



The anti-singularity machine

AI IS SET TO TRANSFORM OUR LIVES IN THE DECADES AHEAD.

But the market's current optimism about the coming productivity revolution is being exaggerated by investment flows and feedback loops which are mechanically driving prices away from the fundamental reality. Such self-reinforcing market dynamics have in the past created extreme overshoots. And the bigger the overshoot, the larger the eventual correction.



HENRY MAXEY

Co-CIO

I WAS RECENTLY REMINDED OF A CLIENT'S POINTED REMARK TO JONATHAN RUFFER IN 2007: "All my clever friends are losing money, all my stupid friends are making money. And, if you think that is a compliment, it isn't!"

So I hesitate before presenting a Review piece which may seem too clever by half.

Yet now, of all times, we need to explain the basis of our continuing caution.

What follows is just one component of a broader bearish thesis.

A QUESTION OF INTELLIGENCE

Singularity is the artificial intelligence (AI) optimist's dream. It is the concept of artificial superintelligence – one that surpasses the brightest human minds in practically every field, including scientific creativity, general wisdom and social skills.

Singularity promises untold benefits to the world, helping to solve some of our biggest problems. Ironically, the market's optimistic reaction to the potential advent of superintelligence looks far from intelligent, with complex self-reinforcing patterns of investor behaviour mechanically distorting asset prices. This is driving what I refer to as anti-singularity: single stock dispersion rises as equity index correlations fall. Index correlation is the degree to which individual stocks in an index move together. High correlation indicates that stocks in the index tend to move in the same direction, ie there

is a common systemic risk driver. Conversely, low correlation implies the absence of systemic risk from stock markets.

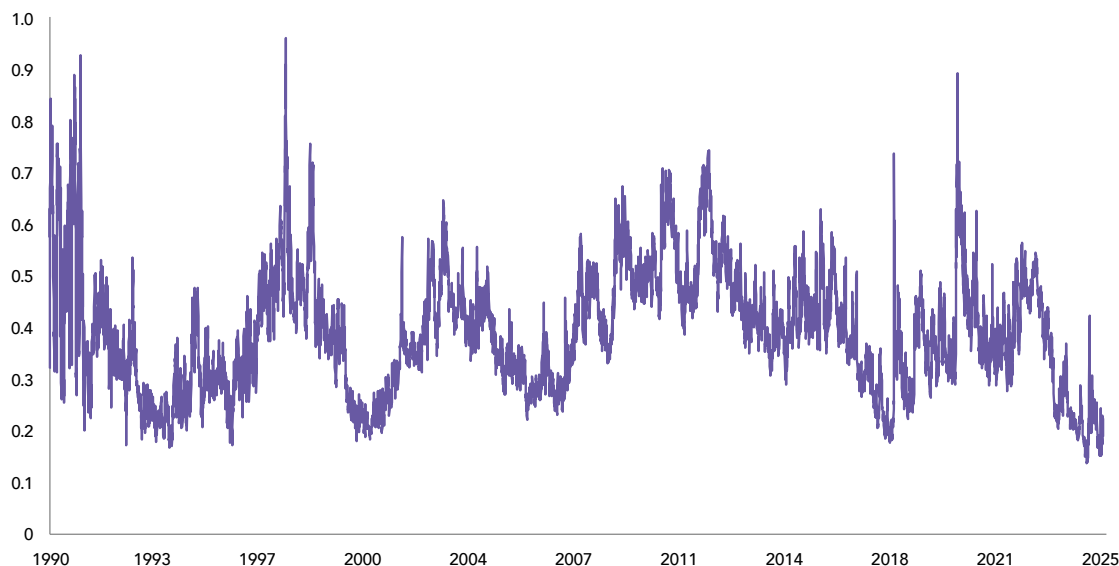
A brief technical aside: when thinking about correlation, we can look at implied correlation (what market pricing of derivatives implies about expected correlation) or realised correlation (what the actual correlation has been over a given period). The two should obviously be related as speculators will trade the relative price of implied correlation to expectations of its realised path.

In 2024, the implied correlation reached its lowest level since 1990, when the data set began, and it remains near that low today (Figure 1). This is market anti-singularity.

What is going on? Has something happened in the world which makes markets more immune to systemic forces? I doubt it. And it certainly doesn't seem like

Figure 1

THREE MONTH IMPLIED CORRELATION OF S&P 500 STOCKS



“Ironically, the market’s optimistic reaction to the potential advent of superintelligence looks far from intelligent.”

a world which is short of systemic risks: wars, revolutions, nuclear threats, Trump II, political paralysis and power vacuums all over the place.

But investors always find a reasonable narrative to justify market extremes. In this case, the rising weight of mega-cap technology companies, which has a depressing influence on index correlation, is justified by the rise of AI, which will drive a productivity revolution. Thus the economy will enjoy much higher real growth without inflation, meaning interest rates can fall and earnings can outpace expectations. Initially, the very largest (mainly tech) companies are deemed the winners. At the centre is Nvidia, whose monopoly on chips gives it the immediate profit tsunami as the space race for compute capacity amongst all the mega-cap tech names accelerates.

Nvidia’s profit growth is real. And the mega-cap tech companies are also highly profitable. Their R&D spend gives Nvidia its profits. But they all get rewarded for this spending – so far, at least – with higher share prices. So this is not a profitless bubble like the dot.com blowout of 1999. Nor are their valuations as extreme as the Nifty Fifty’s in the late 1960s and early 1970s.

So, say the bulls, why can’t the index move higher? And why can’t this happen with low correlations? After all, it is being driven by the largest companies, which will accrue most of the benefits.

In this version of the story, singularity optimism should logically drive anti-singularity in markets.

We think the more likely explanation is that implied correlation is simply a residual variable, the depressed output of different, more powerful market forces acting on the other variables from which correlation is derived.

I don’t want to ruin readers’ experience with a Greek laden maths definition of correlation. The key point is that correlation is a function of the volatility of both the index and the single stocks, and of the weights of those stocks in the index. In this equation, implied correlation uses implied volatilities, and realised correlation uses actual historical volatilities.

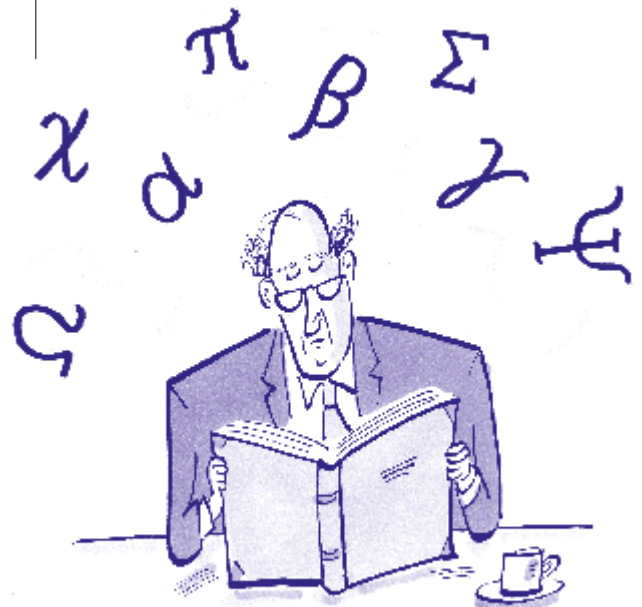
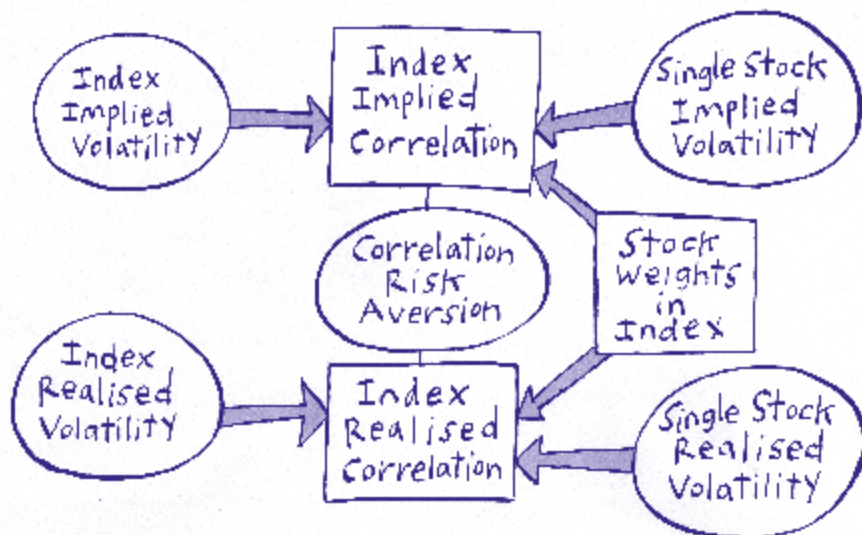


Figure 2

MARKET FLOWS ACTING ON VOLATILITY INPUTS TO CORRELATION

So let's consider the market flows acting on the four volatility inputs to correlation, ie the implied and realised volatility of the index and of the constituent stocks. A diagram may help (Figure 2).

The headline is that increasing flows into different financial products and strategies over recent years have put downward pressure on index volatility but upward pressure on single stock volatility. This combination – index volatility down, single stock volatility up – mechanically forces index correlation to fall. There are then feedback loops between the implied and realised variables which amplify the moves.

INDEX IMPLIED VOLATILITY

Let's start with index implied volatility (at the top left of the diagram). There is growing and persistent selling of this volatility due to a variety of activities.

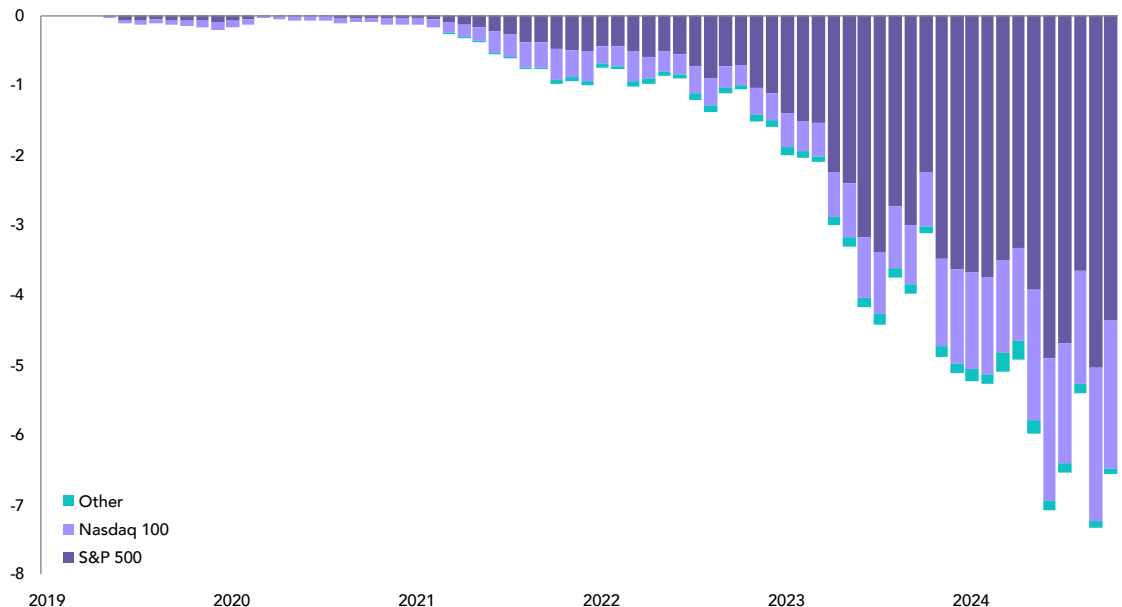
- Portfolio yield enhancement through option overwriting strategies
- Structured notes, like autocallables, which cap the upside in exchange for enhanced yield
- Harvesting the volatility risk premium – the difference between what you can sell implied volatility for and what actual volatility will be. Think of this as investors selling insurance on the market because they believe the insurance is on average expensive, ie that this volatility risk premium is on average positive. This sort of activity used to be the preserve of hedge funds and specialist players, but now it has been packaged up and sold to traditional investors via investment banks' quantitative investment strategies desks.

Most of these activities are not new. But the acceleration in their growth is tipping the balance. Figure 3 gives a flavour of that acceleration. It shows the dollar amount of gamma, or optionality, sold by month – optionality that leaves its seller vulnerable to sharp moves in prices.

The net effect of these growing flows is to depress equity index implied volatility.

“ This combination – index volatility down, single stock volatility up – mechanically forces index correlation to fall.”

Figure 3
GAMMA SUPPLY BY MONTH, \$BN



Source: Courtesy JPMorgan Chase & Co © 2024

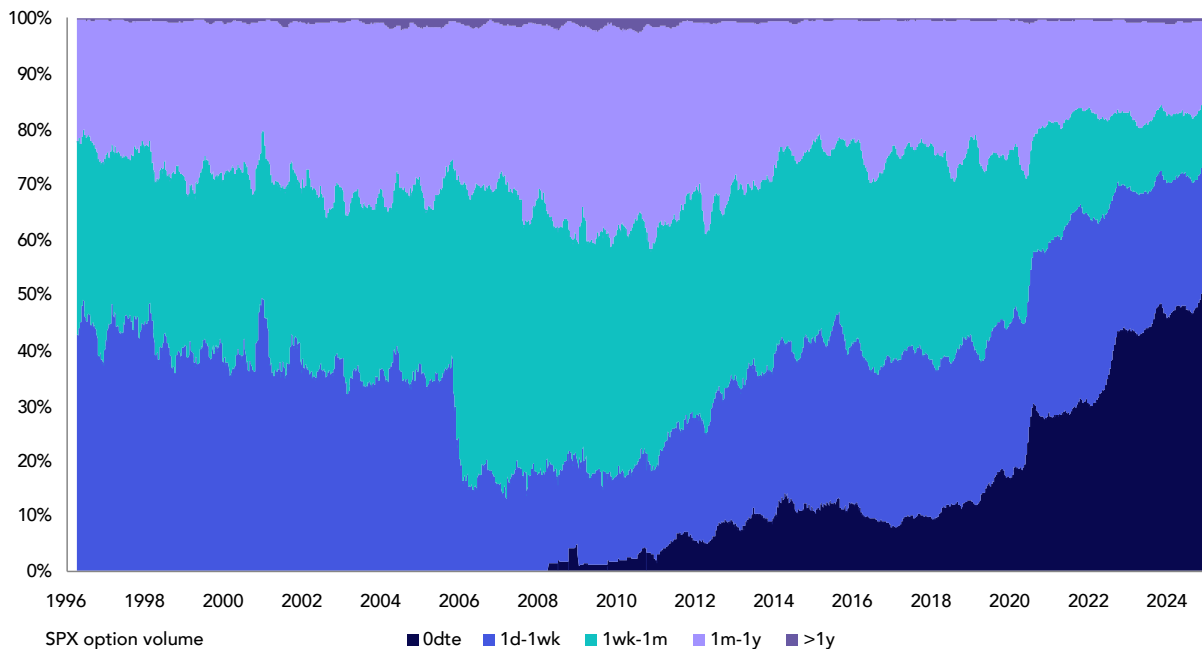
INDEX REALISED VOLATILITY

Now let's consider realised equity index volatility (the bottom left of the diagram). One recent development which is influencing this is the growth in the zero days to expiry (ODTE) options market. Figure 4 shows the growth in volume share by tenor of the option. Over half of this is now held in 0 to 7 days to expiry options.

This has had two effects: the first on realised volatility; the second on implied volatility.

1. The intraday trading dynamics of this market have, on average, lowered daily (ie close to close) volatility whilst increasing intraday volatility.
2. Because market participants can hedge event risk on shorter horizons, they have less need for longer-dated protection, which has reduced demand for longer-dated implied volatility.

Figure 4
OPTION VOLUME BY TENOR



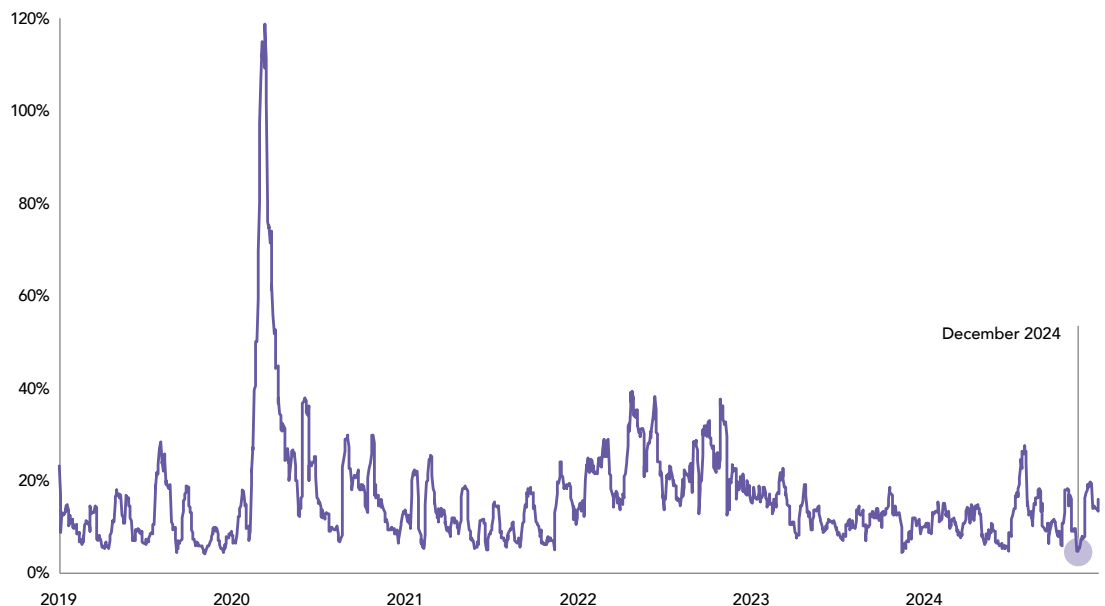
Source: Barclays

Then there is feedback between the flows which depress implied volatility and those which depress realised volatility. This is caused by dealers' hedging activity. When option supply overwhelms dealers' ability to recycle it to other buyers, they are forced to hedge their exposure dynamically. So they sell the index when it rises and buy it when it falls. Known as delta hedging, it can act as a stabilising force on the market, reducing the realised volatility of the index. This can create powerful feedback loops between implied and realised index volatility. For example, as I write this piece in December 2024, dealers' hedging activity is causing realised volatility to fall very sharply (Figure 5).

“The lower realised volatility falls, the higher the apparent volatility risk premium.”

This has self-reinforcing tendencies, because the lower realised volatility falls, the higher the apparent volatility risk premium (the difference between implied and realised volatility), so the more investors are incentivised to sell volatility.

Figure 5
S&P 500 ANNUALISED TWO WEEK REALISED VOLATILITY



Source: Bloomberg, Ruffer calculations

SINGLE STOCK IMPLIED VOLATILITY

Moving to the single stock side of the diagram, the opposite dynamics appear to be at play, enhancing volatility. Starting with single stock implied volatility (the top right of Figure 2), we find the animal spirits of both retail and speculative professional investors.

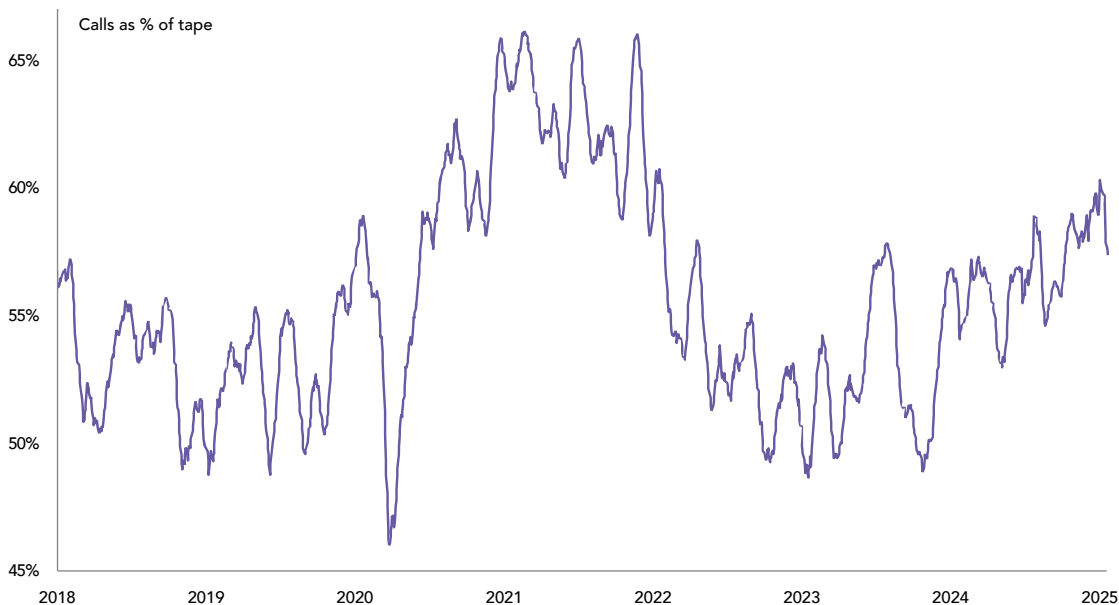
The broad cultural context is a greater ‘speculate to accumulate’ mentality amongst individual investors. These trends seem to have accelerated post covid, probably encouraged by the ‘free’ money the US government sent to individuals during the lockdowns, when there was little sporting activity to bet on. Retail investors’ participation in markets grew rapidly alongside the gamification of investing, hot themes like AI, the popularity of meme

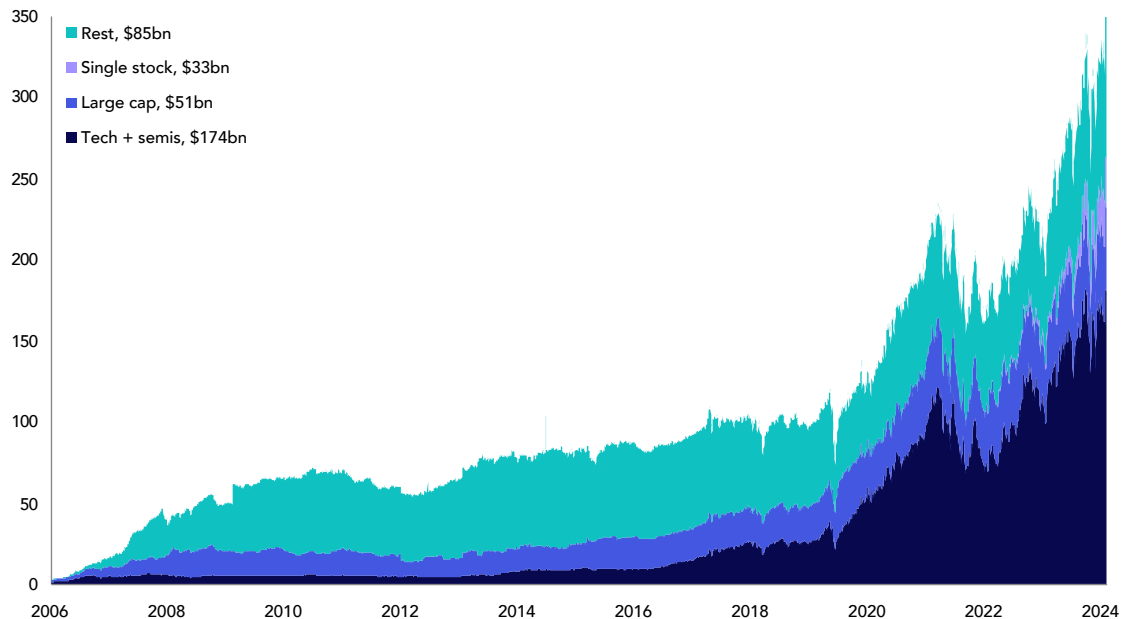
stocks like GameStop, and social media hype of the potential riches available. Access to relatively unregulated markets in the crypto space has doubtless contributed, with the added wrinkle that the crypto ecosystem can create its own parallel leverage, adding fuel to the wider speculative fire.

Access to options, primarily call options, has allowed investors to express their impatience for riches. Figure 6 shows this increased activity. The speculative fervour peaked in 2021 but is now almost back to those levels.

At the margin, this increases the implied volatility of single stocks – particularly thematically popular tech names which have a large weight in the index (I will come on to the influence of index weight on correlation later).

Figure 6
CALL VOLUME AS % OF ALL OPTION ACTIVITY



*Figure 7***LEVERED AND INVERSE ETF AUM, OVERALL LEVERED EXPOSURE \$BN**

Source: Goldman Sachs Global Investment Research, Bloomberg, FactSet

“The speculative fervour peaked in 2021 but is now almost back to those levels.”

SINGLE STOCK REALISED VOLATILITY

The rise of leveraged exchange-traded funds (ETFs) is also driving up realised volatility. As Figure 7 shows, these ETFs are focused on tech and semiconductors, and their assets have accelerated higher.

They have to rebalance at the end of each day to maintain their leveraged exposure to the underlying assets. If an asset has appreciated, they buy aggressively; and they sell aggressively if it has depreciated. These balancing flows are becoming big enough to amplify price changes, increasing the realised volatility of their underlying assets, which tend to be the tech names with heavy weightings in the index.

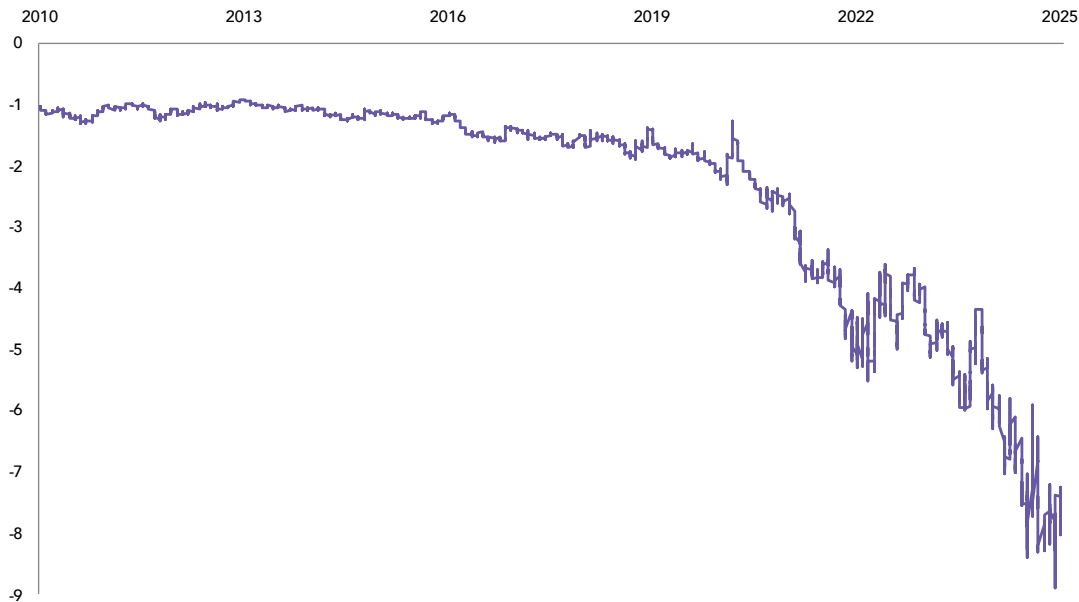
To illustrate the ETFs' growth, Figure 8 shows how much of the underlying asset needs to be sold given a 1% fall in the asset's price. Their impact is becoming noticeable on days when the underlying asset price has moved or liquidity is low.

Another recent development at the single stock level is the growth in the assets of very short-term, leveraged equity players, such as equity pods at multi-strategy hedge funds. Their trading behaviour has had two main impacts. First, it has impaired market-making profitability, which reduces stock level liquidity. Second, it has increased stock

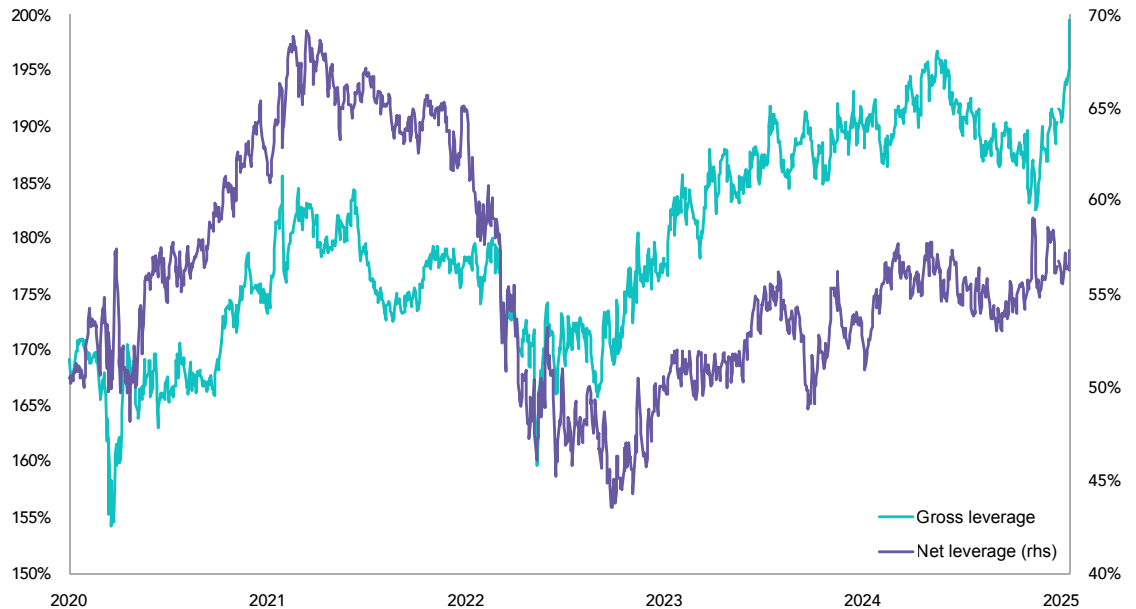
price volatility around news flow, because these players tend to liquidate positions aggressively when surprised. Their gross leverage remains near all-time highs (Figure 9), reinforcing this tendency.

The summary of all this: animal spirits and leverage are creating investor flows which are increasing single stock volatility. This is the opposite of the flow impact at the index level, which is depressing index volatility. The result is downward pressure on index correlation, both implied and realised.

Figure 8
GAMMA OF LEVERED ETFS, \$BN



Source: Morgan Stanley QDS

*Figure 9***GROSS AND NET LEVERAGE OF FUNDAMENTAL LONG/SHORT FUNDS**

Source: Goldman Sachs

“Animal spirits and leverage are creating investor flows which are increasing single stock volatility.”

AGGRAVATING FACTORS

That covers the volatility levers, but two other factors play into the story.

1. CONCENTRATION

I mentioned that the weighting of stocks in the index also has an influence on correlation. Mega-cap tech names' market share has continued to grow (Figure 10).

These companies have undoubtedly delivered very strong earnings growth in the post-covid era. But they have also benefited from the ongoing shift from active to passive investing, because active managers tend to underweight these names relative to the index. They are also the stocks speculative investors are most excited about – think Nvidia and AI – so they attract independent, leveraged flows (from call option buying and leveraged ETFs).

In other words, these stocks have been the central beneficiaries of a market which is biased towards momentum, and investors' desire for leveraged exposure to them has kept their volatilities high. Index correlation is depressed more when the volatility of concentrated names is elevated. This is because correlation is mathematically related to the square of the weight of the index constituent.

An important, but underappreciated, extension of this point: what matters is the correlation amongst the most concentrated names. If those high volatility, concentrated names have low correlation amongst themselves, the downward pressure on index correlation becomes supercharged. That happened in the second quarter of 2024 when Nvidia was, for a time, negatively correlated to the other mega-cap technology companies, driving index correlation to the lows we observed in Figure 1.

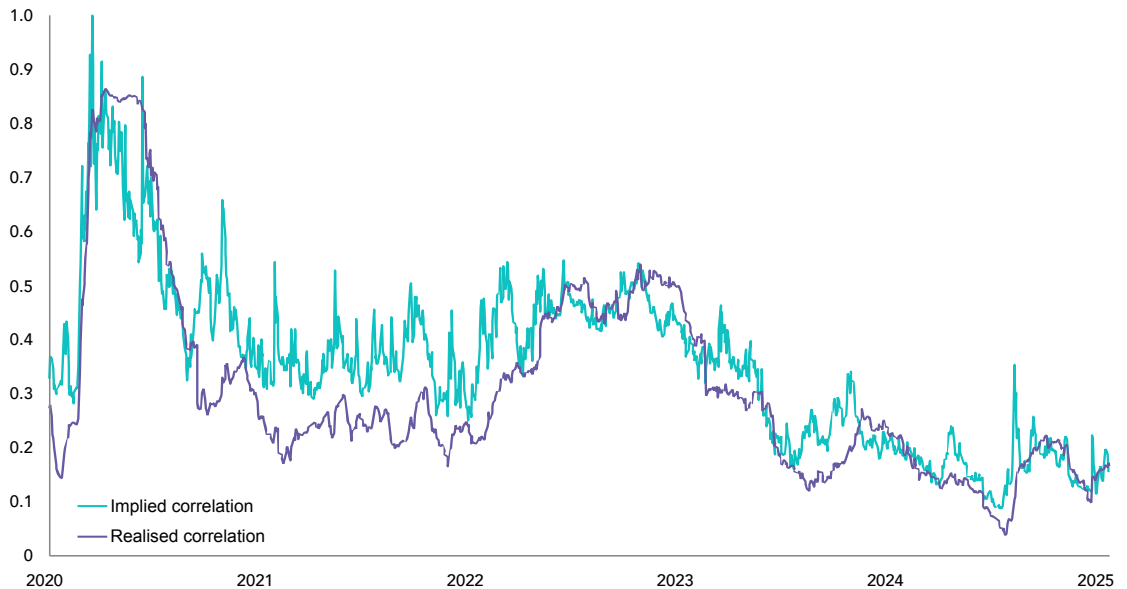
Figure 10

MAGNIFICENT 7 SHARE OF S&P 500 MARKET CAP



Source: Goldman Sachs

Figure 11
S&P 500 THREE MONTH REALISED AND IMPLIED CORRELATION



Source: Courtesy JPMorgan Chase & Co © 2024

2. DISPERSION TRADING

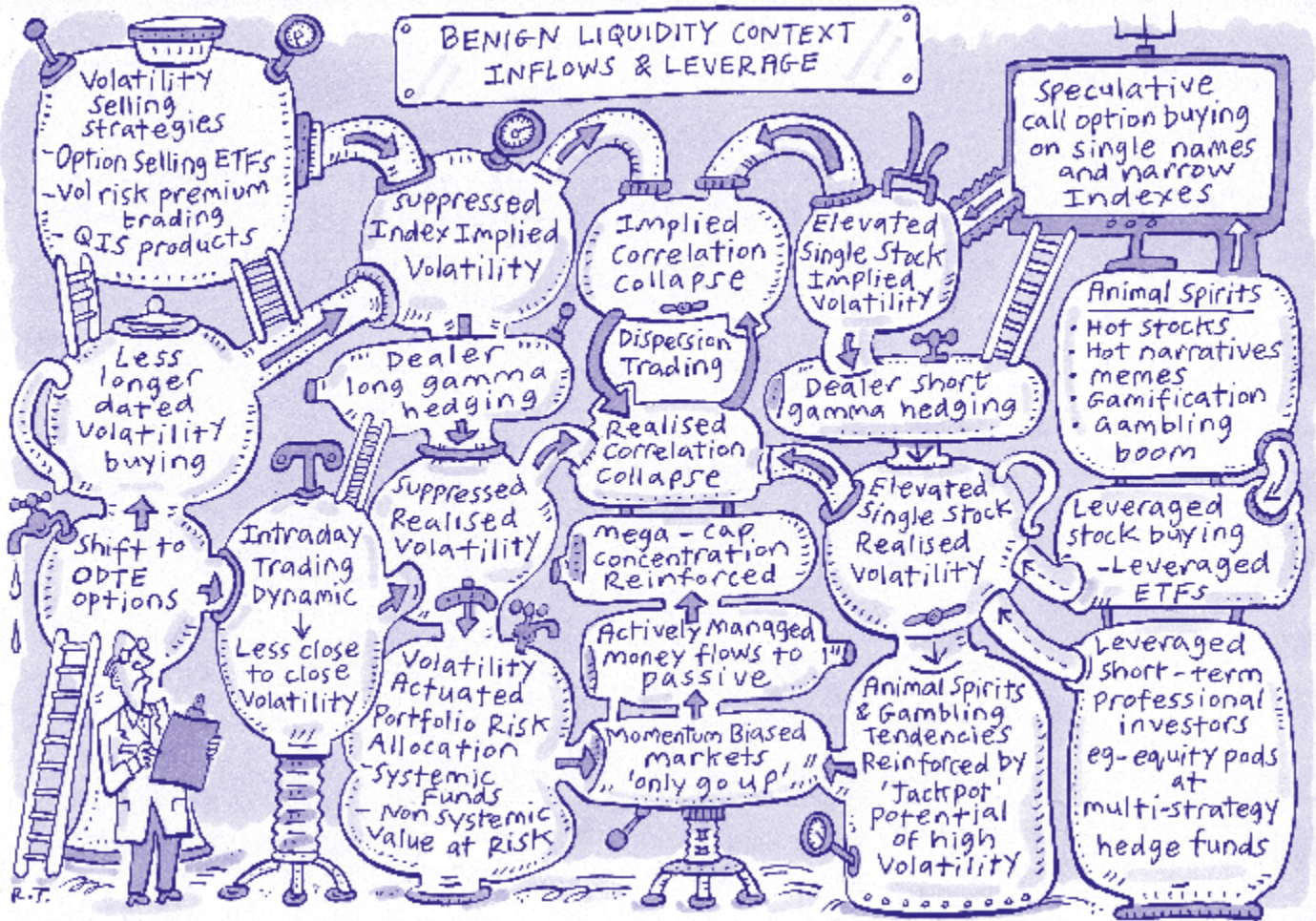
This aims to exploit the difference between the realised and the implied correlation of the index. This strategy has become popular with multi-strategy hedge funds. It originated in the days when single stock implied volatility tended to be depressed by single stock overwriting flows. At the same time, implied volatility at the index level was elevated by banks and asset managers buying downside protection, thus creating a persistent correlation premium.

As we have seen, today's dynamics are the reverse of that. This should mean that the correlation risk premium is compressed and the dispersion trade becomes unattractive. However, feedback loops from implied to

realised variables – like dealer gamma hedging's influence on realised vol – can help drive realised correlation down too. As a result, the dispersion trade can remain profitable even as the absolute level of implied correlation falls to historical lows, because it still trades at a premium to realised correlation. As Figure 11 shows, over the last three years, three-month realised correlation (the purple line, lagged three months as three-month implied is forward looking) has generally trended below three-month implied correlation (the teal line).

When a trade is based on relative values, it can easily become blind to the absolute value of the underlying.

Figure 12
THE ANTI-SINGULARITY MACHINE



THE BUILT-OUT MACHINE

Given all the points above, we can now add some annotation to the flow diagram we started with.

To be clear, Figure 12 is not a complete representation of all the factors at play. Rather, it is designed to show the important marginal drivers of correlation and their interactions. It brings together all the elements of the discussion above to show that falling index correlation is likely to be the outcome of rapid growth in some specific investor flows. This falling index correlation will be perpetuated by feedback loops of hedging and trading behaviours. And it will be energised by both investor extremes – the animal spirits of retail investors and the rigid disciplines of professional and systematic investors. It is an anti-singularity machine.

“If singularity promises superintelligence, the market’s anti-singularity should soon reveal its true nature.”

We haven’t touched on the macro element of our liquidity thesis in this article. Suffice it to say that the favourable liquidity conditions in the US over the last two years have encouraged the flows needed to wire up this machine.

Once it’s wired up, self-reinforcing dynamics can create extreme overshoots. Parallels can be seen, for example, in the relative value trading of structured credit tranches in the build-up to the credit crisis and in retail products on the VIX before the Volmageddon episode in 2018.

This explains our conviction that markets are being driven by flows and feedback loops, more than by fundamentals. And it illustrates nicely one of the mechanics behind the expression hyper-financialisation – that is, a financial system where prices drive fundamentals, rather than vice versa.

Looking into 2025, the supportive liquidity conditions of the past two years are likely to worsen, and that makes the system more vulnerable. On top of this, as Neil McLeish writes in his article, Trump’s efforts to make the US hyper-exceptional are unlikely to mix well. In the meantime, it is hard to gauge how far markets will overshoot. But we can be sure of one thing: the bigger the overshoot, the deeper the correction.

If singularity promises superintelligence, the market’s anti-singularity should soon reveal its true nature. We expect significant market fallout – and opportunities – when it does. ●

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