2022
3RD QUARTER
QUARTERLY COMMENTARY

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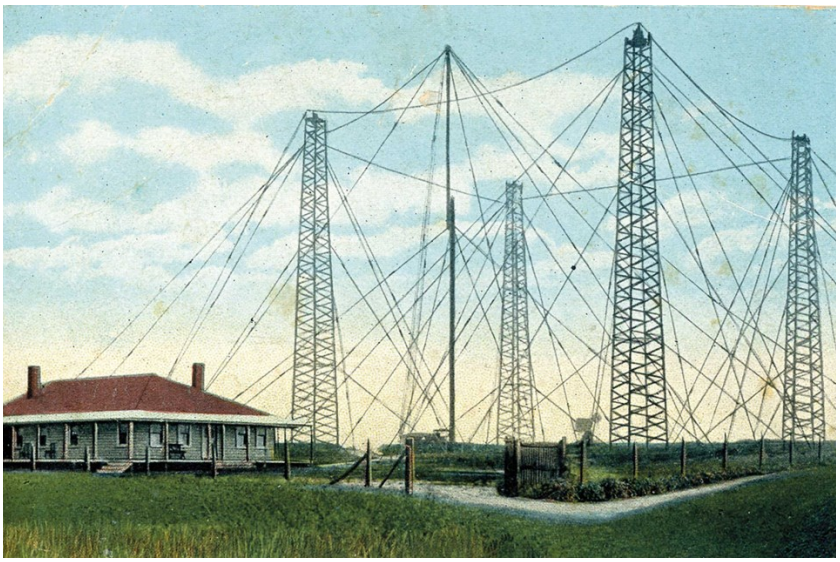


Skywave

On a cold winter day in Devon, England, 75-year-old Oliver Heaviside climbed a ladder by his house to inspect the roof. He slipped and fell and died of his injuries. It was a sudden, but not surprising, end to a strange, but remarkable, life.

His death went unnoted, and his name is unknown to us today. He was, by profession, a telegraph clerk. He was, by temperament, an inveterate and self-educated tinkerer and thinker whose inventions and calculations transformed global communications and our understanding of electro-magnetism to this day. A bit of background first.

James Clerk Maxwell revolutionized our understanding of electricity by proving, through a series of complicated equations, that electricity and magnetism were, in fact, a single force.[1] Fifteen years later, in 1888, Heinrich Hertz demonstrated that electromagnetic radiation could be produced and detected. In 1894, a teenage Guglielmo Marconi, experimenting on his family's estate in Bologna, built a radio transmitter and receiver that allowed his mother to ring a bell in another room by pushing a button.

It was known that radio waves travel in line-of-sight, meaning there is a limit to the distance they can travel and be received. Marconi soon moved to England to continue his experiments. After three years of work, in December 1899, he erected a tall tower and successfully made the

[1] Treatise on Electricity and Magnetism, 1873.

first radio transmission across the English Channel. Still, it was line-of-sight.

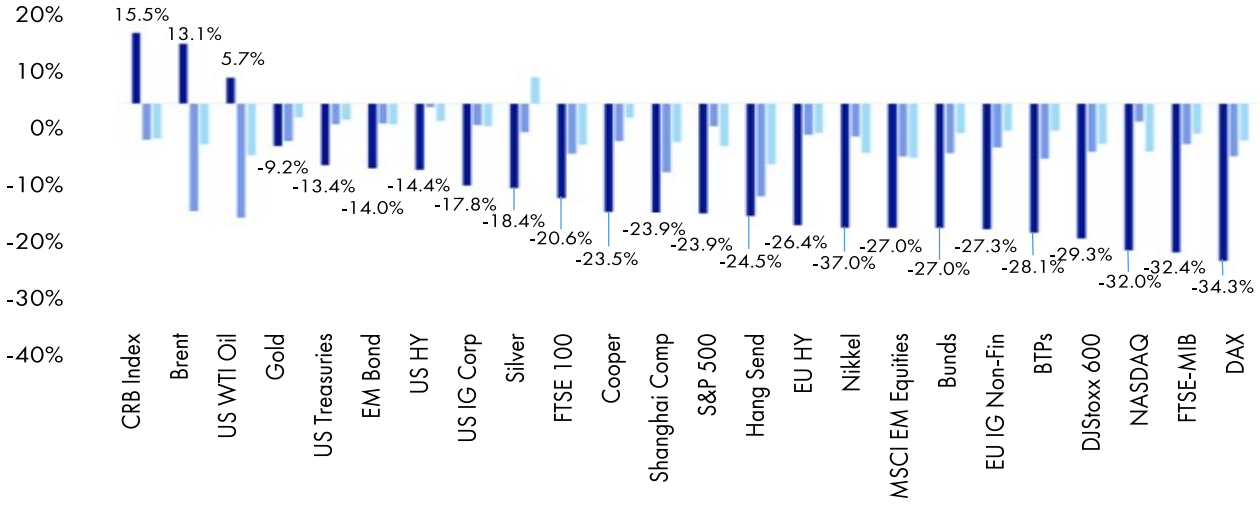
Marconi immediately began working on a trans-Atlantic system. In Cornwall, at the very southwestern tip of England, he attached an antenna to a kite, raised it to 500-feet, and claimed he transmitted a signal to a receiving station he had built in Nova Scotia, Canada. He offered no proof, and his claim was not believed, but a year later, in December 1902, Marconi did, in fact, successfully send a signal to his new receiving station in Wellfleet, Massachusetts.[2] A month later, he sent greetings from President Theodore Roosevelt to King Edward VII, and trans-Atlantic communication by radio waves was established, albeit tentatively, because consistent communication proved elusive.

The problem was that no one knew how radio waves could travel such distances. Due to the curvature of the Earth, a straight-line propagation of radio waves should extend into outer space, not follow the contours of the Earth. It was a mystery how Marconi could send and receive a signal thousands of miles away. Marconi himself had no explanation.

At stake was not just the ability of a president to send greetings to a king. Solving the mystery of how radio waves could be transmitted over long distances changed not only global communications, but was decisive in winning the Second World War and preventing global thermonuclear war.[3] And, of course, there is a lesson for investors here, a lesson especially salient in the midst of a brutal bear market.

How brutal has 2022 been for investors? Let's start with the (relatively) good news. The 25% decline in equities is the fourth worst return for the first three quarters of a year in the past century. Only 2002, 1974 and 1931 were worse. Positive returns could be found nowhere outside the oil patch, with double-digit declines for virtually all asset classes (Chart 1).

Chart 1 **2022 Period Returns for Select Asset Classes, in USD**



Source: Deutsche Bank

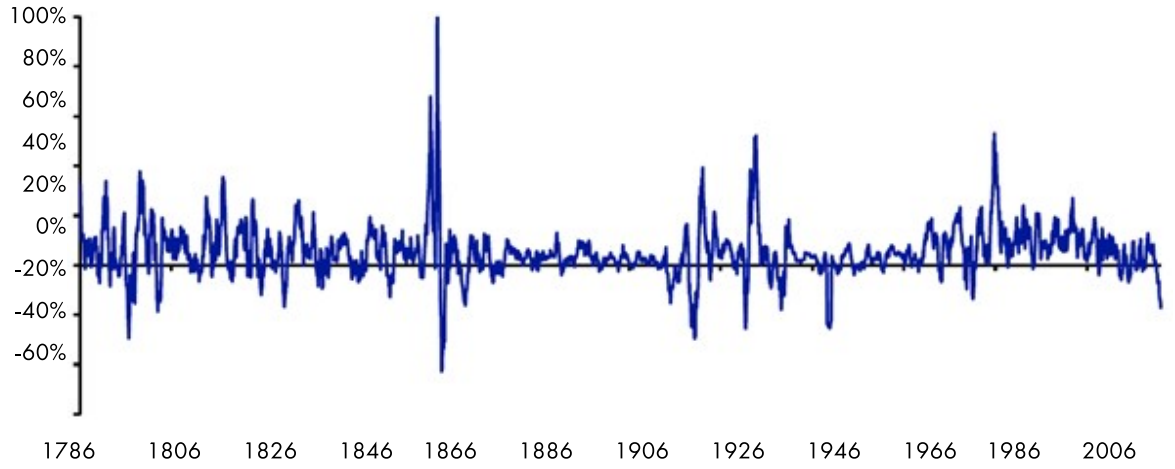
[2] You can visit the site today: https://www.nps.gov/caco/planyourvisit/marconi-beach.htm

[3] *War Games*, 1983: https://www.imdb.com/title/tt0086567/

A 25% decline in equities is painful, but hardly unprecedented. This is the 20th bear market in the past 140 years, with an average drop in those periods of 37%. Of course, some declines have been much worse (the 89% drop in 1929-1932, for example), or the nearly 50% declines in 2007-2009, 2000-2002 and 1973-1974. So far, this has been a fairly "normal" bear market in equities.

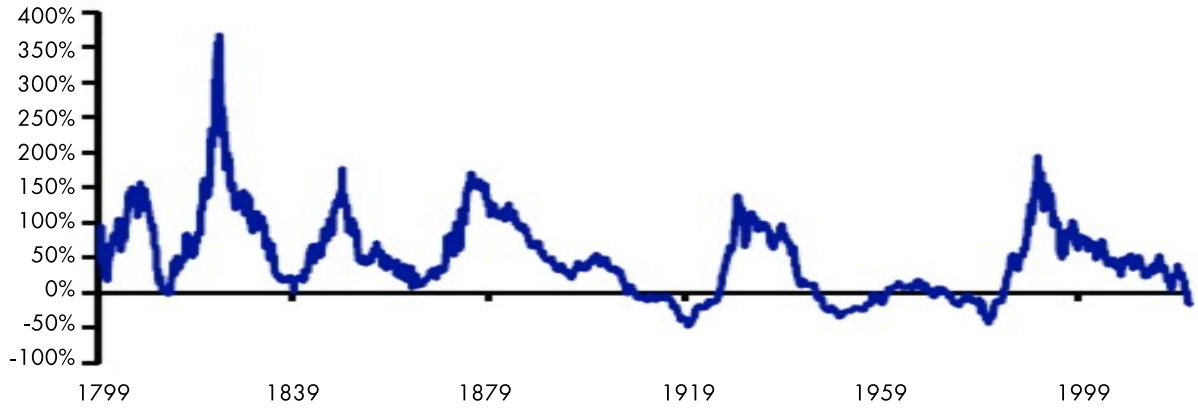
It has been in the bond market, that bastion of prudence, conservatism and security, where we have seen truly historical carnage. Global government bonds have lost more than 20% over the past year (nearly 15% for US bonds), the worst performance in 70 years (Chart 2). Real returns in US Government bonds over the past decade have now turned negative (Chart 3).

Chart 2 **Year-on-Year Nominal Returns for Global Government Bonds, USD, GDP-Weighted, 1786-2022**



Source: Deutsche Bank

Chart 3 **Ten-Year Rolling US Government 10-Year Bond Returns, 1799-2022**



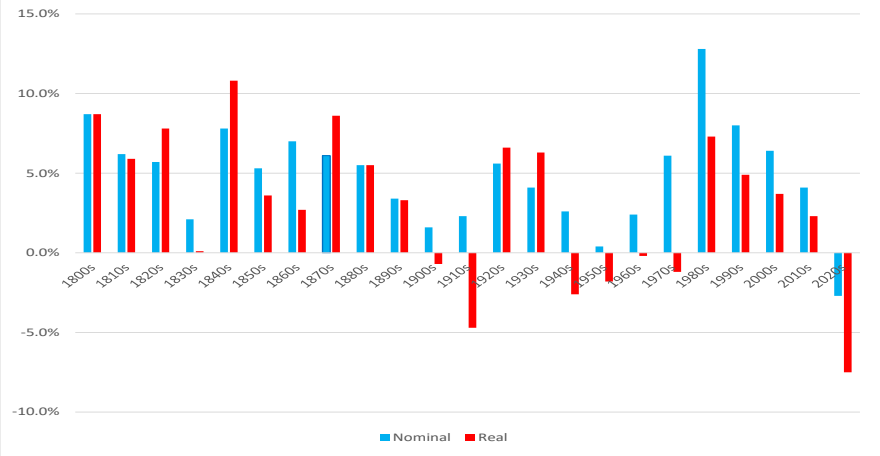
Source: Deutsche Bank

Real returns show some cyclicality, with decades of negative returns followed by decades of positive returns. But there has never been a decade in the United States since 1800 when nominal returns in government bonds have been negative (Chart 4). The decade is still early, but its start augers poorly for investors.

The four-decade bull market in bonds, from 1980 to 2020, the strongest in history, was preceded by a four-decade bear market, from 1946-1981, as yields rose from 2% to 15%. The bull market that began in 1981 was a function of very high starting yields, both nominal and real, in the early 1980s. It is very likely that a multi-decade bear market in bonds began in 2020, when yields on ten-year Treasuries hit an unprecedented 0.5%.

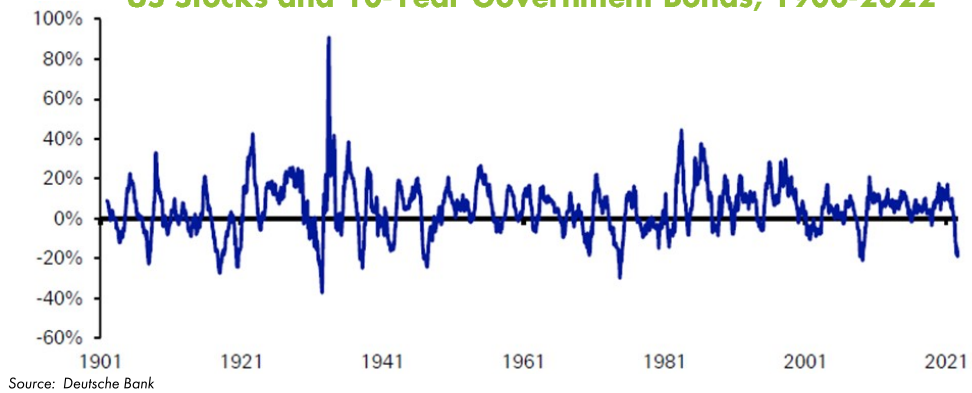
The simultaneous steep declines in equities and bonds and the spike in inflation have caused investors to suffer real losses similar to the 2007-2009 period, although declines then were driven by equity losses, as bonds generally held their value then. We look back to 1973-1974 as the more comparable period of simultaneous declines in both stocks and bonds (Chart 5).

Chart 4 **Real and Nominal US Bond Returns per Decade, Annualized, 1800-2022**



Source: Deutsche Bank

Chart 5 **Year-Over-Year Rolling Real Returns for 50/50 Portfolio of US Stocks and 10-Year Government Bonds, 1900-2022**



Source: Deutsche Bank

At the root of the market turmoil is inflation. For the past 40 years, inflation averaged 2.6% p.a.[4] It spiked to over 9% last month, a level not seen since 1981. The cause was the massive mismanagement of monetary policy by the Federal Reserve.

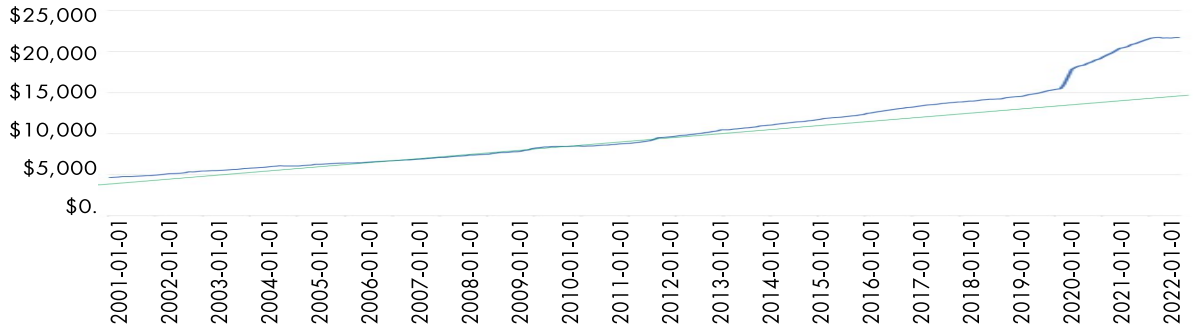
In the late 1970s, Paul Volker broke inflation by directing monetary policy to target money supply growth, specifically, to bring it in-line with the demand to hold money. As inflation moderated over the decades, the Fed abandoned its management of money supply and shifted to targeting overnight (Fed funds) interest rates. In the financial crisis of 2008, the Fed added balance sheet management (Quantitative Easing) to its monetary tools to dramatic effect. The Fed's balance sheet tripled from 5% of GDP to 15% during the financial crisis, and doubled again during the pandemic in 2020 to more than 35% of GDP (Chart 6).

At the same time, the Fed allowed money supply to accelerate sharply (Chart 7). From rising at a steady 6% p.a. pace for 15 years, M2 rose more than 20% in each of the past two years. In the face of diminishing demand to hold money, this jump in money supply is what sparked inflation.

Chart 6 **Federal Reserve Balance Sheet as Percentage of GDP, 1991-2022**

Source: Bloomberg, L.P.

Chart 7 **M2, 2000-2022, ($ Bil)**



Source: Federal Reserve System

[3] Between 1983 and 2021

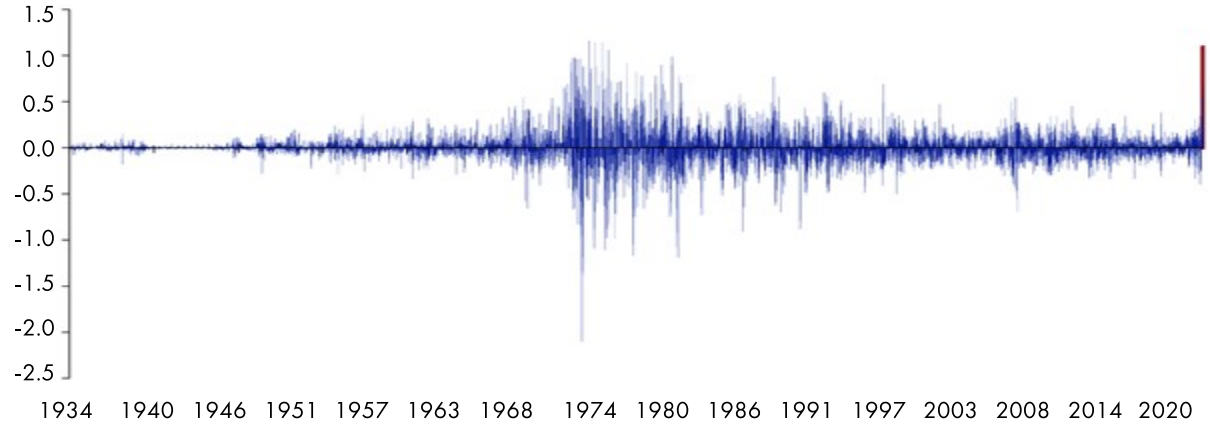
This mismanagement of monetary policy caused inflation to soar and contributed to the greater volatility we see in markets. The MOVE Index is the yield curve weighted implied volatility on one-month Treasury options, a broad measure of interest rate volatility. In the past year, this volatility measure has more than tripled to levels not seen since the financial crash of 2008-2009 (Chart 8).

The Fed cannot be blamed for all the woes of the world, although its policy added to the dry tinder waiting for a spark. That spark came last month when the new UK government announced a "mini-budget" that slashed tax rates for the wealthy without any offsetting spending cuts, meaning it would be financed entirely by debt. This sent the UK markets into a frenzy: stocks in London fell 8%, and the price of 30-year gilts fell 28% as yields rose from 3 ½% to 5% in just a few days. The next day,[5] yields dropped to 4%, the biggest swing in yields in a century (Chart 9).

Chart 8 **MOVE Index, 2002-2022**

Source: Bloomberg L.P.

Chart 9 **Five-Day Rolling Yield Move for 10–Year UK Gilts, 1934-2022**



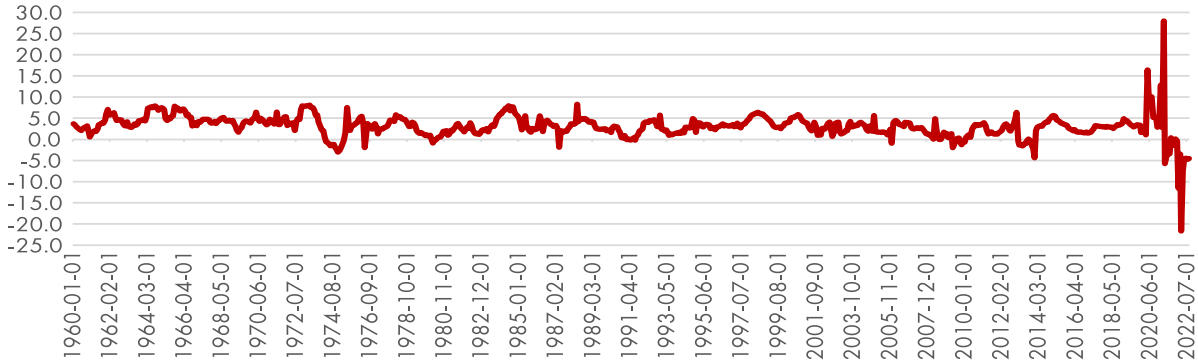
Source: Deutsche Bank

[5] 28 September 2022

The Bank of England, following the Fed, began its monetary tightening at the beginning of 2022 by raising overnight rates and shrinking its balance sheet. The unprecedented sell-off in gilts last month was apparently caused by margin calls on UK pension funds that owned billions of derivative contracts on long-term gilts (forcing them to raise cash to meet those margin calls by selling gilts). This then prompted the Bank of England, which had been selling bonds all year to drive the yields up, to reverse course and buy gilts to stem the crash. A full-blown global financial crisis, à la 2008, was a very real prospect had the Bank of England not stepped in. But its policy is now unclear: does the Bank continue its tightening in order to combat 10% inflation, or does it buy bonds to protect against a collapse in the gilt market? The Old Lady[6] probably does not know herself.

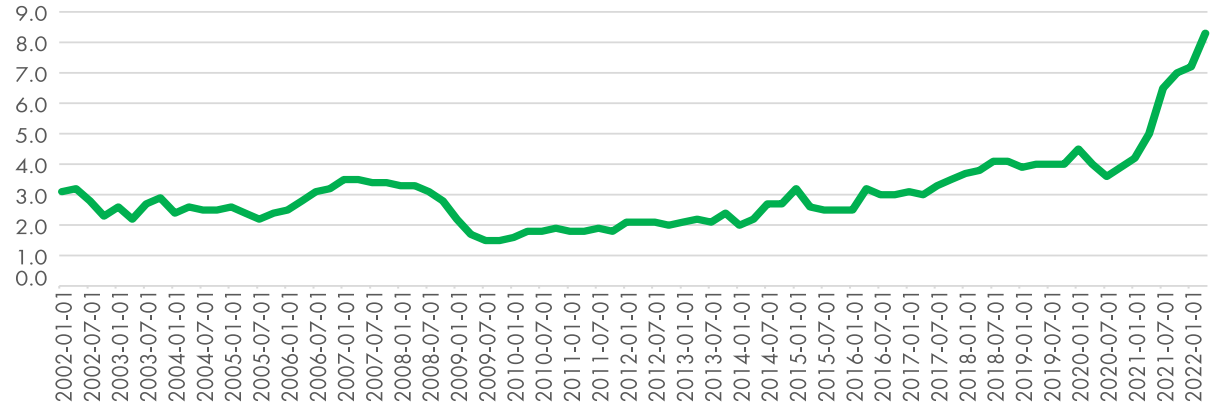
Stagflation (*stag*nant growth with high in*flation*) is the result of the Fed's mismanagement of monetary policy. Real disposable income fell 20% in the twelve months from March 2021 to March 2022, a reversal of the massive 28% increase seen in the prior twelve months, March-to-March 2020-2021 (Chart 10). But real income is still 4 ½% lower than a year ago, despite accelerating wage gains not seen in decades (Chart 11).

Chart 10 Real Disposable Personal Income, Year-Over-Year Percentage Change, 1960-2022



Source: US Bureau of Economic Analysis

Chart 11 Employment Cost Index, Year-Over-Year Percentage Change, 2002-2022



Source: US Bureau of Economic Analysis

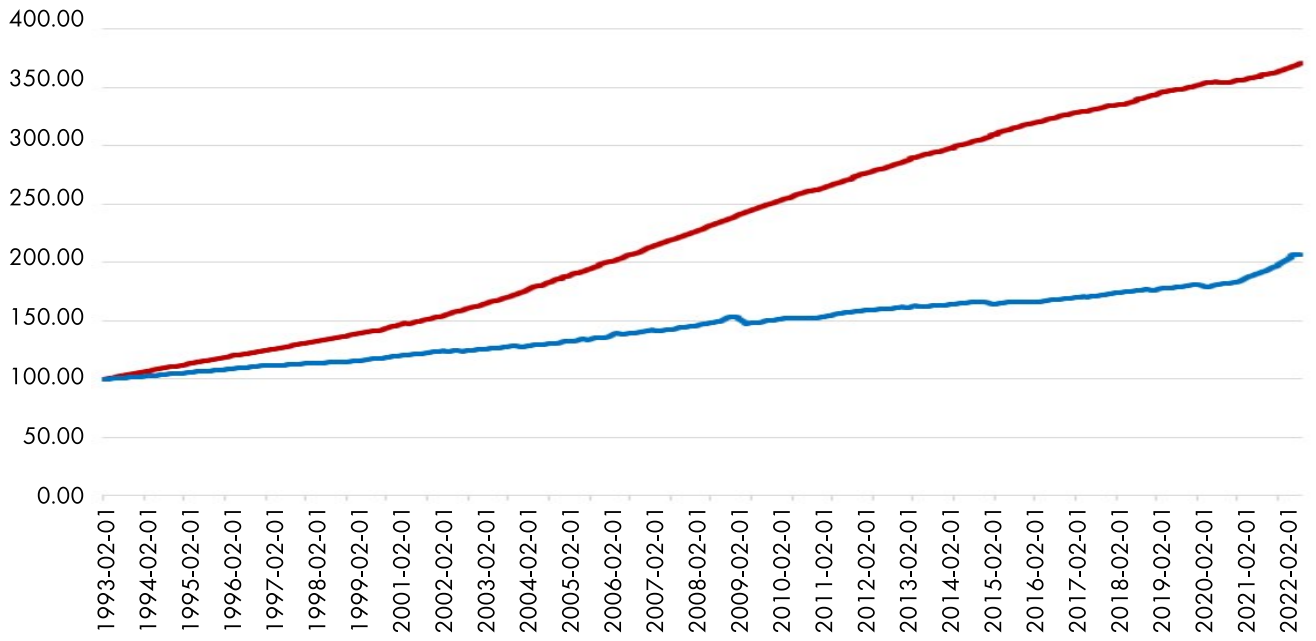
[6] *A term of endearment (?) for the Bank of England*

The Fed is not alone in its policy errors. At a time of high inflation, many states are writing "inflation reduction" checks to people: $1,050 to Californians, miserly compared to Maine, where residents will receive $1,700 checks. To state the obvious, giving away "free" money will not reduce inflation. It's also not "free."

Many G7 countries are coordinating price caps on Russian oil. The only effect of this misguided step will be to provide a subsidy to India, China and other buyers of Russian oil. Price caps exacerbate inflation, as we saw in the early 1970s when they were last imposed. On the subject of oil, we see our President and Secretary of State begging Venezuela and the Saudis to sell us more oil (they just declined to do so, and instead decided to cut their production), while we have effectively banned any new oil exploration on federal lands. Since 1970, there has never been a year in which less than 4.4 million acres have been leased for exploration. This year just 0.1 million acres have been leased. Most of us wish for a world without oil, but wishes do not make good policies.

Perhaps the biggest recent policy error was forgiving $1 trillion of student debt without reforming the system that promoted its accumulation. Why has the cost of education risen at nearly twice the pace of overall inflation (Chart 12)? There are likely many contributors, but a major factor is that subsidizing loans stokes demand, enabling colleges to raise costs with (near) impunity, or certainly without the constraints a free market would impose. This $1 trillion of loan for-

Chart 12 **Consumer Price Index for All Items and for Education, 1993-2022 (Feb. 1993=100)**



Source: US Bureau of Labor Statistics

giveness benefits the small subset of borrowers at the (considerable) cost to everyone else without reforming the systemic flaws that spawned, and will continue to produce, this debt burden. Our policies seem intent on propagating a stagflationary economy. Unforced errors abound.

In the years before he fell off his ladder and died, Oliver Heaviside had become ever more eccentric. He became a recluse, refusing visitors. He painted his fingernails pink, shocking a hundred years ago, and replaced his furniture with granite blocks. It was hard to believe that this was the same man whose work changed the world.

Oliver left school at age 16 to take a job as a telegraph clerk. He continued to study by himself, including devouring Maxwell's newly published two-volume treatise on electromagnetism. He worked out how to simplify Maxwell's original twenty equations to the four differential equations students are taught today. He proved mathematically how to eliminate distortion in telegraph lines. He patented the coaxial cable, found in every home and building today to bring in cable television or broadband internet. He was eventually elected a Fellow of the British Royal Society, and was awarded an honorary doctorate from the University of Göttingen. Not bad for someone whose application to join the Society of Telegraph Engineers had been rejected with the comment, "we don't want telegraph clerks."

RADAR is an acronym coined by the US Navy (*R*adio *D*etection and *R*anging). Bouncing radio waves off of an object and receiving its "echo" requires a line-of-sight between the object and the receiver. The development of the cavity magnetron in 1940 radically boosted the power and reduced the size of the unit, enabling it to be placed on ships and in aircraft.[7] It provided the Allies with a significant performance advantage in the war. Still, it required line-of-sight to work.

Heaviside's interests focused exclusively on electricity transmitted through wires, but Marconi's success in long distance transmission piqued his interest in radio waves and how it could be possible to propagate a signal over the horizon. Heaviside surmised that something was reflecting radio waves back toward Earth. He calculated that the Sun's solar radiation of Extreme Ultraviolet and X-rays could ionize the atoms in the Earth's upper atmosphere,[8] creating a layer of electrons. He called this the ionosphere. If it existed, then certain radio waves of a specific frequency[9] would be reflected back to Earth if they hit the ionosphere at a particular angle.[10]

This was all conjecture, although supported by rigorous mathematical calculations. No one knew if the ionosphere actually existed, but if it did, it would explain how radio waves would be reflected back to Earth and thus be received over very long distances.

In 1923, experiments by British physicist Edward Appleton confirmed the existence of the ionosphere. Appleton would win the 1947 Nobel Prize in Physics for his "discovery" of Heaviside's prediction of the existence of the ionosphere.

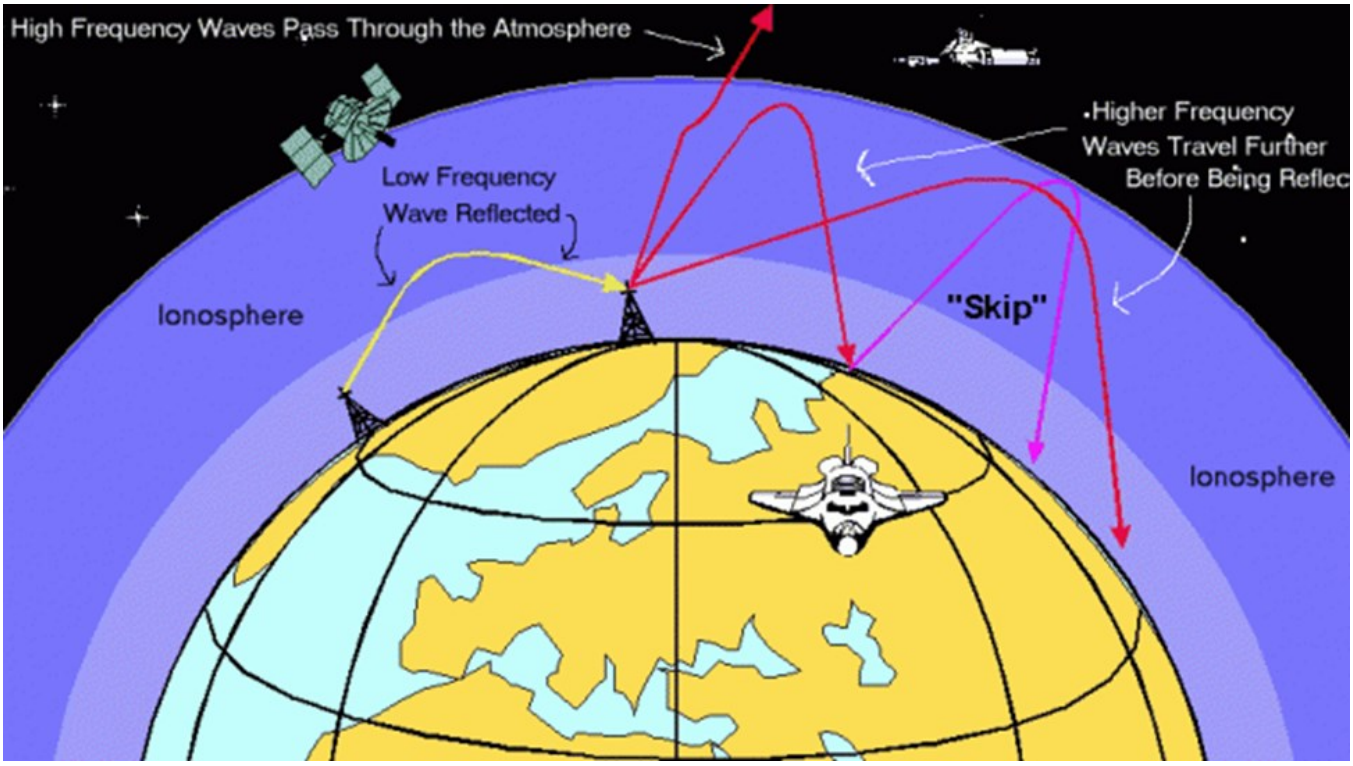
Heaviside showed that over-the-horizon radar, "skywave propagation," was theoretically possible, but there were significant practical complications. Very large radar arrays had to be installed at intervals across thousands of miles, and with each refraction the signal is diffused, or scattered. Distinguishing the target from background noise is extremely complicated mathematically. The problem is further complicated by the movement of the ionosphere itself. It wasn't until the development of more powerful com-

[7] *By John Randall and Harry Boot in Britain. It raised the power of existing radar units 1000-fold.*

[8] *Between 80-600 km above Earth.*

[9] *The high frequency (HF) or shortwave part of the spectrum, between 3-30 MHz.*

[10] *Generally between 2-4 degrees off of the local horizon.*



puters in the 1960s that over-the-horizon systems became practical. For more than fifty years, these systems have been used to detect missile launches, among other potential threats, halfway around the globe, helping us to avoid (so far) global thermonuclear war.

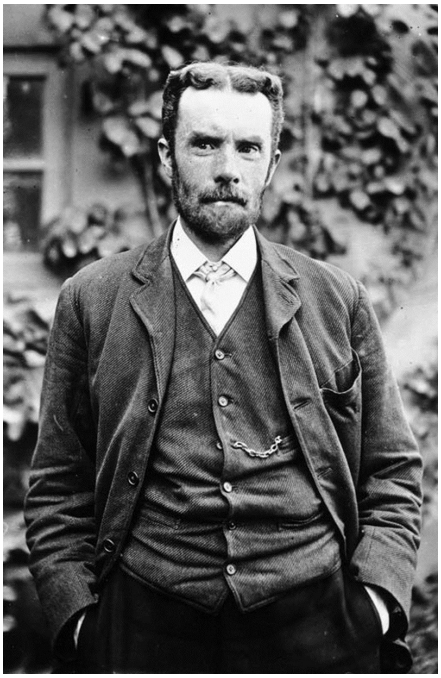
It is easy to see the threats immediately in front of us: inflation is at a 40-year high, and the Fed is trying to make up for its error by tightening monetary policy aggressively. This has many ripple effects, from a liquidity squeeze in the UK to weakening economies around the world. A growing number of countries in the developing world face double-digit inflation and a rising risk of default. These are all consequences of a stronger dollar, which is one of the results of aggressive Fed tightening, all necessitated by the massive mishandling of monetary policy that allowed inflation to soar.

All these factors are in the markets' line-of-sight and are, more or less, priced in. Investors will have to navigate through these known obstacles, but the more significant, and elusive, challenge is to peer over the horizon at the threats, and opportunities, that are fuzzier to recognize and more complicated to assess.

Inflation is stubbornly high today. Despite the aggressive measures by the Fed, inflation has moderated only slightly, from 9.1% to 8.3%. But over the horizon we see signs of inflation abating. M2 growth, which had been racing at more than 20% p.a., has slowed to about 1% growth. This points to lower inflation next year which should allow for a halt to monetary tightening and provide some relief to investors. This has enormous implications for investors, but does not

make our threat assessment any less complicated. A drop in inflation would be welcomed news, but it relies on the continued moderation of money supply growth which is dependent upon the Fed maintaining its course of tightening. This, in turn, raises the opposite risk that the Fed will be slow to recognize the drop in inflation, maintaining a restrictive monetary policy that raises the risks of a significant economic contraction next year.

The threats and opportunities in our line-of-sight are (mostly) clear. The root causes of this bear market are understood, although successfully navigating it is always difficult. The bigger challenge is to look beyond the horizon, to try to see where the next levels of threats and opportunities may come. Oliver Heaviside imagined a way to see over the horizon, and we must do the same.



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October 2022

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