



PERSPECTIVES THAT DRIVE ENTERPRISE SUCCESS



MAY 2022

Inflation & Interest Rate Research

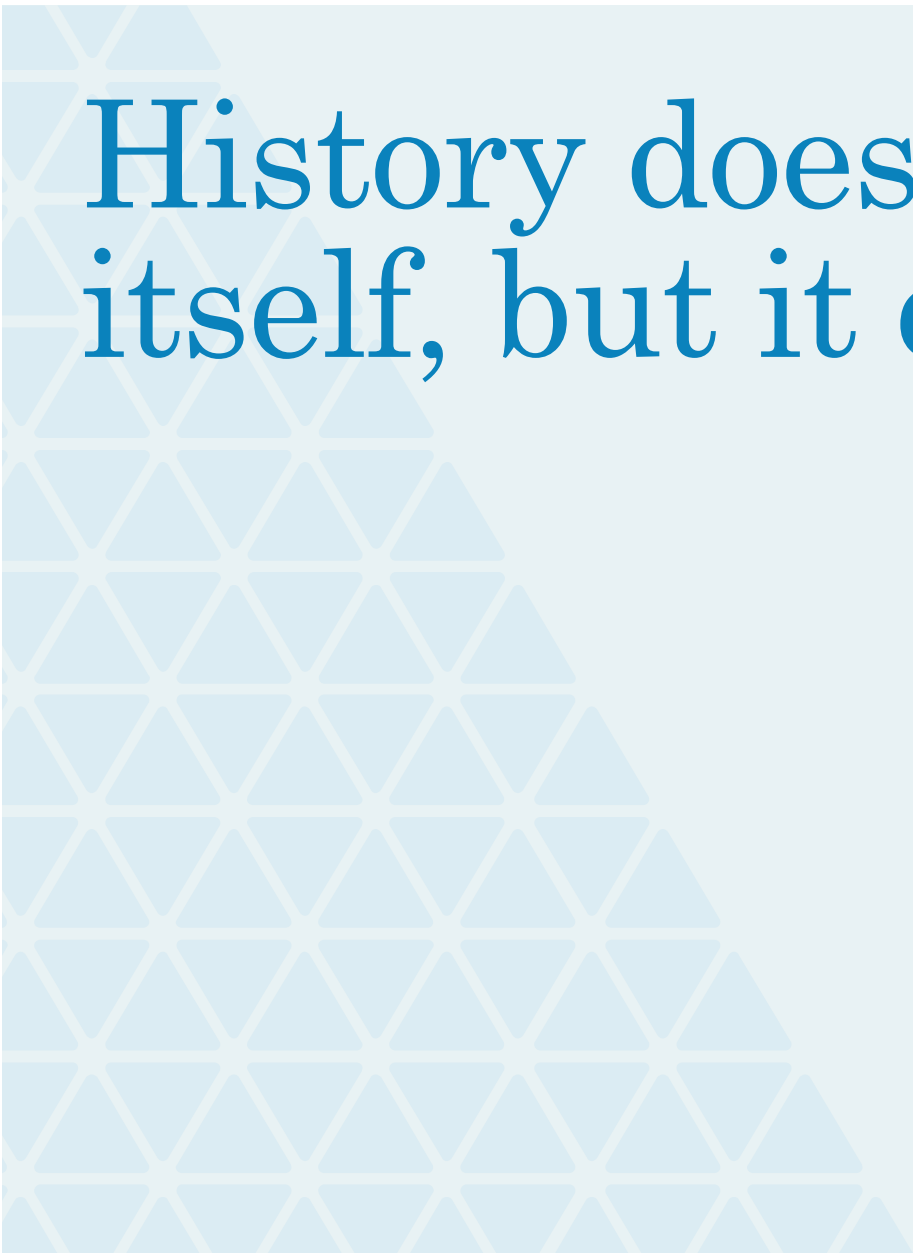
Fresno County Employees' Retirement Association

Summary

In this deck we review the historical characteristics and interplay between U.S. Treasury yields, the Federal Funds Rate, and U.S. Inflation. Then, we look at current conditions and expectations to contrast these to history. Overall, we work to answer the following questions:

- What is the market pricing today, in terms of expected future inflation and interest rate levels? What context does history provide us here? *Consensus forecasts might be thought of as a reasonable “base” case assumption.*
- Historically, how have interest rates moved with the level of inflation?
- During high inflation environments, have interest rates headed higher because of inflation? Or have interest rates headed higher because the Federal Reserve was hiking interest rates?
- If in the current environment the Federal Reserve is only planning to raise rates by a modest amount (2.25%-2.50%), does this limit the ability of interest rates to go up?
- U.S. bonds are already among the highest yielding in the developed world. If U.S. interest rates increased, would foreign investors funnel capital into the U.S. market? To what degree would this push interest rates back down? *(i.e. how powerful do we expect this effect to be)*

NOTE: We selected the Federal Funds rate in this research as this represents the interest rate that the Fed controls. It is a proxy for what the Fed is doing. We selected the 10-year U.S. Treasury because this represents long-term interest rates that the Fed does not control.

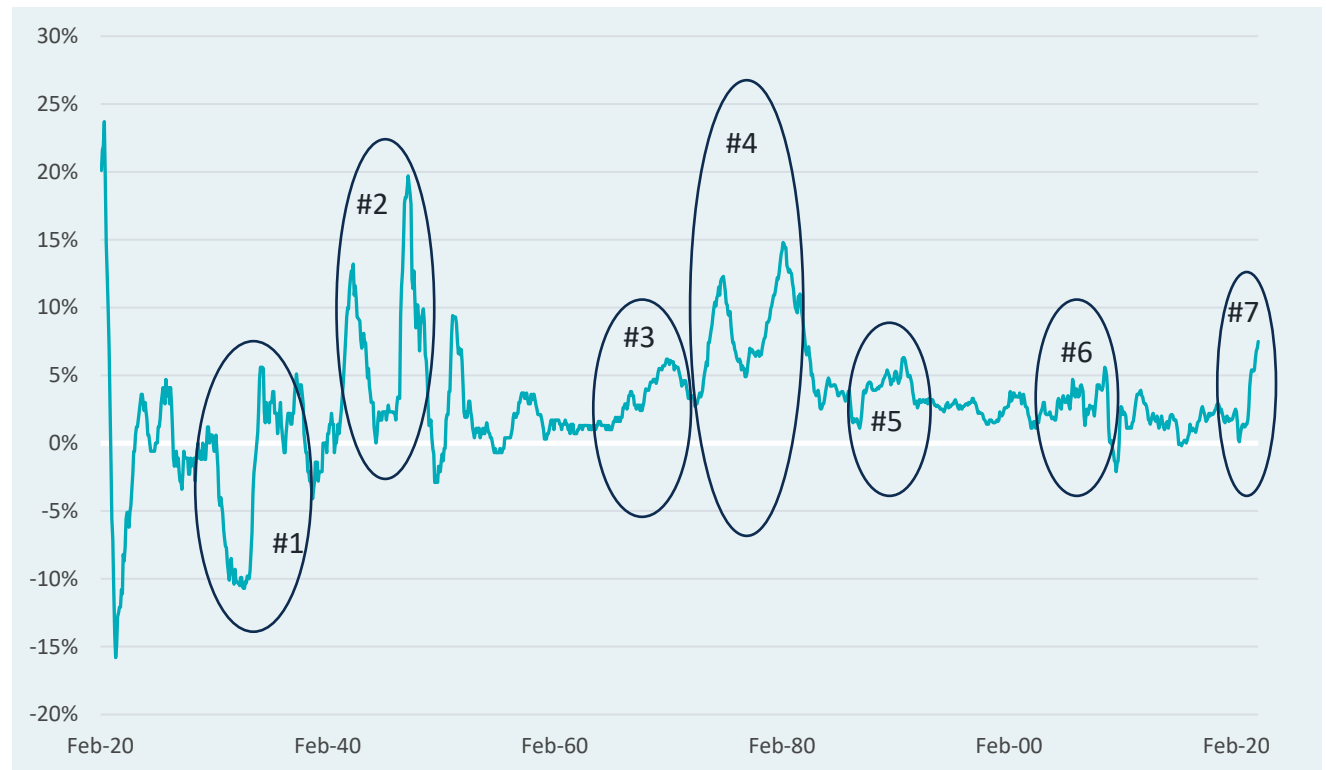


History doesn't repeat itself, but it can rhyme

What can history tell us about today's inflationary episode?

Over the next few slides, we will review previous periods where inflation was at extreme levels with the goal of determining the similarities and differences between those periods, and the period we find ourselves in today. The periods we will consider include the following:

1. Great Depression of the 1930s
2. World War II
3. Late 1960s expansion
4. 1970s oil shocks
5. 1990s Iraqi invasion of Kuwait
6. 2008-2009 Global Financial Crisis
7. COVID-19 pandemic recovery



Source: BLS, Bloomberg, as of 1/31/22

Great Depression of the 1930s

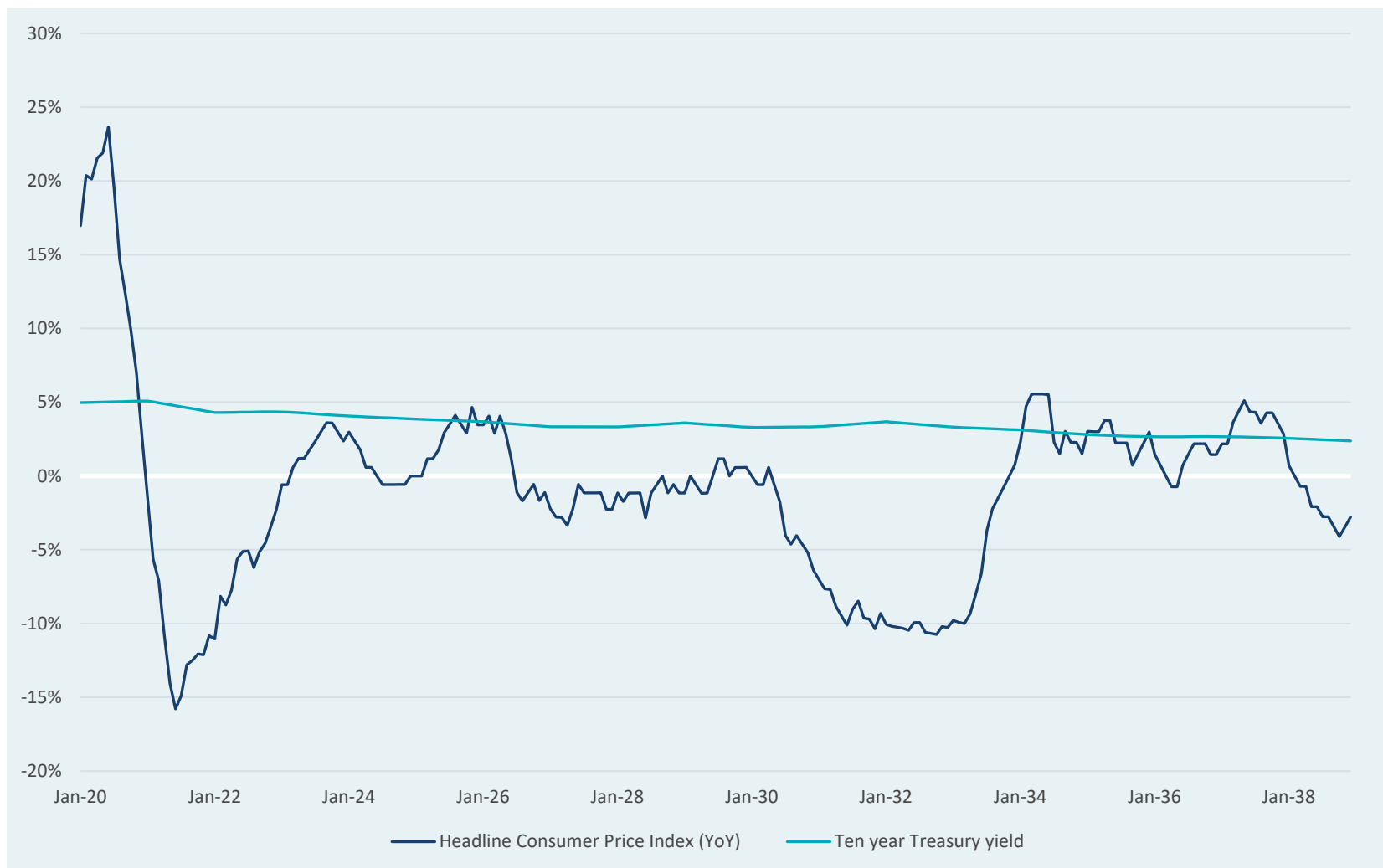
Summary

- The Great Depression was a global economic downturn, which began with a stock market crash, known as Black Tuesday.
- Between 1929 and 1932, the worldwide economy shrunk by an estimated 15%. Some countries began to recover by the mid-1930s, while others languished until World War II.
- Heavy industrial production plummeted, and international trade was cut in half. Some historians attribute the Great Depression to the extreme exuberance and overheating of the economy in the years prior (the “roaring 20s”), while others blame the stock market crash and the subsequent decline in consumer spending as the catalyst.

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- U.S. inflation had hovered around 0% in the years preceding the Great Depression. Then, the recession led to a deflationary environment, and inflation reached a low of -10%. The rate of inflation then recovered to a range of 0-4% until the late 1930s when inflation began to fall, once again.
- Beginning in the late 1920s, the Fed hiked short term interest rates from around 4.5% to above 7%. At the onset of the recession, rates were brought down quickly, reaching a low of 0.5% in 1935 before stabilizing above 1%.
- The 10-year U.S. Treasury yield sat at around 3.5% prior to and throughout the Great Depression. Yields steadily fell through the 1930s to around 2.0% in 1940. It is worth noting that the Treasury did institute a form of monetary easing during this time, purchasing government bonds on the open market, though the estimated impact of this program on longer-term bonds was roughly 50bps.

Great Depression of the 1930s



During this period, Treasury yields showed little sensitivity to inflation fluctuations

Source: Shiller data, as of 3/1/22

World War II

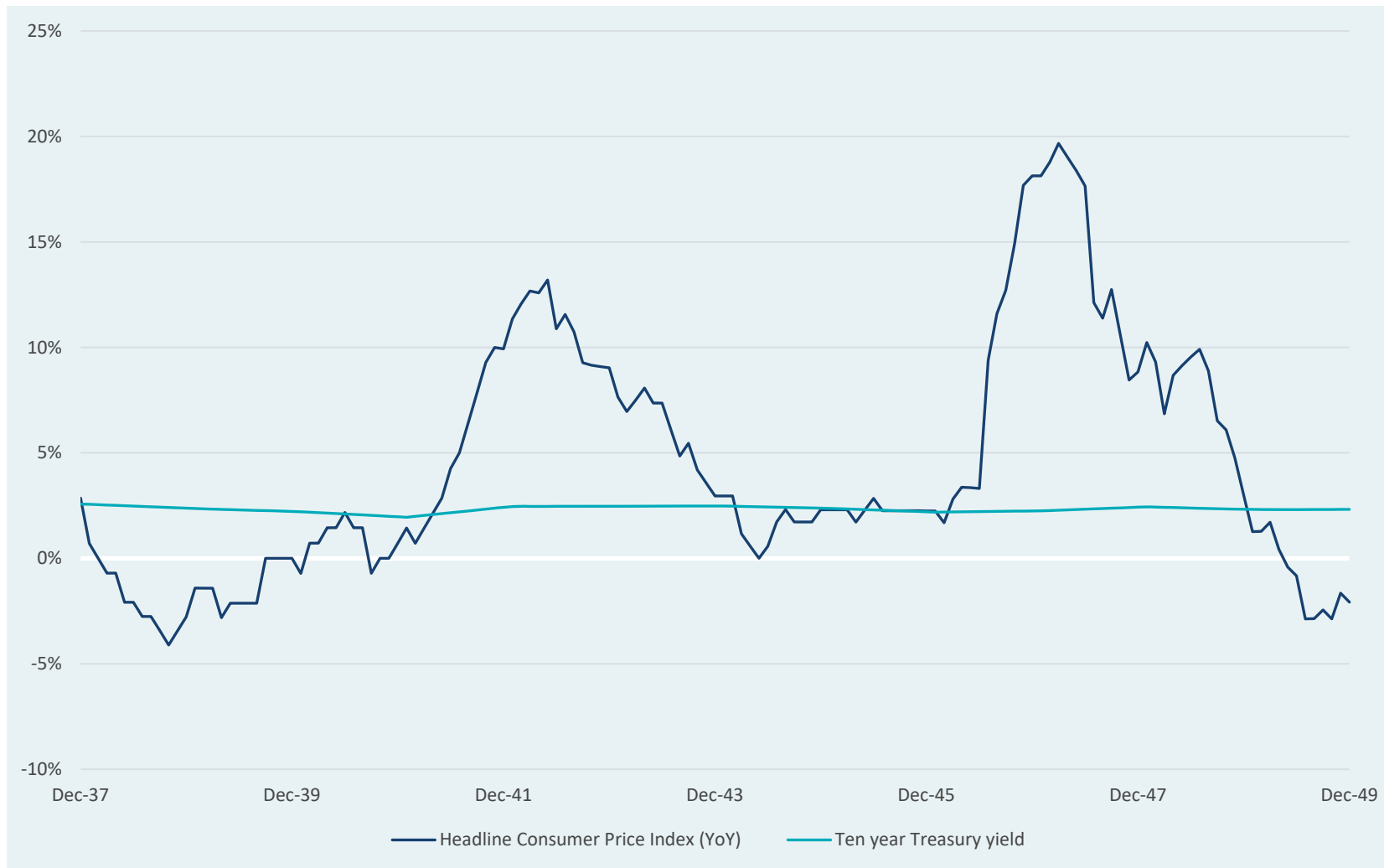
Summary

- The U.S. economy was still recovering from the Great Depression of the late 1930s, and unemployment remained high. This changed considerably in 1940, as the need to support the war effort led men and women to find new work in (or were recruited to) war-related industrial production.
- Manufacturing output doubled, the need for commodities and energy drastically increased, and railroad transportation volumes increased to never-before-seen levels. Unemployment reached extremely tight levels as the economy fired on all cylinders (likely the tightest labor market in modern history).

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- U.S. inflation had been relatively benign in the late 1930s, hovering around 0%. This changed in 1941 as inflation jumped from 0.7% to 9.9%, on the back of an extreme boom in economic growth (GDP increased from 8.8% in 1940 to 17.7% in 1941). This was unlike other periods of extreme government spending, because the spending was not intended to shore up a falling economy (enormous new government spending on top of a stable economy likely created unique inflation pressures). However, inflation after 1942-1943 fell back to a relatively low level of 2-3%.
- To keep costs of war under control, the Treasury asked the Federal Reserve to maintain short term interest rates at a below-average level. Short-term rates were pegged near 0.5% from 1942 to 1947 (prior to this time, rates of 2-4% were the norm).
- The 10-year U.S. Treasury yield kept generally stable, along stable short-term interest rates. Treasury yields did not react to large inflation and economic fluctuations, remaining between 2.0-2.5% throughout the 1940s.

World War II



Once again, Treasury yields showed nearly no sensitivity to large inflation moves during this time

Source: Shiller data, as of 3/1/22

Late 1960s

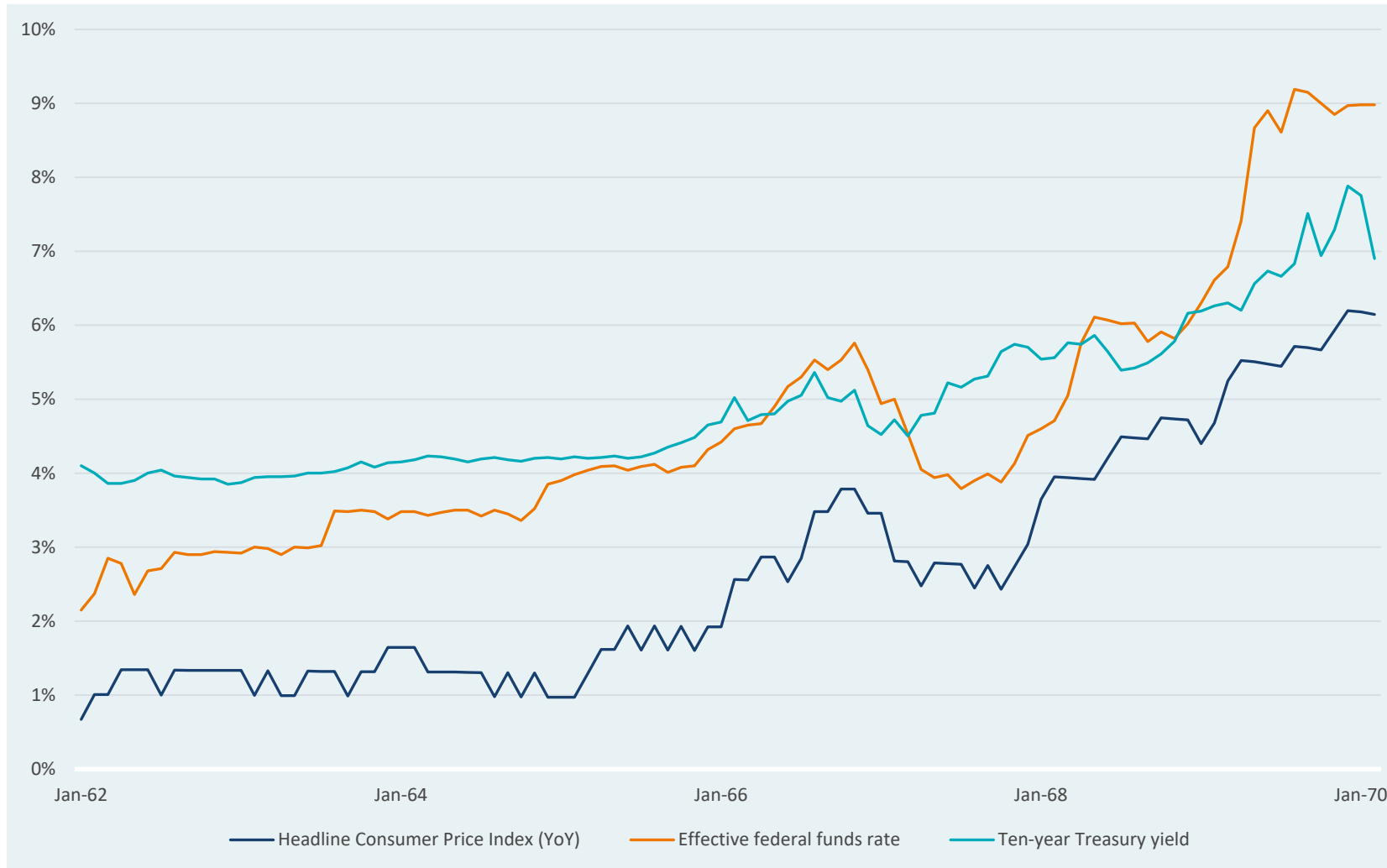
Summary

- Growth and inflation of this period can likely be partially attributed to the pro-spending and pro-growth policies of President Kennedy, who made notable efforts to repair economic growth following the 1960 recession. JFK was not worried about deficit spending, and explained publicly that increasing the national debt was necessary to get the economy moving.
- The next administration of Lyndon B. Johnson (1963-1969) furthered these spending trends, increasing the national debt by 13%. The Revenue Act of 1964 reduced income taxes, which was believed to have large positive impacts on economic growth. In 1965, Johnson committed the United States to the Vietnam War, which led to significant government spending, likely further placing upward pressure on inflation.

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- Inflation was very stable from 1960 to 1965, between 0-2%, but began rising in 1966 and reached 6% in 1970.
- Coming out of the 1960 recession, the Federal Reserve held the Fed Funds Rate near 2.0%. This rate was slowly increased to 4.0% in 1965, then was hiked more significantly, reaching 9.0% in 1969.
- The U.S. 10-year Treasury followed the same general trend of the Fed Funds Rate. The yield was very stable at 4% through 1965, then steadily increased to 7.5% in 1969.

Late 1960s



During this period, the Fed was hiking rates as inflation headed higher

Treasury yields moved in tandem with those rate hikes

Source: BLS, Federal Reserve, Bloomberg, as of 3/1/22

1970s oil shocks

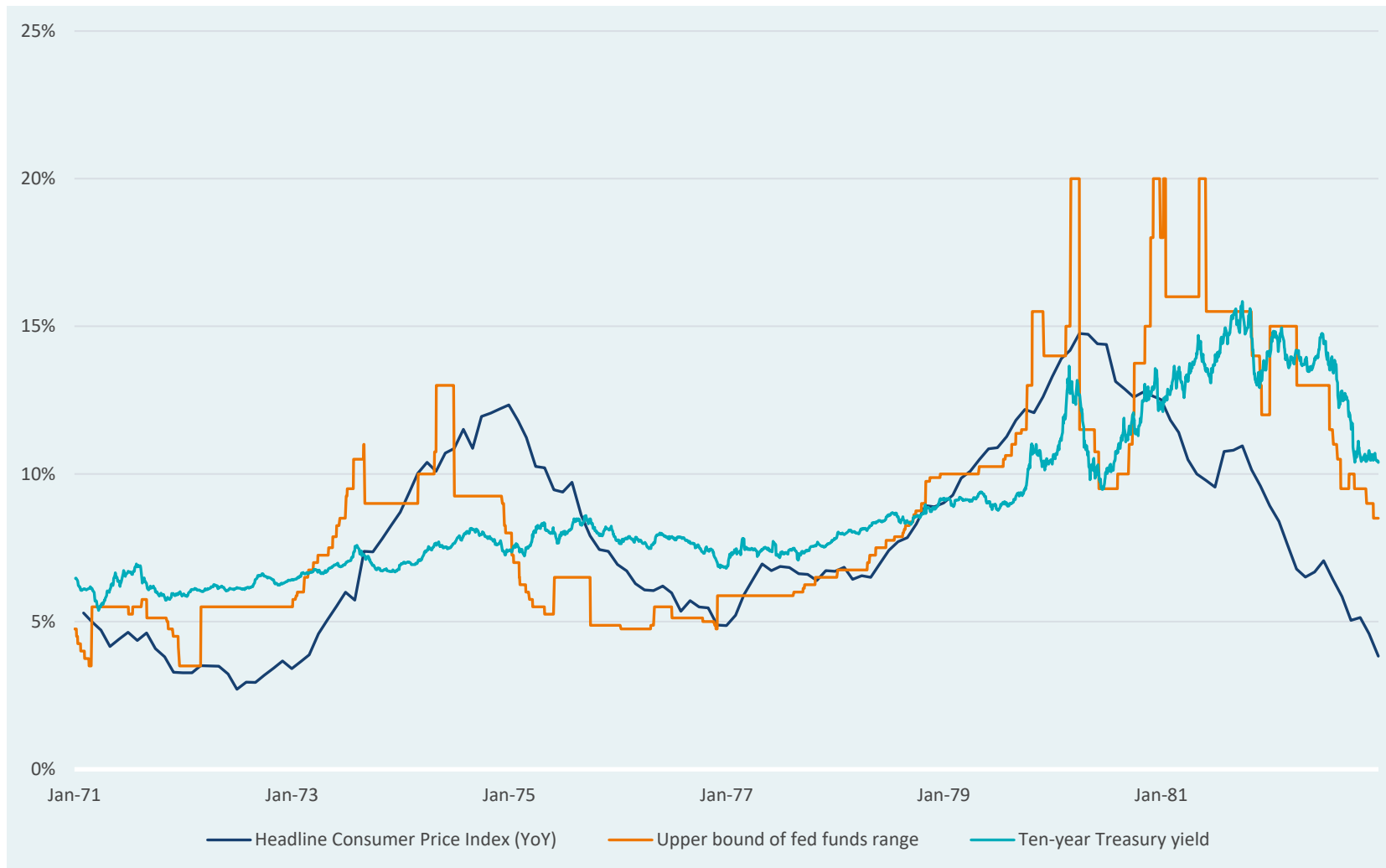
Summary

- The United States suffered its longest stretch of elevated inflation in the 1970s, driven by two separate surges in oil prices. The first was caused by an oil embargo implemented by OPEC, and the second was caused by a decline in oil production due to the Iranian Revolution and the Iran-Iraq War.
- The dramatic acceleration in inflation between 1972-1974 can be attributed to two main shocks:
 - Rising food and energy prices
 - The end of the Nixon wage-price controls program
- Thus, the state of demand had very little to do with either the acceleration or the deceleration of inflation between 1972-1976. While it did play a role, the inflation spike was primarily a supply-side issue.

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- Inflation was very stable from 1960 to 1965, between 0-2%, but began rising in 1966 and reached 6% in 1970. However, following the imposition of the oil embargo by OPEC, headline CPI rose as high as 12.3%, and by the summer of 1980, inflation has risen north of 14%.
- The Fed Funds Rate rose from around 3.5% in early 1972 to as high as 13.0% in 1974 as Fed officials attempted to rein in inflation caused by the first oil shock in 1974. After dipping slightly, inflation continued to climb into the late 70s, and Fed Chairman Volcker raised the upper end of the fed funds range to 20.0% in 1980, with the goal of taming inflation.
- Through the 1970s, the 10-year Treasury yield grinded higher fairly steadily and rose from 7% to 10% over the decade.

1970s oil shocks



During the early 1970s, inflation spiked considerably, and the Fed hiked rates as inflation jumped. However, Treasury yields were minimally impacted

This is in stark contrast to the late 1970s, where Treasuries were very sensitive to rate hikes

Source: BLS, Federal Reserve, Bloomberg, as of 3/1/22

1990s Iraqi invasion of Kuwait

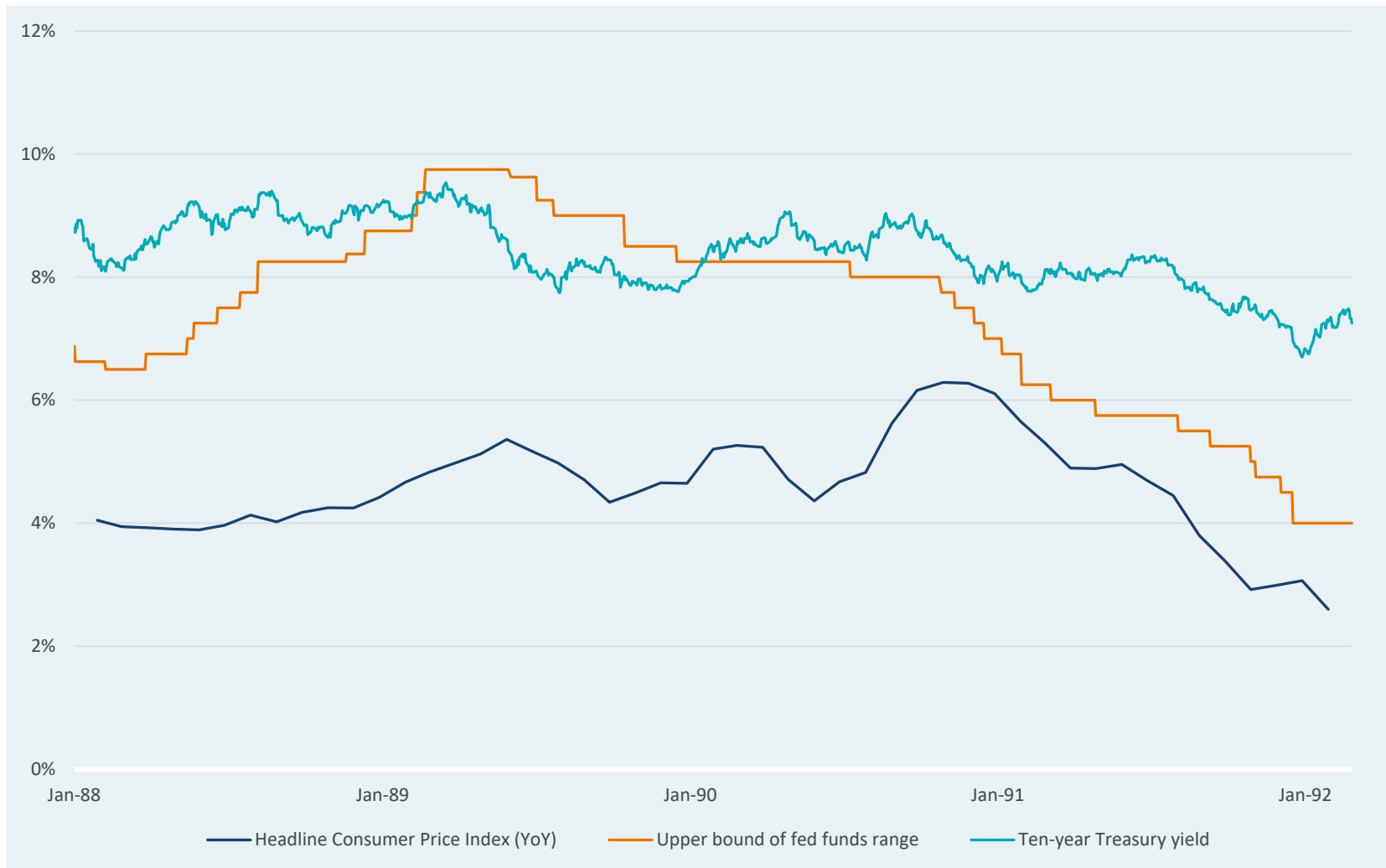
Summary

- The Iraqi invasion of Kuwait kicked off the first Gulf War, and the resultant uncertainty led to significant increases in the price of crude oil, and a short bout of high inflation.
- Rapid intervention by the United States mitigated risks to future oil supplies and helped to calm the markets and restore confidence. The oil price spike subsided after just nine months, although it took years for the combined oil production of Iraq and Kuwait to regain its former level.

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- After reaching as low as 1.1% year-over-year in December 1986, its lowest level since the mid-1960s, headline consumer price inflation picked back up to the 4-5% range in the late 80s and peaked at 6.3% in November 1990.
- The Federal Reserve did not choose to hike interest rates during this period, likely because inflation was rising specifically due to an international oil crisis. This compares to the 1970s, when the Fed hiked rates because of more broadly rising prices in the United States. In fact, the Federal Reserve actually cut the lower bound of the range for federal funds from 8.0% when Iraq invaded to as low as 3.0% by September 1992, perhaps less concerned with the risk of cutting interest rates in an environment characterized by relatively high levels of inflation caused by an energy price shock.
- From around 1990-1993, the 10-year US Treasury yield gradually fell lower, along with the Federal Funds Rate. Treasury yields jumped from 5.4% to 7.9% during 1994 while the Federal Reserve was hiking rates, but then proceeded to gradually fall, once again, throughout the 1990s.

1990s Iraqi invasion of Kuwait



The Fed hiked rates moderately along with rises in inflation

Treasury yields proved only moderately responsive to rate and inflation moves

Source: BLS, Federal Reserve, Bloomberg, as of 3/1/22

2008-2009 Global Financial Crisis

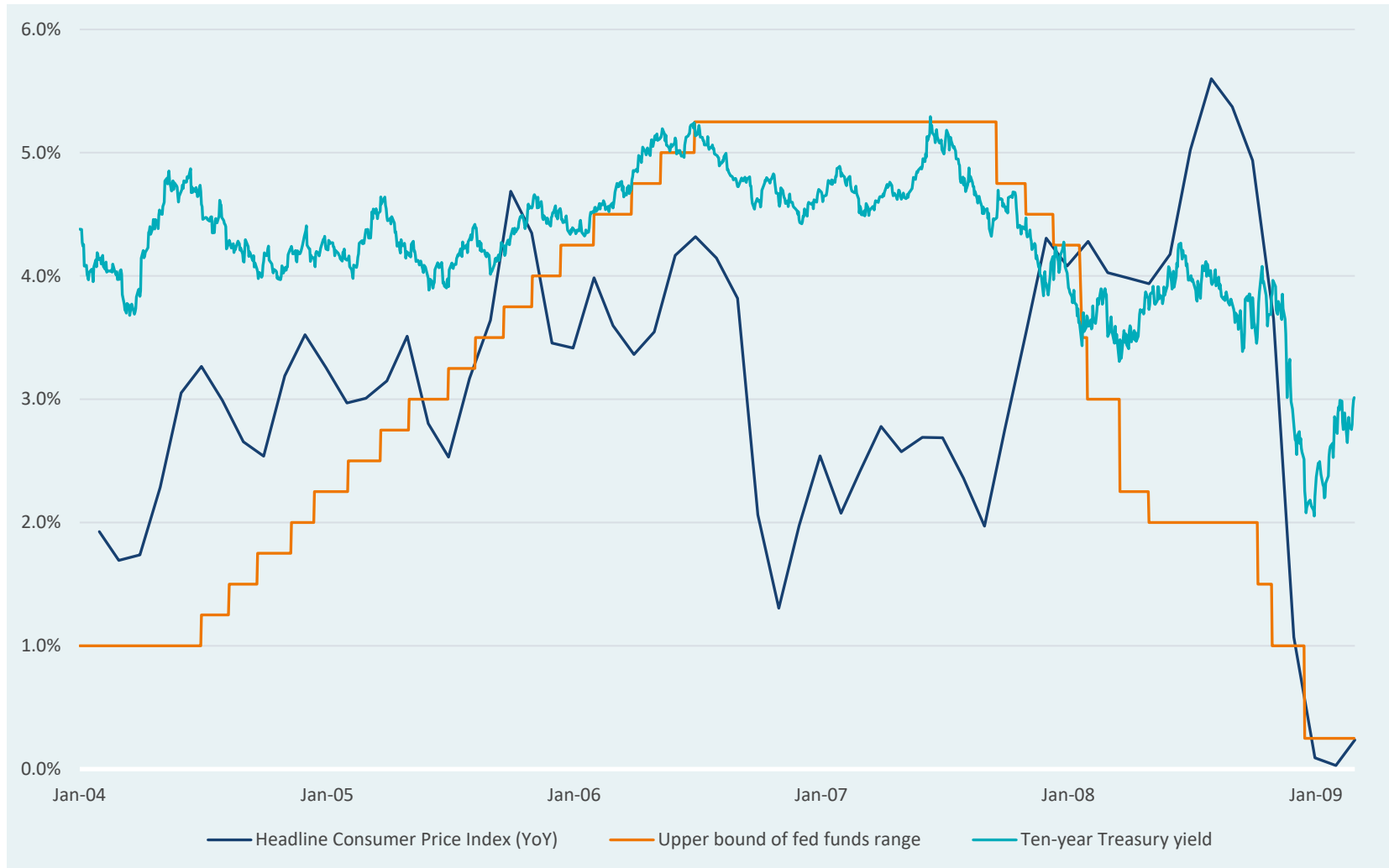
Summary

- During the Global Financial Crisis, tremors in the U.S. housing market sent shockwaves through the U.S. financial market, which then spread from the United States to the rest of the world through linkages in the global financial system.
- Banks incurred large losses and depended on government support to avoid bankruptcy, and millions lost their jobs as major advanced economies experienced their deepest recessions since the 1930s. Recovery from the crisis was also much slower than past recessions, which were not associated with a financial crisis.

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- In 2008, CPI growth rose above 5% for two months, primarily due to skyrocketing gas prices. One barrel of West Texas Intermediate crude oil cost more than \$140/barrel in July 2008, compared to \$70 just a year earlier. High levels of inflation proved to be fleeting, as the onset of the Global Financial Crisis in Q3 2008 presented massive deflationary pressure, and led to deflation that maxed out at -2.1% over the twelve months ended July 2009. Over the next 4-5 years, inflation recovered and then moderated to 2% on average.
- The effective fed funds rate fell from around 4% to around 2% in the months leading up to the GFC, and was subsequently cut to near-zero levels as the crisis fully developed.
- The 10-year Treasury yield was sitting at around 5% in mid-2007, and started to fall just a few months before the Fed started cutting interest rates in September 2007. By the peak of the inflation spike the following July, the 10-year yield had fallen from around 5.25% to around 4.00%.

2008-2009 Global Financial Crisis



Inflation moved mildly higher during this period, while Fed rate hikes were considerable

Treasury yields were only mildly affected by significant Fed rate hikes, but appear to have been sensitive to rate *cuts*

Source: BLS, Federal Reserve, Bloomberg, as of 3/1/22

COVID-19 pandemic recovery

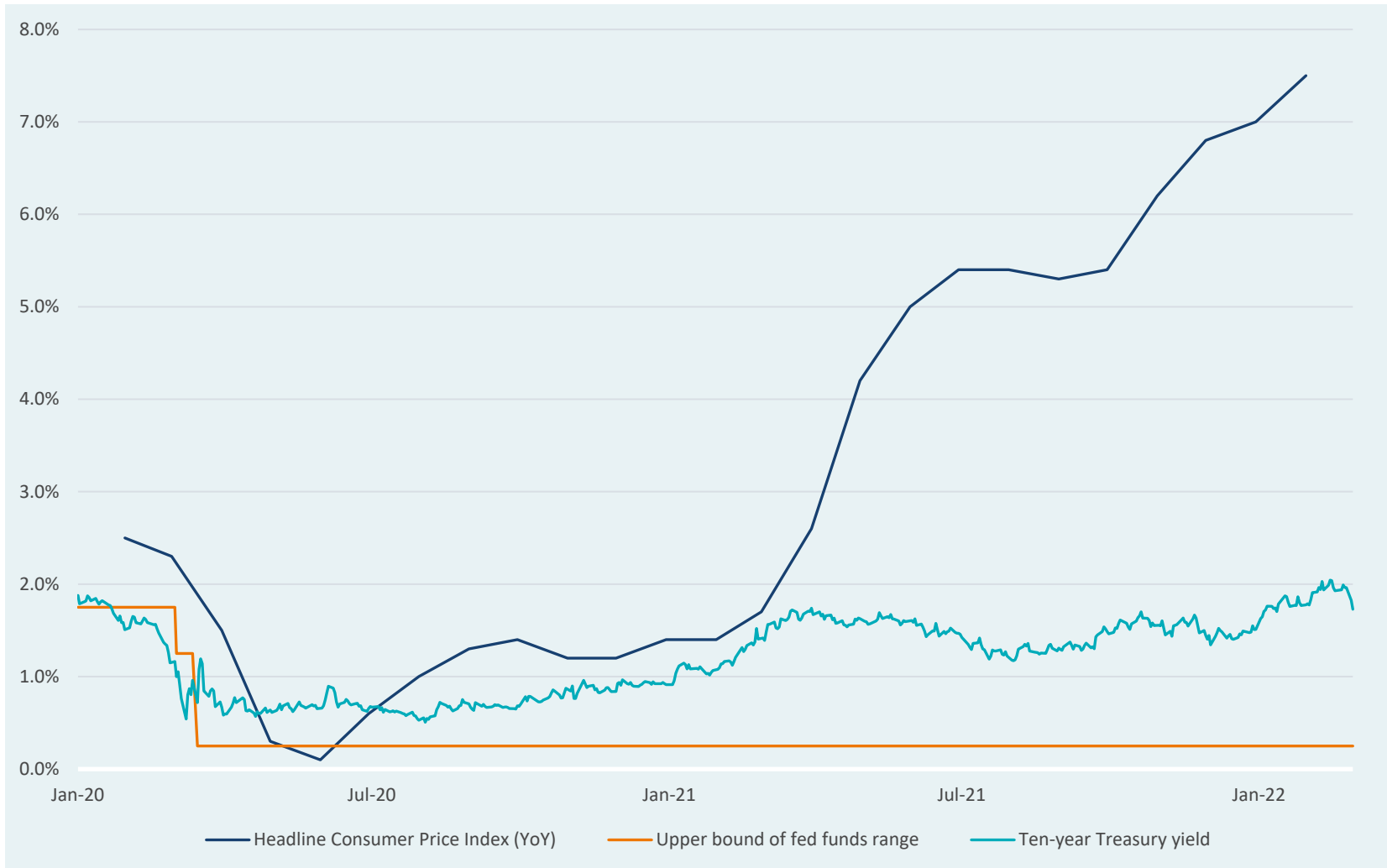
Summary

- In early 2020, a novel coronavirus emerged in China and proceeded to spread around the world. The ensuing pandemic was the most significant in scope since the Spanish flu of nearly 100 years prior, and resulted in an unprecedented global shutdown of economic activity.
- Massive amounts of fiscal and monetary support were provided by government and central bank officials in the interest of “building a bridge” to the post-pandemic future. The sudden stop and then restart of economic activity, the enormous amount of uncertainty overhanging consumers and businesses, and the magnitude of global support measures, along with pandemic-related supply chain issues and labor shortages resulted in a surge in inflationary pressures. Those pressures were originally viewed as more “transitory” in nature, but by the end of 2021, Fed officials retired that term.

What Happened? *Inflation, Fed Funds Rate, and U.S. Treasury Yield*

- Inflation fell as low as 0.1% at the beginning of the pandemic, before surging as high as 8.5% in March 2022. The surge in inflation was at first attributed to a recovery in energy prices from low levels, and to the outsized impact of a few CPI components which saw massive price surges due to pandemic-related supply chain issues. Used car & truck prices were the best example, as price increase were driven by low semiconductor supplies. In late 2021, after inflation had risen from 0.1% to around 5.0%, inflationary pressures showed evidence of broadening to other categories such as food and shelter.
- During the beginning of the equity market sell-off, the federal funds range was cut to 0.00-0.25%. At the time of writing, the Fed is planning to hike the Fed Funds rate to between 2.25%-2.50% for the long term.
- The 10-year U.S. Treasury yield fell as low as 0.54% during the pandemic, then recovered to 2.8% in April 2022 as the economy recovered. Treasury yields were fairly rangebound during 2021 but have lifted in early 2022.

COVID-19 pandemic recovery



During this period, Treasuries fell along with Fed rate *cuts*, but have remained low along with a low Fed Funds rate

This is despite a large jump in inflation

Source: BLS, Federal Reserve, Bloomberg, as of 3/1/22

Inflation environment scorecard

	DEMAND & SUPPLY DYNAMICS			MONETARY/FISCAL DYNAMICS			OTHER
	Significant increase in demand	Supply disruptions	Labor shortage	High fiscal spending	Monetary accommodation	Deficit spending	Geopolitical tensions
Great Depression (peak inflation 5.6%)						 *	
World War II (peak inflation 9.4%)							
Late 1960s expansion (peak inflation 6.2%)							
1970s oil shocks (peak inflation 14.8%)							
1990 oil price shock (peak inflation 6.3%)							
2008-2009 GFC (peak inflation 5.6%)							
Covid-19 pandemic recovery (peak inflation 7.5%)							
MAGNITUDE	 High	 Med-High	 Medium	 Low	 None		

Note that this table aims to represent conditions that *contributed to* each inflationary environment

Note: The economic events listed above are admittedly incredibly complex, with intelligent arguments on many sides regarding causes, effects, and general dynamics of each variable listed. Please accept this summary as a well-meaning attempt at an approximation.

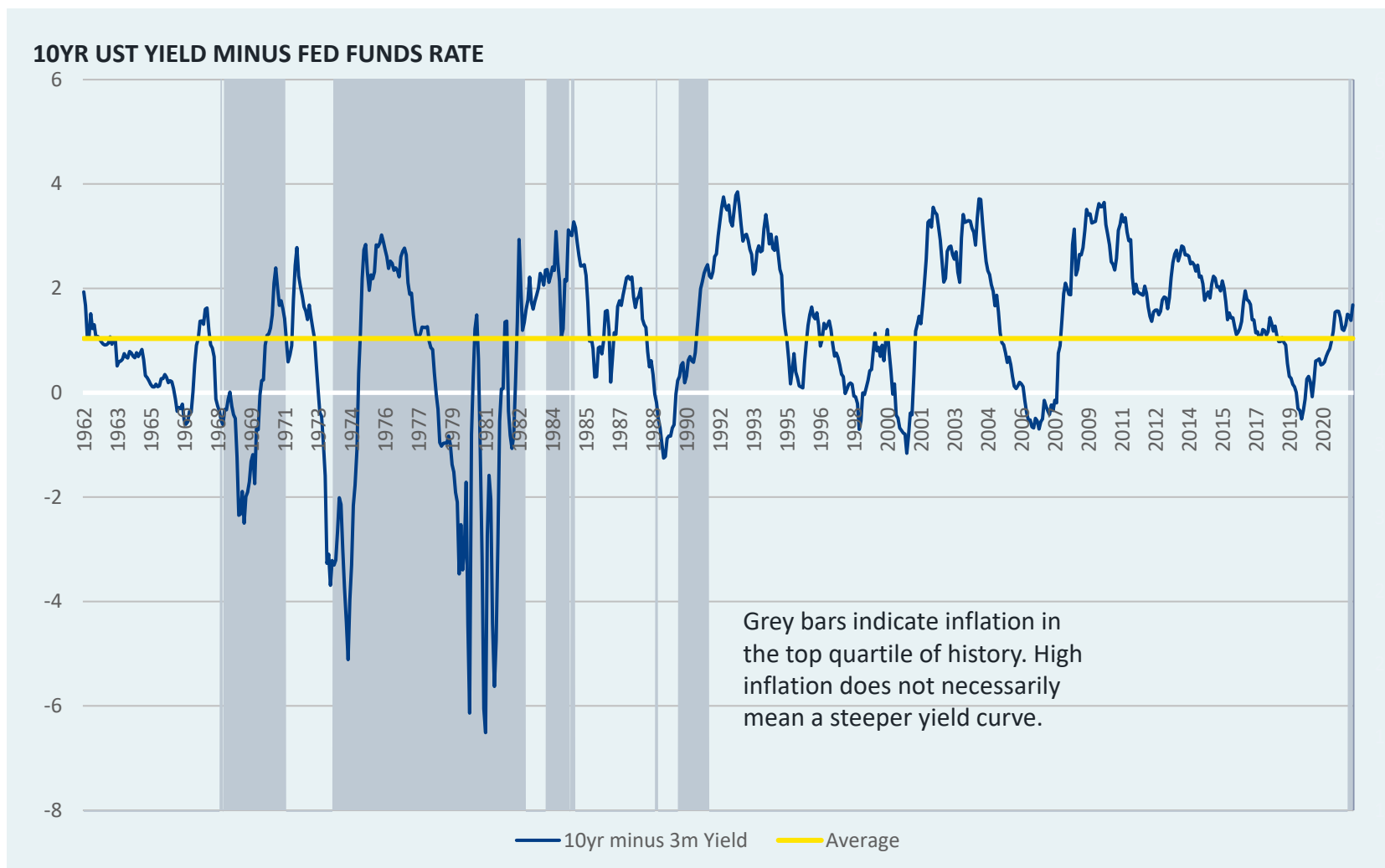
*The U.S. Government ran a budget surplus in the years leading up to the Great Depression. As the recession began, this surplus changed to deep deficit. This deficit spending peaked at 5.4% of GDP in 1934.

The relationship between Fed Funds Rate, Treasury Yields, & Inflation

Summary

- After studying inflation events of the past 100 years, we find that bond yield levels have always been restrained by the Federal Funds Rate. In other words, there has not been a “rising rate environment” where bond yields rose significantly without the Federal Reserve pushing through most of those rate rises by raising the Fed Funds Rate (p. 5-18). In this section we take a closer look at the data:
 - We support this idea by showing that the maximum gap between the Fed Funds Rate and the U.S. 10yr Treasury yield has been around 3.5% (p. 22). In the current environment, this suggests that we should expect a maximum U.S. 10yr Treasury yield a bit above 5.9%, unless the Federal Reserve changes their interest rate guidance significantly (p. 29). “Average” curve steepness in the future would imply a 10yr UST yield of around 3.4% (p. 29). This compares to current market pricing for U.S. 10yr Treasury yields, which suggests a yield of around 3.2% in 10 years (p. 26).
- Events of the past 100 years suggest that bond yields do not necessarily rise in reaction to higher inflation. There are historical examples of spiking inflation, without much of a reaction by U.S. Treasury yields (p. 10 World War II, and p. 17 current day, for example).
 - During historical events where the Fed did not hike rates, inflation rose but interest rates stayed in place, resulting in notably negative real interest rates. Many investors today seem to expect interest rates to naturally move higher along with stubbornly higher inflation, but history shows us that this may not be an appropriate assumption.

Bond yields are restrained by the Fed



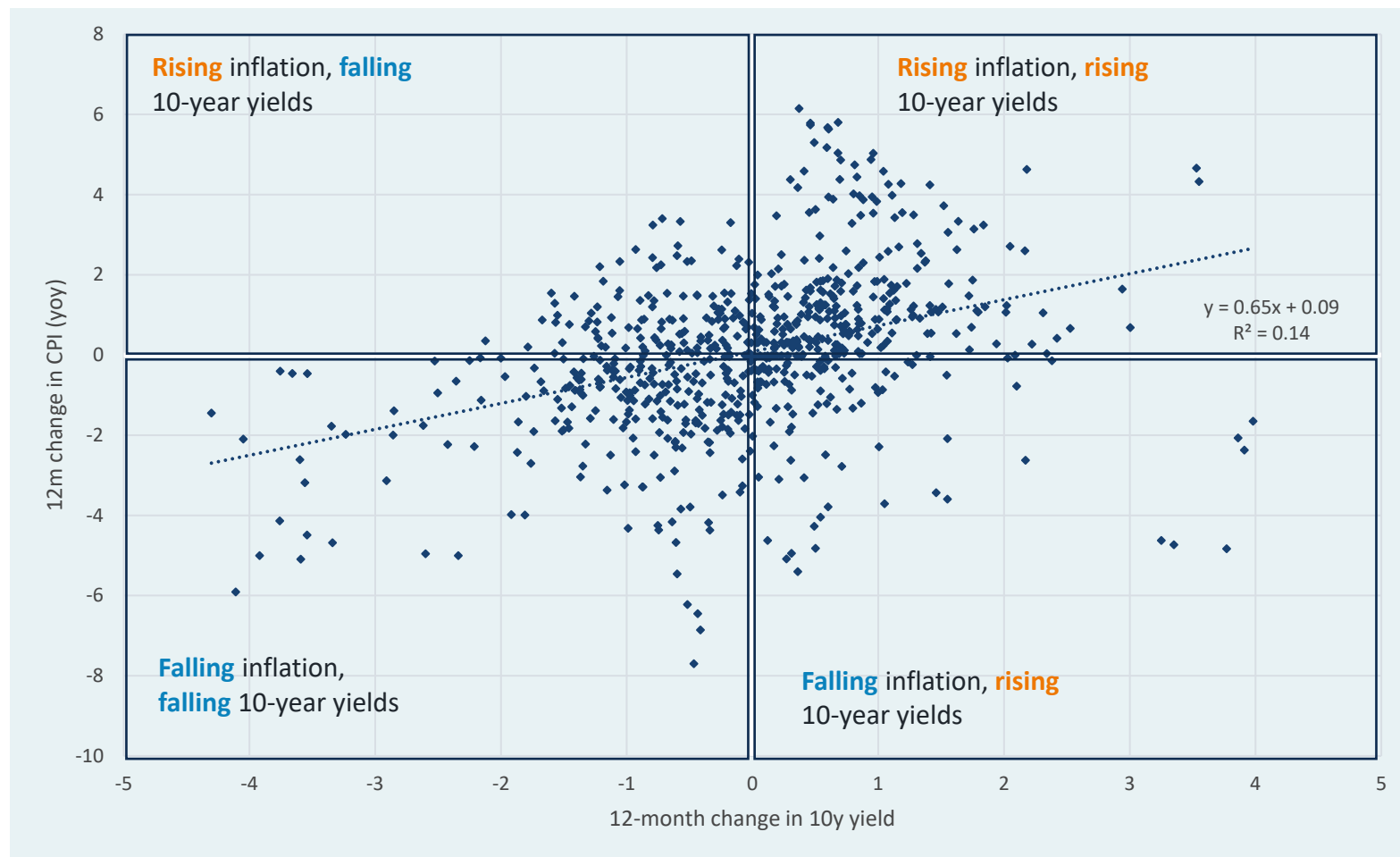
The average yield curve steepness has historically been 1.0%

Maximum steepness has been around 3.5%. **In other words, history suggests that rates cannot rise too much unless the Fed is hiking**

Source: Verus, FRED

How have long rates moved with inflation?

INFLATION & THE 10-YEAR YIELD

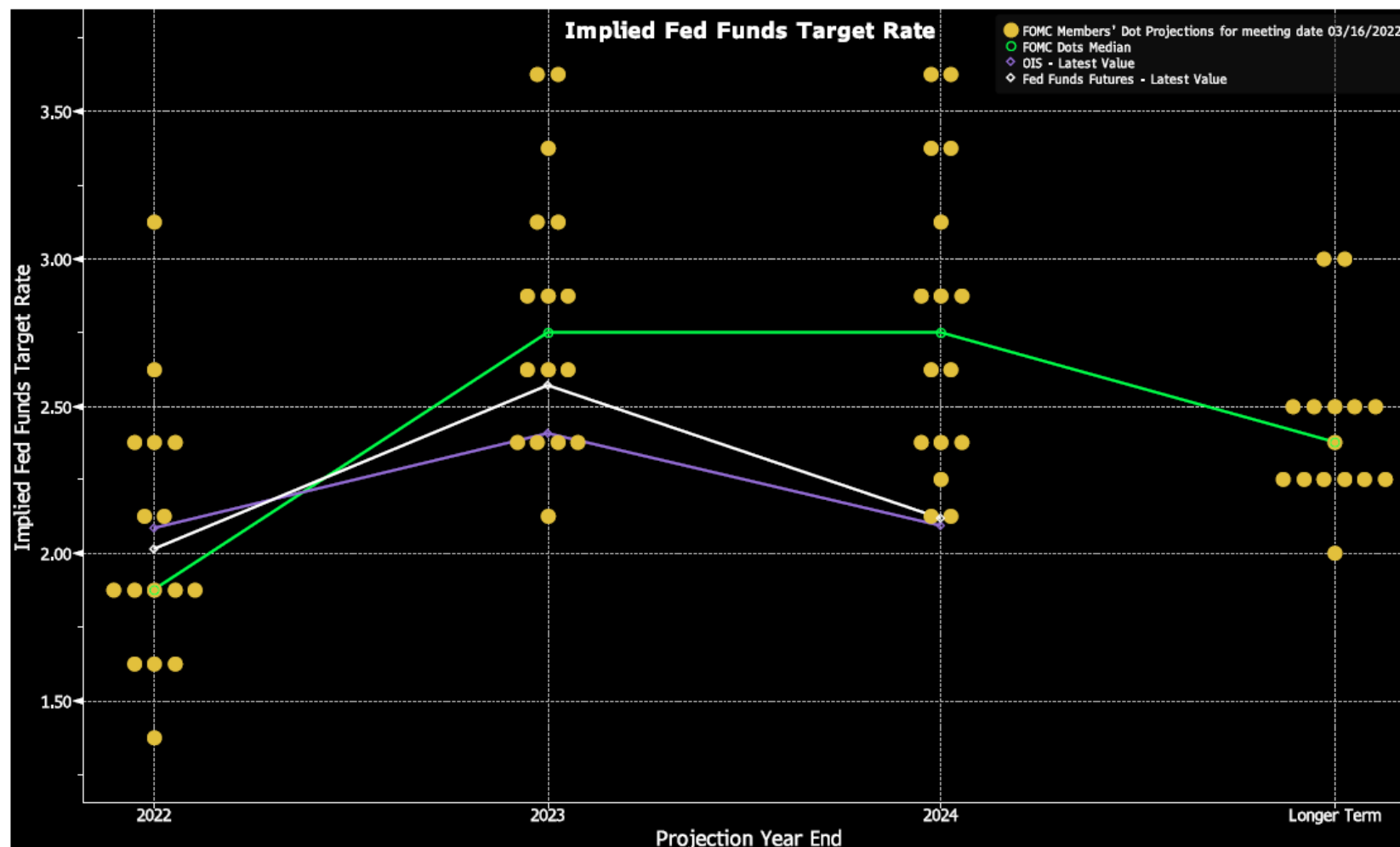


Source: Bloomberg, as of 1/28/22

While yields and inflation do not necessarily move together, they have moved in the same direction more often than not, over history

As outlined in this document, much of this co-movement was due to Federal Reserve rate policies

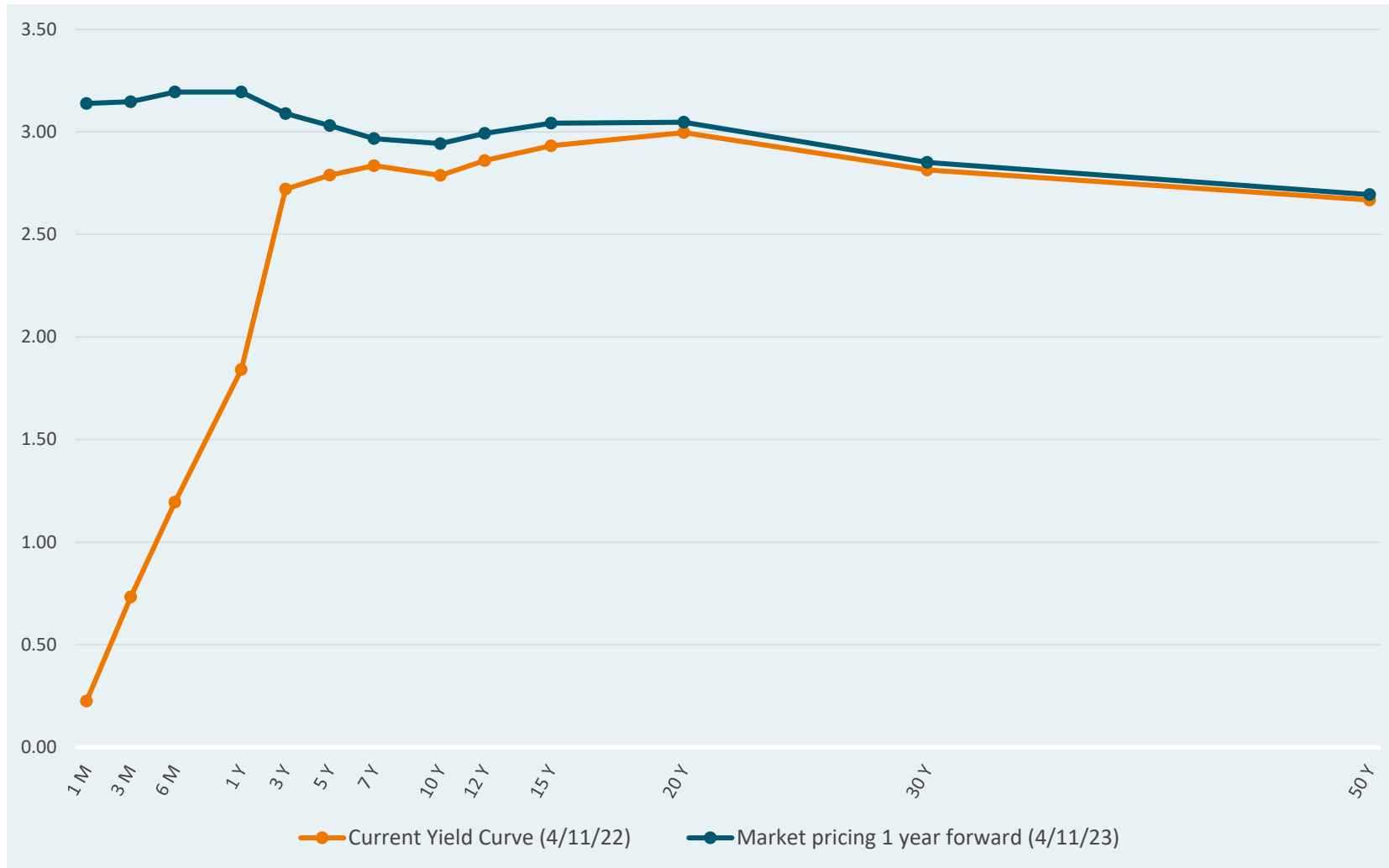
Fed “dot plot”



Federal Reserve FOMC members predict a long-run interest rate of approximately 2.25-2.5%

Source: Federal Reserve, as of 3/16/22

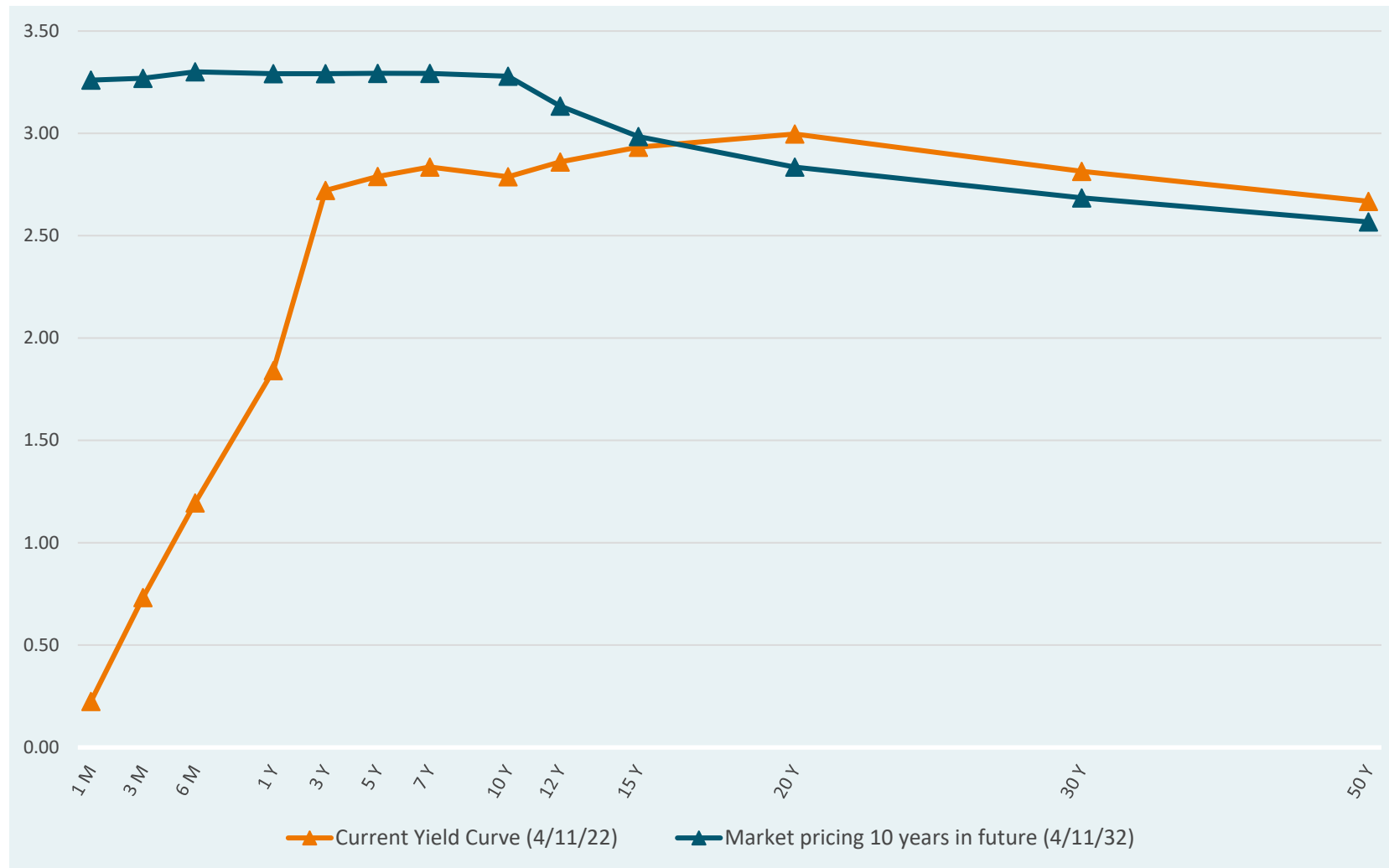
Expected “flattening” of the yield curve (1 year into the future)



The Fed's rate hikes are expected to only impact very short-term interest rates

Source: Bloomberg, as of 4/11/22

Expected “flattening” of the yield curve (10 years into the future)

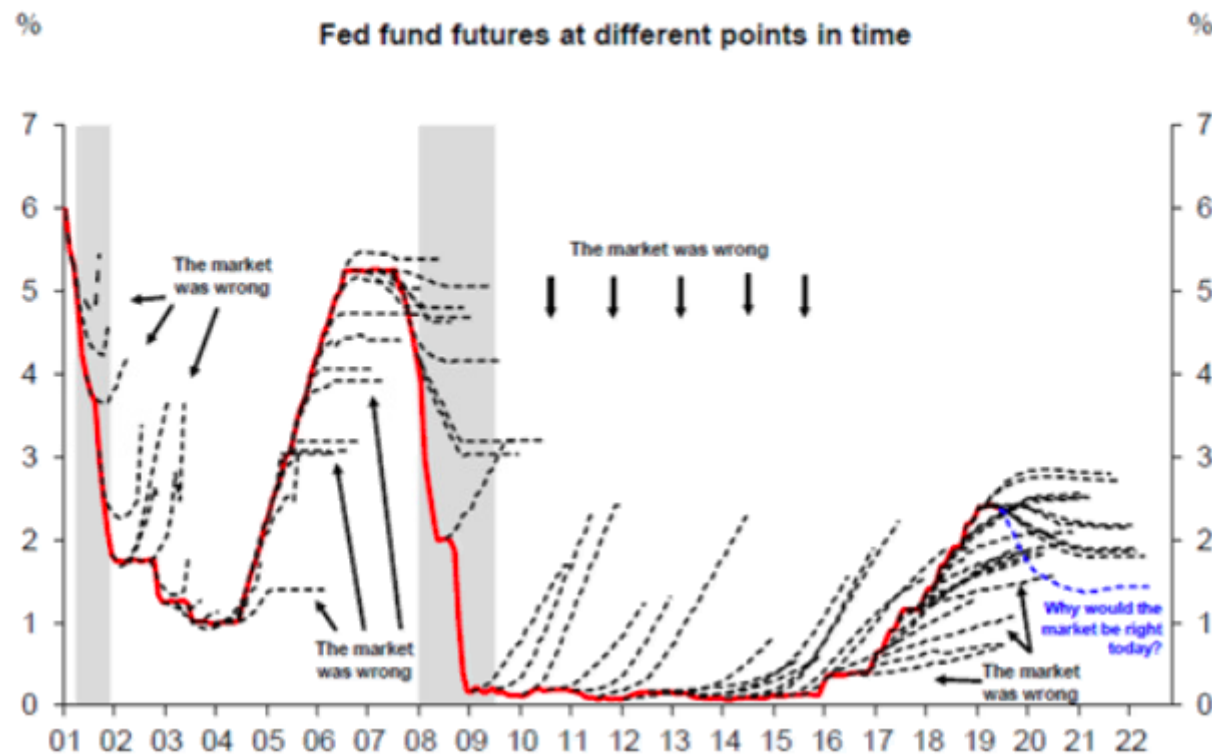


The market expects the Fed to successfully hike the Fed Funds Rate to approx. 3.2%

Source: Bloomberg, as of 4/11/22

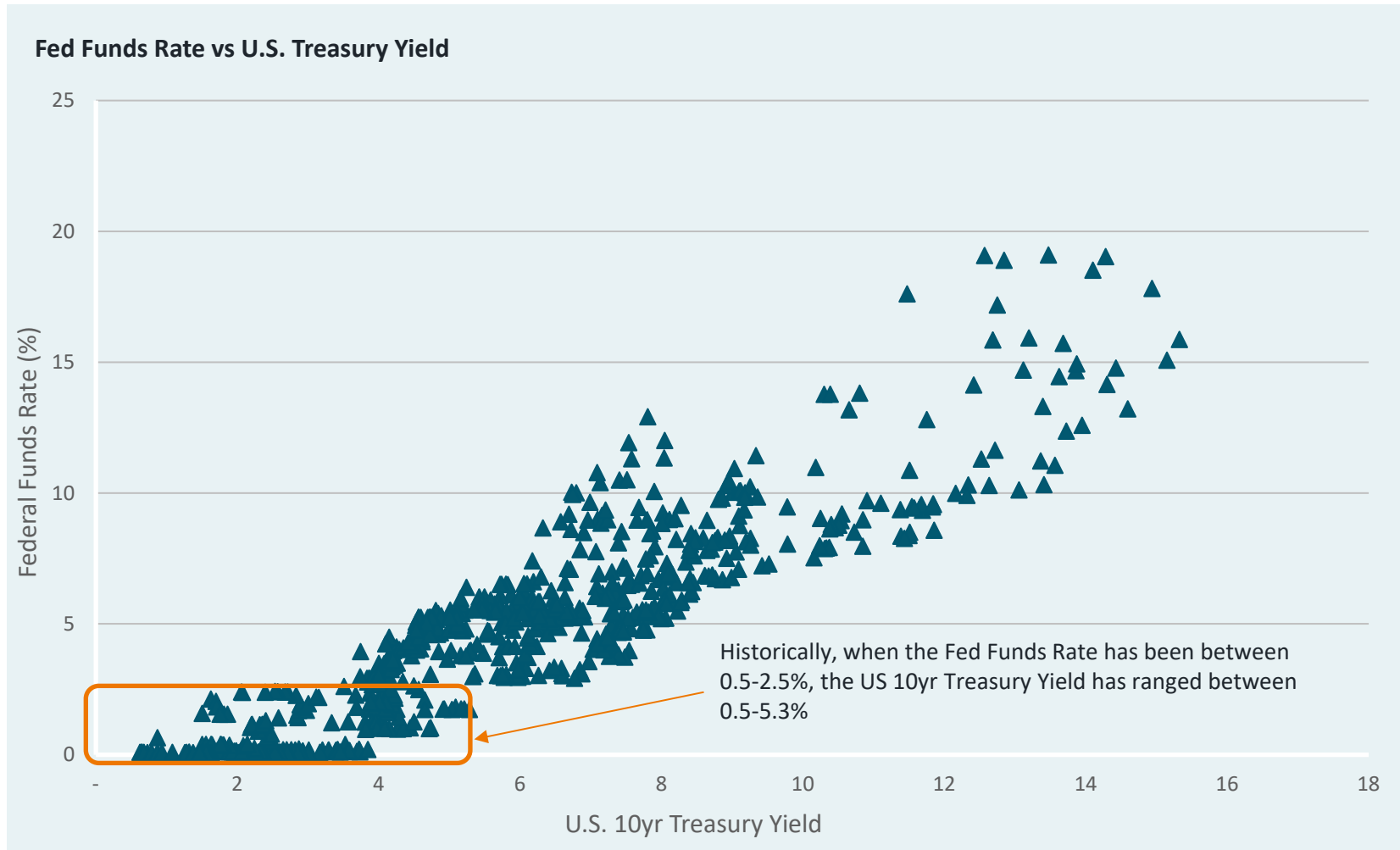
...though forecasts of rate hikes have not always been particularly accurate

The market is almost always wrong about what the Fed will do



Source: Deutsche Bank

Historical relationship between Fed Funds Rate & 10yr U.S. Treasury yield



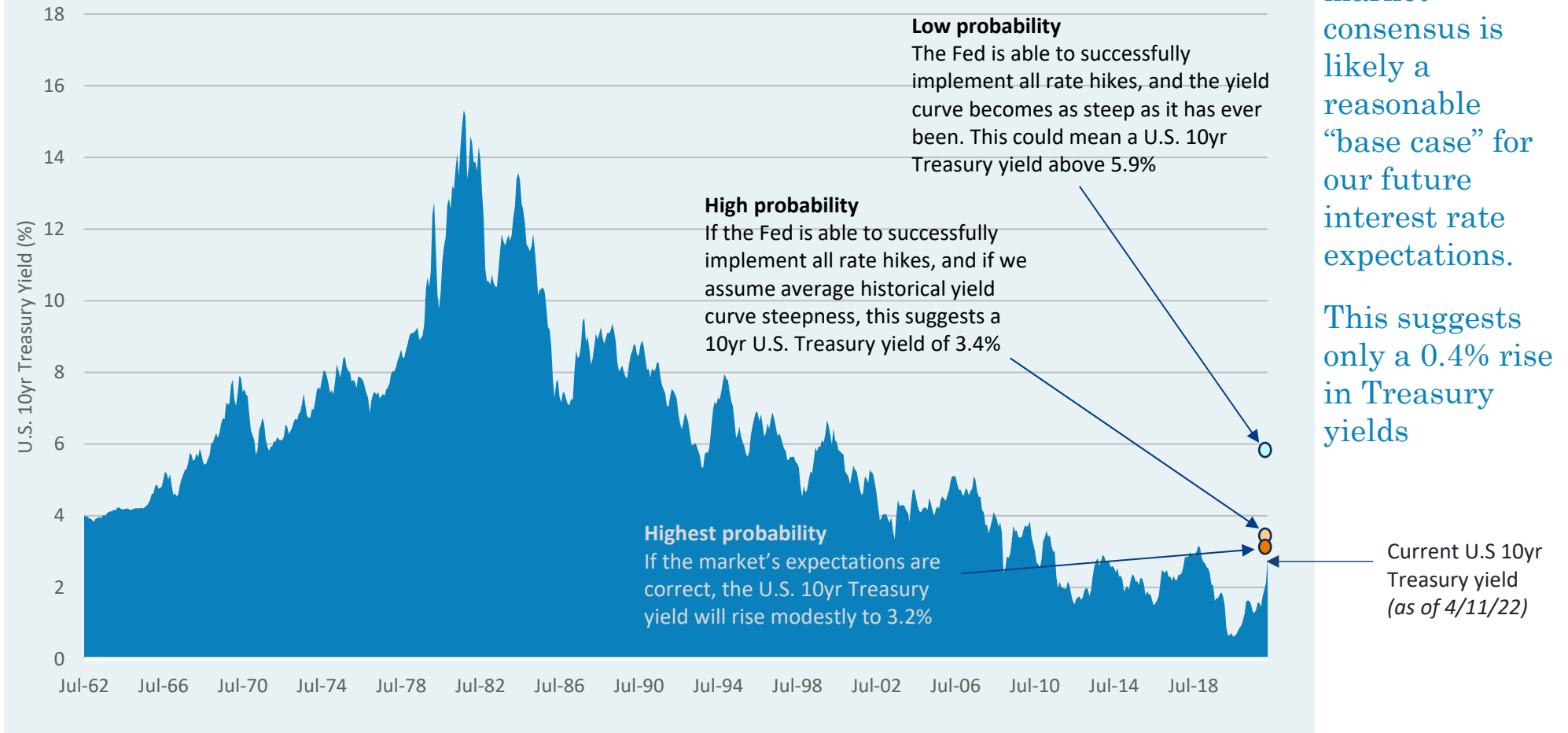
In all historical inflation environments examined, the U.S. 10yr Treasury yield followed the path of the Fed Funds Rate

This implies that, currently, the Fed Funds rate will determine interest rate levels

Source: Verus, FRED

Identifying some possible scenarios, using history as a guide

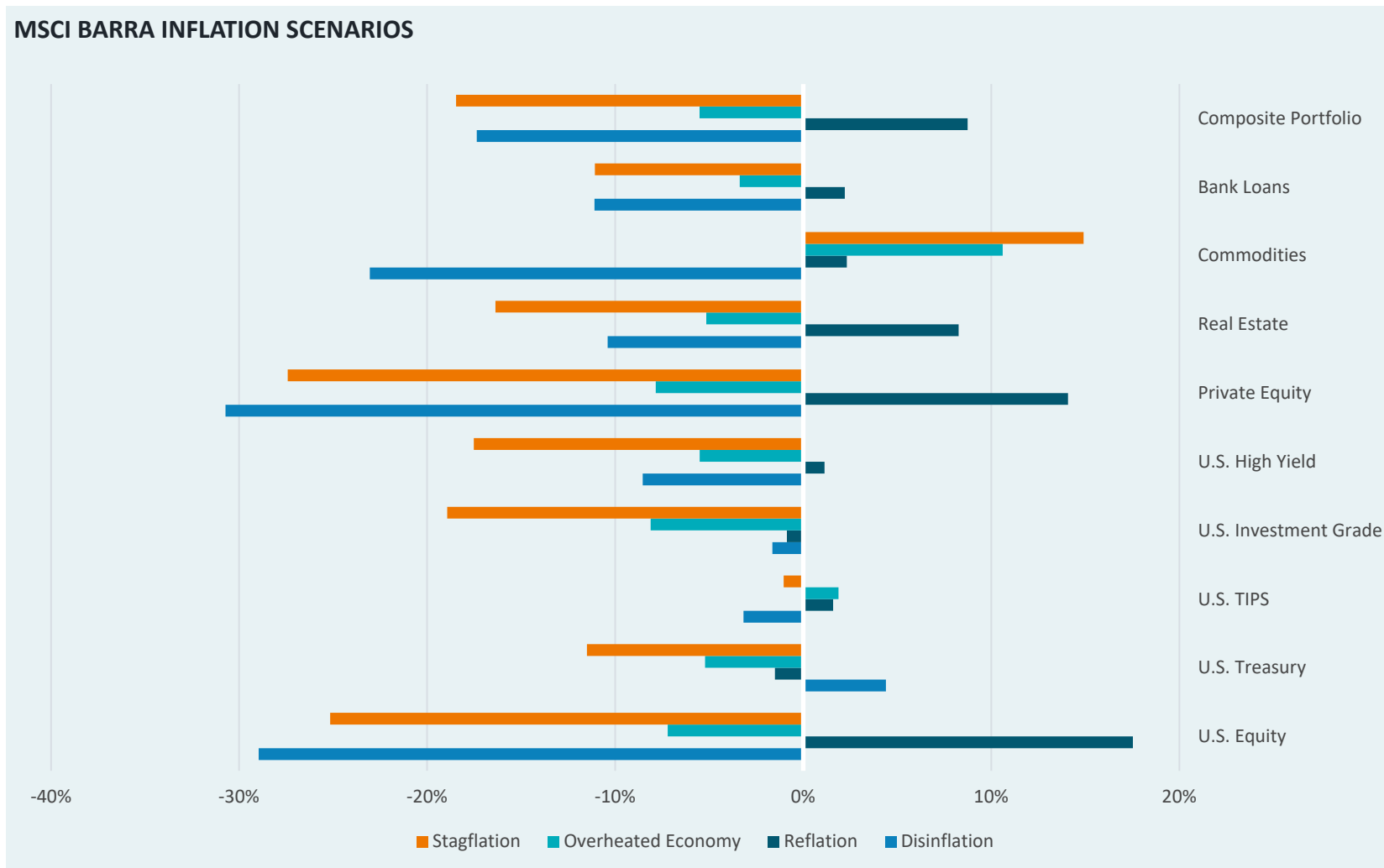
10YR U.S. TREASURY YIELD



Source: Verus, FRED

MSCI BarraOne: Possible implications of a booming inflationary environment for the markets

MSCI Barra inflation scenarios



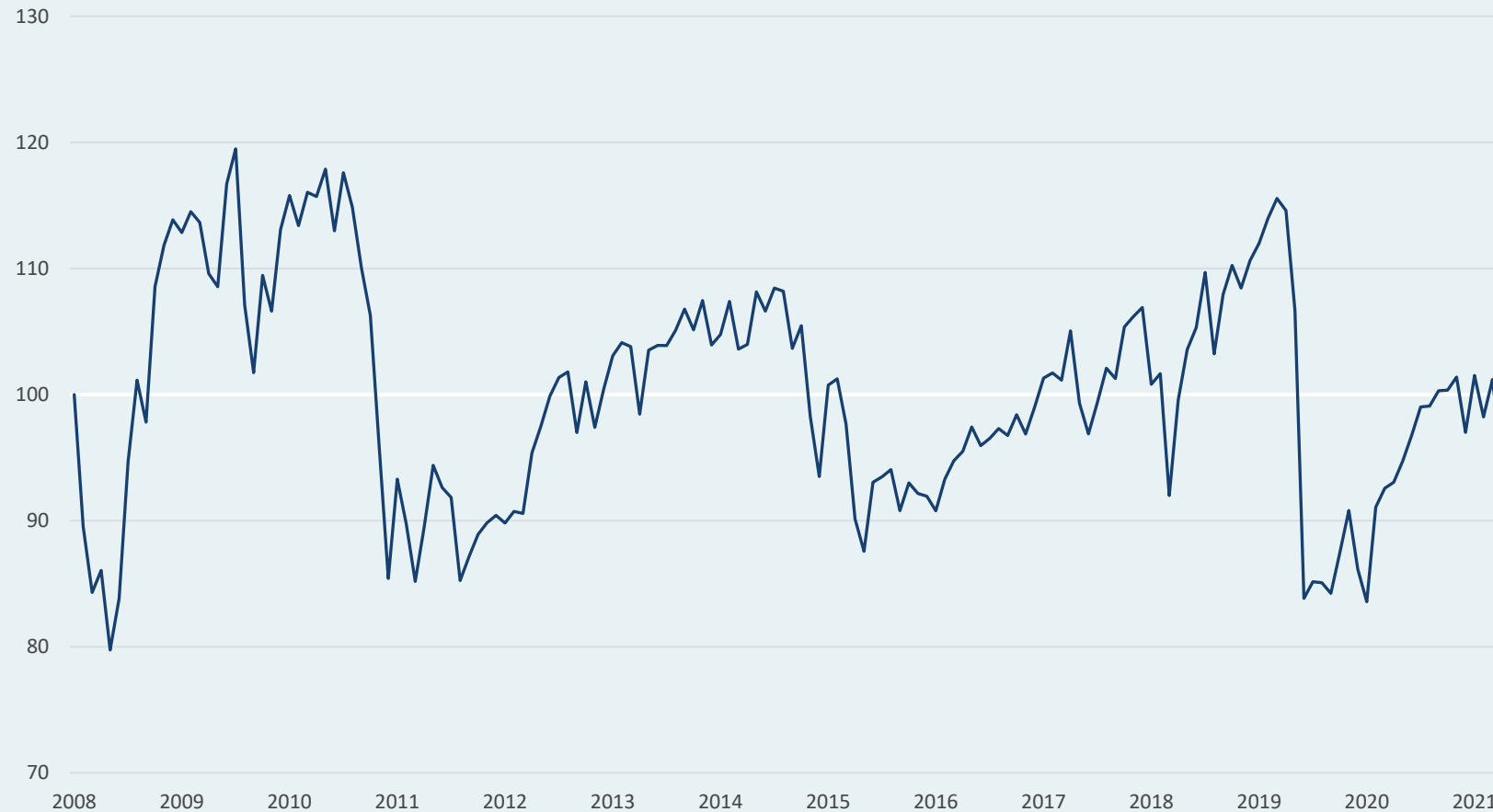
Source: MSCI, please reach out for details of MSCI Barra Inflation Scenarios

Composite portfolio composition: U.S. equity all cap 35%, UST 10%, US TIPS 5%, US Corp IG 15%, US HY 5%, Private Equity 15%, Real Estate 5%, Commodities 5%, Bank Loans 5%

Other considerations

How balance sheet dynamics may affect inflation

ACWI / BIG FIVE CB BALANCE SHEETS, NORMALIZED TO QE1

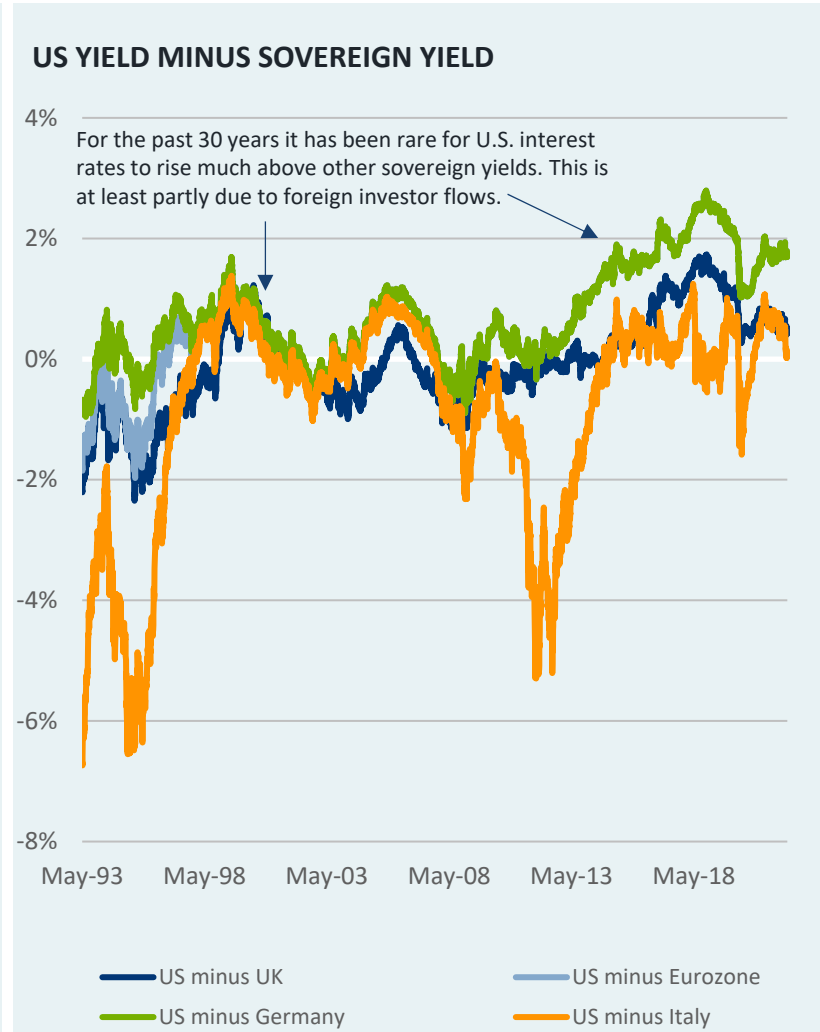


Expansion of major central bank asset purchases has created some inflation in financial asset prices, but not so much goods and services prices.

The MSCI ACWI Index has traded mostly sideways since the GFC when accounting for balance sheet expansion.

Source: Bloomberg, MSCI, Federal Reserve, Bank of England, European Central Bank, People's Bank of China, Bank of Japan
ACWI refers to MSCI ACWI IMI TR (USD), monthly.

Limiting effect of foreign money flows



U.S. interest rates have historically been anchored to the interest rate levels of other developed nations

This is intuitive, as foreign investors may pour funds into U.S. Treasuries if they offer higher relative yields, which pushes U.S. rates back down

Conclusions

Conclusions

- Longer-term bond yields have, surprisingly, not been particularly sensitive to big rises in inflation (demonstrated by the low *r-squared* measure on slide 23). But they have been sensitive to big changes in Fed interest rate policy. This is shown on slides 5-18, as environments where inflation spiked but the Fed did not hike (Great Depression, WWII, and current day, for example) resulted in very little interest rate movement, but environments where inflation spiked and the Fed did hike (late 1960s and 1970s oil crises, for example) resulted in material interest rate rises.
 - During environments where inflation spiked but the Federal Reserve did not hike, real yields often went negative for sustained periods of time.
- This suggests that, if history is a guide, there will not likely be a large rise in interest rates unless the Fed changes its interest rate policy (i.e. if the Fed signals plans to hike interest rates much more than current policy communication suggests).

Investors still need to be aware that the sensitivity of portfolios to even small rises in interest rates can result in portfolio losses. Even limited moves at the long end of the curve driven by moves on the short end of the yield curve can have substantial portfolio performance impacts. Investors relying on their bond portfolio as a ballast should keep this effect in mind.

Conclusions

- So, what might we expect for interest rate levels (10yr US Treasury yields), going forward?
 - **If market pricing is correct:** almost no material rise in interest rates over the next 1 year (about 0.1%), and over the next 10 years about a 0.4% rise.
 - **What was the historical range, given a 2.5% Fed Funds Rate:** US 10yr Treasury yields have ranged between 0.5% to 5.3% at a 0-2.5% Fed Funds Rate.
 - **Assuming historical yield curve steepness:** 2.8% US 10yr Treasury yield assuming a flat curve, 3.8% yield assuming average curve steepness, 5.9% assuming maximum historical curve steepness.

Notices & disclosures

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