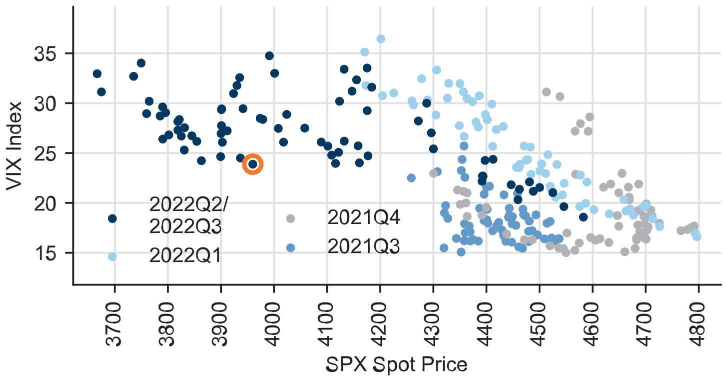


Source: Goldman Sachs Global Investment Research, Bloomberg

SPX Volatility Level: Even at the bottom of its range, the VIX is high

Exhibit 11: The VIX is at the bottom of its range

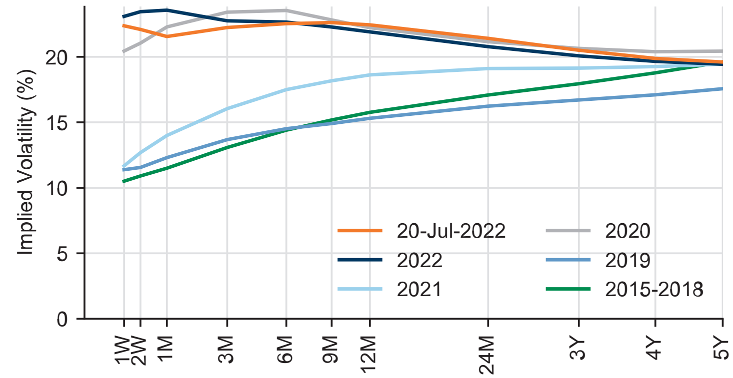
SPX spot price and VIX index; 20-Jul highlighted



Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 12: Implied vol has been consistently high in 2022

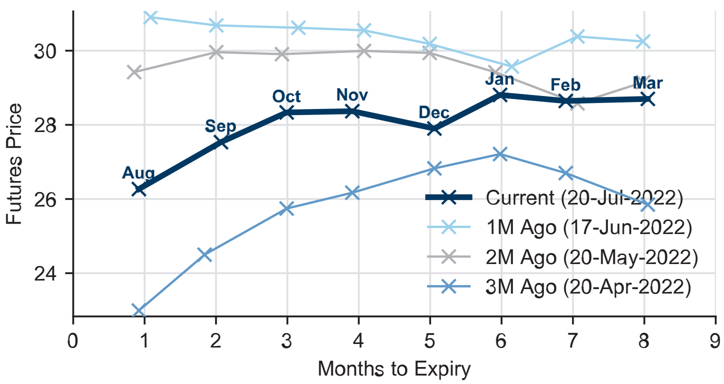
Median 50-delta SPX implied volatility (x-axis spaced according to the square root of time to maturity)



Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Exhibit 13: Implied vol is well above pre-May levels across tenors

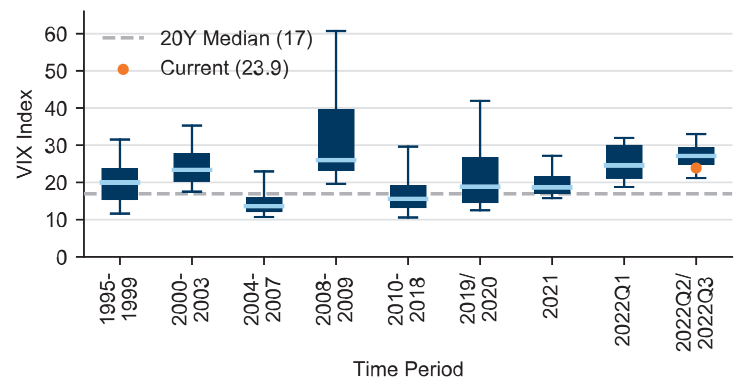
VIX futures curve



Source: Goldman Sachs Global Investment Research, Reuters

Exhibit 14: The VIX has been well above its long-term median throughout 2022

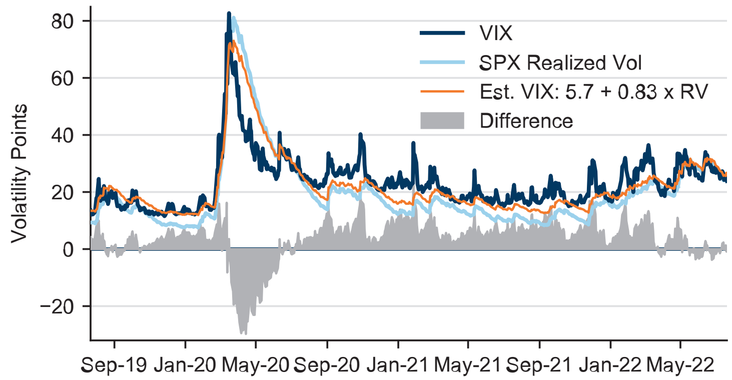
VIX index spot price: box plot shows 5/25/50/75/95th percentiles by period



Source: Goldman Sachs Global Investment Research, Bloomberg

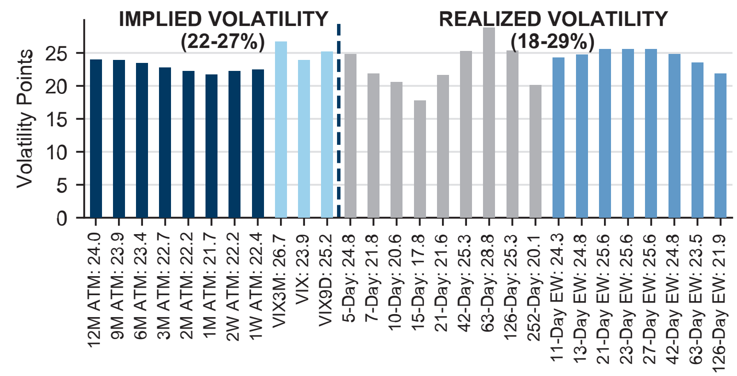
Vol Risk Premium: Implied vol has been below realized for the first extended period since pre-COVID

Exhibit 15: The VIX is no longer at a premium to its RV-implied level
VIX, and estimated VIX based on regression equation as a function of exponentially-weighted SPX realized volatility (13-day half-life)



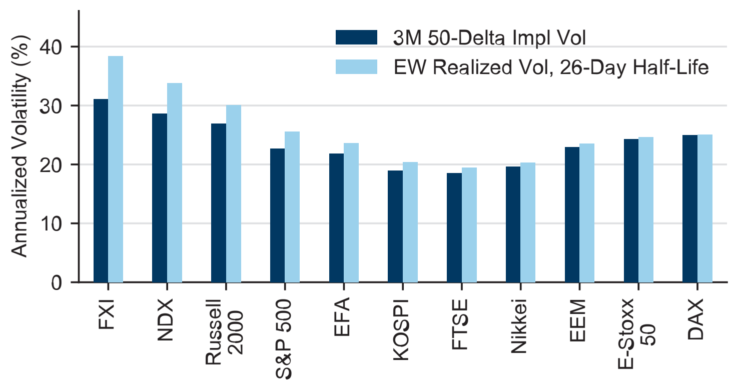
Source: Goldman Sachs Global Investment Research, Bloomberg

Exhibit 16: Most key implied and realized vol metrics are in the 20-25 range
SPX implied volatility, SPX volatility indices, fixed-window realized volatility metrics, and exponentially-weighted realized volatility metrics



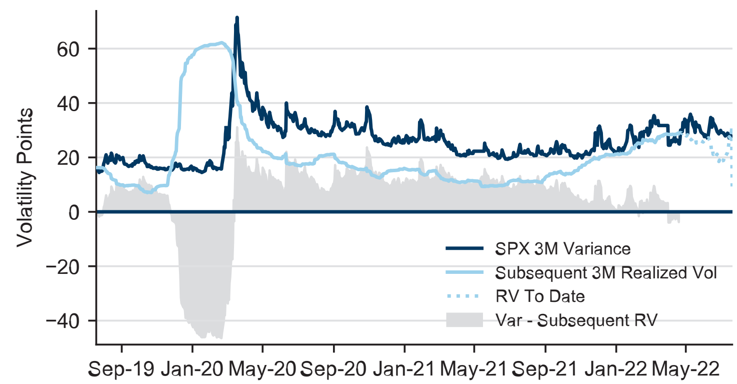
Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc., Bloomberg

Exhibit 17: Implied vol is below recent realized vol across regions
3-month 50-delta implied volatility and exponentially-weighted realized volatility (26-day half-life), sorted by implied-realized gap



Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

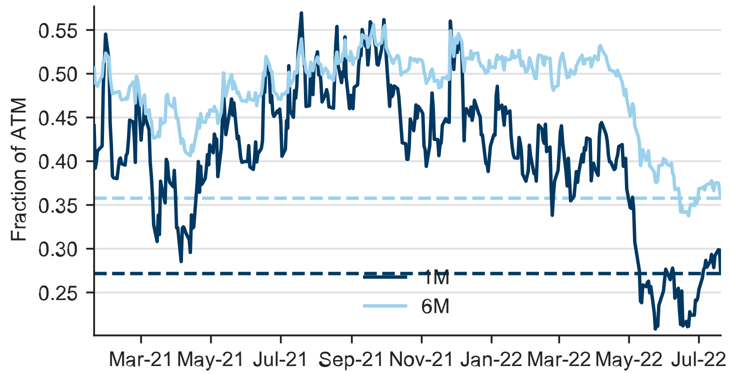
Exhibit 18: Realized vol has been slightly above ex-ante variance swap levels for the first time since 2020
SPX variance swap price and subsequent 3-month realized volatility (realized vol to-date for the last 3 months)



Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc., Bloomberg

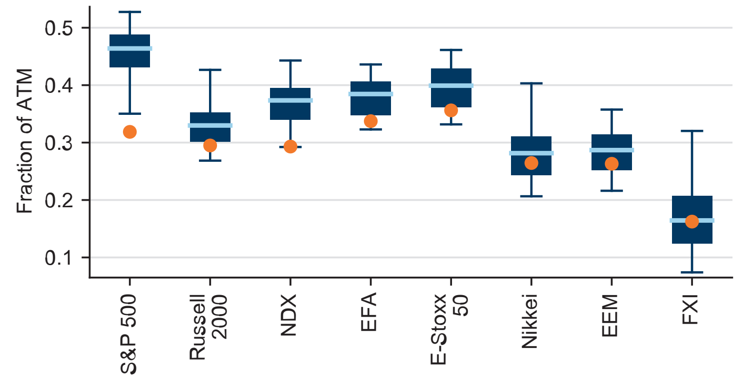
Skew: SPX skew has been rising but remains very low

Exhibit 19: SPX skew has been rising following extreme lows in May/June
SPX 25-delta put-vs.-call skew at each tenor, normalized by at-the-money



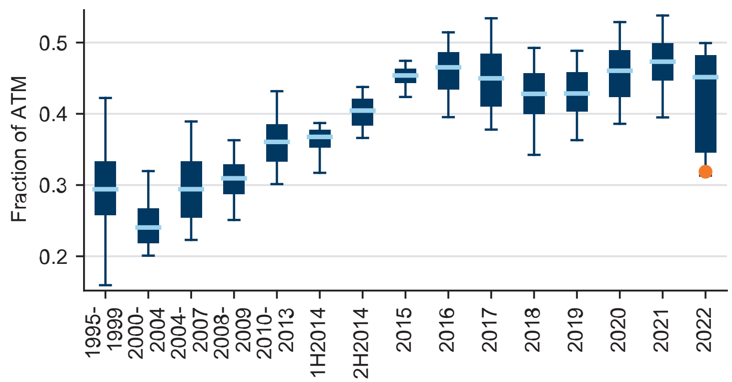
Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Exhibit 20: Unusually, SPX skew is below that of the EFA and E-Stoxx 50
3-month 25-delta put vs 25-delta call implied volatility skew, normalized by at-the-money: box plot shows 5/25/50/75/95th percentiles, last 3 years



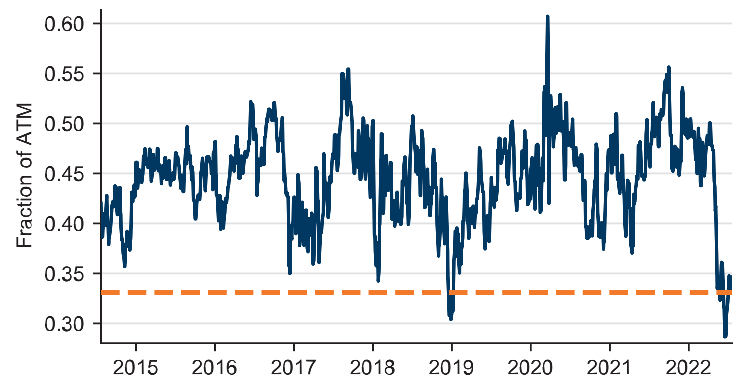
Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Exhibit 21: SPX skew remains well below its 2014-2021 range
S&P 500 3-month 25-delta put vs 25-delta call implied volatility skew, normalized by at-the-money; box plot shows 5/25/50/75/95th percentiles



Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Exhibit 22: 3-month implied volatility skew is still at the bottom of its historical range
SPX 3-month 25-delta put vs 25-delta call implied volatility skew, normalized by at-the-money, 3-day rolling median

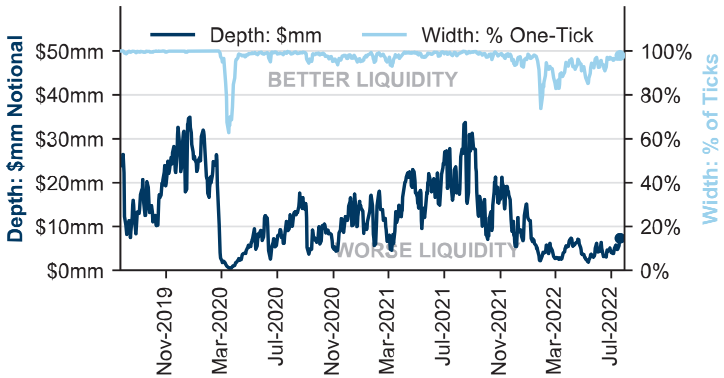


Source: Goldman Sachs Global Investment Research, Goldman Sachs Group Inc.

Liquidity: Top-of-book depth has been improving slowly

Exhibit 23: As volatility has faded, SPX futures liquidity has improved

3-day rolling E-mini future median top-of-book depth ($mm notional) and width (% of ticks exactly 25 cents wide), based on 1-minute intraday snapshots



Source: Goldman Sachs Global Investment Research, Reuters

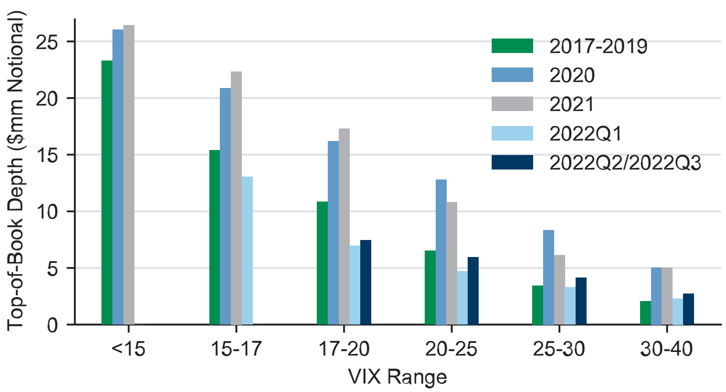
Exhibit 24: Top-of-book depth is still at a level associated with market stress despite recent improvement

10-day rolling median E-mini future bid-ask depth ($mm notional), based on 5-minute intraday snapshots

Source: Goldman Sachs Global Investment Research, Reuters

Exhibit 25: In 2020-21, there was typically over $10mm on SPX futures' bid/ask when the VIX was in the 20-25 range

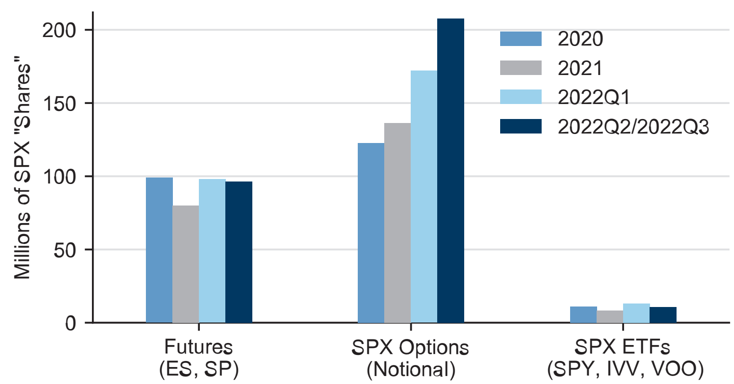
Median E-mini top-of-book depth ($mm notional) for each range of intraday VIX levels



Source: Goldman Sachs Global Investment Research, Reuters

Exhibit 26: Despite surging SPX option volumes and high volatility, future and ETF volumes have not risen this year

SPX future, option, and large ETF (SPY, IVV, VOO) average daily volumes, millions of "shares"



Source: Goldman Sachs Global Investment Research, Bloomberg

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