
AMBRUS

CAPITAL

VOLATILITY AND THE CHANGING MARKET STRUCTURE DRIVING U.S. EQUITIES



I. ABSTRACT

In this paper, we explain how and why we believe equity markets have become increasingly fragile due to structural changes. It is no longer uncommon to see days with wild swings, yet dip buyers are continually rewarded, giving investors the false impression of stability. For example, on Jan 24, 2021, the SPX index sold off 3.8% and then went up more than 4.5%, all in one trading session. Like a forest where naturally occurring fires have been doused quickly each time, we believe we are in a market with immense amounts of dry kindling just waiting to explode. We describe both the threats and opportunities this market fragility has created, and how investors should position themselves to survive the threats and exploit the opportunities.



The Party of the Gods by Flemish Mannerist Master

II. REFLEXIVITY IS FRAGILITY

A trader from the past would not recognize today's equity market. In the last few years, we have seen both 3 out of 4 of the lowest VIX prints ever (in 2017) and 4 out of the 5 highest prints (in 2020). We have also seen the phenomena of meme stocks (AMC, Gamestop, etc) where retail traders launched coordinated attacks on large sophisticated institutions and won. Modern market characteristics have allowed many stocks to thrive or at least have very fruitful trading opportunities despite their poor fundamentals, at times going up more than 1000% in a single rally. These new market traits indicate considerable market fragility.

We can describe this fragility in terms of a concept called **Reflexivity**. Reflexivity is a term borrowed from the field of epistemology and made popular by George Soros for financial markets. Soros explains reflexivity as follows:

"...imperfect views can influence the situation to which they relate through the actions of the participants. For example, if investors believe that markets are efficient then that belief will change the way they invest, which in turn will change the nature of the markets in which they are participating (though not necessarily making them more efficient). [That is the principle of reflexivity.](#)¹"

What we are talking about here is a bit broader than reflexivity, in that we are talking about negative and positive feedback loops that stabilize and destabilize markets respectively. However, for convenience, we will use the more concise term reflexivity to represent these feedback loops in this paper.

Our assertion here is that the markets have become increasingly reflexive, due to several factors. Reflexive markets are fragile markets since they seem relatively stable but can suddenly veer out of control.

stocks and even options with a few clicks from your phone, and you have the makings of a dangerous positive feedback loop. As more retail investors buy stock and call options, the market moves up in response. And this draws in more capital and more retail investors who are afraid of missing out on the next big move.

III. CAUSES OF REFLEXIVITY

i. Speculative Frenzy

Many financial professionals believe we are in a euphoric phase of the market. Despite recent pullbacks, major market valuation indicators such as the market's price / book ratio or Warren Buffet's favorite, composite market cap / GDP are at or near all-time highs. The financial crisis of 2008 is now 14 years old. We have a generation of investors who have only seen continually rising markets and have never seen a sustained drawdown. At the same time, trading has become faster and easier for retail investors due to technological advances. Acronyms and memes such as "HODL" (Hold on for Dear Life), "YOLO" (You Only Live Once), and "FOMO" (Fear of Missing Out) have become widespread trading lingo. Combine this with the instant gratification culture of the mobile age wherein you can trade

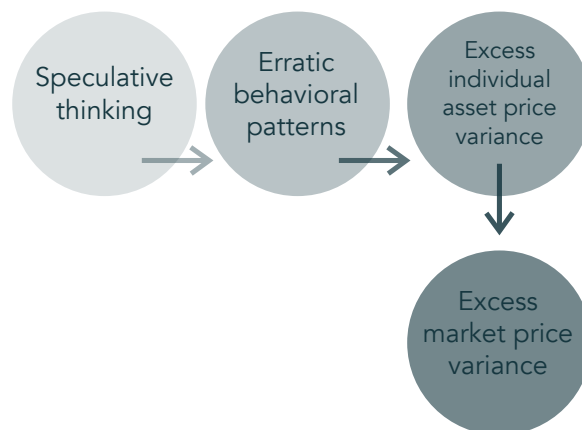


Figure 1: The Buffet Indicator
Source: Data from [FRED St Louis Fed](#)

One factor that adds gasoline to the fire is the size of the wealth transfer from baby boomers to millennials.² A risk-seeking segment of the population is coming into new money. This likely will compound their extreme investing habits, not rectify them. Furthermore, this hyper-aggressive attitude towards risk is not being deployed via traditional fixed income and equity investments. It is instead commonly being focused on atypical and hyper-volatile instruments (think crypto & tech). This is why we continue to see rising correlations throughout different risk assets.

One of the results of this is evident in option skew. The figure below shows implied volatility (corresponding to price) for put and call options, with call options on the right side of the graph. As we can see, the demand for call options has increased dramatically since 2018. The new investor base has an appetite for speculative leverage and that is expressed directly in the volatility smile.

Increasing call skew shows increasing appetite for risk

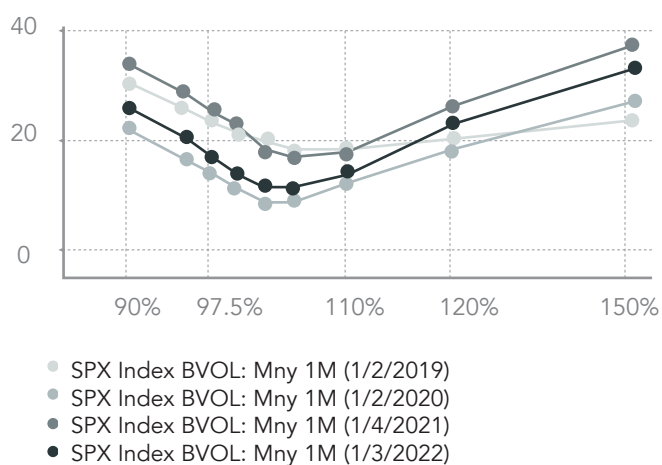


Figure 2: Options Skew is increasingly Higher on the Call Option Side
Source: Bloomberg terminal

Arguably nothing summarizes our unorthodox risk-friendly environment quite as well as Dogecoin, which was created as a joke but was still valued at \$85 billion at its peak on May 5, 2021³ with an intraday peak of \$98 billion. At the time of this writing, \$85 billion is larger than the market cap of companies such as Uber, Ford, Fed-Ex, and Chipotle. The psychology and social values of the new investor base are not the same as previous generations. We believe asset prices and market variance will continue to reflect that.

We believe Bitcoin and NASDAQ correlation have been increasing due to similar investor bases

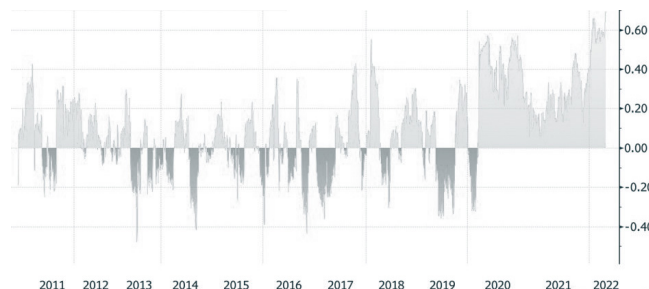


Figure 3: Bitcoin Correlation with NASDAQ
Source: Bloomberg

ii. Changes to Market Microstructure

The ecosystem of financial products, brokers, liquidity providers, exchanges, matching engines, and clearing agents that defines how U.S. equities are traded is not static. This landscape constantly seeks increased efficiency while being subject to the limits of technology and the current regulatory framework. We believe the accelerating changes in the markets are creating dynamics that are not yet understood by most market participants. With automated algorithms taking the role of human participants, large volumes of trades can occur very quickly. At the same time, many shock absorbers have been removed. On the regulatory front, the complexity of algorithmic trading means regulatory changes have often been passed without regard to important second-order effects on the markets.

iii. Unprecedented Stimulus

Most traders will agree that we have seen unprecedented amounts of fiscal and monetary stimulus injected into the economy over the past decade, affecting asset prices⁴. More money in markets means larger portions of risk being allocated at a time and more opportunities for stress to develop in market microstructure. Simply put, given that order flow has so much more mass than it used to, it seems fair to conclude that liquidity providers' margin for error is decreasing.

iv. Growth of Option Trading

There has been a massive rise in the use of options by both institutions and individual investors over the last few years. Figure 4 shows how option trading volume has been expanding at a tremendous rate since 2017. Figure 5 shows how more and more mutual funds and other funds registered under the Investment Company Act of 1940 are using options in their portfolios.

Notional dollar value of option positions is on track to become greater than that of common stock positions⁵. If that fact isn't eye-popping enough, the CBOE is now creating Tuesday and Thursday expirations for S&P index-based trading vehicles. This means there will be an option expiration every day of the week.

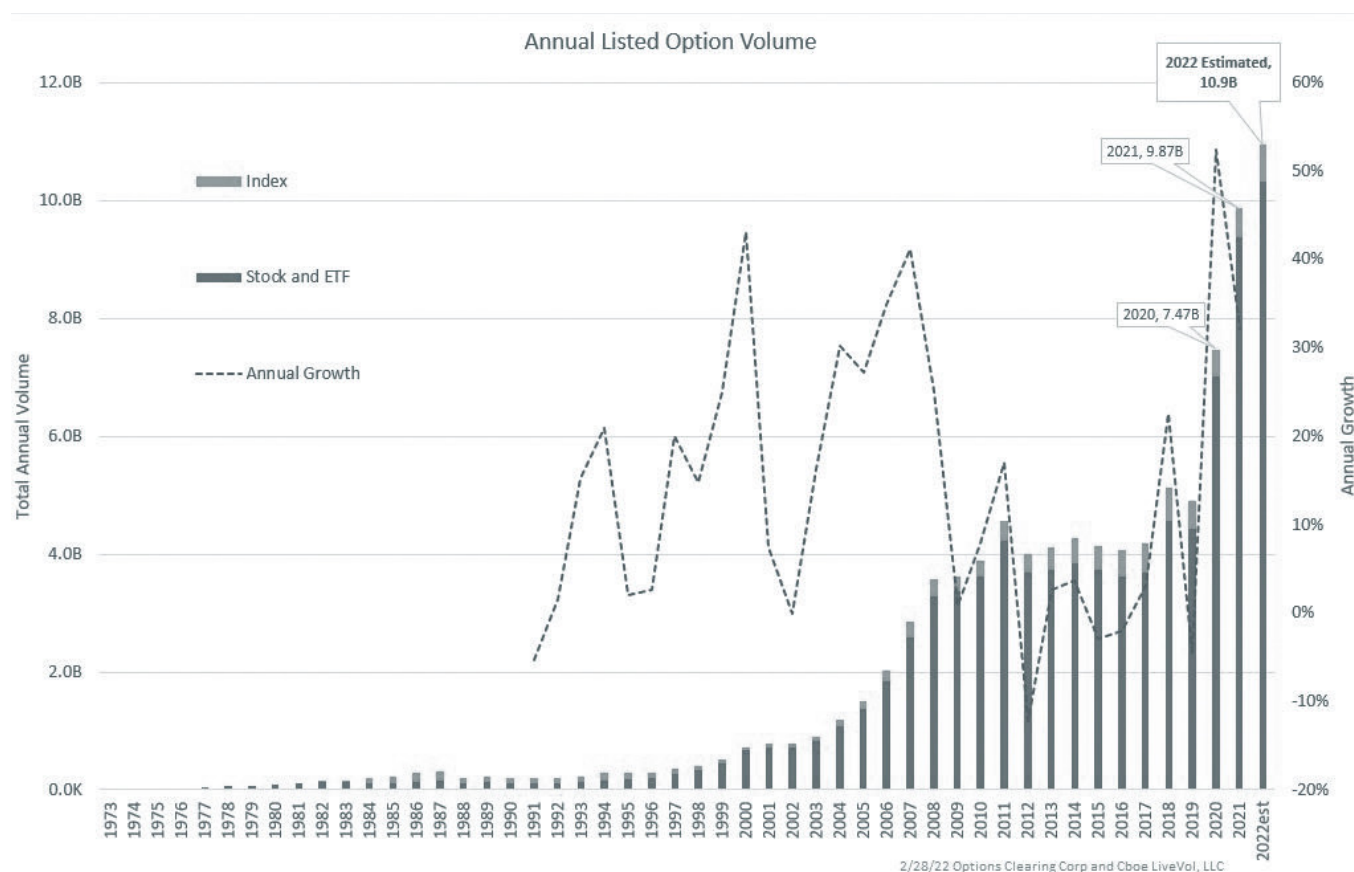


Figure 4: Growth in Option Trading Volume
Source: [Seeking Alpha](#)

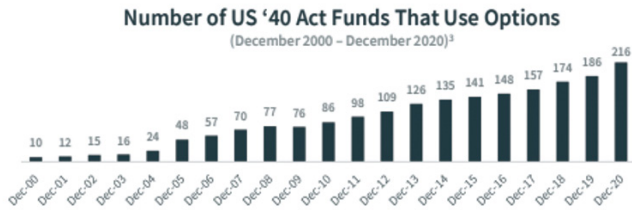


Figure 5: Increasing Use of Options by Mutual Funds
Source: [CBOE](#)

The growing use of options causes market makers and dealers to respond in predictable ways as the market moves. We call this effect gamma reflexivity. Gamma reflexivity can be explained as follows.

- 1) Large institutions such as pension plans, insurance companies, hedge funds, and other end users, tend to be buyers of derivatives in the U.S. equity market
- 2) Most of these orders to buy the derivatives are sent to market makers, this in turn, makes the market maker short the derivative as the end user is long the derivative
- 3) In order to maintain a delta neutral portfolio, the market maker needs to offset this risk by purchasing or selling equities
- 4) This purchase or sale of equities inherently drives the price of the underlying asset further (up or down)
- 5) The sensitivity to the change in the asset price (gamma) then impacts the price of the derivative
- 6) This change in the derivative's delta forces the market maker to buy or sell more of the underlying
- 7) In certain situations, this creates a feedback loop that can propel asset prices further than people realize. This dynamic works in both directions.

In summary, gamma reflexivity means small moves are quickly reversed, giving investors false confidence. However, if we get a large market shock, things can fall apart very quickly. The growing derivatives market increases the likelihood of an exogenous event triggering this dynamic.

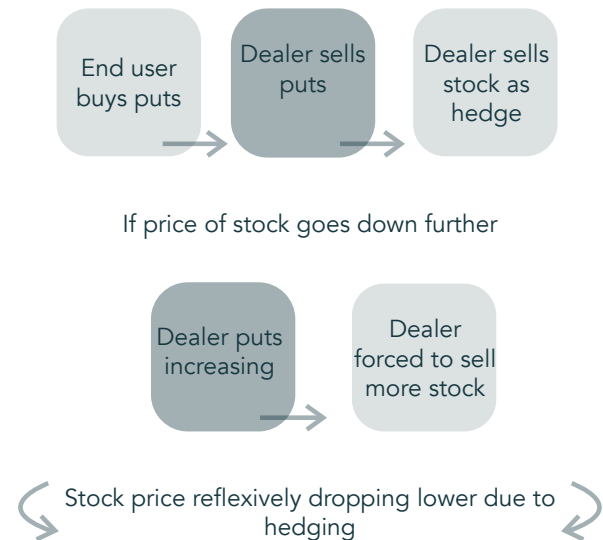


Figure 6: Reflexivity Due To Dealer Hedging

We can also show how dealer gamma hedging affects underlying prices by looking at option expiry dates. Equity options have a monthly expiry calendar. As large option positions are closed on these dates, dealers need to reduce their hedging and they usually start doing this before option expiry. The effect we described above where dealer gamma stabilizes markets is massively reduced on these dates, causing increased volatility and a corresponding drop in price. The figure below shows the growth of a portfolio that buys the S&P index at the close the night before option expiry and sells it at the close on the option expiry date.

Over a 3 year period, our backtest shows a 15% loss from buying the S&P 500 during OpEx

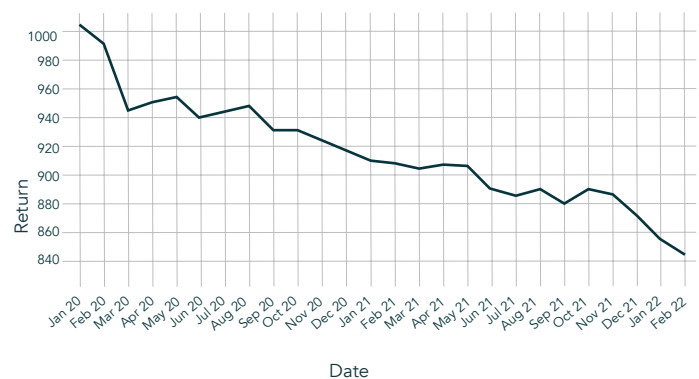


Figure 7: Decline in a Portfolio Trading the S&P 500 During Option Expiry

An anecdote that drives home the importance of gamma reflexivity is the history of LOR Associates. LOR was a firm that sold a product labeled “portfolio insurance”. Portfolio Insurance purpose was exactly what it sounds like - a mechanism to protect investors against large adversarial outcomes in markets. The way in which LOR set out to execute their portfolio insurance can most simply be described as a systematic selling of assets when the market fell below a certain level. On paper this sounds great: when positions fell, they would exit quickly to prevent larger losses. However, when the product was adopted en masse, it created a suction of liquidity by creating a profile of sellers that grossly outweighed buyers at the pre-set exit prices. The result was chaos for markets. It is generally acknowledged that portfolio insurance was one of the reasons for the stock market crash of 1987, [dropping the stock market by more than 20% in one day](#)⁶. Although today's market structure has different participants and the participants have different titles than the days of LOR, the liquidity implications are eerily similar. LOR destabilized markets by pulling liquidity when prices went down, price insensitive-gamma hedging seems to be mechanically very similar. Quoting Mark Twain: “History doesn't repeat but it often does rhyme”.

v. Few Options Market Makers

Concentration risk is a well-known concept in the financial markets, and it is important in the U.S. derivatives market. The options markets, unlike the equity markets, have only a few important dealers. Four dealers control the majority of large institutional order flow. Quoting the Office of the Comptroller of the Currency report on bank trading and derivatives activities:

“A small group of large financial institutions continues to dominate trading and derivatives activity in the U.S. commercial banking system. During the third quarter of 2021, four large commercial banks represented 89.3 percent of the total banking industry notional amounts and [78.1 percent of industry net current credit exposure \(NCCE\)](#)⁷.”

80% of all retail contracts getting routed to just four main wholesalers, and four main banks controlling the institutional orders certainly suggests there is concentration risk. Furthermore, all of these banks are subject to Dodd-Frank

regulations which means they have hard limits on the amount of risk they can take. Limits on risk means that in times of severe market stress, out of a matter of compliance, many wholesalers will be pulling liquidity which could further hurt already struggling securities. We saw this during March 2020 when not only options, but the underlying SP 500 E-mini futures became highly illiquid. Lack of liquidity drives prices further as dealers and investors play a game of “pass the hot potato”. Everybody is trying to get rid of illiquid products simultaneously. At the same time, they are desperately trying to buy options to curtail risk and protect their book, driving volatility higher and asset prices lower.

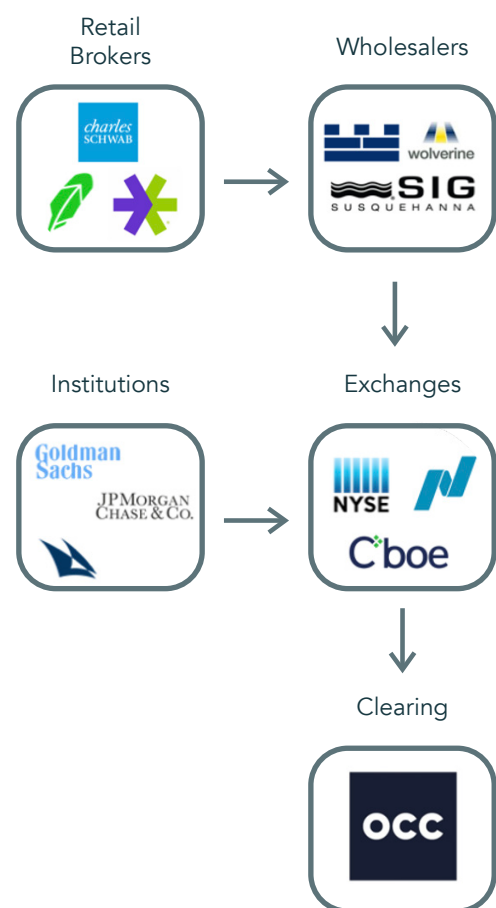


Figure 8: Options Market Structure
Source: [Frontmonth](#)

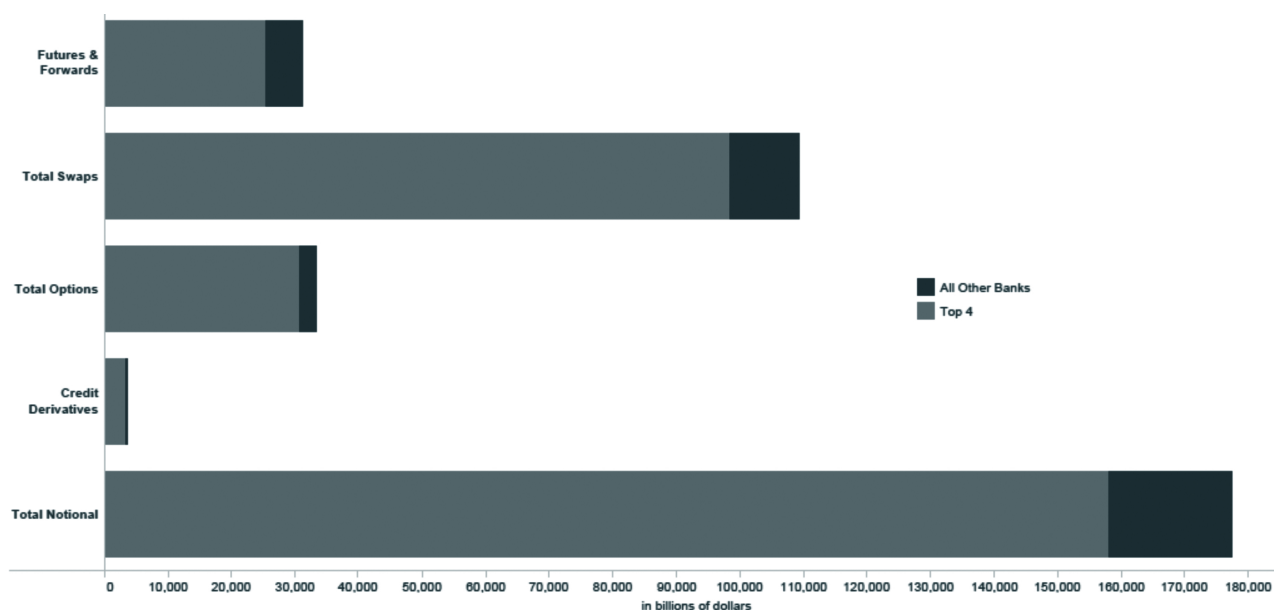


Figure 9: High Concentration Risk Due to Four Banks
 Dominating the Derivatives Markets
 Source: [OCC](#)

vi. The Dodd-Frank Act

The Dodd-Frank act was passed in 2008 to improve regulatory measures to protect the public from insurance companies' and banks' risky behavior. This act changed how large banks operate on Wall Street: the regulators made it so that banks could only assume a certain amount of risk at any given time. We would agree that this rule is a net benefit for financial markets. But secondary consequences concerning the impact of the market microstructure occur because of this (in the previous section note how we mentioned Dodd-Frank puts compliance standards on the risk banks can warehouse). If you were a trader at a bank in the 90s, you had a cushion of risk that you could assume. If a position were to move against you, you could use the bank's balance sheet to create funding to keep it. Due to the new regulatory framework, traders can only have a certain amount of risk on their book at one time. And this creates a cascading effect in the market. When traders are forced over their risk limits due to market movement, they are required to hedge or exit the position very quickly. This hedging activity further moves the price of the asset. Some would argue that the previous regulatory framework would have led to more substantial blowups. Others would contend that this framework leads to cascades as more frequent and aggressive hedging leads to more price swings.

It is important to note that when an institutional trader has to hedge a position in order to stay within risk limits, this is a compliance matter. As such this hedging is done in a way that is price-insensitive, and hedges usually have to be purchased even when they're at exorbitant prices. This mandate on institutional traders further polarizes volatility.



The Creation of Adam by Michelangelo

vii. Rise of Structured Products in the U.S.

With low bond yields, investors and dealers are forced to be creative to come up with ways to create yield. Additionally, the herd mentality of markets has moved investors to passive, index-linked products. The combination of these two factors has created a huge market for structured products. Structured products were once only popular in Asia, but now have a large customer base in the U.S. The growth of this market has had an impact on the listed derivatives market and the aforementioned listed derivative hedging tactics are very similar when a structured product is sold. To understand the concept of structured products, let's take the example of a one-year worst of auto callable with a 25% barrier tied to AMZN, AAPL, TSLA stock yielding 14.5%. In layman's terms, the buyer makes a 14.5% yield if AAPL, AMZN, or TSLA stock prices don't drop more than 25% in a year. This can sound like a great idea to an investor in a zero-yield market. The investor ends up being short a synthetic put, and the dealer ends up being long this put. The dealer is going to have to consider how to hedge this new exposure, and more dry kindling is added to the proverbial forest. The majority of the hedging is done with listed options. This synthetically creates a calendar profile for banks that can harm them if short-dated volatility starts to rise rapidly. In turn, this will cause the banks to hedge their losing positions more aggressively which will

drive volatility higher. [This exact situation was witnessed in March 2020.](#)⁸

We have seen buoyed derivative exposure hurt markets badly in the past. In 2008 mortgage-backed securities became toxic and were a catalyst for the Great Financial Crisis. Portfolio Insurance products that were supposed to limit risk ended up being the main factor in the black Monday crash of 1987. And many believe defaults in credit swaps played an integral part in the Asian debt crisis of 1997. Experience shows that when Wall Street gets a new toy, they often abuse it to maximize profit. Considering the increase in total risk appetite and the nature of the derivatives investors are hoarding today, we think there is fair reason to worry about the probability of hyper-aggressive price action.

The byproduct of this type of dealer hedging can be observed in a few notable recent option expiration (OpEx) dates. In March 2020 the absolute bottom of the Covid induced sell-off came right after the monthly OpEX. Some would argue this is more than mere coincidence. If you subscribe to this argument it would suggest market term structure and its volatility can trump prevailing economic conditions at times. That speaks volumes to the power of gamma hedging.

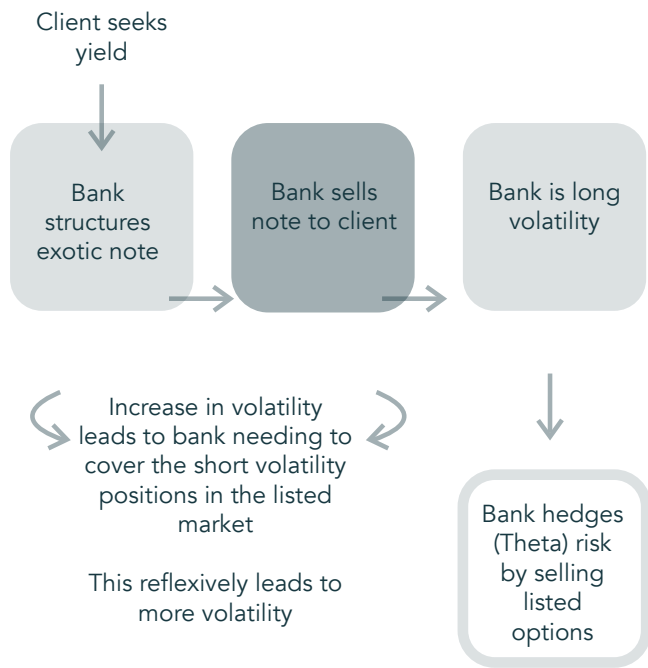


Figure 10: Reflexivity due to Structured Notes

viii. The Growth of Passive Investing

Passive investing has made a huge splash, and it's not going anywhere. As of 2021, \$7.3 trillion was held in passive open-ended ETFs that invest primarily in the U.S. markets, according to Morningstar, [outweighing the \\$6.6 trillion in actively managed funds](#)⁹. At the same time, we have more and more ETFs linked to other ETFs, which we believe increases the odds of a contagion effect. [The value of the global ETF market is now over \\$10 trillion](#)¹⁰. That is roughly 1/5th the size of the U.S. equity market. ETF inflow has grown at a massive rate with Blackrock, Vanguard, and State Street dominating the crowd. Many investors and advisors gravitate toward them for simplicity and tax advantages. Some of these provide leverage and some provide an inverse of the linked ETF. This means that diversification provided by the thousands of listed stocks in the US is truly an illusion; in reality more and more money follows the same few equities. The five largest ETFs in the U.S. equity market are listed below. All carry substantial exposure to the same underlying stocks (AAPL, MSFT, AMZN, GOOG, TSLA)

Symbol	Name	AUM	Avg Daily Share Volume (3mo)
SPY	SPDR S&P 500 ETF Trust	\$371,534,000.00	107,885,766
IVV	iShARES coRE S&P 500 ETF	\$304,349,000.00	7,576,786
VTI	Vanguard Total Stock Market ETF	\$267,116,000.00	4,733,648
VOO	Vanguard S&P 500 ETF	\$257,474,000.00	6,948,153
QQQ	Invesco QQQ Trust	\$178,596,000.00	79,177,711

Figure 11: Five largest ETFs in the U.S.

Source: [ETFDB](#)

Buying or selling by leveraged or inverse ETFs is price insensitive. The ETF is forced to buy or sell the underlying asset (or derivatives) when its price moves, regardless of valuation. Volatility in U.S. equities increases during the last thirty minutes of trading. A part of this has been attributed to the reflexive rebalancing approach of levered and inverse daily ETFs. If a 3X ETF has \$100M in net assets, \$300M of net exposure to the underlying index needs to be maintained. If the index increases by 1% the gross exposure would increase to \$303M and net assets would increase to \$103M. Since gross exposure must always keep an equal 3X weighting at the beginning of each trading day, \$6M must be added to the portfolio (\$309M = \$103M X 3). And with so much money following a few names, we get both positive and negative feedback loops driving prices. We believe this scenario contributed to the famous "Volmageddon" crash of February 2018.

It is not only rebalancing passive flow that helps drive markets higher and lower. Tesla stock over the last few years offers a great example showing how passive investing creates reflexivity. The stock price has appreciated more than 20 times since its split-adjusted closing price of \$37.03 in May 2019. As the company gained traction and started increasing revenue rapidly, the stock price moved up. Momentum traders started pouring in, driving the price higher. Eventually, its large market cap forced the S&P 500 committee to include it in the index. This in turn caused price-insensitive buying by institutional investors who were forced to buy it to stay indexed to the S&P 500 either partially or fully. Furthermore, some investors were forced to buy TSLA due to mandated ESG exposure requirements.

Passive investments are also increasing via Robo-Advisors, which is slowly becoming a big industry. According to Statista, [Robo-Advisors as an industry is expected to grow at annual rate of 15% for the next four years](#)¹¹. Several large banks have already started incorporating a Robo-Advisor into

their clients' financial planning. Robo-Advisors often move clients into similar suites of ETFs and single stocks, leading to a high concentration of investors carrying similar exposure. Pensions, endowments, retail investors, target-date funds, and target-volatility funds end up holding similar and highly correlated portfolios. The last decade has been great for equities, but when a market melt-down occurs, we may very well see fast and accelerating losses in these positions as it's likely they will deleverage in lockstep with each other.

ix. Herd Mentality in Deleveraging Triggers

Over the last ten years, we believe many banks, hedge funds, and institutions have adopted similar risk guidelines. Risk models tied to equities tend to focus on two factors: the percentage change in the S&P 500, and the level of the VIX. Many managers using the same risk level can cause rapid declines as selling begets more selling and additional volatility. This condition creates a dynamic similar to the effect of the crowded movie theater in which someone yells "fire" and there is just a single small exit that everyone tries to fit through.

Banks use value at risk (VaR) to quantify maximum expected loss over time and they assign a confidence level based on prevailing market conditions. Big banks are subject to the market risk capital rule, 12 CFR 3, subpart F. They must report their VaR-based measures quarterly on FFIEC form 102. The VaR measurement is calculated daily using a one-tailed, 99 percent confidence level. The metrics used to measure VAR are backward-looking and only address historical relationships. Markets are dynamic systems: relying on a historical connection to quantify an outlier event is borderline impossible and subject to serious oversights. Relying on faulty risk models such as these can do more harm than good during moments of market stress. Managers in control of billions commonly pride themselves on applying and following these metrics. The most substantial factor in the Sharpe calculation is the volatility input also known as the standard deviation of the portfolio's excess return. This should be alarming to any market operator since the standard deviation is backward-looking. The volatility component of that calculation only captures what previously occurred and has a blind spot in terms of what is possible in the future. The fact that so

many of these risk models mirror the same metrics and signals, adds to the concentration risk of the overall financial system.



The Punishment of Prometheus by Theodoor Rombouts

x. The 30,000 foot view

As stated earlier, four institutions are responsible for the vast majority of derivative market making today. Naturally, that seems like risks are not appropriately distributed throughout the capital market system. When you couple that with massive increases in net derivative exposure and incentives to only keep that exposure growing you have a very sensitive financial ecosystem.

Furthermore, we believe we have a risk-friendly culture coming into more assets, at the same time that central banks have injected enormous amounts of liquidity. A tight concentration of market makers have to satisfy the customer demands for derivatives and structured products in these conditions all while staying adherent to Dodd-Frank risk measures. It seems like a regime that investors should be cautious about.

IV. THREATS OF MARKET FRAGILITY TO YOUR PORTFOLIO

i. Variance Drag of Large Losses

Variance Drag refers to the fact that a portfolio with high volatility will underperform a portfolio with low volatility even if they both have the same average return. For example, a \$100 portfolio with a 50% loss followed by a 50% gain will end up with \$75 while a portfolio with a 10% loss followed by a 10% gain will end up with \$99.

It is well known in trader lore that it is often extremely difficult to recover from large losses. If you are lucky, you learn this early in your career, usually the hard way. From that point on, you “learn to love small losses”, i.e., you close losing trades quickly, take the loss and live to fight another day. As the saying goes, “you can have a trade that ruins your day, ruins your month, or ruins your career”. With that in mind, we believe good traders avoid large losses at all costs.

Large losses make it difficult to compound gains over time

Portfolio Loss	Gain needed in order to break even
-10%	+11%
-20%	+25%
-30%	+43%
-40%	+67%
-50%	+100%
-60%	+150%
-70%	+233%
-80%	+400%
-90%	+900%

Figure 12: Increasing Returns Needed to Recover From Losses

However, given the reflexivity of markets, large, fast losses are a lot more common than most people realize. The figure below shows rolling 30-day drawdowns since January 1, 2000. There have been 5 drawdowns of 20% or more in that period. If you get more granular, you will also see that the S&P has larger intraday moves than most investors realize. The likelihood of a sharp drawdown is statistically higher than most would expect.

The S&P 500 has been seeing high levels of intraday swings.

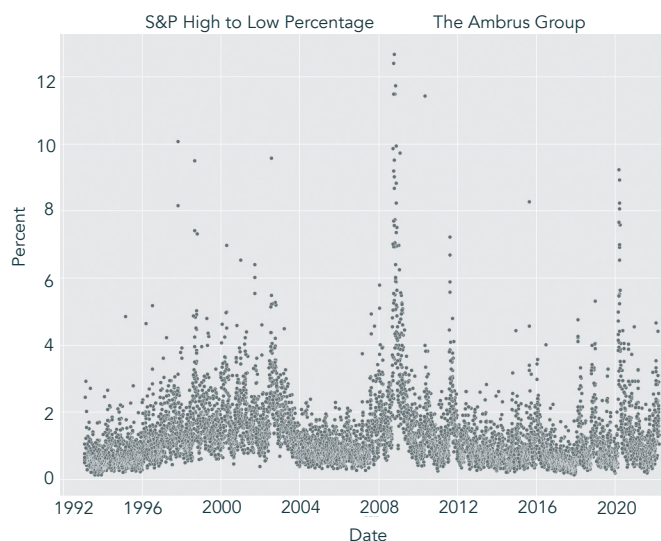


Figure 13 - S&P Intraday Range

Rapid 20% drawdowns occur more frequently than investors expect.

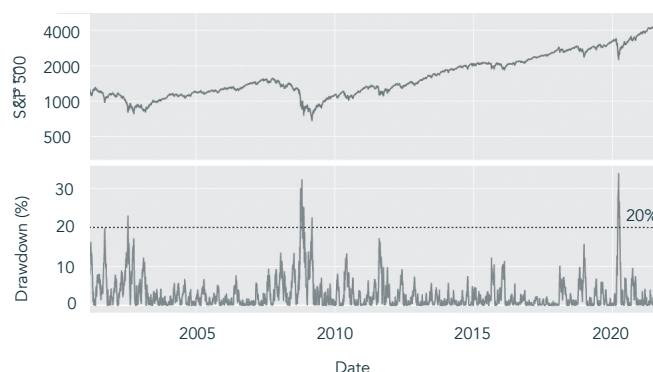


Figure 14: Frequency of Large Drawdowns

The lesson here is that if you want to invest well, never ever take a big loss. As Warren Buffet says: “The first rule of an investment is don’t lose [money]. And the second rule of an investment is don’t forget the first rule. And that’s [all the rules there are](#)”¹². Yet substantial losses seem to be a reasonable expectation at some periods in time with S&P exposure alone. But look at investment performance if those five 20% drawdown periods had been omitted. Despite the S&P 500 having done exceptionally well since 2000, the return would have more than quadrupled if we could have eliminated these losses.

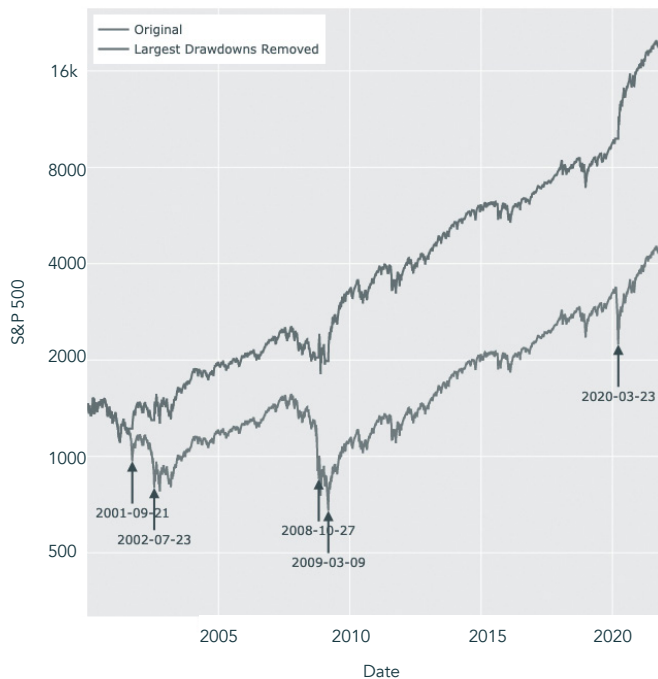


Figure 15: Effect of Removing the Largest Drawdowns on the S&P 500

ii. Timing Risk

Large losses also contain timing risk. In 2008, many individuals who were close to retirement suddenly lost more than 40% of the value of their retirement portfolio. Similarly, in 2020, when the market crashed, many investors who were close to retirement were forced to sell quickly to protect themselves from financial catastrophe. The same applies to institutions. Large losses can come at very inconvenient times, forcing companies to have to shut down or be put up for sale. When businesses allocate capital, they are at a big advantage if they are exposed to less unpredictability than their competitors.

Furthermore, the markets are non-ergodic, meaning that the average outcome of a group of simultaneous bets is NOT the same as the average outcome of the same bets taken over time. For example, consider a bet with 50/50 odds of either making \$20 or losing \$10. If you could make this bet simultaneously a million times, you would almost be guaranteed to make a fortune. However, if you take this same bet sequentially a million times, you are almost guaranteed to lose everything at some point and you will therefore be unable to continue.

Even if you don't lose most of your wealth, you may be financially disabled for a long time. For

example, investors who kept "buying the dip" in 2000 surely did not think that after losing 37% of its value, the S&P 500 would take 7 years to recover back to its pre-crash high on March 24, 2000. And once they did recover on May 6, 2007, it was not long before they would lose big again in the 2008 crash. And for NASDAQ, after losing 72% of its value, the recovery back to its pre-crash high of March 10, 2000 would take 15 years till April 23, 2015.

V. HOW TO PROTECT YOUR PORTFOLIO

There is evidence to suggest that the traditional 60/40 Stock/Bond portfolio recommended by financial advisors no longer works well. With continuous monetary stimulus keeping yields low for more than a decade, bonds have been creating a large unproductive drag on equity portfolios. Worse, stocks and bonds are no longer negatively correlated during market crashes. The figure below shows bond returns were actually positively correlated to equity returns during the last few crashes.

Similarly, gold recently has not provided the protection it once did. Gold is a non-productive asset (it does not represent income-generating assets like equities and bonds) and thus creates a drag on overall portfolio return. And its negative correlation to equities is no longer reliable. The graph below shows that in the 2009 and 2020



"The Money Changer and His Wife" by Quentin Matsys

market crashes, gold had either a small negative or zero correlation to the S&P 500.

One problem with using long volatility for protection is that when there is no market crash, the derivatives have a continuous cash bleed as they keep expiring worthless. However, there are approaches to mitigating this bleed that can be quite effective in our experience. We will not go into the details of these proprietary approaches in this paper. However, we believe alpha-focused strategies are much more lucrative and effective than static solutions such as buying puts on the S&P and rolling them. Investors should seek help from professionals. Volatility products can be complex, but if used correctly, we believe they can be tremendously rewarding.

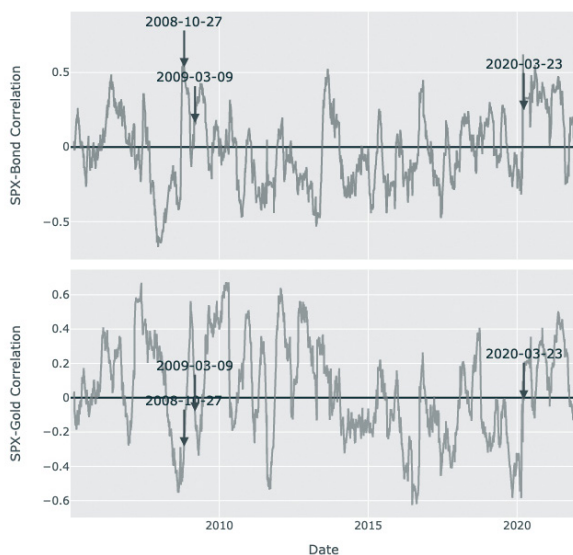


Figure 16: Correlation of Bonds and Gold with Equities During Market Crashes

Given these points, our assertion is that a small allocation to volatility may not only protect against market fragility but in fact, can take advantage of reflexivity to generate cash at the most advantageous times.

VI. OPPORTUNITIES FROM REFLEXIVITY

i. Peace of Mind

Peace of mind is not something typically associated with equity investors. However, the peace of knowing that a large market crash would generate cash, and if it became large enough, would actually increase net worth, is

something that could prove invaluable. Although an intangible benefit, it allows the investor to make business decisions with fewer unpredictable factors in play.

ii. Buying When There Is Blood in the Streets

Baron Rothschild, the 18th-century financier, is credited with the saying "the time to buy is when there's blood in the streets." He later made a fortune after the battle of Waterloo against Napoleon when markets were collapsing. During a crash, unprotected investors are often forced to sell valuable assets at fire-sale prices. They have to do this, for example, to satisfy risk managers and senior management whose first priority is to survive. Margin calls from exchanges and collateral requirements from brokers further increase the need for cash. Also, from our experience during these crashes, it becomes easier to spot great opportunities when the market is panicking. For example, during the COVID crash in March 2020, several smaller companies that would actually benefit from COVID went down in price along with the rest of the market.

For example, EDUC, a small-cap publisher of children's books that makes much of its revenue from sales directly to consumers, fell in line with the S&P 500, even though they were very well suited to benefit from the home education trend that took off during COVID.



Figure 17: EDUC stock price (normalized) vs the S&P 500 during 2020

iii. Competitive Advantages

Not only are large losses difficult to recover from, but they also have reflexive consequences for an organization's survival. If a fund or an allocator loses 30% it will most likely experience

accelerating investor withdrawals. This could force it to sell securities that have already been battered, and cause prices to further decline, causing more investors to withdraw, and so on, resulting in a death spiral.

Further, it is difficult to recover from the reputational damage of a large drawdown. Employees of institutional allocators and pension funds will find it difficult to convince their boards to invest in a fund that has had large losses. The saying “nobody ever got fired for buying IBM” has some truth to it. Institutional investors often invest in high reputation companies, sometimes even at the cost of lower returns, because these decisions are less likely to be questioned during bad times.

Having cash on hand is often critical to survival when credit markets freeze as they did during the 2008 financial crisis. If you have excess cash when your competitors are under stress, you have the ability to buy them out or take business they no longer have the ability to serve.

VII. CONCLUSION

We believe equity markets will be supported at the micro-level by the structural flows mentioned in this paper. However, along the way, they will experience fast crashes with large explosions of volatility. We believe the same factors we mentioned that drove the market up, will play a role in driving it down. We cannot predict when this will happen. It may be this year or it may be several years away. However, the causes of market fragility (reflexivity) are becoming stronger than they have been. We believe investors should protect themselves with a carefully managed allocation to volatility. This allocation should have consideration for transaction costs (volatility derivatives can have very high bid/ask spreads) and for controlling losses due to being long volatility. We feel that this allocation not only can protect investors from catastrophe, but can even provide them with opportunities to increase overall wealth.

IMPORTANT DISCLOSURES

The information contained herein is provided for informational purposes only and should not be construed as the provision of personalized investment advice, or an offer to sell or the solicitation of any offer to buy any securities. Rather, the contents including, without limitation, any forecasts and projections, simply reflect the opinions and views of the authors. All expressions of opinion reflect the judgment of the authors as of the date of publication and are subject to change without notice. There is no guarantee that the views and opinions expressed herein will come to pass. Additionally, this document contains information derived from third party sources. Although we believe these third-party sources to be reliable, we make no representations as to the accuracy or completeness of any information derived from such third-party sources and take no responsibility therefore. Information related to the performance of certain benchmark indices is provided for illustrative purposes only as investors cannot invest directly in an index.

Past performance is not indicative of or a guarantee of future results. Investing involves risk, including the potential loss of all amounts invested.

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