"*We agree with your analysis… There is nothing we can do. Vanguard and Blackrock own the regulatory apparatus. If we raised the alarm, all we'd do is get fired. We have to wait for the event*."

~ IMF's Financial Stability Group in response to a presentation on the dangers of passive investing

Summary

- Financial markets are undergoing a dramatic structural shift
- Typical diversification strategies will not be sufficient to safeguard the wealth of clients
- Monetary stress can be inferred, and volatility reasonably predicted

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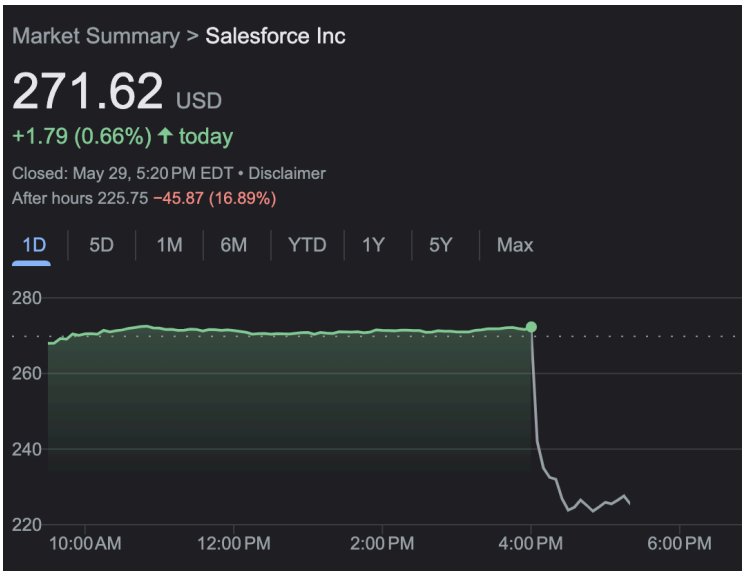
Ask a wealth manager why the stock market goes up over time and the response will be some variation of "it just does". Indeed, the wealth management complex has been built around the notion that markets go up over time and that the primary job of a manager is thus to simply 'hold the hands' of clients through turbulent periods.

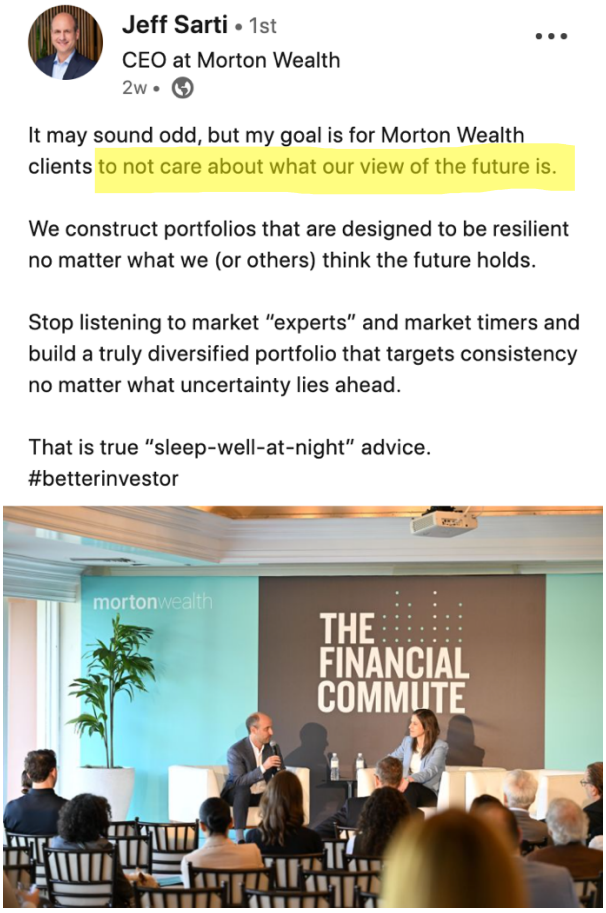
By doing so, managers are implicitly arguing that markets are "ergodic"- that the future will resemble the past. But this is a false- and dangerous- assumption. Financial markets and the broader macroeconomy are non-ergodic systems: there are no immutable laws governing these systems. They change over time.

At the time of this writing, Salesforce dropped 17% after reporting earnings. Revenue marginally missed expectations ($9.13 billion vs. $9.15 billon expected), with earnings per share beating expectations ($2.44 vs. $2.38 expected). The company also raised its full-year outlook.



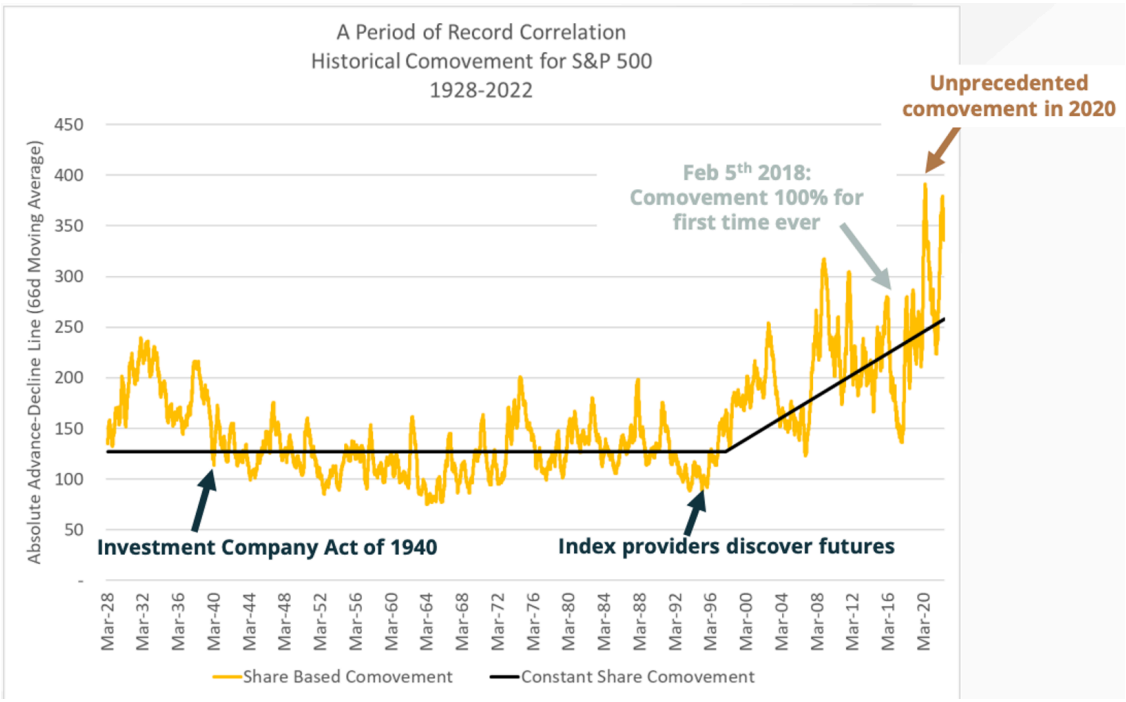
Does this seem like normal price movement? Would a move like this- on a mildly disappointing earnings report – have occurred 40 years ago?

My contention is that financial markets are dramatically changing in structure. This change- and its implications – are not understood or explored by the wealth management industry. Indeed, if one operates under a blind assumption that markets simply 'go up over time', then what's the impetus for studying the structure of markets at all?



This is not to pick on Jeff: his sentiment is standard. But how can one possibly know how to build a diversified portfolio if they have no idea what the future holds? Buying real estate in Florida and California may provide 'natural disaster' diversification, but if hurricanes in the South become correlated with earthquakes or fires in California, then these holdings no longer provide diversification benefits. In dynamic systems, what constitutes "diversification" changes.

Note the drastic increase in the correlation of stocks in the S&P 500 in recent years:



Clearly something has changed. For reasons that will be explained shortly, this is a phenomenon that will likely increase in severity, with effects spanning outside of equity markets. The key point to appreciate for the time being, however, is not why these changes are occurring or how portfolio construction should change as a result, but rather that markets **can** change. We all want comfort and security, and wealth managers are very good at selling the idea that one doesn't need to worry about the future; but this is fool's gold. The standard diversification strategies- higher allocation to alternatives, investments in high dividend stocks, etc. – all still expose clients to systematic risk.

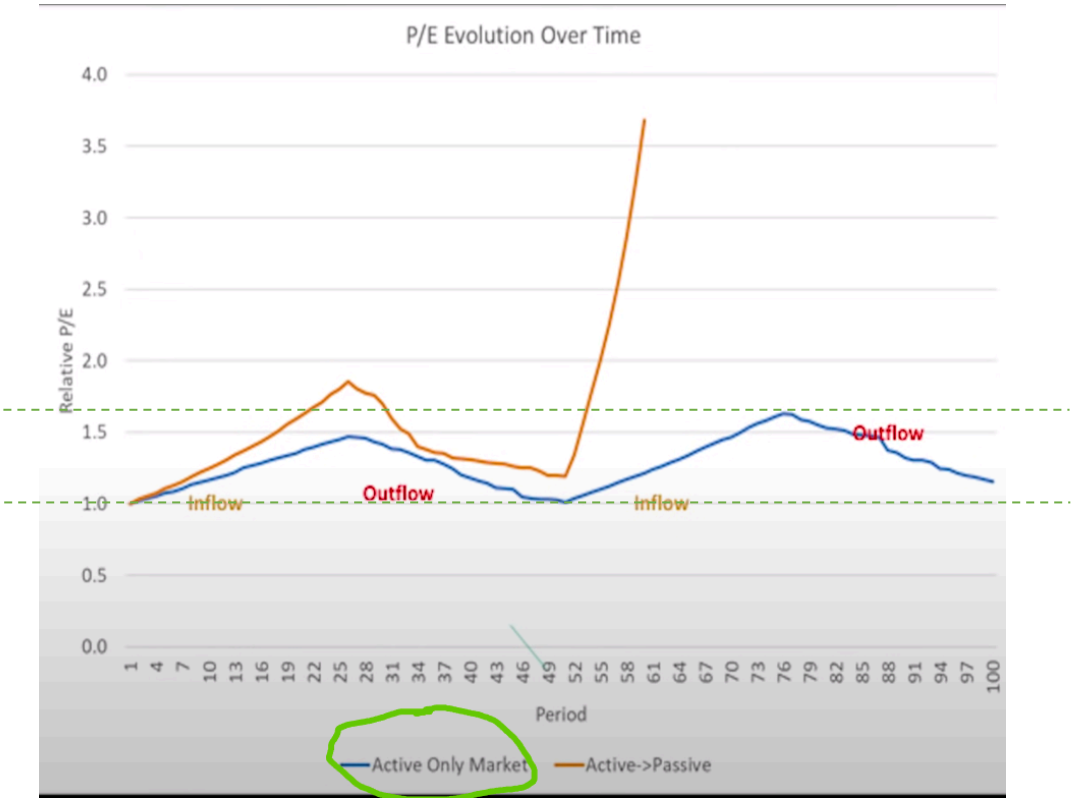
Let's now examine how markets are changing before we examine mathematically why these changes are so dangerous.

"*The percentage of participants with professionally managed allocations has grown significantly over the years, from 9% in 2005 to 66% in 2022, driven mostly by the 59% of participants invested in a single target-date fund*." ~ Vanguard

Passive investing is a very new phenomenon, taking off in earnest in the past three decades. As Vanguard proudly touts in the above quote, workers increasingly allocate their retirement savings to a single "Target Date Fund", which scales asset allocation by one's time until retirement. For a variety of regulatory reasons, it is all but guaranteed that passive will

continue to grow at the expense of active management. While this phenomenon seems benign on the surface, it has profound implications for the behavior of asset markets.

Below is a simulation put together by Michael Green of Simplify Asset Management (still one of the only people examining this issue). The blue line represents a market of purely active investors, while the orange line represents a mixture of active and passive investors, with the percentage of passive growing throughout time.



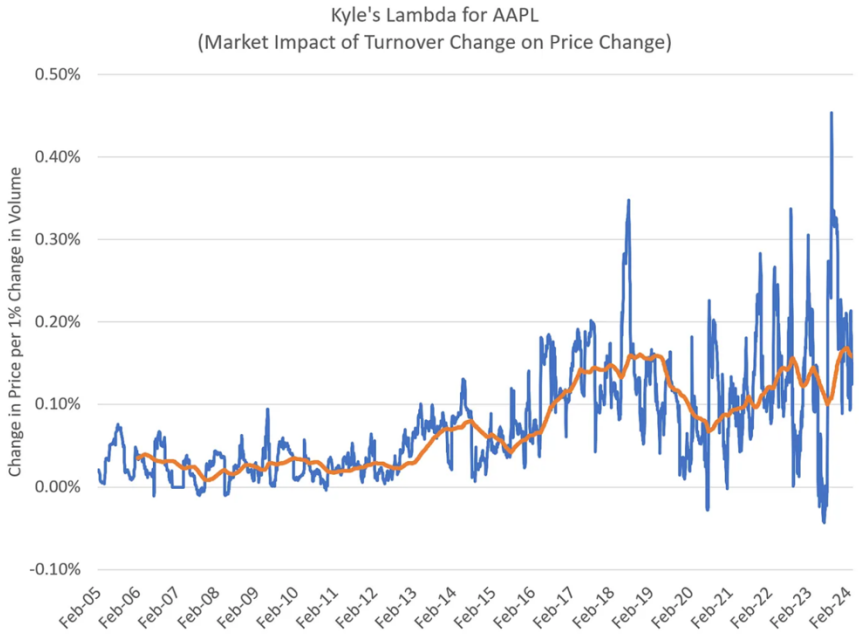
Note how the blue line "mean reverts": when the price to earnings ratio increases or decreases to a certain degree, it reverses course, staying within the dashed lines. By contrast, the orange line becomes completely unstable as time increases. Why is this?

The blue line possess only active market participants, who buy shares when prices are considered low and supply shares when prices are considered high. It is this phenomenon of buying and selling- given relative valuations- that provides liquidity and 'guardrails' to markets. The orange line, on the other hand, possess an increasing percentage of passive investors (e.g., Vanguard), who are completely price agnostic. The appetite to buy or sell for these investors is simply a function of flows to and from their funds.

Crucially, the larger passive becomes, the larger the fraction of shares that are effectively unavailable for transactions. This is how you get a result like Salesforce dropping 17% on a relatively mundane earnings report: the disappointing report causes active investors to want to

sell, but it is simply much more difficult to find a buyer as the appetite for passive investors to transact is not a function of price.

One way that we can evidence the impact of this changing market structure is through a metric called "Kyle's Lambda", which measures the sensitivity of a stock's price to a change in order flow. Using Apple as an example, note the dramatic increase in Kyle's Lambda in recent years.



As this graph illustrates, active investors are having an increasingly difficult time finding a counterparty to transact with. This phenomenon will scale exponentially as the penetration of passive increases. According to Michael's calculations, as passive reaches about 70% penetration, asset prices will hit multiples of 200x on inflows and 0 on outflows. This is a function of the decreased liquidity and cash in a passive dominated marketplace.

In short, the widespread adoption of passive investing has decreased liquidity, increased the percentage of price agnostic buyers, and caused ostensibly unrelated assets to move in an increasingly correlated fashion. Because flows to passive vehicles (e.g., retirement funds) have been net positive, this has 'juiced' markets to the upside; however, because contributions to retirement funds are a function of incomes and withdraws are a function of asset prices, net flows will turn negative in the coming years. This flow dynamic will be reinforced by the aging of our population, as the vast majority of baby boomers have not saved enough for retirement.

"*What matters is the particular, not the average.*" ~ Benoit Mandelbrot, inventor of fractal mathematics

On August 31, 1998, the Dow Jones industrial average plummeted 6.4 percent. Standard financial models would put the odds of a crash of this magnitude at one in 20 million. Even more alarming, this was but one of three such crashes during the same month, the odds of which would be one in 500 billion.

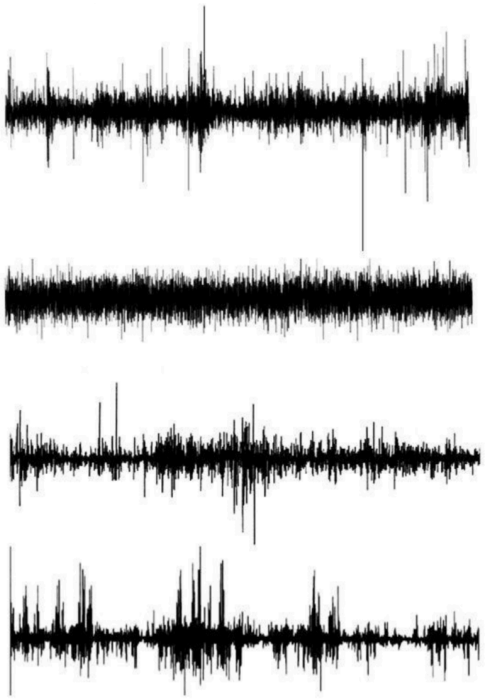
Indeed, these "impossible" events occur with unusual regularity: in July 2002, the Dow endured 3 steep falls within seven trading days, the probability of which would be roughly one in four trillion if standard risk models were correct. Most alarming, on October 19, 1987, the DJIA fell 22.2 percent. The probability of this occurring was assumed to be one in 10^50 – a number that is outside the scale of nature.

Obviously traditional financial mathematics does a very poor job at understanding price movements, but why is this so?

The foundation of financial mathematics is the idea that prices follow a random walk. Thus, martingales, Brownian motion and normal distributions are utilized to analyze price movements. Crucially, these models assume "continuous" movement. Picture a coin toss: continuity assumes that the amount of, say, "heads" one gets in a row is increasingly unlikely, with each result being unrelated. This idea undergirds the "normal distribution" structure.

But stock prices do not behave in this sort of manner: there is 'discontinuity'. Given an 'unlikely' (volatile) movement, it is more likely to get another unlikely movement. In short, movements in stock prices are related: they are not independent 'random' events. **Volatility clusters**.

Note the following charts:

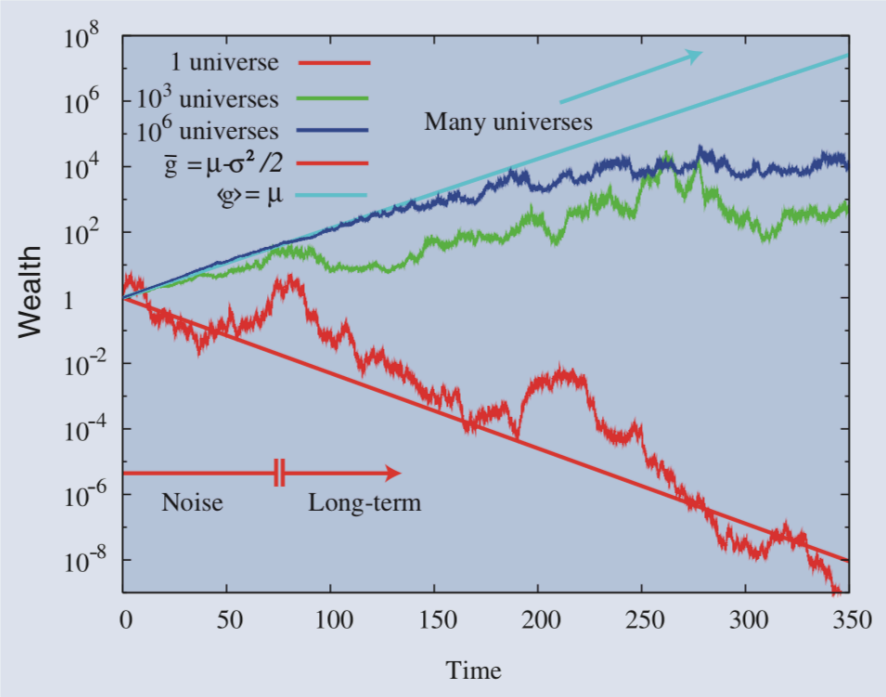


Which of these charts least resembles the daily movements of stock prices? The second chart is the clear winner. Ironically, this chart is constructed using daily price movements implied by Brownian motion. The top chart depicts the actual daily change of a representative stock (IBM in this case), while the third chart down depicts the daily change of an FX pair (USD / EUR). The chart on bottom depicts the daily change as implied by a model called "fractional Brownian motion in multifractal time". This model clearly does a much better job at depicting the 'clustering' nature of asset price movements.

Crucially, the classic Brownian motion model also assumes 'statistical stationarity' of price changes, meaning that the system that governs price changes is assumed to not change over time. In "coin toss" terms, the coin itself is assumed to never change- prices follow a random walk and that is that. There is simply no room to input a changing market structure into price dynamics.

We have all been told that markets go up over time, and that by simply weathering volatility, one can expect a roughly 10% return from equities. This is extremely faulty mathematics.

Note the following image:



This graph depicts a game that is rigged favorably. Picture this as being a simulation of one's wealth in the stock market, rigged so that 70% of the time the market goes up on a given day. Despite this market being favorable on any given day, one's wealth over time still trends negative (the red line). It is only when we are allowed to average across "multiple universes" that the positive expected value enables us to achieve positive wealth.

The effects of this phenomenon are exacerbated in financial markets because volatility clusters. Thus, even if one's wealth can be expected to increase on any given day, there is an increasingly high probability that a number of negative days will cluster together, and that this will reduce one's wealth given the multiplicative nature of returns. Recall that passive investing increases the correlation of assets and decreases market liquidity. As such, it increases the effects of this phenomenon.

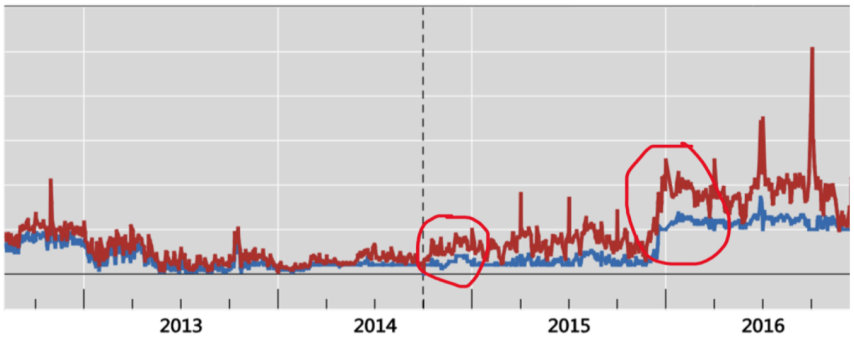
*This is all very complicated, counterintuitive material, so please reach out if you are interested in a more detailed description.

Okay, so what can be done to safeguard one's wealth?

Recall that standard financial theory posits that markets follow a random walk. Luckily, this isn't true. There are clear cause and effect mechanisms at play.

The following examples possess indicators of monetary stress that are proprietary; however, note the correlation between these indicators and asset prices:

a)


2013
2014
2015
2016


FRED
Nominal Emerging Market Economies U.S. Dollar Index (left)
S&P 500 (right)
Index Jan 2006=100
130
125
120
115
110
105
100
95
2014-01
2014-05
2014-09
2015-01
2015-05
2015-09
2016-01
2016-05
2016-09
2017-01

b)


2012
2013
2014
2015
2016
2017
2018
2019


FRED
S&P 500
3,000
2,900
2,800
2,700
2,600
2,500
2,400
2,300
2,200
2,100
Index
2017-01
2017-04
2017-07
2017-10
2018-01
2018-04
2018-07
2018-10
2019-01

c)

[redacted]

Global Co-Head of Discretionary Macro/Fixed Income at [redacted]

Zachary Cameron • 8:01 PM

[redacted] I'm seeing profound stress manifesting all over the place... widespread corroboration in different regions of the world. [redacted]

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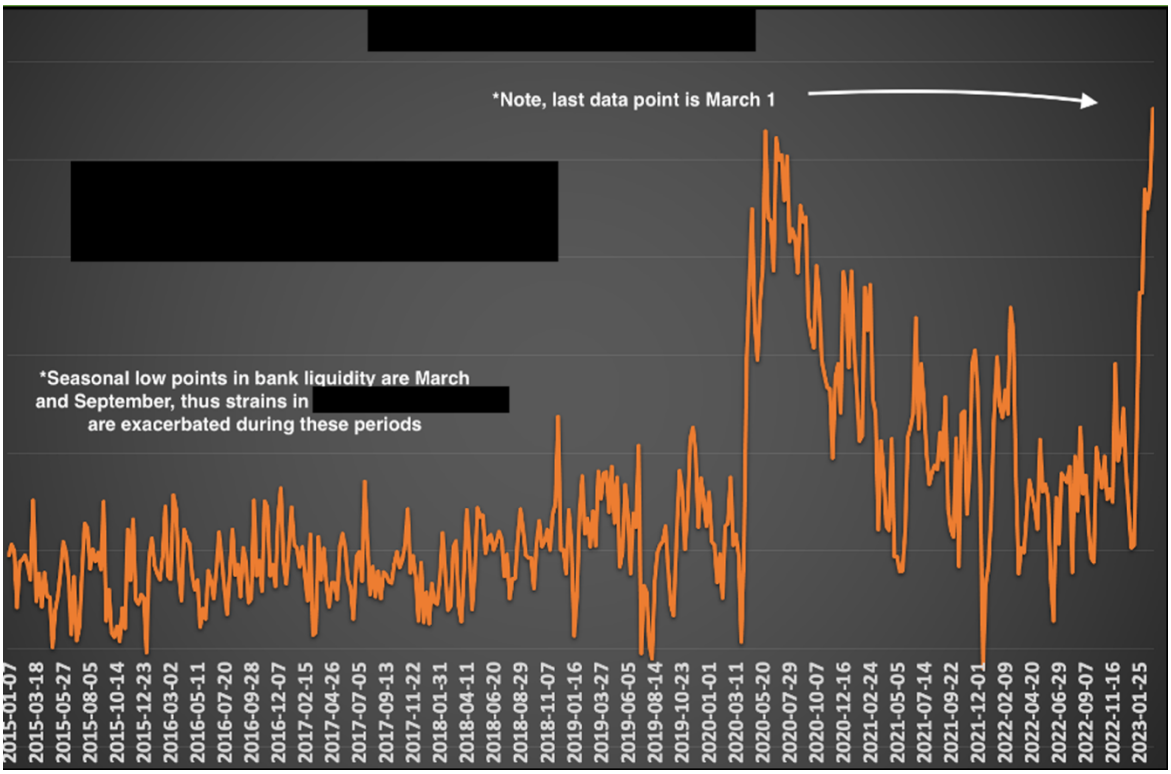
d) Immediately preceding the failure of SVB:



No one has a crystal ball. This indeed is true. However, as these examples illustrate, one can make reasonable inferences as to the conditions in the monetary system and position accordingly. Equity prices are likely to go much higher from here- albeit it in a much more volatile manner- before they collapse. Investors must stay allocated. However, it is crucial that payoff structures are implemented that have a negative correlation to equity markets and the global economy. No other mechanism can offer true protection.

Candidly, these are all very complex topics that this primer only sought to briefly introduce. Please reach out for a more detailed description on the dangers of traditional wealth management strategies and what one can do to best protect and grow their wealth.