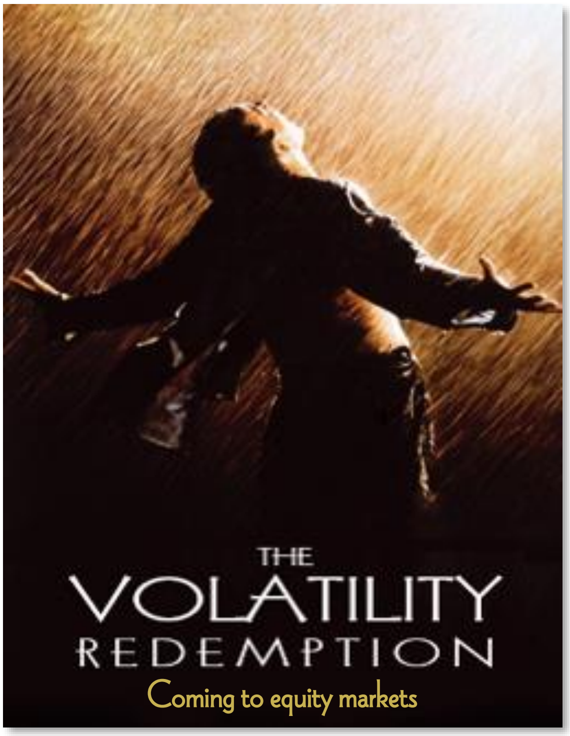
January 2023

The Volatility Redemption

Consequences of an era-ending paradigm shift



Source: Adapted from public domain.

The Volatility Redemption

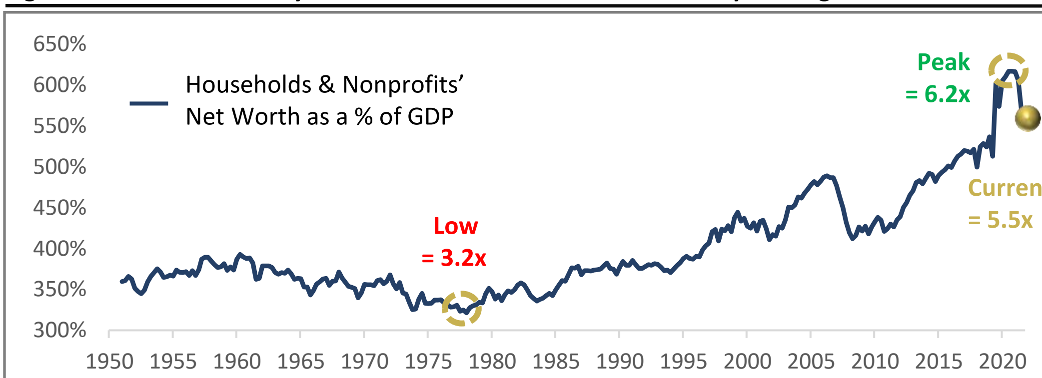
Andrew Scott
Andrew.Scott@BachOption.com
+852 3468-8517

Dr. Miao-dan Wu
Miao-dan.wu@BachOption.com
+852 3468-8519

This period of the "Great Moderation" in financial markets will be immortalized in the history books for boasting the longest ever U.S. equity bull market and the lowest ever levels of interest rates. However, at long last this era appears to be coming to an end. Many would argue it was only this protracted because of the distinct lack of moderation and restraint exercised by global central banks as their policies irresponsibly and repeatedly over-reached. Some concrete signs of a different era have already emerged: as we suffer through the highest inflation since the 1970s, an unprecedented removal of central banking liquidity and the speediest rate hikes on record, creating a global bond market sell-off of epic proportions. On top of financial market distress, we also face an unresolved global health crisis, an emergence of Cold War II and following Russia's invasion of the Ukraine, the first real hot war in Europe since the end of World War II. If this were submitted as a Hollywood movie script, it would be instantly rejected on the grounds of believability. However, this is sadly our current non-fictional reality.

If there is one single chart that can capture the financial Zeitgeist of the last 4 decades, it is probably figure 1. The ratio of the private sector net wealth to GDP in the U.S. rose inexorably from the late 1970s to almost double the level in 2021. Around the time when Greenspan wondered aloud about "irrational exuberance' in late 1996, the stable range held for almost 50 years was broken. Despite the dot.com collapse and the GFC thereafter, the ascent gathered pace in the 2010s. The COVID-pandemic counterintuitively gave rise to the final vertical blow-off.

Figure 1. The extraordinary era of the "Great Moderation" is finally coming to an end



Source: Board of Governors of the Federal Reserve System & Federal Reserve Bank of St. Louis.

Since much of the wealth reflects the prevailing valuations of the financial assets, i.e., "paper" wealth, the doubling of this ratio means that future income streams associated with the assets are valued twice as much as before in relation to the income currently generated by the entire economy. Ironically, the average growth rate of the GDP over the prior 4 decades before 1980s was actually higher than that of the subsequent 4 decades, and especially so compared to that of the 2010s. That a significantly higher ratio of paper wealth to GDP coincided with the decade of weakest actual growth suggests the triumph of imagination over reality. The thesis of this paper is that we are at the outset of a secular trend that will reverse much of the previous trend of the last 40 years, the trend of hyper-financialization. The cause of this reversal is the dissipation of the disinflationary forces which in addition to the misguided policy of the central banks, led to the lowest interest rates in the history of humankind. Convulsions that inevitably accompany such reversions from heights of fantasy will be fertile ground for the deployment of a long convexity strategy.

Throughout much of the last 4 decades, particularly since the late 1990s, the financial world was conditioned to deal with deflation and the incessantly decreasing interest rates. In the new era of inflation, it will be confronted with an entirely different set of issues. The previous solutions that seemed robust will be obsolete, if not erroneous. The relationships between various variables that were stable for a long time, will undergo "structural" breaks, just like the aforementioned wealth versus GDP. Recency bias in human decision-making, like inertia in physics, is unavoidable. This process of adjustment will therefore be certainly difficult and painful.

Other than be vigilant against that bias and adapt proactively to the new paradigm, a long convexity stance is crucial in navigating this new investment landscape of perilous uncertainty. In this paper, we examine three key questions:

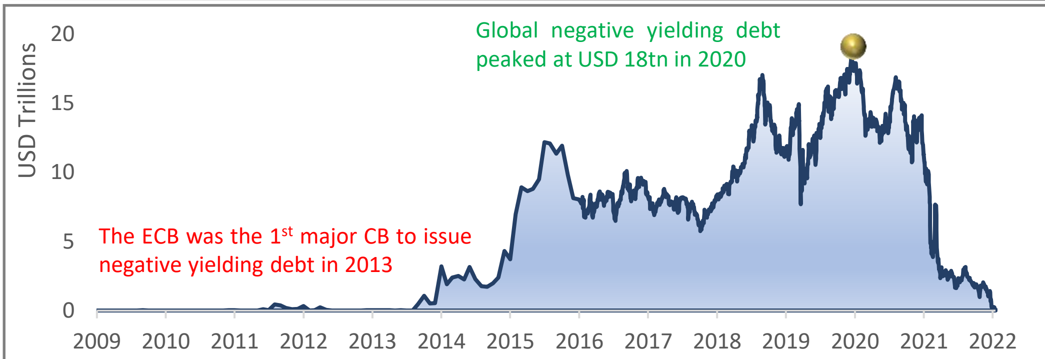
1. What is marking the end of this era?
2. Why has equity volatility not reacted more meaningfully to the ensuing carnage? and finally:
3. Why do we believe an equity volatility redemption could be ahead of us?

1. What is marking the end of this era?

1.1 The Whirlpool of Speculation

Insofar as a period of time can be regarded as a distinct era, it ought to possess certain salient features sufficiently distinct from those of other time periods. For the past 4 decades, especially the 3 decades after the fall of the Berlin Wall, there have indeed been a number of economic and financial developments setting the era apart certainly from the past, and the future as well if our contention is correct. The first is the dramatic fall of interest rates. Benchmark 10-year US Treasury rates declined from 16% in 1981 to 0.5% in 2020. Most extraordinarily, for much of the period from 2015 to 2022, there were tens of Trillions of bonds with negative yields (figure 2). Truth really does seem stranger than fiction. Whereas fiction, as Mark Twain astutely pointed out, is obliged to stick to possibilities, in the sphere of finance, the central banks don't.

Figure 2. Global negative yielding debt



Source: Bloomberg.

The causes of this secular decline of interest rates are subject to much debate, but its impact on the financial system and the broader socio-economic affairs is relatively straightforward to delineate. Everything else being equal, the lower cost of borrowing spurs more investment in real enterprises and financial speculation. However, there is a subtle and yet significant difference in its importance for an entrepreneur versus a speculator. In assessing the merit of a "real" investment, the marginal utility of a reduction in the interest rate, is apt to decline considerably beyond some level, due to the typically much higher uncertainty in forecasting the "long-term" profitability of the real enterprise. Given that an investment decision rests on the perceived excess return relative to the downside risk, one readily sees that if the potential return is assumed to follow a fairly wide probability distribution, say, between -10% and +20%, a 25 bp rate cut from 2% would barely sway the decision. Moreover, there is uncertainty about the probability distribution itself on which the risk/reward analysis is contingent. Keynes' invocation of animal spirits as a major determinant of a large proportion of positive activities is not just due to the irrational characteristic of human nature, but also due to the intrinsic uncertainty of forecasting the future. Japan's experience since the bursting of the bubble in 1990 is a case in point: no matter how low the rates, there has been by and large very little effect in either real Capex or financial euphoria. Compared to the risks concerning real investment, both by fact and by illusion, those associated with financial speculation are regarded as much more quantifiable

Firstly, since the future cash flows for many securities (certainly the fixed income ones) are clearly defined, one major source of uncertainty is absent. Secondly and more importantly, the availability of abundant historical price data from either the securities themselves or suitable proxies leads to the notion that the uncertainty can be quantified and represented by some metrics computed from the historical data, such as the realized volatility. To summarize, whereas in the realm of real investment, there is a large degree of fuzziness in accounting for the uncertainty, statistical clarity and analytical tractability are implicitly taken for granted in financial investment. This tendency has been reinforced of late by the vogue for big data and AI. Such a false sense of precision makes leverage much more admissible, which amplifies any otherwise insignificant increase in the expected return to render a marginal investment proposition seemingly opportune. Therefore, the marginal utility of a rate cut emphatically does not diminish rapidly in financial speculation. There is additionally a reflexive mechanism whereby the previous effects of lower interest rates induce buying of the financial assets and lower the volatilities, which then in turn make the risks seem lower and encourage more buying. This analysis, based on the risk/reward consideration, is naturally only applicable to those investors who are rationalistically disposed. For the rest, assiduous weighing of risk and reward is not normative. Their behaviours are driven by a combination of expecting the future to be but extrapolations of recent trends and FOMO (as J.P. Morgan put it, nothing so undermines one's financial judgement as the sight of one's neighbour getting rich). The higher the stock price, the more enthusiastic the buying. The same, however, cannot be said for the demand for industrial equipment and others necessary for real wealth creation. Moreover, there is a powerful transmission mechanism aided by the embracing of quantitative finance that readily transmits moves in one corner of the global financial system to the rest. For instance, a decrease in interest rate can justify a higher valuation in stocks, since the future cash flows are now worth more. It can also cheapen the debt-financed corporate share buy-back. By the narrative of TINA, it gives rise to more buying of risky and higher-yielding assets such as stocks, junk bonds or real estate, which then further reverberates through to the rest of the risk spectrum such as private equity.

The original intention on the part of the central banks to incentivize real investment has essentially failed. Instead, this extraordinary decade or so of QE and NIRP has created the MOTHER of all bubbles. Financial speculation and bubbles are of course part and parcel of the capitalistic system with fiat money. Whereas previous instances are localized in both time and asset class: Japan in the 1980s, Nasdaq tech. stocks in the late 1990s or the US real estate bubble before the GFC, the sheer scope and scale of it dwarfs all of those. Especially during the crescendo period post-COVID, there were many bubbles occurring simultaneously, each one of which was the stuff of legend on its own merit: bonds with negative yields (guaranteed to lose money if held to maturity), to MEME stocks (Gamestop) and growth stocks such as TESLA, to Cryptocurrencies, to real estate prices globally. Figures 3-7 show the parabolic price increases of the more egregious offenders, together with the LPPL (log Periodic Power Law) fit, which is a signature boom-bust pattern.

Figure 3. 100-year Austrian bond (2017-2022)

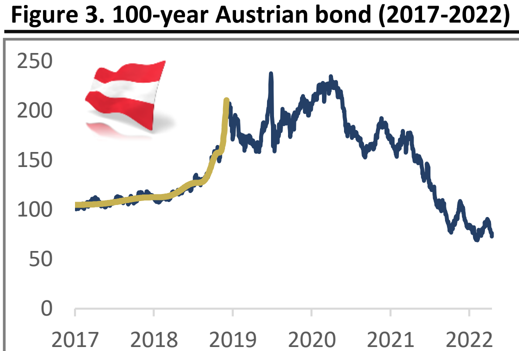


Figure 4. Tesla shares (2020-2022)

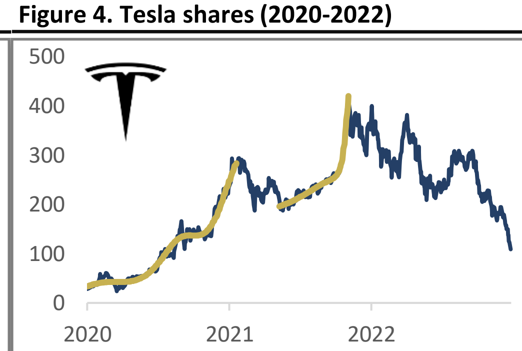


Figure 5. Bitcoin Cryptocurrency (2020-2022)

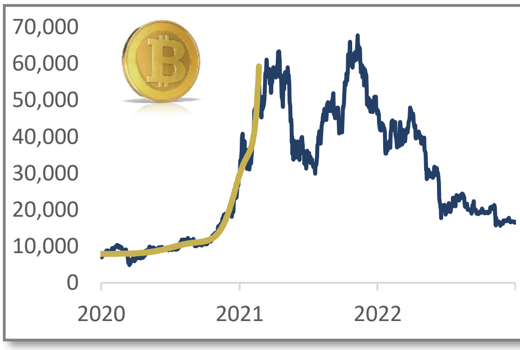
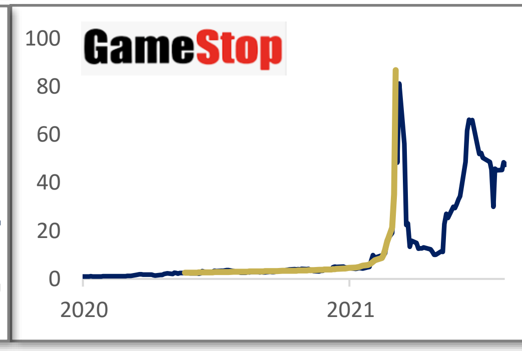
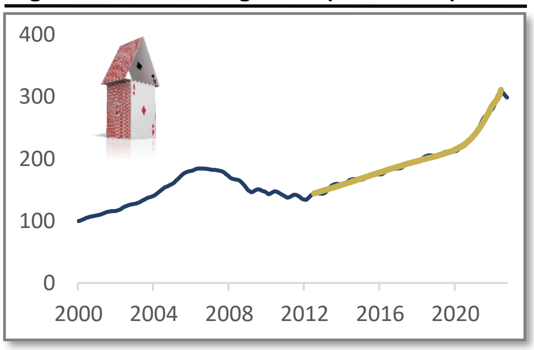


Figure 6. Gamestop shares (2000-2022)



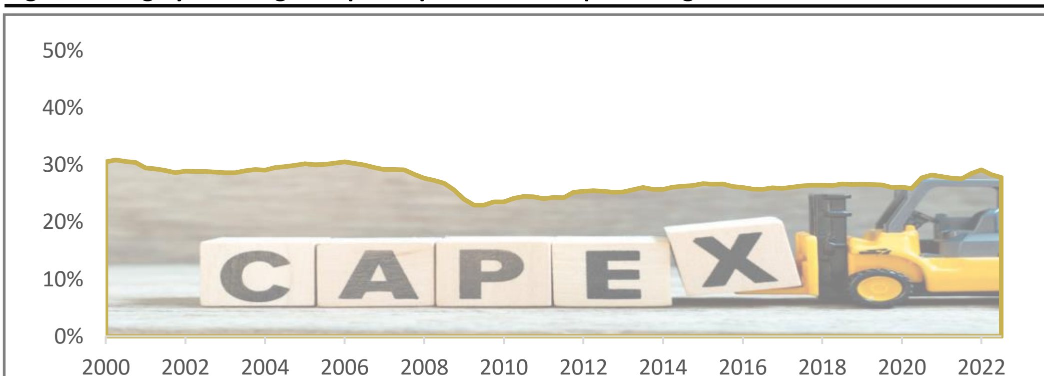
Source for all : Bloomberg.

Figure 7. U.S. Housing Index (2000-2022)



Keynes wrote: "Speculators may do no harm as bubbles on a steady stream of enterprise. But the position is serious when enterprise becomes the bubble on a whirlpool of speculation". There is little ambiguity that such a whirlpool with the inconspicuous enterprise is precisely what the tremendously misguided monetary policy managed to engender (see Capex in figure 8).

Figure 8. Largely unchanged Capex expenditure as a percentage of nominal GDP since 2000



Source: Bloomberg. Note: Figure relates to total U.S. non-financial Capex.

1.2 End of Global Disinflation

In previous publications, we have attributed the era of disinflation since the 1980s principally to the unprecedented labour supply increase: the entrance into the global production system of almost 1 billion workers since the opening-up of China and the end of the Cold War. Enabled by the advent of the information technology, this vast increase in cheap labour caused a major reorganization of the supply chain and persistent downward pressure on wages in the industrialized West. Such unbridled globalization lasted approximately 3 decades, benefitting mostly erstwhile destitute workers in EM and the capitalists worldwide, at the expense of the middle class in the West. The impact on inflation has been twofold. Firstly, due to the reduction in labour cost and the efficiency of a highly integrated supply chain, core goods inflation in the U.S. has been zero or even slightly negative in the two decades before the pandemic.

In comparison, services inflation, more immune to competition from foreign workers, has been 2.8%. Secondly, since the marginal proclivity to consume of both the newly prosperous workers in the EM and the rich, is less than that of the middle class of the West with stagnate real income growth, there were both weakness of aggregate demand in the West and surplus of savings globally. Inequality of wealth and the divergence between the main Street and Wall Street deteriorated.

Given those secular disinflationary forces, low inflation was in fact an outcome of a positive development that ought to be welcomed and certainly nothing to fret about. There indeed were imbalances such as aforementioned demand shortfall and excess saving, but they ought to have been addressed by fiscal policy and international coordination, rather than incessant monetary accommodation. Unfortunately, in addition to indulging in self-congratulation over their policy credibility or averting a potential stock market crash, the central bankers embarked on a quixotic campaign to boost inflation with hitherto unimaginable means and flights of fancy. Now that the resultant mother of all bubbles has burst and they got more than what they bargained for with inflation spiking to 9%, one wonders if the world of finance will get back to the previous regime or a new era will be ushered in.

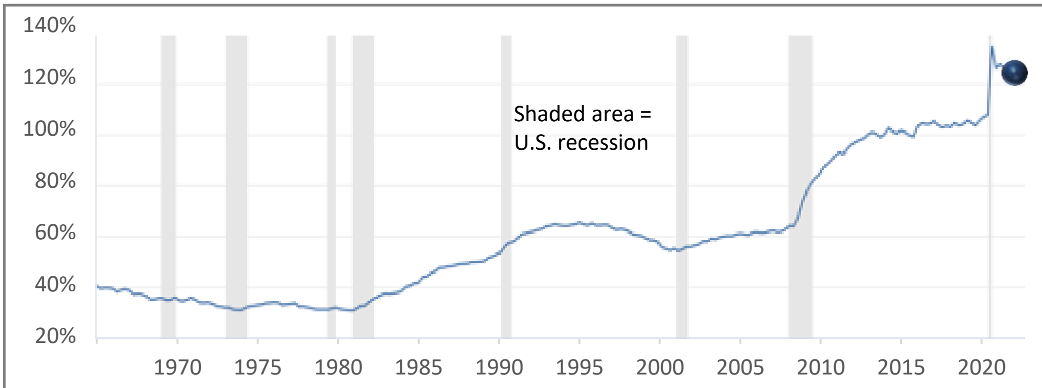
No economic trend lasts for ever. It ultimately engenders conditions which then lead to its own destruction. In the case of the globalization, the impoverishment and alienation of the middle class in the West was politically untenable. Geopolitically, the emergence of China as a potential superpower able to challenge the U.S.-dominated order was unacceptable to the U.S. We are firmly of the view that Brexit and the Trump Trade war heralded the end of globalization, and the Ukrainian War signified the start of Cold War II, where China, as opposed to the USSR in the first Cold War, is the senior partner of the anti-West pact. The COVID-pandemic also demonstrated unequivocally the lack of robustness of the supply chain. Thus just-in-time inventory management and single sources of supply are in the process of transitioning to just-in-case inventory management and multiple sources of supply. Reshoring or friendshoring are the political consensus. Russia's invasion of Ukraine and the secular demand for Green energy meant that at least for the next decade or so, cheap energy will be unlikely. The major pillars of the disinflationary globalization era: cheap labour, cheap energy, and efficiency (rather than resilience) of a supply chain optimized to exploit the comparative advantages of the countries involved, have begun to crumble.

1.3 Inflation as the Only (Viable) Solution & the Insoluble Dilemma

Whilst the disinflation lasted and the central banks were busy concocting ingenious policy instruments to increase inflation, another trend quietly emerged: fiscal deficit spending. In the early 1990s, Bill Clinton's strategist Carville famously said: "I used to think that if there was reincarnation, I wanted to come back as the President or the Pope… But now I would want to come back as the bond market". Such was the power of a vigilant bond market that the ensuing fiscal restraint led Greenspan to wonder in 2001 about the impact of the lack of future issuance of the Treasury bonds, given the budget surplus. Even in the immediate aftermath of the GFC, fiscal responsibility was still the main policy plank of the Republican party.

However, with continuous disinflation, and especially in light of the feared inflation failing to materialize after the first QE attempt, politicians came to believe that deficits no longer matter. The facile MMT went from a fringe theory to something respectable and Bernanke's Helicopter money came into being in the wake of the pandemic. At the end of 2021, the U.S. unemployment rate was close to all-time lows and yet the budget deficit as a percentage of nominal GDP amounted to -5%, one cannot help but wonder what the deficit would be in the event of a full-fledge recession. Figure 9. on the page 7 shows the U.S. total public debt as a percentage of GDP. From the late 80s to the GFC, the ratio averaged around 60%. After the GFC, and despite the gargantuan QE, the debt ratio doubled to 120% as of Q3 2022. If the borrowing cost is 4%, then the primary budget surplus will have to be 5% just to stabilize the debt.

Figure 9. U.S. Total Public Debt as a percentage of GDP



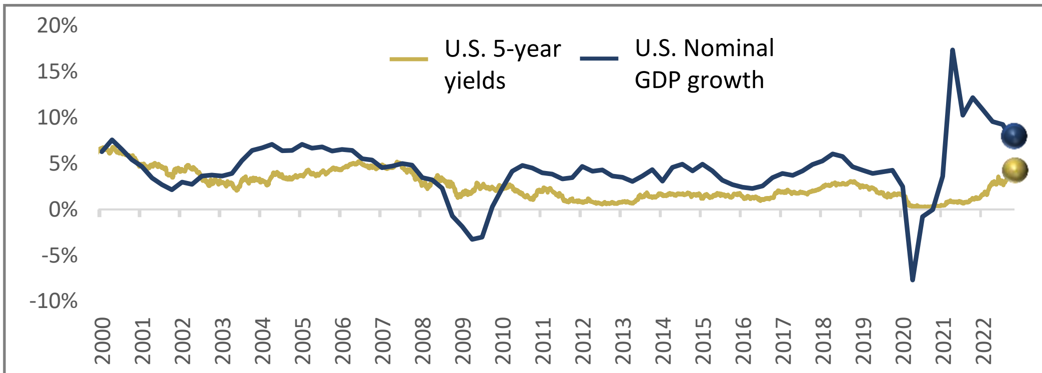
Source: Bloomberg & Federal Reserve Bank of St. Louis.

Lord Tytler allegedly remarked that: A democracy cannot exist as a permanent form of government. It can only exist until the majority discovers it can vote itself largess out of the public treasury. After that, the majority always votes for the candidate promising the most benefits with the result the democracy collapses because of the loose fiscal policy ensuing, always to be followed by a dictatorship, then a monarchy. Since in a democracy, policy-making is driven by the expected votes to be received, short of an especially ascetic populace, the politicians are inclined to choose policies that are gratifying in the short term over those that are advantageous in the long term. Debt-financed fiscal largesse therefore has been a recurring feature even at times with normal levels of interest rates. It is thus hardly surprising that the deficits have spiked so much, given the QE and NIRP. Now that the disinflationary tailwind has reversed and the central banks have been forced to normalize monetary policy, how to prevent the government debt from spiraling out of control will in our view be one of the most pressing political issues.

One of the most widely quoted statements regarding inflation is that it is always and everywhere a monetary phenomenon by Milton Friedman. This strikes us as a trifle tautological. A more insightful one by him in our view is that “inflation is taxation without legislation”. In its essence, inflation redistributes wealth from creditors to debtors. If the government itself is a profligate debtor and its ability to increase tax is severely hampered by the intractable political division, the incentive really cannot be stronger for pursuing an inflationary policy. What’s more, since the creditors are often the minority (in the case of the U.S., many are foreigners), and the lower and middle classes have been both compelled and encouraged to take on large debt to maintain their living standards, the political cost would be much smaller compared to that arising from austerity. Incidentally, it could help to diminish the wealth inequality, which is in itself politically popular. The rapid aging of the population, and the sharp increase in defense spending (N.B. Germany’s defense spending was up 50% in 2022) and energy subsidies as a consequence of Cold War II, will further strain the fiscal burden. In conclusion, given the extraordinary level of government debt, and the composition of debtors versus creditors, by far the most politically expedient solution is to inflate the debt away. Nonetheless, to engineer such controlled inflation over an adequate period of time would require political finesse of the highest order. If too low, it will not reduce real interest rate adequately. If too high, visibly negative real income will lead to political unrest.

The central banks would therefore be confronted with a dilemma: on the one hand, both the exogenous (the aforementioned disinflationary forces) and endogenous (political expediency of reducing real debt burden by inflation) factors unleash powerful inflationary forces; and on the other hand, they need to fulfil their mandate of price stability. To compound the difficulty, they will also need to manage the systemic risk of the financial system in the midst of the deflation of a monstrous bubble. Thus far, with unemployment low, nominal GDP growth high (i.e. real cost of debt servicing is negative), and the adjustment of the financial system orderly, the tightening campaign has not met with undue difficulties. This is precisely because the tightening has not been sufficiently constraining, with nominal growth still much higher than nominal interest rates (see figure 10 on p 8).

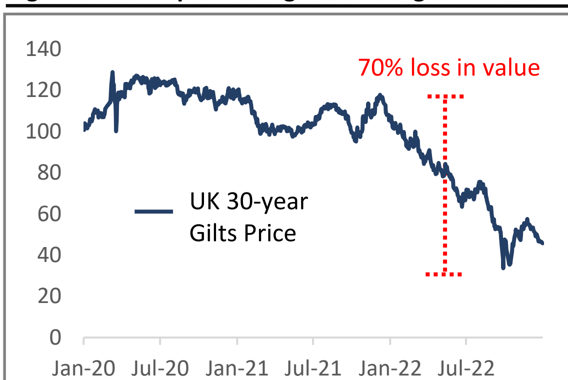
Figure 10. U.S. 5-year yields vs. U.S. Nominal GDP growth



Source: Bloomberg.

However, we have little doubt that their mettle will be continually tested, as demonstrated by the Gilt crisis in September (see figure 11.), which resulted in the resignation of the P.M. and renewed QE by the BoE. Those conflicting objectives will cause them to vacillate wildly and the financial system will react to, and amplify those policy gyrations.

Figure 11. Collapse in long-dated UK govt bonds



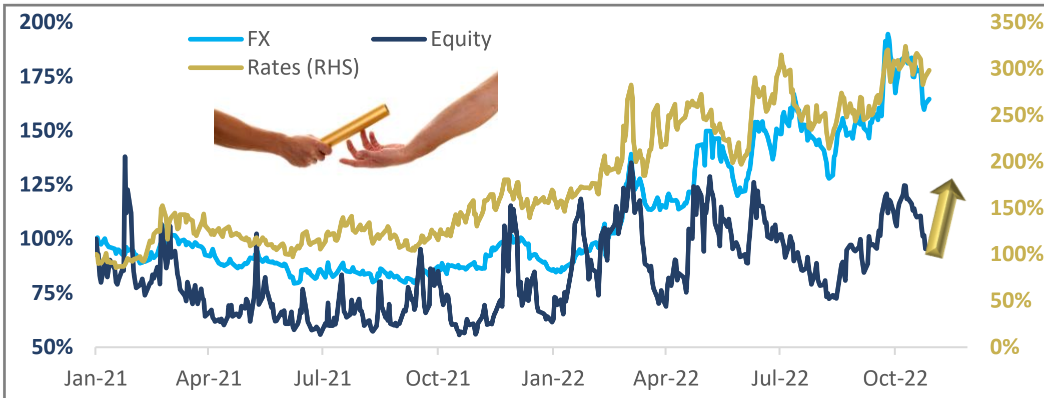
Source: Bloomberg.

There will be of course cyclical variations of inflation within a secular period of high inflation. Cyclical weaknesses of the economy can reduce inflation and vice versa. Once inflation expectations become untethered, however, the "inflation uncertainty" will add to the inherent cyclical uncertainty. If the future prices are expected to increase significantly, business owners may take the precaution of "hoarding" extra inventory and labour. If the expectation turns out to be wrong, they may be forced to shed both, thereby exacerbating the downturn. Consumers will behave in a similar fashion. Like many other socio-economic variables, inflation is expectational and inflation thus begets inflation. Once the expectation becomes unanchored, the macro uncertainly including political instability will surge. So far there has not been much evidence to suggest that the expectation has changed in any substantive way. But complacency such as that displayed by the bond market will surely make it more likely. In addition to equity index hedges, it will be important to be long upside tails of precious metals and related equities, lest that authorities should flagrantly resort to uber-inflationary tactics to manage fiscal and financial problems. In those circumstances, with Argentine type of inflation, risk assets may not decline much in nominal terms and thus time-honoured precious metals will be *the* most effective hedge.

2. Why was Equity volatility not higher?

In our paper Inflation - a Plinian eruption waiting to happen in February 2021, we asked investors to envisage a world where oil traded through $100 (i.e. double where it was), and inflation was 1, 2, or even 3 percentage points higher. Now there is no longer any need to imagine. The macro landscape shifted even more aggressively than we anticipated. Yet, as depicted in figure 12. on p 9., despite the explosion upwards in currency and rates' volatility, it is somewhat perplexing how relatively calm equity volatility behaved during this period, when we compare the normalized vol moves.

Figure 12. Passing of the volatility baton from Equity to FX & Rates



Source: Bloomberg. Note: Rates (MOVE index), FX (CVIX Index) & Equity (VIX Index): normalised (Jan-2021).

More specifically, the 3rd month future contract for VIX for instance, is back down to post-COVID lows (see trend in figure 13.), whilst Investment Banking-focused stocks such as Morgan Stanley and Goldman Sachs on a 6 month implied volatility basis have travelled even further, moving from a 40-50% range to mid 20s (see figure 14.), which is right back to pre-2020 levels. Clearly if a financial crisis were to erupt, these volatility markets would be among the first to explode.

Figure 13. VIX 3rd month fts back to '21 lows

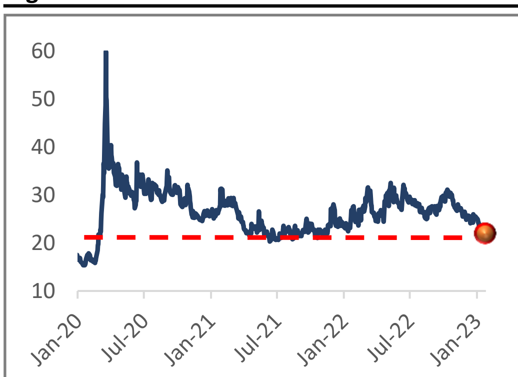
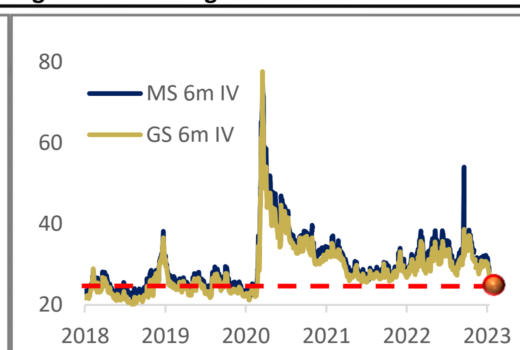


Figure 14. Banking IVs back to '20 levels



Source: Bloomberg.

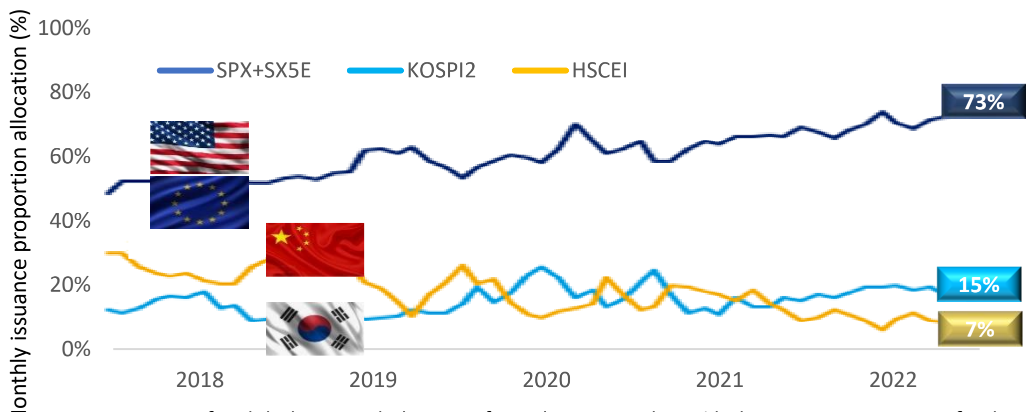
We believe that there were many contributive factors to the relatively low equity volatility environment in 2022, and in the next sections accordingly assess some of the key drivers of volatility supply and demand over that period.

2.1 Retail Structured Product Supply of Volatility

In our white paper [Retail Investors – The Largest Player in the Room], we described in significant detail the increasingly outsized impact retail clients exert upon volatility markets via the channel of retail structured products (RSP). At issuance, these products depress volatility and skew, as a consequence of the dealers' hedging activity (i.e. the sale of downside puts). Whilst the pace of issuance has slowed, according to most data providers it was still not unusual to see $20+m vega per month issued from 2021 through to H1 2022 from the largest issuing countries such as South Korea. If markets consistently rally, such as in the period between April 2020 through to year-end 2021, then these products are periodically called and generally reissued in an orderly fashion. However, if markets fall, as per 2022, an accumulation of outstanding positions builds, which creates additional supply of volatility because the lower spots go, the longer the dealer's long vol exposure grows. N.B. over the period of the S&P500 20+% sell-off, for every –1% spot move, dealers' vega exposure would grow longer by around $2m according to most market estimates. This effect has been more pronounced of late because of the large concentration of issuance centered on U.S. markets in particular. As one can see from figure 15. on page 10, the deviation away from products referencing Asian underlyings became increasingly pronounced in the past few years.

Note, in terms of scale, the outstanding RSPs referencing the S&P500 is currently in excess of $14bn notional (equivalent to approximately $65-70m vega), compared to almost zero exposure in 2015. This 'Asianisation' of the U.S. equity volatility surface has significant consequences for vol behavior and this serves as one of the primary technical drivers for the lower-than-expected U.S. equity implied volatility regime we witnessed this past year.

Figure 15. Almost 3/4 of retail structured product issuance now references non-Asian indices



Source: BofA Global Research data as of October 2022. The 5% balance covers a range of indices.

The other more nuanced dynamic to appreciate here is not easily observed, but relates to the evolution of hedge fund activity. Every year since the GFC, dealer hedging flows seemingly become more formulaic. This, coupled with huge advancements in RSP data transparency, mean that it is reasonably straight froward for sophisticated vol arb portfolio managers to anticipate these flows and pre-position ahead of them. This clearly exacerbates the depression of vol. To be clear, there is nothing sinister about this practice, and there is no inside information being exchanged, it is simply a result of timely data transparency and regulatory-enforced hedging limits on banks.

2.2 Limited Institutional Demand for Volatility

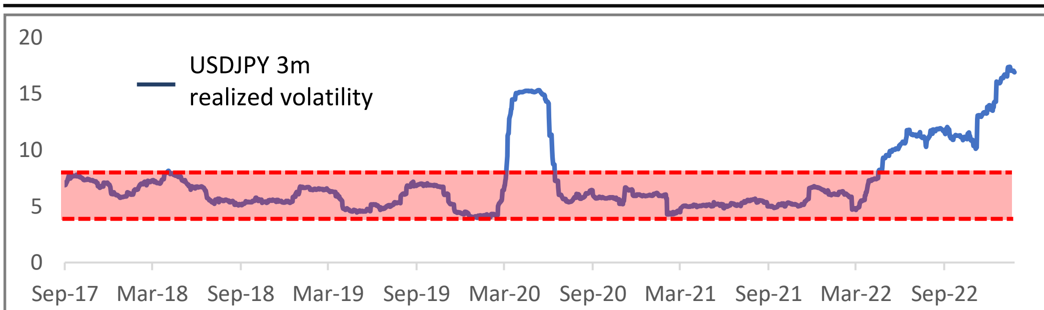
Putting RSPs to one side for a moment, in years gone by, one would also expect a 20+% spot move lower to instigate some major vol-covering from the short tail community, however, many of these systematic programs blew up, or were vastly restructured in recent years. March 2020 may have been peak pain for this universe of funds, though, the size of this community was already much reduced compared to 2017 and 2018, as allocators continued to redeem out of such strategies following poor performance. This explains in some part why we did not observe any stressed panic-buying, or forced unwinds of scale. Similarly, one would expect corporate pension funds historically to be active in the option market in the midst of large stock market sell-offs, stepping in to buy puts or put spreads as protection. This was not the case last year, however, since bonds simultaneously sold off. As a function of pension accounting, somewhat bizarrely, when rates rise, it actually starts to improve the funding status of pension funds, not worsen it. During much of 2022 as this dynamic played out, pension funds were thus mostly on the sidelines, waiting to see where terminal rates would settle, rather than actively engaging in hedging.

Finally, anecdotally in the regular conversations we have with the sell-side and some of the largest institutional investors, we have more broadly observed a tangible shift toward hedging equity portfolios, with short future positions rather than with optionality in 2022. There is clearly a reflexive element to selecting a preferred choice of hedging instrument and put options have not proved their utility, as much as one would expect, in recent history. The price action of 2020 in particular serves as a perfect example that influenced the mindset, where markets recovered much too quickly for many participants to monetize their hedges. The effect of this is the removal of yet another natural offset to volatility sellers in U.S. markets.

2.3 Better bang for your "hedging buck" in FX & Rates

For the better part of a decade and a half, the largest central banks carefully and collaboratively exerted great influence over global bond/credit markets, and in turn currency markets. The bi-product of this activity provided for very few escape valves for volatility to be released from. The only real outlet for volatility over this period, even if minimal, was in certain equity markets (ex-Japan of course with the BoJ explicitly on the bid in equities), and to some extent digital assets. Wherever volatility threatened to flare up, it was swiftly and aggressively dealt with, by one or all, of the central banking triumvirate consisting of the Fed, the BoJ and the ECB. The BoJ was perhaps the most aggressive in their suppression of macro volatility (see figure 16.) but all three happily stepped in as the buyer and seller of first resort across multiple markets.

Figure 16. USDJPY realized movement maintained in an exceptionally tight range ex-COVID



Source: Bloomberg.

The unnatural stability in FX and funding markets removed much active participation in markets, which ordinarily drives volatility. However, fast forward to today, and volatility is no longer confined to equities; cross-asset volatility has rocketed. We are no longer seeing Macro Funds' hedging their FX/rates books with the VIX anymore because there is so much volatility to contend with directly in their core strategies again, thus "tourist" participation in equity volatility markets was light in 2022. To demonstrate some sense of scale, we compare the ex-anti 3 month implied volatility to the ex-post maximum realized drawdown across stock markets (using the S&P500 as a proxy), FX markets (USDJPY as a proxy) and long duration bonds (TLT US as a proxy). In doing so, it becomes very clear that equity risk hedges offered the least bang for your 'hedging budget' buck in 2022 (see figure 17. below):

Figure 17. Market's expectation of movement vs. the scale of drawdown across asset classes

EQUITY (S&P500)	24 vol vs. -25% max drawdown -> 1.0x
BONDS (TLT US)	20 vol vs. -54% max drawdown -> 2.7x
FX (USDJPY)	10 vol vs. -32% max drawdown-> **3.2x**

...increasing bang for your buck

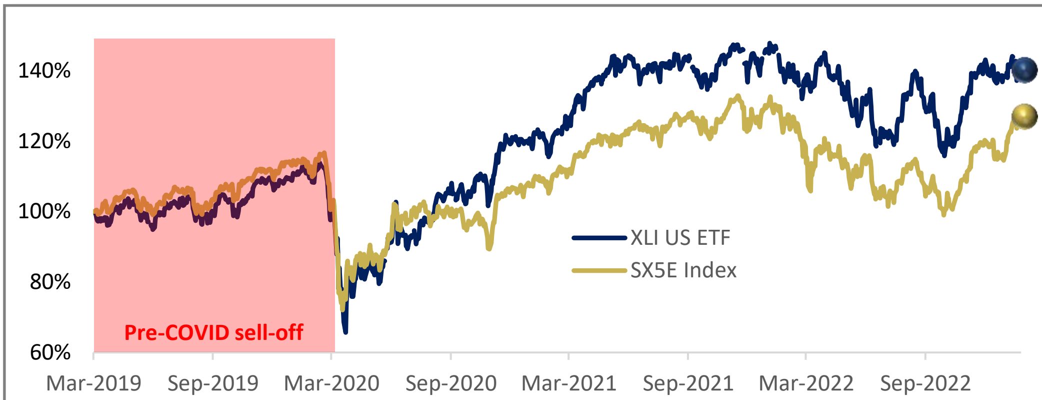
Source: Bloomberg.

Note: Vol = average 3m implied over past 12 months.

3. Why do we believe an equity volatility redemption could be ahead of us?

Going forward, we believe that there is plenty of scope for new tail risks to materialize, consequently causing a sizeable redemption in equity volatility. Firstly, however, we wish to address the view that global equity markets have already sold off more than enough. In our opinion, we do not believe the scope of the moves to date remotely represent the pricing in of a recession. If this were the case, there would not have been such robust price performance in the North American industrial complex or in European large-caps (see figure 18).

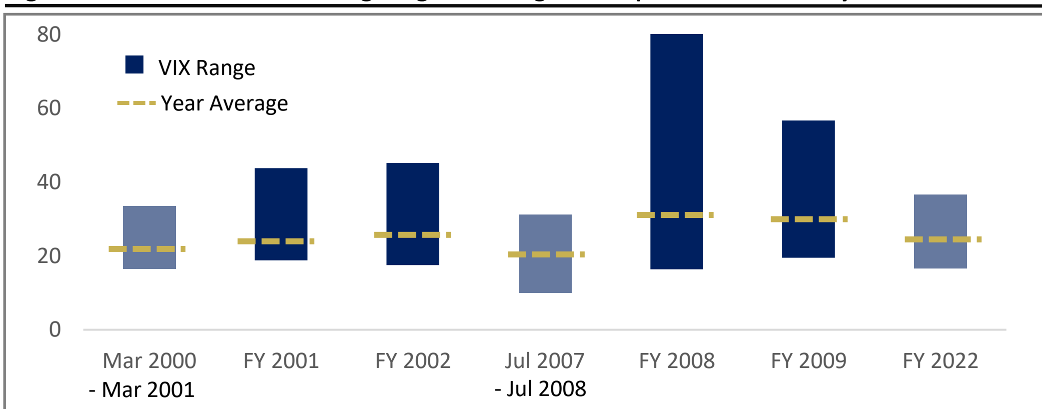
Figure 18. Normalised performance of XLI US & SX5E from 1yr prior to the COVID sell-off



Source: Bloomberg. Bach Option Quantitative Research.

It is also important to appreciate that in the most brutal market downturns of the past 3 decades, volatility reared its head quite significantly only after the first year of the crisis. And we see no reason why equity volatility would not continue to follow this historical pattern in 2023. This was observed in both the aftermath of the bursting of the tech bubble in the early 2000s and again following the GFC (see figure 19). In fact, during the first 12 months of both these crises, the VIX was capped as low as 35, as it was throughout the whole of 2022.

Figure 19. The annual VIX trading range & average in the period immediately around a crisis



Source: Bloomberg. Bach Option Quantitative Research. Note: VIX data based on day end closes .

Then in 2002 the VIX eventually traded as high as 45, averaging 27 for the full year, whilst in 2008 achieving a high print north of 80, and averaging almost 33. It takes time for market participants to adjust to the new paradigm and for unforeseen risks to take form. As Hemingway's Law of Motion informs us, every crisis happens "gradually, then suddenly".

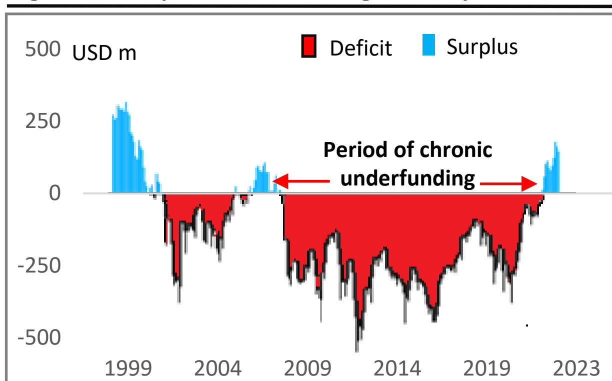
In the following section we outline some likely sources of volatility demand, as well as the potential for a reset lower in corporate earnings that could potentially take equity volatility significantly higher in the near future.

3.1 New Demand for Equity Volatility

Equity volatility is not low in absolute terms, it is just relatively low compared to other asset classes and given the level of uncertainty and complacency on inflation. Ultimately, for equity volatility to trend materially higher, market participants will need to accept the end of the era of "Great Moderation". Until then, there are several technical flows that should be followed closely. A shift in the pension fund dynamic, is one area of great interest heading into a new calendar year. Pension funds in aggregate are presently more overfunded than they have been since the GFC. These surpluses were already steadily growing due to the record-breaking equity market bull run and have now been favourably boosted further following a re-valuation of liabilities using current long-end corporate bond yield levels, which have more than doubled. This causes pension funds to require less assets to be put aside. As a back-of-the-envelope calculation, assuming that the average duration of these liabilities is 20 years, and with US 20 year rates moving from 2% to 4% in just 12 months, we can approximate a reduction in that liability of over 30% [e.g. $1/(1.02)^{20}$ -> $1/(1.04)^{20}$ ~ -32%]. Note, according to Milliman and JP Morgan, defined benefit pension funds specifically, have reached 110% in terms of funding.

This created a cash-build of US$ 133bn (see figure 20). Note that 35-45% of total pension fund allocation on average are generally held in equity markets. In terms of investor flows, pension funds therefore have the potential to become larger incremental buyers of downside protection (or at a minimum persistent sellers of stocks for choice) as they re-assess their asset-liability match and attempt to lock in their gains following two decades of chronic underfunding.

Figure 20. Surplus at the 100 largest U.S. pension funds



Source: Milliman 100 Pension Funding Index & Bloomberg.

We also believe that the RSP dynamic has the potential to shift particularly aggressively, and the trigger will simply be lower spot levels. As we explained at great length in [Retail Investors – The Largest Player in the Room] the peak vega mechanism can hugely influence vol markets. From Chinese equity blowups in 2008 & 2015 to U.S. equity sell-offs in 2018 & 2020, history revealed just how critical it is to have a sense of where this concentration of risk lies. This level essentially represents the blended average point on spot where the deep in the money puts embedded in these retail structured products knock in. More accurately, however, one must appreciate that this level is actually more of a range than a point, given the varying spot levels RSPs have been referenced off and hence our preferred terminology is "plateau vega" (trademark pending). In practical terms, when spot falls below this level, RSP dealers very quickly become huge forced buyers of volatility. As indices like the S&P500 crash through peak vega levels, tremendous chaos in vol markets ensues because of vol covering from dealers and natural hedgers, in addition to the pre-positioning vol arb activity we outlined earlier. Dealers alone could be cumulatively buying back tens of billions of notional of puts (or equivalent vol products) over this period, in times of low liquidity, which is why there is such a squeeze on vol during such trigger events.

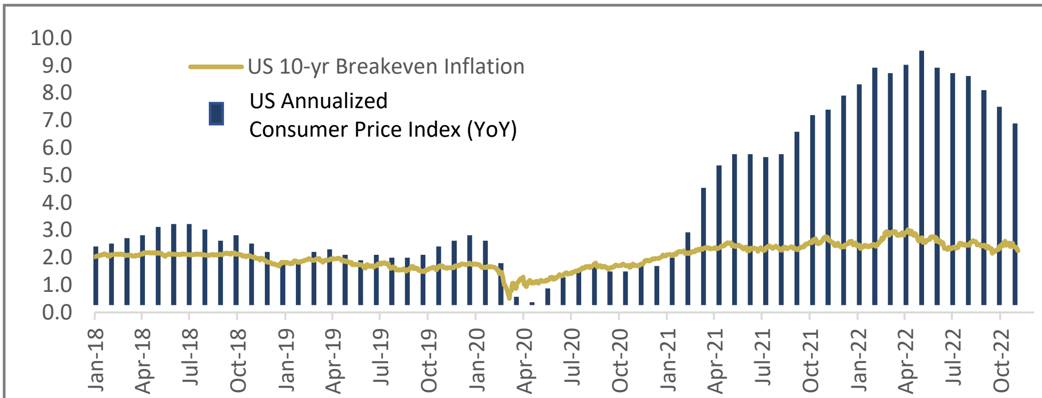
Even without falling markets, higher risk-free rates make bond substitution in the form of RSP issuance decidedly less desirable and thus there will also be a pivot toward more capital guarantee structures; thereby removing a systematic monthly seller of volatility and skew.

Additionally, the existing short tail community are much more constrained in their mandate and generally more cautious in their approach. This coupled with strengthened stress testing at the largest asset owning institutions mean that more explicit equity hedges could be quickly added going forward at the earliest signs of distress, given the complacency in the past. It is also fair to note that much of the outsized moves in FX and rates markets that could have taken place already have. It is therefore reasonable to expect that any new sources of surprise, and ergo new hedging activity will likely shift in the direction of equity markets.

3.2 Questionable Fed Put

From a pure macro perspective, as explained, in the Fed's attempt to tame inflation, they finally abandoned their self-appointed mandate of price stability in capital markets, to focus on price stability in goods and services. Yet, despite the Fed's very understandable worries on inflation, we find it incredible that investors do not appear to share these concerns. To depict this complacency, in figure 21. we overlayed U.S. 10-year inflation break-evens against the record-breaking monthly CPI prints. As is clear, with breaks trading in an exceptionally tight range around 2.5%, investors barely flinched, continually clinging on to this "transitory" narrative despite the immense body of proof to the contrary.

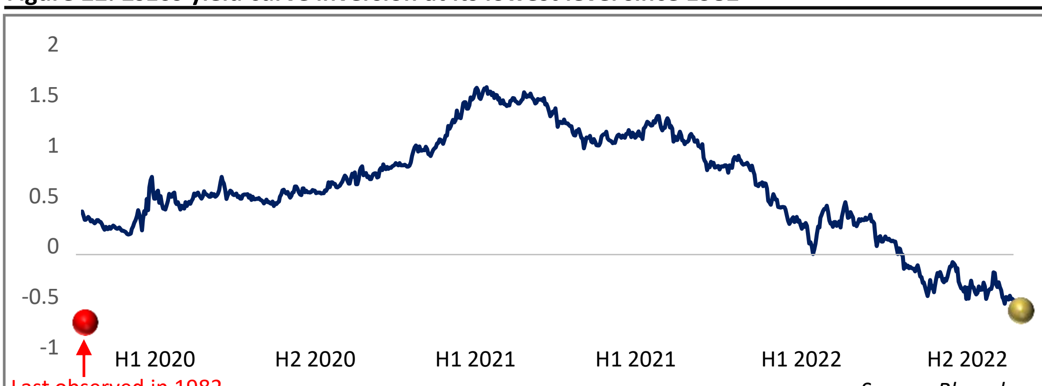
Figure 21. Unmoving US inflation breaks vs. significantly larger monthly CPI prints



Source: Bloomberg & Federal Reserve Economic Data.

Moreover, it is abundantly clear that investors are not only complacent on inflation but given the price action in the bond markets, fully expect a Fed pivot in the not so distant future. The chart in figure 22 below for instance, depicts the recent inversion in 10 and 2-year yield curves. This is the lowest this technical indicator has traded at, in 40 years, and the 2s were trading at 12%, back then so this move is even more substantial in percentage terms. However, this should not be taken as a bullish signal for equity investors since historically, such an occurrence has been a frighteningly accurate predictor of recessions. Moreover, the cruel irony of this inversion of course, is that it serves to undermine policy, as it reduces the effectiveness of the Fed hikes enacted, and actually therefore encourages the Fed to hike even more aggressively.

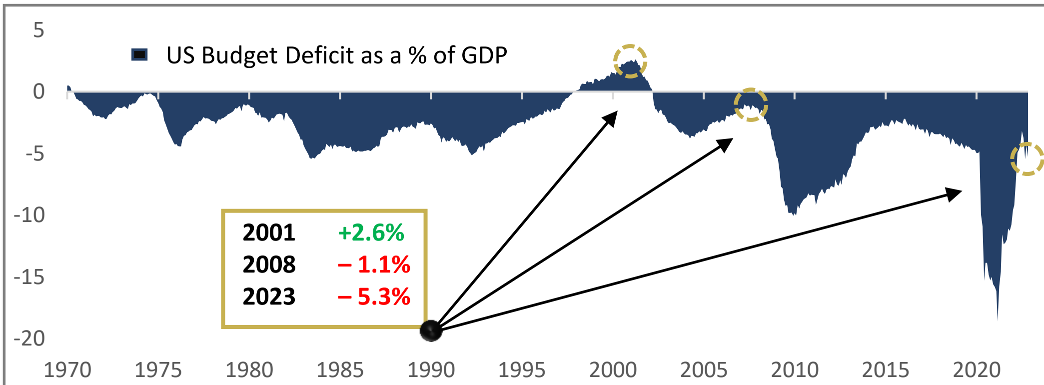
Figure 22. 2s10s yield curve inversion at its lowest level since 1982



Source: Bloomberg.

The Fed, therefore find themselves at a critical juncture, an era-defining moment in history no doubt. From their perspective, it is unlikely that they will be in a position to implement QE of scale unless the situation deteriorates drastically. Indeed, while the last cycle was all about banks, this time the debt burden of sovereigns is more germane. Additionally, the scope to deploy fiscal bullets is much reduced compared to previous crises as demonstrated in figure 23:

Figure 23. Diminishing scope of fiscal ammunition following each crisis



Source: Bloomberg & Federal Reserve Economic Data.

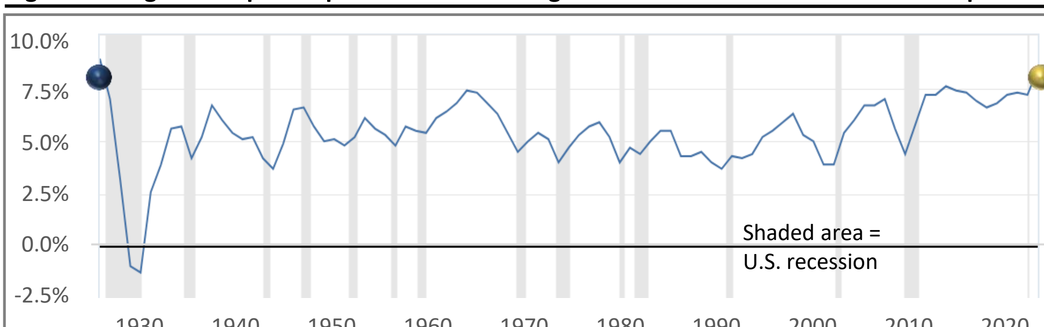
To our minds, the potential for a policy misstep is thus a real and present danger. Moreover, with the bond-equity correlation flipping, those investors who previously relied on bonds to hedge their risk assets' exposure may now explicitly have to rely on equity volatility hedges.

The last catalyst we intend to discuss that we expect will meaningfully contribute to greater realized equity volatility going forward is the fundamental factor of an earnings' recession.

3.3 Resilience in Corporate Earnings to Finally Crack

In addition to the the macro drivers (outlined in section 2) containing equity volatility in a range, it must also be appreciated that overall corporate performance has generally been strong, which has limited the absolute magnitude of any sell-off to date. Indeed, quite incredibly, earning expectations for the S&P500 in aggregate are actually higher now than they were at the beginning of last year. However, there are increasingly bearish signals everywhere one looks in regard to the health of corporate earnings. Rather unbelievably, U.S. corporate profits as a share of national income is now back to the same level of the great depression 90 years ago (see figure 24.). We believe that this extraordinary rise has resulted from the following trends: Firstly, stagnation of wages largely due to the integration of China/Eastern Europe into the global economy. Secondly, financialisation of the economy with much larger debt/leverage and ultra-low interest rates and thirdly, an efficient globally distributed supply chain.

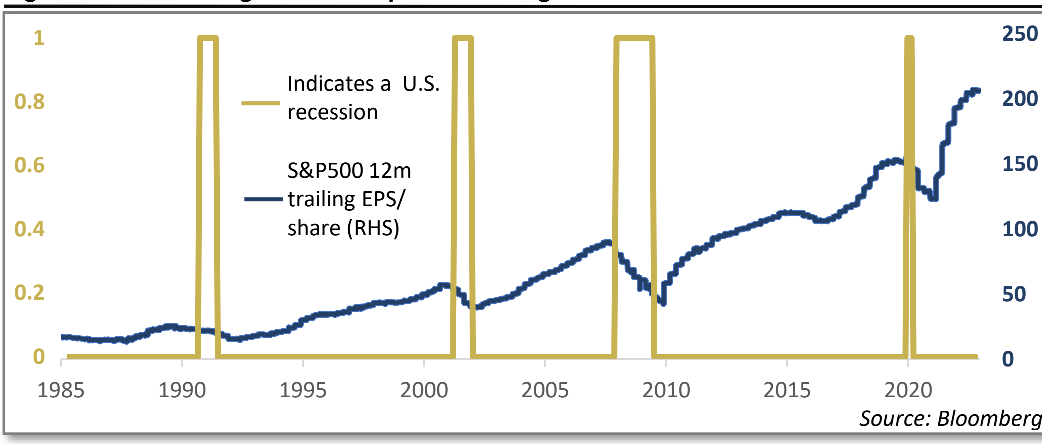
Figure 24. Highest corporate profits as a share of gross domestic income since Great Depression



Source: U.S. Bureau of Economic Analysis, St. Louis Fed.
Note: Profits after tax with inventory valuation and capital consumption adjustments.

Essentially the same (secular) trends that caused disinflation have also given rise to the profit boom. If our thesis concerning those trends liable for reversal is correct, the profit trend will be equally likely to turn down. In addition, the principle of circular flow of income means that without much dissaving on the part of the working and middle classes, and large government deficits, the lack of demand due to the stagnant wages would have depressed profits. Thus if either the workers are forced to save more owing to the bursting of the financial bubble or both they and the government are to spend less due to the increase in the borrowing cost, profits will certainly decrease. Lastly, since higher inflation is almost certainly associated with larger variability of inflation, hoarding of inventory and disincentive to invest due to larger macro uncertainties will both suppress profitability. Lastly, to have earnings overachieve in perpetuity would be politically unacceptable in a democracy. Figure 25. reveals the extent of this earnings outperformance in the U.S., and it appears long overdue a correction.

Figure 25. Relentless growth in corporate earnings since the 1990s

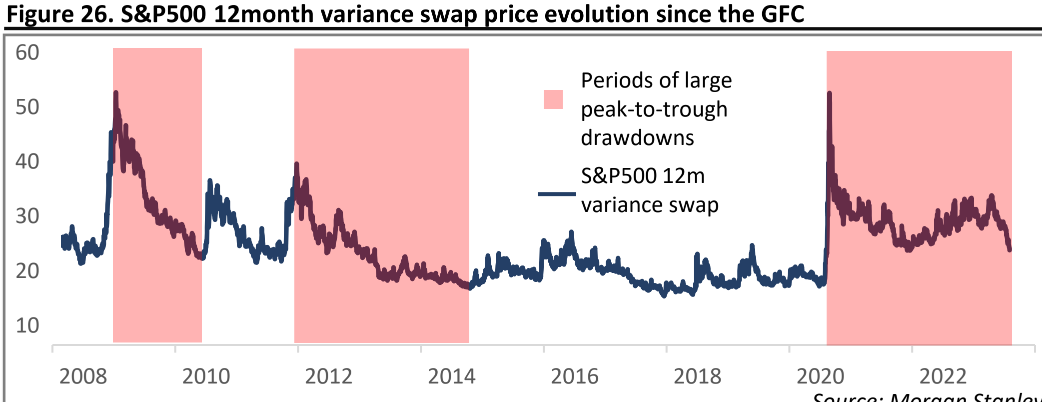


To date, equities have essentially re-rated lower solely based on a pickup in the discount factor, however, an earnings contraction of scale could take stocks materially lower again, and this will unavoidably send equity volatility substantially higher.

Final thoughts – State of the World as of January 2023

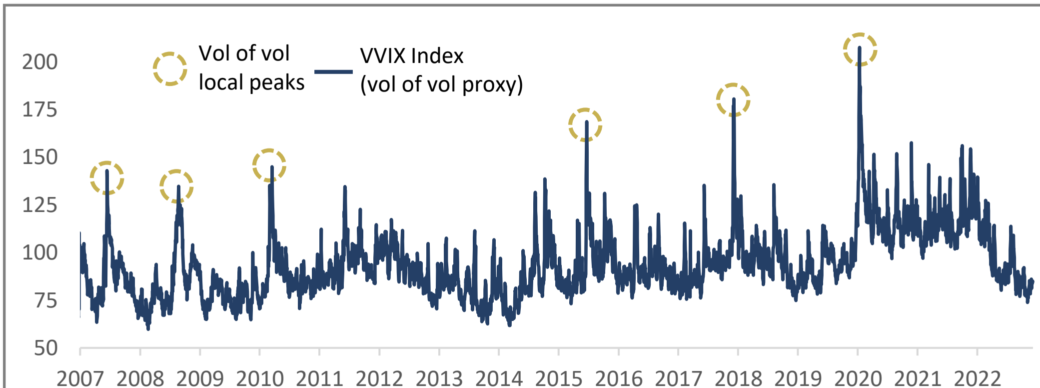
Figure 26. shows the time series of the 12-month S&P variance swap level. The decline since October 2022 has been the sharpest since 2012. It is now less than the lows of 2021 and is close to the median of the period since 2012. The equity volatility market basically prices in a volatility regime typical of the post-GFC decade. Based on the inflation break-evens, the bond market is also coming to the same conclusion regarding inflation. In short, both markets expect the return of the 2012-2021 period characterized by moderate volatility and inflation: 2022 being nothing but a transitory aberration. Both of our macro and technical analyses indicate strongly that the likelihood of the continuation of the era of the “Great Moderation” is very low.

Figure 26. S&P500 12month variance swap price evolution since the GFC



Heightened volatility is always a feature after a bubble bursts. If our characterization of the bubble is not wide of the mark, the turmoil will be even larger than usual by virtue of its breadth and degree of excess. Unlike 2007 where the original bubble was contained to the U.S. housing market, there are a confluence of market bubbles this time around, which means the scope for severe wealth destruction in the economy is substantial. Moreover, valuations historically do not just revert to “fair”, and almost always overshoot considerably to the downside. In such a scenario, we should not just expect an orderly vol regime rebased higher, but rather one characterized by explosive bouts of volatility. Volatility will likely gyrate back and forth from local troughs to ever-increasing peaks, making it extremely challenging to manage portfolio risk. Rather ominously, as figure 27. displays, U.S. equity markets have experienced consistently higher vol of vol following every major tail event since the GFC.

Figure 27. Ever rising spikes in vol of vol



Source: Bloomberg.

Economic and political forces that gave rise to secular disinflation are certainly faltering and shifting direction. In particular, we believe that the completely unsustainable fiscal position of most of the developed countries predispose them to high inflation as a means to inflate away the real debt burden. This tendency will clash with the inflation mandates of the central banks, the requirement for low interest rates on the part of a hyper-financialised economy, and the political need to pacify the lower and middle social strata whose income growth typically lags the inflation rate.

In the disinflationary era, economic downturn and market turmoil have been counteracted by aggressive monetary easing, because the tradeoff between growth and inflation was unnecessary. The immortalized Fed Put, together with debt-financed share buy-backs, had the effect of truncating the left tail. In the inflationary era, the potency of the Fed Put will be far more questionable since the central banks will genuinely have to agonize over the tradeoff. This consideration makes the current apathy towards tail-hedging perplexing. We think it is yet another demonstration of the recency bias and shows that the market is still in the early stages of the grieving process for the halcyon days. As Morgan Freeman’s character in *The Shawshank Redemption* informs us “Hope is a dangerous thing.” Hope is also a terrible hedging strategy heading into “The Volatility Redemption” we envisage for equity markets.

In conclusion, the majority of investors seem to dismiss 2022 as a transitory episode that will revert to the old paradigm of disinflation and “Great Moderation”. Moreover, even for those of us who are intellectually vigilant about the risk of this paradigm shift, very few have visceral experience of navigating such terrain. Therefore, it will be of critical importance to incorporate systematic and robust long-tail strategies to hedge uncertainties and exploit opportunities in the new era.

Thank you kindly for reading. Godspeed!

If you would like to know more about the team or strategy at Bach Option, please feel free to reach out directly IR@BachOption.com or visit our wesbite.

BACH OPTION

Important Disclosures

This document is confidential and intended solely for the addressee and may not be published or distributed without the express written consent of Bach Option Limited, Bach Option Master Fund. This document is not intended for public use or distribution. This document does not constitute either an offer to sell or a solicitation of an offer to buy any interest in any fund associated with Bach Option Master Fund. Any such offer would only be made at the time a qualified offeree receives the fund's confidential offering memorandum and related subscription documentation (together, the "Offering Documents"). To the extent, therefore, there is any inconsistency between this document and the Offering Documents, the Offering Documents govern in all respects.

The information contained in this document, including with respect to portfolio construction, risk management parameters and strategy-type information, is current only as of the date listed herein, supersedes any prior disclosures and is subject to change without notice.

There is no secondary market for the sale of an investor's interest in any fund and none is expected to develop. In addition, there are restrictions on transferring interests in the funds. Bach Option Master Fund has broad latitude with respect to risk management and is not subject to any formal diversification policies limiting the fund's portfolio investments or to policies restricting leverage, position size or duration of any position within any Bach Option Master Fund -managed fund's portfolio. Any information regarding portfolio characteristics contained herein is intended for general guideline purposes only and not as a limitation on the portfolio construction of any Bach Option Master Fund -managed fund at any time.

Bach Option Master Fund -managed fund could experience volatile performance from time to time depending on prevailing market conditions. Past performance results of a fund are not necessarily indicative of future results and future results could therefore materially vary. Moreover, fees payable by the fund could offset profits. Accordingly, an investment in a Bach Option Master Fund -managed fund is speculative and involves a high degree of risk and could result in the loss of all or a substantial portion of the amount invested. Neither Bach Option Master Fund, nor its principals, officers, employees or associated funds or entities hereby makes any representation to any person or entity as to the suitability for any purpose of an investment in any fund associated with - Bach Option Master Fund.

Figures provided herein are rounded as applicable. Information contained herein is believed to be accurate and/or derived from sources which Bach Option Master Fund believes to be reliable; however, Bach Option Master Fund disclaims any and all liability as to the completeness or accuracy of the information contained herein and for any omissions of material facts.

Securities or investment ideas listed are not presented in order to suggest or show profitability of any or all transactions. There should be no assumption that any specific portfolio securities identified and described herein were or will be profitable. Bach Option Master Fund may, at any time, reevaluate its holdings in any such positions.