White Paper
Quantitative Research

Q1 2023

Asset Performance in Different Inflation and Interest Rate Regimes

Kartik Chawla
Senior Quantitative Research Analyst
SPDR ETF Model Portfolios, State Street Global Advisors

Jedrzej Miklaszewski
Quantitative Research Analyst
SPDR ETF Model Portfolios, State Street Global Advisors

Anthi Tsouvali
Senior Macro Strategist
State Street Global Markets

Daniel Ung, CFA, CQF, CAIA, FRM
Head of Quantitative Research & Analysis
SPDR ETF Model Portfolios, State Street Global Advisors

STATE STREET GLOBAL ADVISORS SPDR®

Contents

03 Research Paper: Asset Performance in Different Inflation and Interest Rate Regimes

04 1.0 Monetary Tightening and Easing

06 2.0 Markov Regime Identification
07 2.1 Interest rates regime analysis
07 2.2 Interest rates-inflation regime analysis

11 3.0 How to position in current environment?
11 3.1 Energy
12 3.2 Health Care

As the world was still recovering from the after-effects of the COVID pandemic, Russia invaded Ukraine. Both of these events led to significant disruption in supply chains and sent shockwaves throughout the world economy and have manifested in inflation levels not seen since the 1970s. Against this backdrop, central banks have attempted to contain inflationary pressures by hiking interest rates. The consensus view among economists is that the Fed will continue to raise its benchmark rate at a rapid pace until inflation eases much more, even though economic growth has slowed markedly.

As noted in the 2023 Global Market Outlook, there is the risk of a central bank policy mistake, brought about by monetary tightening that could prove too aggressive. This risk remains even if central banks were correct in initiating or accelerating price hikes in a bid to bring monetary policy in line with employment and price indicators. In view of this, investors should exercise caution over the positioning of their investment portfolios and pay due regard to the evolution of interest rates and inflation.

To assist investors in their decision making, we have carried out a detailed analysis on how investment returns have behaved across different macroeconomic regimes since the late 1970s and early 1980s. While history may not necessarily repeat itself, historical analysis can nevertheless be an instructive guide to the future.

In the first section, the paper examines the behaviour of a variety of common, publicly traded investment exposures in both monetary tightening and easing environments. In the second section, we examine the performance of these assets in different macroeconomic variable regimes, determined through a variety of Markov regime switching models, to see if any useful insights can be gleaned from history. Most studies focus on evaluating the performance of different assets on the basis of one macroeconomic variable (e.g. interest rates) and, specifically, one manifestation of that variable (e.g. change in interest rates). Here we seek to study the performance of different assets based on the joint regimes of two different macroeconomic variables (e.g. inflation and interest rates) or, more precisely, the different manifestations of those variables (e.g. inflation level and interest rates volatility).

The joint regimes are created by combining the individual Markov regimes for the variables under consideration. For example, we have studied the performance of select assets on the basis of inflation and interest rate volatility, whose individual Markov regimes are determined separately and then combined later to create a joint regime. In addition to interest rate volatility, we have examined joint regimes between inflation and interest rate level, interest rate change and the volatility of interest rate change. As additional analyses, we have also created joint regimes on the basis of different manifestations of interest rates involving interest rate volatility, interest rate change and interest rate levels, among others. The focus of this study is the US.

1.0 Monetary Tightening and Easing

In this first section, we study how assets behave in monetary tightening and easing regimes by examining both the Fed funds and three-month T-bill rates. In accordance with the definition from Exploring Rates Sensitivity,[1] the hiking regime occurs when both the Fed funds and three-month T-bill rates rise above their 12-month rolling average or the T-bills exceed the 12-month rolling average by 0.8%. The cycle comes to a halt when the T-bill is lower than the 12-month rolling average by 0.4% and the Fed funds rate is also lower than the 12-month rolling average, or the T-bill is less than the rolling 12-month average by 0.8%.

Figure 1 shows that around 30% of the observations are in the hiking cycle whereas 70% are in the normal cycle. According to our results, the assets that have experienced the largest return differential are commodities, inflation-linked bonds and staples. Of particular note is that a hiking rate cycle is unfavourable to fixed income instruments, particularly in the case of inflation bonds where the performance decline is acute. However, this sharp response to rate rises may largely be due to the long duration of the inflation bonds being studied, rather than purely the inflation characteristics of those bonds.

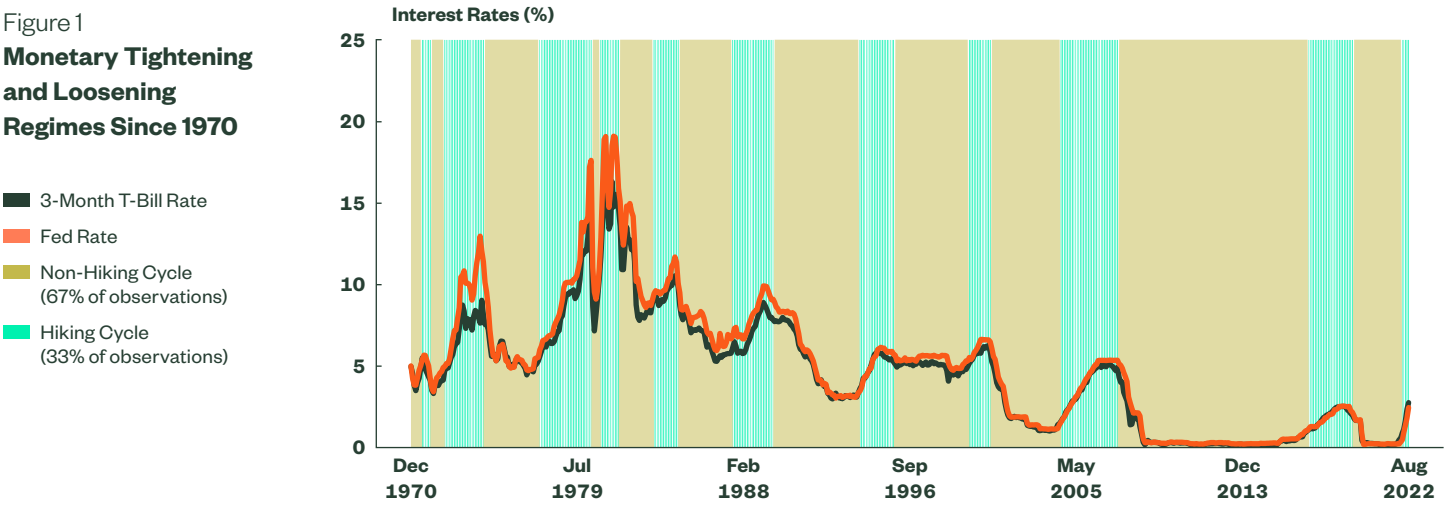
Consumer discretionary is another exposure that reacts adversely to rate hikes. The economic rationale behind this is that this sector performs well in a bearish market when the economy weakens and, as interest rate increases are generally associated with a stronger economy, the performance of the sector is generally expected to weaken. This finding is largely consistent with that of de Franco, Monnier and Rulik (2017),[2] which finds that the consumer staples sector has a significant loading to the interest rate factor in their regression model. Put differently, interest rates are statistically linked to consumer discretionary stocks and, consequently, the sector experiences a sharp deterioration in performance when interest rates increase, as evidenced by the results in Figure 2.

Another interesting finding relates to commodities. The results in Figure 2 suggest that commodities appear to perform better in hiking cycles than normal cycles and that this is at odds with other research, which finds that there may be a relationship between monetary easing, rather than monetary tightening, and commodity prices (Anzuini, Lombardi, Pagano (2010)).[3] A reason for this puzzling observation is that interest rates may not entirely capture adequately the movements of commodity returns. Authors such as Barksy and Kilian (2002)[4] and Frankel and Rose (2009)[5] assert that the evidence on the relationship between the impact of interest rates on commodity prices is mixed at best and, for this reason, the observation reported in Figure 2 should be treated with caution.

The assets that have responded least to interest rate rises include utilities, financials and industrials. Of particular interest is utilities, where it is widely believed that rate rises should be negative for these companies. The economic intuition for this is that they usually earn stable cash flows, often have to refinance long-term debts and would therefore be negatively impacted by any rate rises. However, our results show only a modest return spread between the two interest rate cycles. **A possible explanation for this is that the relationship between utilities and interest rates is unstable** (e.g. see Franco, Monnier and Rulik (2017) and Staikoura,s S., 2003),[6] even though the performance of utilities can often be explained by interest rates in a statistically meaningful way.

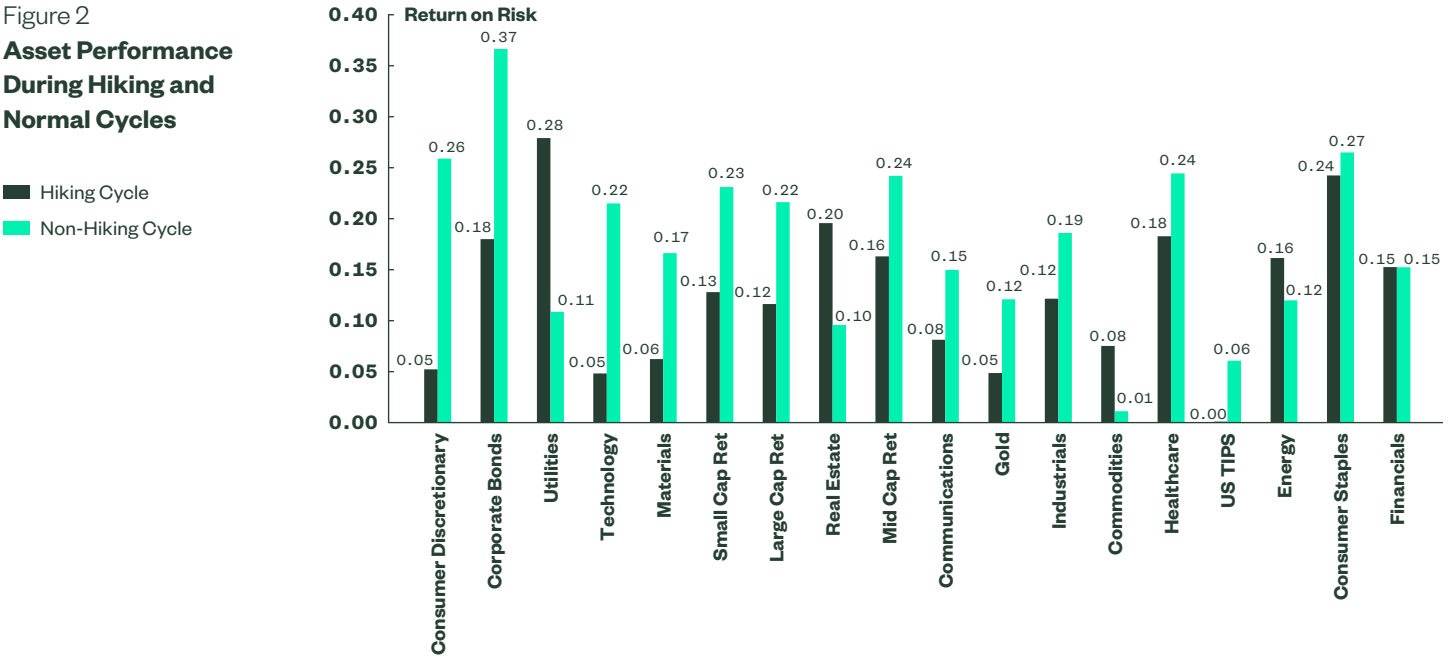
In regard to the financial and industrial sectors, we do not find a statistically significant relationship between interest rates and the performance of these companies and this is in line with the findings of Franco, Monnier and Rulik (2017). This may also explain why the return spread between the two interest rates cycles is immaterial.

Figure 1
Monetary Tightening and Loosening Regimes Since 1970



Source: State Street Global Advisors, FRED. Data from June 1970 through August 2022.

Figure 2
Asset Performance During Hiking and Normal Cycles



Source: State Street Global Advisors. Monthly data between 1979 and April 2022. The chart above shows the risk-adjusted return of various assets during hiking and normal interest rate cycles.

2.0 Markov Regime Identification

The second part of the analysis involves studying the performance of investment exposures in regimes defined using different macroeconomic variables (i.e. inflation, interest rates or a combination of the two). To create the combined regime against which the performance of different investment exposures is mapped, we utilise a Markov switching model, which is a type of regime-switching model that assumes that unobserved states (regimes) are determined by an underlying stochastic process known as a Markov chain. Put differently, the model seeks to define the process of a given time series as being governed by different regimes where switches between them are based on a probabilistic estimation. A key feature of the Markov model is the transition probability, which describes the likelihood that the current regime remains the same or changes to another regime. The model also assumes that future regimes depend only on current regimes.

To conduct the analysis, we define the joint regime for two macroeconomic variables (or two manifestations of the same variable). For each of the variables in focus, we define the appropriate number of regimes by running various Markov regime switching models, including a constant variance model, a variable variance model and an autoregressive model. The the best model, selected on the basis of Akaike and Bayesian Information Criteria, is selected to represent the regimes. The results of the Markov models representing the two variables are then combined to produce a final regime model, which is used to conduct our performance analysis.

To ensure interpretability of the results, we choose models that have a total of no more than six combined regimes. The reason for doing this is that if we assess asset performance on fewer regimes, then there are more observations to measure asset performance on but less granularity in the macroeconomic regimes. Conversely, if we use too many regimes, we achieve more granularity in the macroeconomic regimes at the expense of the number of observations in each regime. For this reason, we opt for an approach where we evaluate the asset performance on six or fewer combined regimes and compare the performance to reach an overall conclusion on which assets have fared well historically in a given macroeconomic environment.

In the sections that follow, we first examine the performance of assets using a combination of different interest rate variables and then we perform the same exercise using a blend of interest rate and inflation regimes.

2.1 Interest Rate Regime Analysis

The previous analysis on asset performance in hiking and normal cycles is interesting but it relies only on whether interest rates are in a hiking or normal cycle. To develop the analysis further, we study the impact of interest rate level and interest rate volatility using a combination of single Markov regimes that comprise high interest rate level and high interest rate volatility, high interest rate level and low interest rate volatility, low interest rate level and low interest rate volatility and low interest rate level and high interest rate volatility.

For each of the analyses in question, we measure the performance against two sets of combined Markov regimes, one with more regimes and the other with fewer regimes and attempt to see which assets performed well regardless of the definition of the regimes. In doing so, we attempt to balance competing considerations. Fewer regimes inevitably mean that the analyses will not achieve the granularity that accurately reflects the current situation and more regimes mean that we have the granularity but do not have enough observations to make meaningful observations. By looking at the consistency of the results using both approaches, we aim to conclude with some pertinent insights.

We start by examining the low interest rate level/low interest rate volatility regime. This regime covers the bull market period in 2005, the aftermath of the financial crisis in 2009 and the COVID pandemic in 2020. Overall, this regime mostly covers periods of a strong economic rebound, with the exception of the last period, which encompasses the COVID pandemic. At first glance, this regime seems astonishing because it does not appear to coincide with any particular market or economic cycles. A plausible explanation is that quantitative easing, particularly during COVID, has distorted the interest rate regimes materially. Focussing on the asset performance during this phase, the picture is equally murky. We see both cyclical assets, such as consumer discretionary, and defensive assets, such a health care, outperforming.

Next, we examine the high interest rate/high interest rate volatility regime. This regime generally encompasses periods in most of the decades until 2009, particularly in the 1970s and 1980s when both interest rates and interest rate volatility were elevated. This regime often coincides with unfavourable economic outlooks and bearish markets, and during this phase most of the assets with stronger performance are predictably the more defensive assets, such as consumer staples, health care and utilities. Surprisingly, some cyclical assets such as small caps also perform well in this phase, implying that while high interest rates and high interest rate volatility can often point to a nervous market, it may not be a pure measure of that.

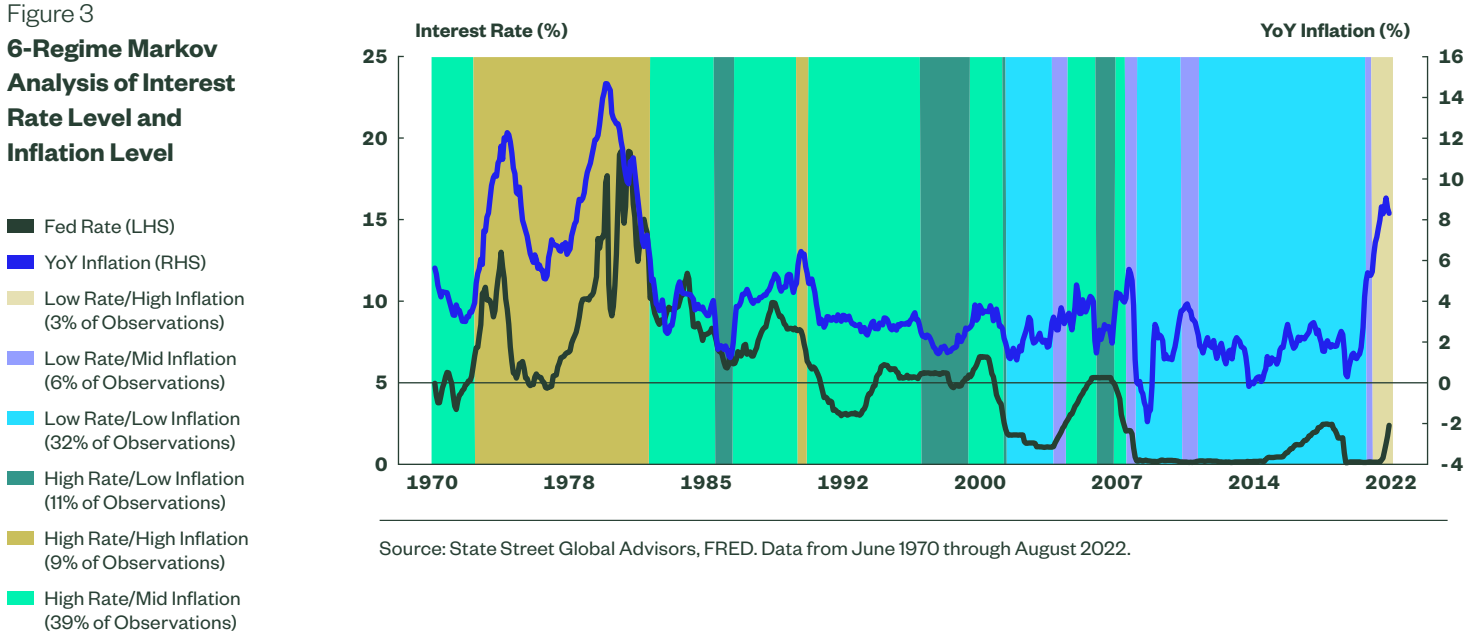
In addition to determining the market regimes using interest rate levels and interest rate volatility, we have also conducted a similar analysis using interest rate levels and interest rate changes and we have made similar observations. Indeed, across all analyses, we observe that there is a relatively low performance hit ratio of these assets in regimes made up purely of interest rate variables. Taking into consideration all our results, it is difficult to make sense of interest rate regimes by themselves because they are materially distorted by quantitative easing in the recent past. They may become more meaningful as rates normalise and better reflect the state of the economy.

2.2 Interest Rate Inflation Regime Analysis

Given our previous conclusion that interest rate regimes by themselves do not seem to give meaningful macroeconomic regimes, we have added inflation into our study in an effort to better understand the current environment. Once again, we created a joint regime from individual Markov regimes that consist of inflation level and interest rate level, inflation level and interest rate volatility as well as inflation and interest rate change.

Figure 3 shows the interest rate level and inflation level regime analysis corresponding to the time period between December 1970 and August 2022. Figure 4 shows the asset performance beginning from December 1979 and the performance of select asset classes in the three regimes in scope.

Figure 3
6-Regime Markov Analysis of Interest Rate Level and Inflation Level



Source: State Street Global Advisors, FRED. Data from June 1970 through August 2022.

Figure 4
Asset Performance in Different Interest Rate Level and Inflation Level Regimes
Median (%)

Regime	Large Cap Ret	Mid Cap Ret	Small Cap Ret	Real Estate	Financ.	Con. Staples	Con. Dis.	Comm.	Energy	Health Care	Materials.	Ind.	Tech.	Utilities	Corp Bonds	US TIPS	Com.	Gold
High Rate/ High Inflation	6.22	16.18	19.25	20.11	8.19	17.19	5.12	8.17	16.10	22.96	17.67	13.60	6.83	8.83	2.36	-8.83	6.21	-1.09
High Rate/ Mid Inflation	10.36	16.76	16.02	14.11	13.89	16.29	10.62	9.05	13.12	13.23	9.42	12.12	8.88	12.00	9.54	-0.56	5.93	-0.82
High Rate/ Low Inflation	23.67	19.82	17.98	19.72	19.18	16.11	29.28	35.24	12.07	28.89	15.55	16.21	27.57	15.53	8.85	15.56	-8.48	-0.28
Low Rate/ Low Inflation	11.25	11.48	9.93	4.26	7.71	7.69	14.69	1.89	-3.80	8.94	8.18	8.37	16.23	4.65	7.05	2.85	-3.65	7.52
Low Rate/ Mid Inflation	8.99	14.26	13.92	12.34	1.36	8.91	11.01	4.58	28.29	5.53	14.23	14.49	4.61	9.90	4.91	-6.16	21.67	17.13
Low Rate/ High Inflation	18.17	5.91	1.74	24.72	26.00	12.28	10.15	7.46	55.68	16.32	16.28	12.48	22.60	11.06	-3.27	-21.85	34.50	-3.19

Frequency of Positive Returns (%)

Regime	Large Cap Ret	Mid Cap Ret	Small Cap Ret	Real Estate	Financ.	Con. Staples	Con. Dis.	Comm.	Energy	Health Care	Materials.	Ind.	Tech.	Utilities	Corp Bonds	US TIPS	Com.	Gold
High Rate/ High Inflation	63.04	69.57	71.74	65.22	69.57	100.00	65.22	73.91	69.57	89.13	60.87	63.04	60.87	84.78	52.17	26.09	56.52	50.00
High Rate/ Mid Inflation	83.82	83.82	81.37	77.45	77.45	83.33	73.53	71.57	83.82	70.59	80.88	88.24	71.08	83.33	90.69	49.51	70.59	46.08
High Rate/ Low Inflation	96.49	85.96	84.21	70.18	92.98	85.96	96.49	96.49	77.19	94.74	82.46	92.98	94.74	87.72	98.25	85.96	26.32	49.12
Low Rate/ Low Inflation	73.65	70.66	68.86	62.28	59.88	77.25	80.84	54.49	42.51	73.65	67.66	65.27	79.04	62.28	86.23	54.49	38.32	67.66
Low Rate/ Mid Inflation	70.97	70.97	70.97	77.42	54.84	90.32	77.42	77.42	87.10	70.97	74.19	67.74	74.19	83.87	90.32	22.58	77.42	93.55
Low Rate/ High Inflation	64.29	64.29	50.00	78.57	64.29	100.00	64.29	57.14	100.00	92.86	71.43	64.29	78.57	100.00	28.57	0.00	100.00	28.57

Risk-Adjusted Return

Regime	Large Cap Ret	Mid Cap Ret	Small Cap Ret	Real Estate	Financ.	Con. Staples	Con. Dis.	Comm.	Energy	Health Care	Materials.	Ind.	Tech.	Utilities	Corp Bonds	US TIPS	Com.	Gold
High Rate/ High Inflation	0.33	0.63	0.60	0.54	0.30	1.67	0.33	0.70	0.59	1.11	0.40	0.49	0.39	1.10	0.25	-0.42	0.21	0.43
High Rate/ Mid Inflation	0.85	1.02	0.87	0.83	0.78	0.93	0.66	0.56	0.96	0.68	0.60	0.87	0.48	0.84	1.10	0.05	0.49	0.19
High Rate/ Low Inflation	1.66	1.11	0.95	0.66	1.23	1.10	1.83	1.96	0.91	1.62	0.84	1.22	1.02	1.04	1.52	0.93	-0.76	0.06
Low Rate/ Low Inflation	0.39	0.52	0.50	0.08	0.24	0.52	0.63	-0.03	-0.23	0.52	0.30	0.28	0.54	0.03	1.05	0.30	-0.24	0.50
Low Rate/ Mid Inflation	0.45	0.62	0.59	0.48	0.00	1.16	0.42	0.36	1.14	0.44	0.64	0.53	0.44	0.78	0.89	-0.58	0.93	1.41
Low Rate/ High Inflation	0.81	0.52	0.45	1.04	0.79	1.86	0.37	0.18	3.18	1.27	0.80	0.58	0.85	2.82	-0.74	-5.06	4.35	-0.14

Source: State Street Global Advisors, Bloomberg Finance L.P., for the period June 1979 through August 2022.

First, we cover the **low interest rate level and low inflation period**. This is predominately the time period after the global financial crisis until 2020 when the pandemic started and caused inflation to spike. With a few exceptions, such as COVID, that period provided a strong economic backdrop — strong demand and growth in earnings. During this time equities outperformed all other asset classes and the riskiest part of equities saw outperformance. In particular, small and mid cap stocks outperformed large caps on a risk-adjusted basis.

When looking within equities, that period coincided with the rise of technology and that was by far the sector with the best absolute performance. However, when looking at risk-adjusted returns, the results were less clear. As highlighted in the interest rate regimes, this is probably a result of the unprecedented easing that markets experienced from the global financial crisis until the end of 2021. **On a risk-adjusted basis, consumer discretionary and gold performed best while on the other side of the spectrum we find communication, energy and commodities.** The strong performance of gold should not come as a big surprise given it tends to do well when interest rates fall.

In the **high interest rate level and high Inflation regime**, results are more straight forward. This regime covers the 1970s and the start of the 1980s and then again the first two years in the 90s. The regime often coincides with unfavourable economic backdrops and more defensive assets have outperformed both in terms of returns and risk-adjusted performance. Interestingly, consumer staples and health care (defensive) are found among the top outperformers. As expected, cyclical assets are ranked toward the bottom of the table.

Finally, the majority of observations fall into the high interest rate and low inflation regime. This regime dominated the 1980s and 1990s, in between different cycles. This regime has not occurred since the financial crisis and we generally notice that most assets delivered positive performance during this regime, with the exception of commodities and gold.

Last, we looked at the low interest rate level and high inflation regime, which is the current environment. This regime occurred in the aftermath of COVID when the economy reopened and the Fed brought down interest rates considerably and continued with quantitative easing to support economic growth. **Despite this regime being historical in nature and only 3% of all observations, we may draw some useful conclusions from the data. Interestingly, in this environment, energy, commodities and financials have done well** while gold and US TIPS have underperformed on an absolute basis. Normally, in a high inflationary environment, TIPS would be expected to do well and yet they underperformed in this regime. This is because the duration of the TIPS under analysis had a much bigger impact on performance than their inflation characteristics.

Separately, we also examined the performance of different assets based on interest rate volatility and inflation regimes. **Looking at the high interest rate volatility and high inflation level regime analysis, results are similar to the observations above in respect of high interest rate level and high inflation. Energy, health care and consumer staples fared best, while US TIPS and commodities underperformed.**

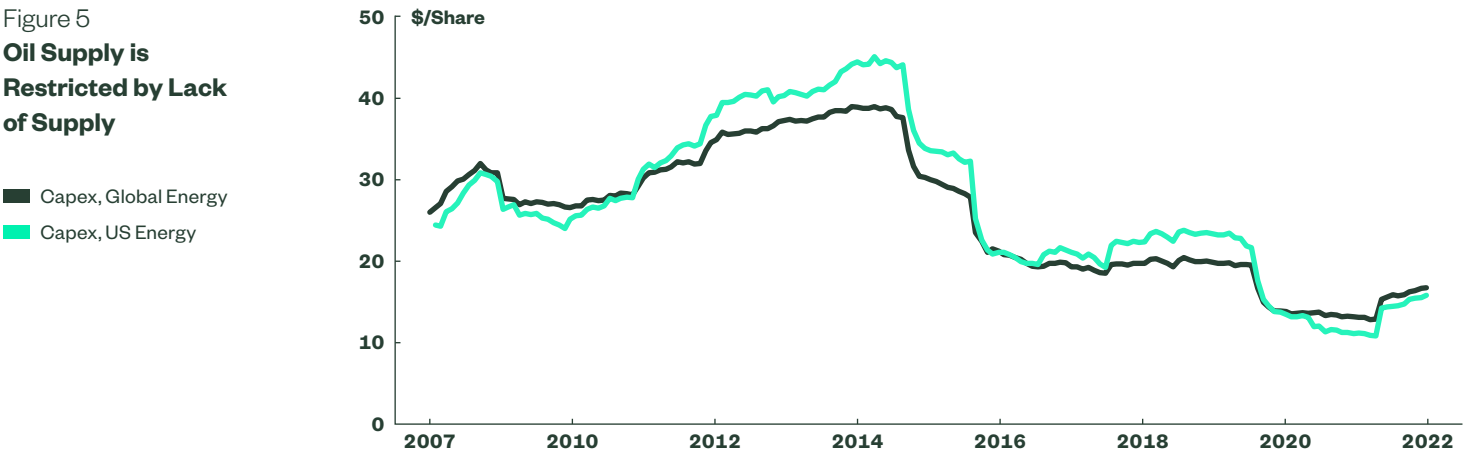
3.0 How to Position in Current Environment?

3.1 Energy

Against the current backdrop, based on historical analysis, energy and health care stand to benefit. Some could argue that energy should not do well in a slowing demand environment with tightening monetary policy. We agree that the demand side of the oil equation is slowing; however, the supply side remains constrained. **Chronic underinvestment, the war in Ukraine and OPEC's recent decision to actively manage supply have put the risk to the upside for oil prices** (see Figure 5).

While supply/demand dynamics remain positive, fundamentals are also strong. After the 2015 energy crisis, companies became better asset allocators and, by creating lean cost structures, they were able to become profitable at $40/barrel. *At double that price*, energy companies have been able to generate high free cash flows, improve margins by 3.3% and pay down debt while returning to shareholders in the form of dividends and share buybacks. Admittedly, after the energy rally this year, positions are now well above benchmark and the sector is by no means cheap. However, looking at the sector's history, positions and valuations are not yet extended, when considering both of those metrics at similar oil price levels (see Figure 6).

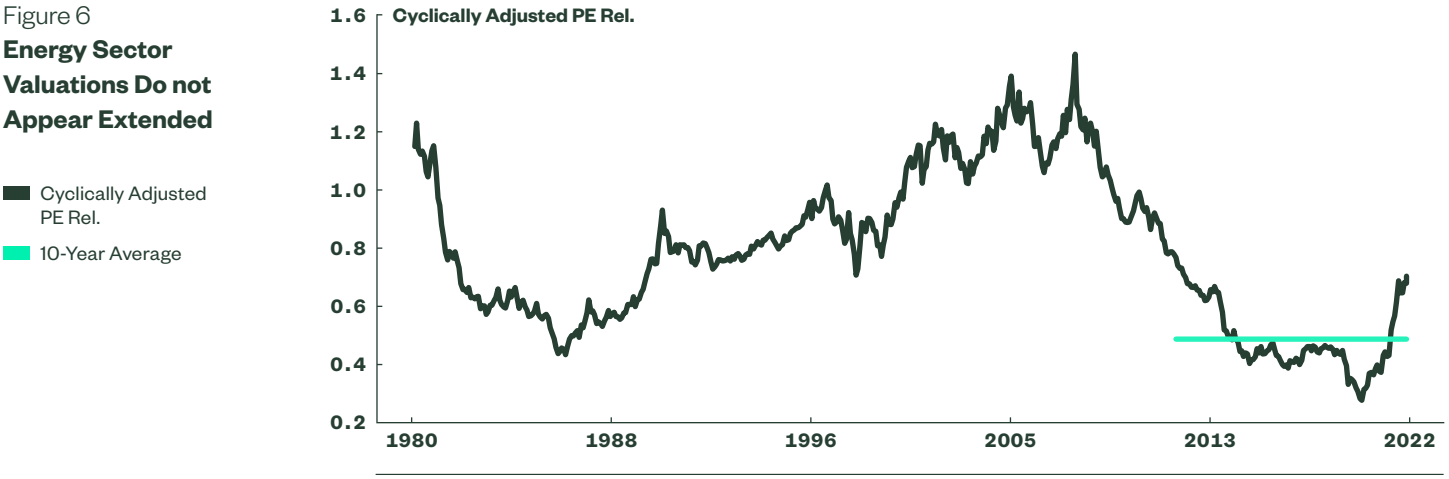
Figure 5
Oil Supply is Restricted by Lack of Supply



Source: State Street Global Markets, Bloomberg Finance L.P., as of August 2022.

Figure 6

Energy Sector Valuations Do not Appear Extended



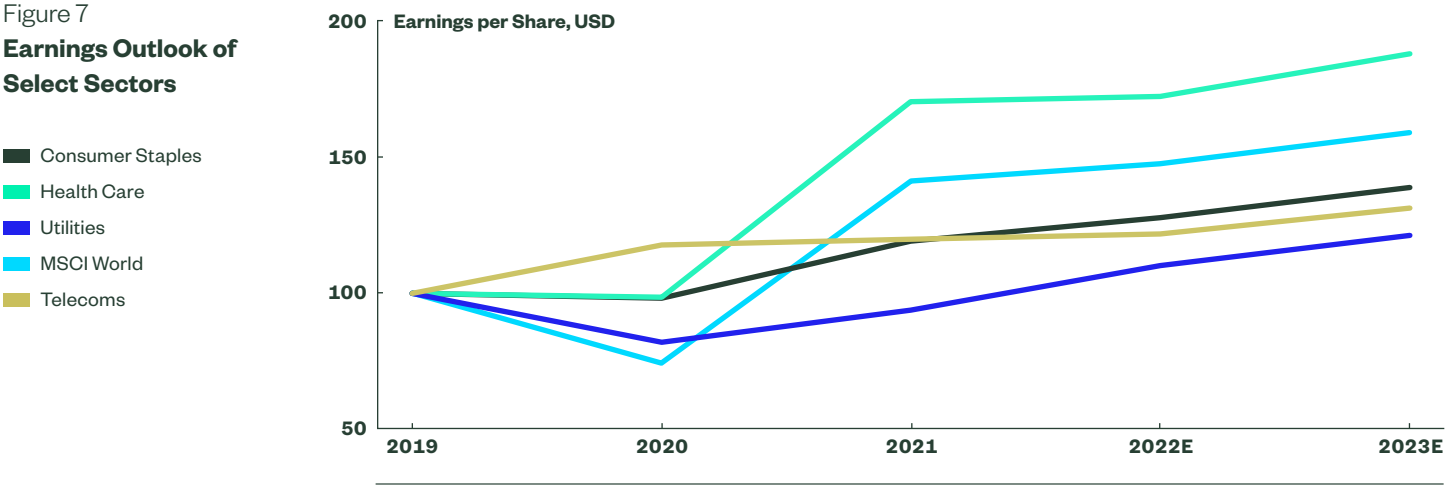
Source: State Street Global Markets, Refinitiv Eikon, as of August 2022.

3.2 Health Care

Health care, on the other hand, is a defensive sector that offers robust fundamentals that should outperform in the current economic environment. Despite its defensive nature, heath care offers earnings growth through pharma and biotech companies (see Figure 7). Following the pandemic, investment in the sector has increased and M&A activity has improved drug pipelines. The sector offers the highest margins and better free cash flow compared to the rest of defensives (see Figure 8). Positioning has been just above benchmark levels but the sector is currently trading at a 5% premium to its 10-year cyclically adjusted PE. Regulatory risk remains a risk to our thesis; however, regulators are aware that if there is a ceiling in drug prices, companies will not be able to invest more in R&D, which is no longer supported substantially by public funds.

Figure 7

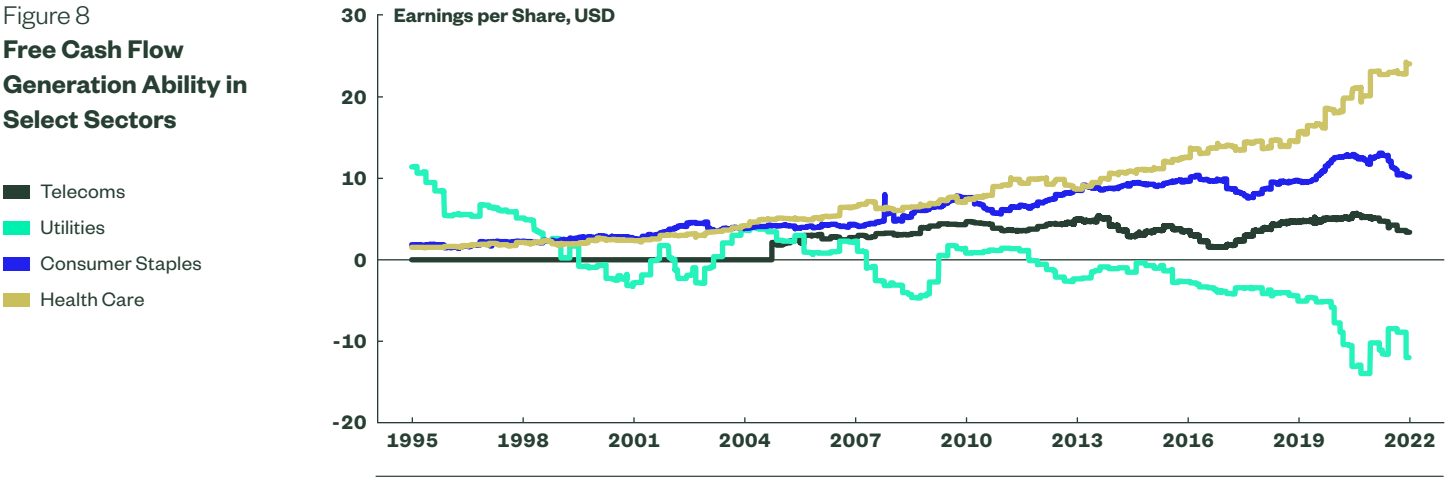
Earnings Outlook of Select Sectors



Source: State Street Global Markets, Refinitiv Eikon, annual figures for 2019 through 2022.

Figure 8

Free Cash Flow Generation Ability in Select Sectors



Source: State Street Global Markets, Refinitiv Eikon, for the period January 1995 through September 2022.

Endnotes

1 Source: AQR, Q2 2017.

2 de Franco, Monnier, Rulik, *Interest Rate Exposure of Volatility Portfolios*, Journal of Index Investing, 2017.

3 Anzuini, Lombardi, Pagano, *The impact of monetary policy shocks on commodity prices*, European Central Bank, 2010.

4 Barksy and Kilian, *Do we really know that oil caused the great stagflation? A monetary alternative*, NBER Macroeconomics Annuals 16, 2002.

5 Frankel and Rose, *Determinants of agricultural and mineral commodity prices*, Unpublished working paper, 2009.

6 The Interest Rate Risk Exposure of Financial Intermediaries: A Review of the Theory and Empirical Evidence, Financial Markets, Institutions and Instruments, Volume 12 Issue 4.

About State Street Global Advisors

For four decades, State Street Global Advisors has served the world's governments, institutions and financial advisors. With a rigorous, risk-aware approach built on research, analysis and market-tested experience, we build from a breadth of index and active strategies to create cost-effective solutions. As stewards, we help portfolio companies see that what is fair for people and sustainable for the planet can deliver long-term performance. And, as pioneers in index, ETF, and ESG investing, we are always inventing new ways to invest. As a result, we have become the world's fourth-largest asset manager* with US $3.26 trillion† under our care.

* Pensions & Investments Research Center, as of December 31, 2021.
† This figure is presented as of September 30, 2022 and includes approximately $55.12 billion USD of assets with respect to SPDR products for which State Street Global Advisors Funds Distributors, LLC (SSGA FD) acts solely as the marketing agent. SSGA FD and State Street Global Advisors are affiliated. Please note all AUM is unaudited.

ssga.com/etfs

Marketing communication
For professional clients use only.

Information Classification: General Access

Important Information