CFM
INSIGHT.DATA.CLARITY.

15th May 2022

INFLATIONARY REGIMES AND ASSET CLASS PERFORMANCE

Part 2: Convexity of Trend Following

Executive Summary

In the first paper of this series **we proposed a 'macro-economically agnostic', systematic technique of identifying inflationary regimes** and measured the performance of key asset class benchmarks and alternatives within those regimes. We showed that systematic macro strategies, but especially trend following strategies outperformed most asset classes during periods of high and accelerating inflation. **These results are consistent with what is being observed in markets today.**

We now extend the study in the first paper by constructing generic trend following strategies on various asset classes and examine and compare the performance of these within our defined inflationary regimes. Using a longer historical backtest period, we observe results that are consistent with those of the first paper, and conclude that **trend following is a reliable hedge against high levels of inflation, but especially against inflationary shocks**, demonstrating a favourably convex profile conditioned on inflation.

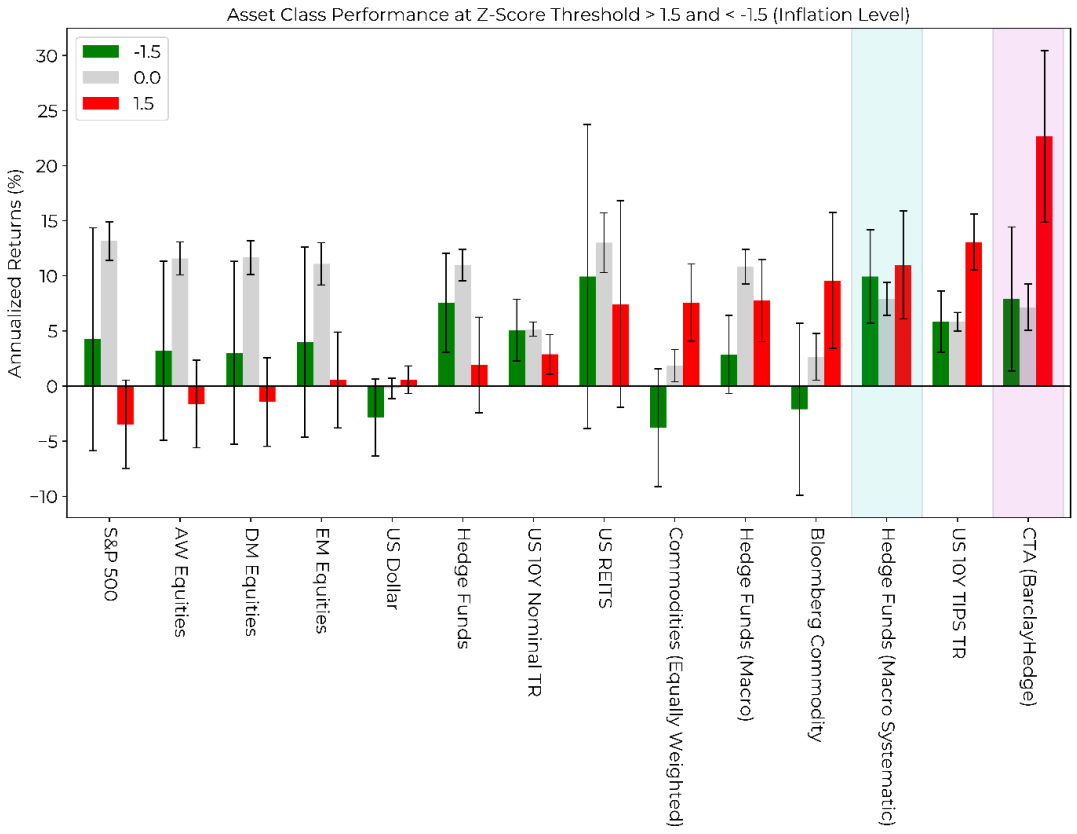
Contact details

Call us +33 1 49 49 59 49
Email us cfm@cfm.fr

Introduction

In the first paper[1] of this series we proposed a procedure for identifying inflationary 'regimes', followed by an assessment of various, individual benchmark asset classes' performance during those regimes where the level of inflation was both high (low), and accelerating (decelerating). We opted, informed by macroeconomic insight and availability of data to draw statistically significant conclusions, to set high (low) levels or accelerating (decelerating) inflation where it deviated above and below 1.5 standard deviations using a Z-score approach[2].

The main results, as per the first paper, are presented in figures 1 and 2 and updated since its first publication.

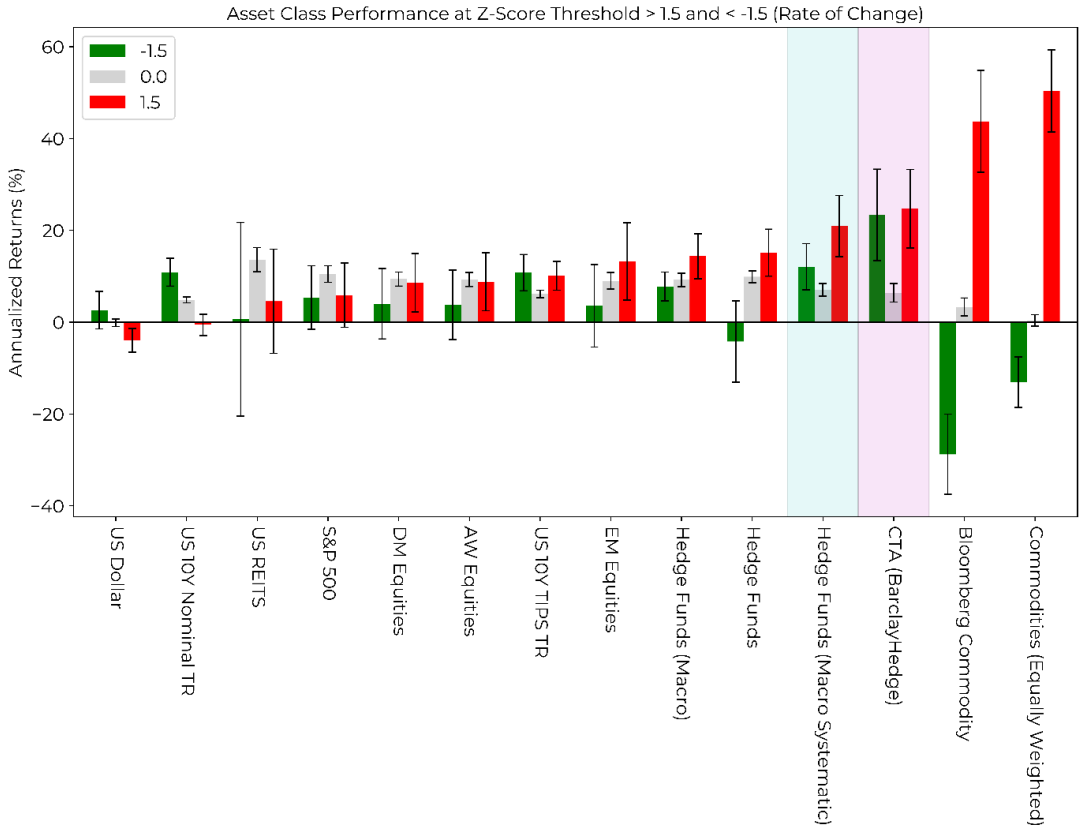


Source: Bloomberg, GFD, CFM

Fig.1 An updated version of figure 4 in the first paper of this series showing the annualised returns of various key individual asset classes in each of the pre-defined 'regimes'. The regimes are Z-Score greater than 1.5 (high levels of inflation), and Z-Score smaller than -1.5 (low levels of inflation). Zero is the regime where inflation is considered 'stable', i.e. fluctuating between 1.5 and -1.5. The annualised returns are ranked according to performance during periods of high inflation from right to left. The results have changed only marginally since the publication of the first paper (November 2021), given the long history we used to calculate the average annualised returns. The one exception is that macro hedge funds have nudged ahead of both US REITs and a proxy of an equally weighted commodity index. Macro hedge funds as a strategy returned 11.3% between November 2021 and the end of April 2022. The details of benchmark proxies and first observation dates are detailed in the appendix.

[1] The paper 'Inflationary Regimes and Asset Class Performance' is available on our website at the following link.

[2] Z-scores were computed using a rolling 7-year window of YoY changes in inflation for the level of inflation, and, equally, a rolling 7-year window on the difference of YoY changes in inflation, i.e. the rate of change in inflation (or second derivative).



Source: Bloomberg, GFD, CFM

Fig.2 An updated version of figure 5, showing the annualised returns of various key individual asset classes in each of the pre-defined 'regimes'. The regimes are Z-Score greater than 1.5 (accelerating inflationary period), and Z-Score smaller than -1.5 (decelerating inflationary period). Note that the performance of hedge funds and trend following strategies remain stable and robust irrespective of inflationary regime, but, systematic macro hedge funds and especially CTAs (trend following) reveal a certain level of 'convexity', i.e. where performance is near-equally positive in the two extremes.

We observed, as was highlighted in the first paper, that commodities – as dictated by expectations given their perceived inflation hedging properties; Treasury Inflation Protected Securities (TIPS); as well as systematic macro but especially trend following acted as superior inflation hedging strategies during periods of high levels of inflation.

Interestingly, however, trend following strategies showed a certain convexity, that is positive and near-equal performance in periods where inflation accelerated and decelerated, whereas commodities as an asset class underperformed in periods of low inflation, and dramatically so in periods where there were a negative inflation shock.

Given then that inflation has continued to drift higher, and that trend following strategies ostensibly did best during periods where inflation levels were high, but especially where the rate of change deviated significantly from its long-term mean, we unpack the strategy and investigate how a trend following strategy on different asset classes performed within the same setting.

We extend the backtest period from ~30 years (the history of data available for aggregated proxies of trend following strategies), to more than 70 years (and in some cases up to a 100 years for which reliable data is available).

Our results support the finding of the first paper. The performance of trend following strategies are broadly positive during periods of high levels of inflation, but, crucially, the performance shows a neat convexity – i.e. positive returns in both accelerating and decelerating periods of inflation.

We observe that trend following on commodities yields some of the best hedging potential, both during periods of high and accelerating inflation, and, as such, we disentangle a holistic commodity trend following strategy to its sub-sectors to investigate the underlying drivers.

Trend Following on Individual Asset Classes

To measure the performance of trend following within different inflationary regimes, we construct generic trend following strategies on major asset classes leveraging the same approach as in our previously published 'Two Centuries of Trend Following' paper[3]. The methodology used simulates a constant risk trading strategy, and for the sake of simplicity, ignores trading cost.

The trend following signal at the beginning of month t is constructed as follows:

$$s_n(t) = \frac{p(t-1) - \langle p \rangle_{n,t<t-1}}{\sigma_{n\,(t-1)}}$$

Where:
s = Trend signal
p = Exponential moving average of past prices, with a decay rate equal to n
σ = Volatility, equal to the exponential moving average of the absolute monthly price changes, with a decay rate equal to n
n = Decay rate in months, which we set to 5

The average strength of the trend is then measured as the statistical significance of fictitious profits and losses (P&L) of a risk managed strategy that buys or sells (depending on the sign of s_n) a quantity of the underlying asset class:

$$Q_n^{\alpha}(t) = \sum_{t'<t} sign[s_n(t')] \times \frac{p(t'+1)-p(t')}{\sigma_{n\,(t'-1)}}$$

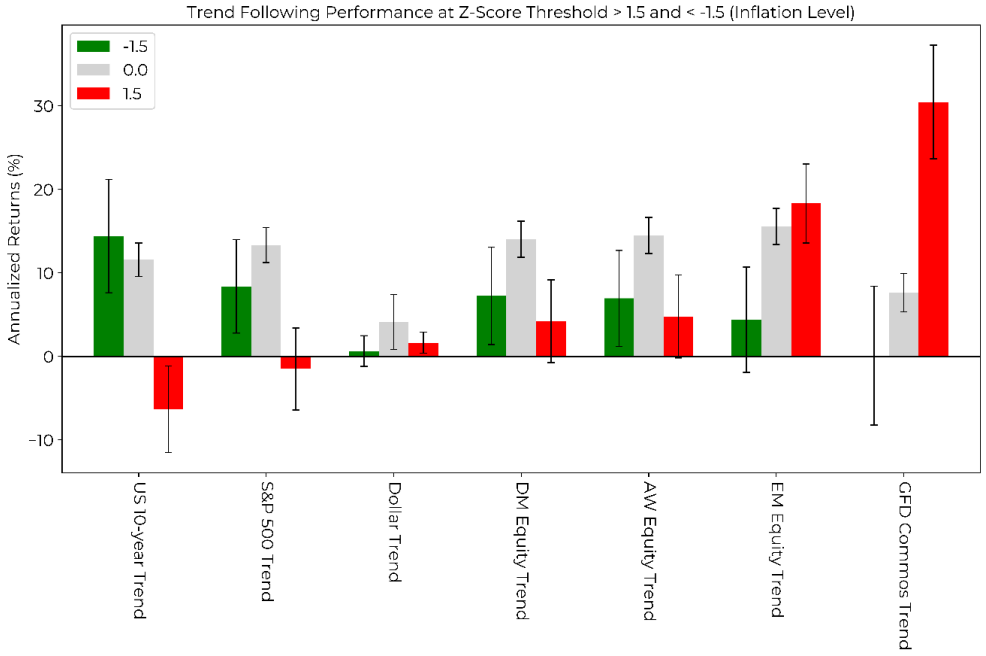
To allow for a longer backtest period, we leverage monthly data from Global Financial Data (GFD) for a selection of major asset classes, along with individual spot prices of 19 individual commodities.[4] We derive monthly P&Ls for each of the benchmark asset classes using the procedure above, and construct a single, equally-weighted commodity portfolio from the individual trend following P&Ls of each underlying commodity.

With these P&Ls in hand, we repeat the exercise of the first paper by examining the annualised returns of these strategies within in our inflationary regimes. The results are presented in figures 3 and 4.

To mitigate any critique of the use of US inflation as a proxy to construct our inflationary regimes (as in the first paper), we run the same analysis and compare results of using US inflation to a variety of other global measures of inflation. The results, as expected, did not change materially given the very high correlation between US and alternative proxies for global CPI measures. See Exhibit 1 in the appendix.

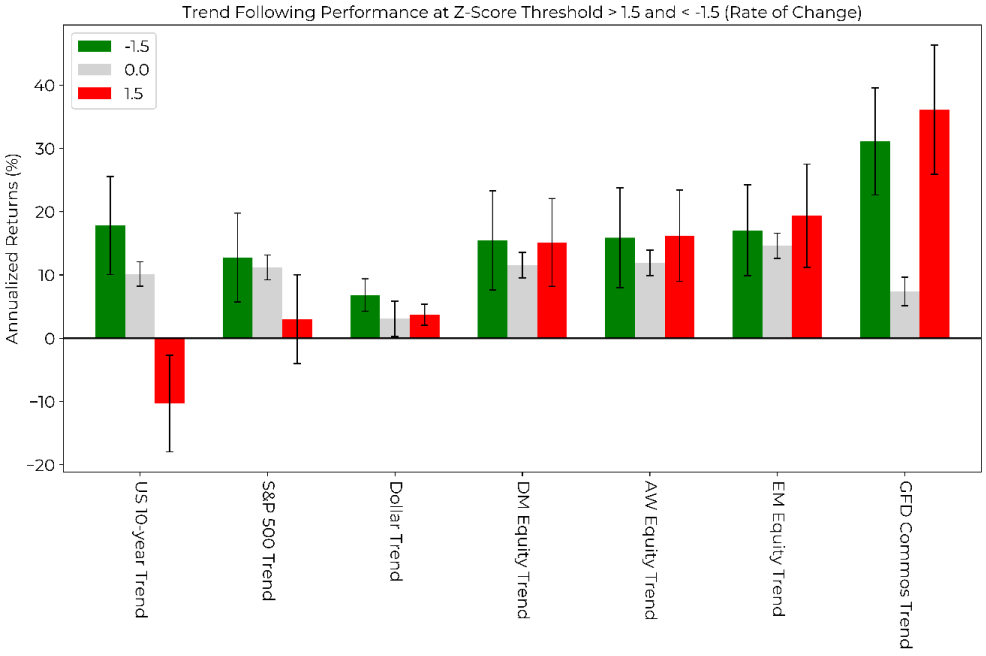
[3] Interested readers can refer to the academic paper by following this link

[4] The choice of commodities was based on the availability of data from GFD. We limited the universe of commodity spot prices from 1950, to overlap with the high inflationary period of the 1970s, and we limit the start of each time series to when reliable monthly data became available. Where multiple prices for a single or derivative of a commodity exists, we eliminated the duplicity by choosing the time series with the longest history.



Source: GFD, CFM

Fig.3 The annualised returns of generic trend following strategies, individually normalised such that their risk is equal to the volatility of the S&P 500, in each of the inflationary regimes defined as levels being either high (Z-score > 1.5) or low (Z-score < -1.5). We observe that trend following on most asset classes show positive performance during periods of high inflation, especially commodities and emerging market equities. The performance of emerging market equities (EM Equity) could be explained by their higher correlation to commodity prices – many of the markets being exporters of raw materials. The other equity proxies used, DM Equity and AW Equity, are Developed Markets and an All World Equity respectively – refer to the appendix for further details.



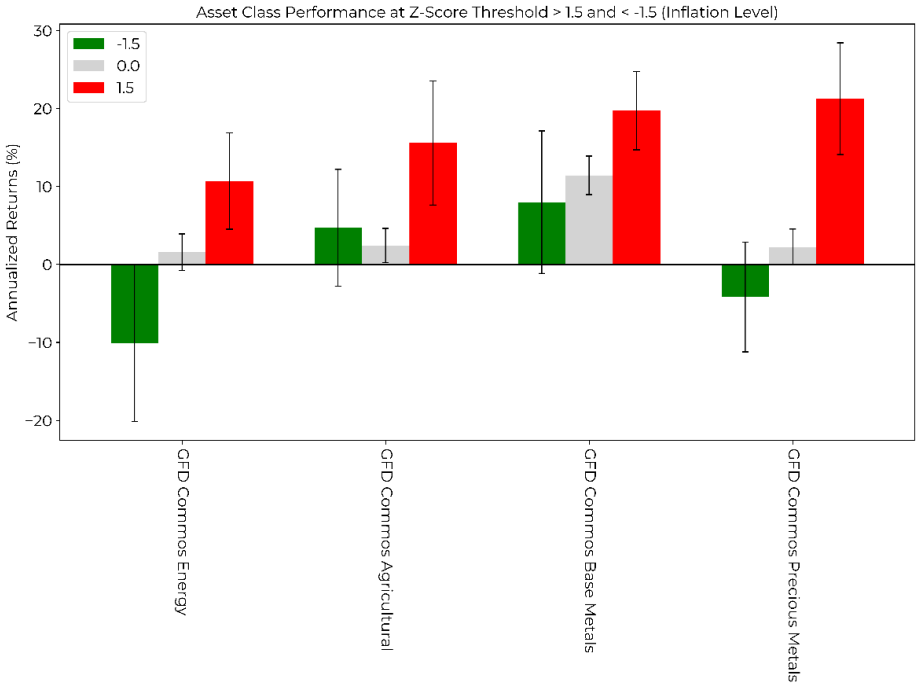
Source: GFD, CFM

Fig.4 The annualised returns of generic trend following strategies, individually normalised such that their risk is equal to the volatility of the S&P 500, in each of the inflationary regimes defined as the rate of change of inflation being either high (Z-score > 1.5) or low (Z-score < -1.5). The performance of trend following strategies where the rate of change of inflation is particularly strong, performs near universally positively, with performance during decelerating periods comparable to that in periods of accelerating inflation. This result rhymes with the convexity observed using aggregated trend following proxies. The strongest convexity can be seen as coming from trending on commodities.

Now, given the performance of trend following on commodities in both high and accelerating inflationary regimes, we investigate further by looking at the trend following performance at the sub-sector level to examine which, if any, subsectors perform best within our defined setting of inflationary regimes.

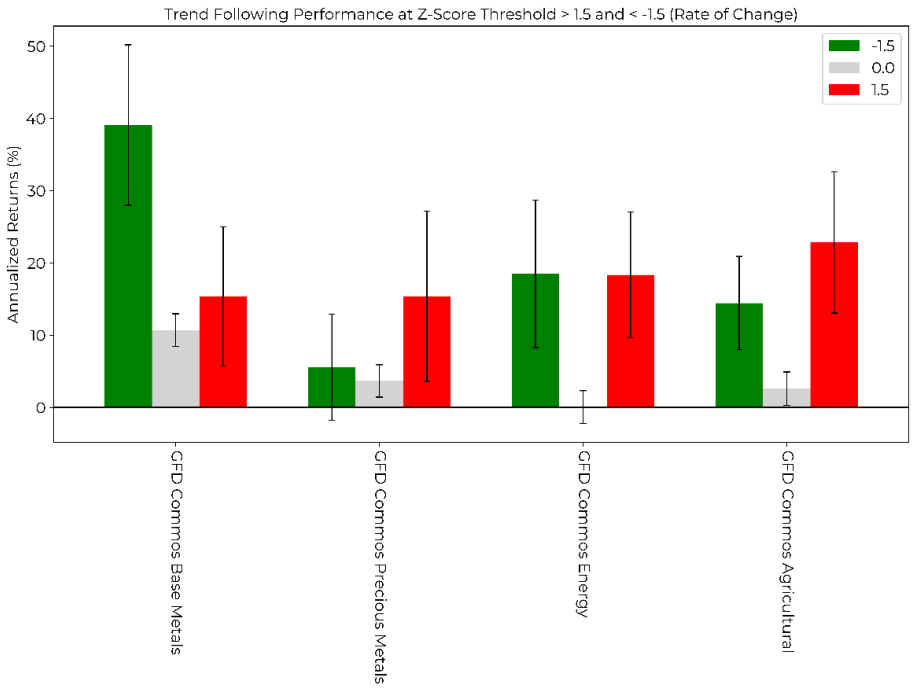
Trend Following on Commodities

To further investigate the performance of commodities, given it seems to show the best performance in especially accelerating inflationary periods vis-à-vis other major asset classes, we decompose by grouping the trend following strategies into individual commodity sub-sectors, i.e. Energy, Metals – Precious and Base, and Agricultural. The results, again using the same procedure as throughout, are shown in figures 5 and 6.



Source: GFD, CFM

Fig.5. The annualised returns of the generic trend following strategies of commodity sub-sectors in the inflationary regime defined as having high (low) levels of inflation. As above, each of the individual trend following strategies are normalised to equal the volatility of the S&P 500



Source: GFD, CFM

Fig.6. The annualised returns of the generic trend following strategies of commodity sub-sectors in the inflationary regime where the rate of change of inflation is high (low). As above, each of the individual trend following strategies are normalised to equal the volatility of the S&P 500. Trend following on commodity subsectors displays some idiosyncratic behaviour during inflationary shocks, but are, nevertheless, universally positive during both positive and negative inflationary shocks. Akin to an aggregate portfolio of commodities, each subsector equally shows similar convexity.

Trend following performance of various commodity subsectors show consistent positive performance during periods of high inflation, with the metal subsectors yielding the best returns. During periods of low levels of inflation, the performance seems less consistent.

However, results, obtained in periods of significant acceleration and deceleration of inflation for every one of the subsectors, mirror those of the overall commodity portfolio. The performance from trend following on all subsectors yields a distinctively convex profile, i.e. outperformance in both extremes. These results should not be all that surprising.

The convexity of Trend Following has been discussed at length elsewhere.[5] The Global Financial Crisis of 2008 revealed this feature of Trend Following to investors as short positions in equities and long positions in fixed income provided upside against the implosion of the market. This protection is a mechanical feature of the strategy, all the while the move in the underlying occurs on a timescale comparable to or slower than that of the trend strategy (as was the case in 2008 where the crisis lasted ~12-18 months which is longer than the timescale used by most CTAs). In this paper we are instead considering protection against high (low) levels and acceleration (deceleration) in inflation.

As shown in Exhibit 2 in the appendix, regressing consumer inflation against the returns of financial assets shows that commodities dominate in terms of explanatory power. As such, it becomes clear that large moves in commodities coincide with large moves in inflation and a trend follower gets into position long/short commodities to protect the holder against such inflationary changes.

Performance of trend following post-Covid has, it can be argued, in large part been driven by commodity exposure. The rally in commodities since the nadir of the Covid-crisis has been the strongest at this stage of the rally from all other cycles since the 1960s – even when adjusted for inflation. See Exhibit 3 in the appendix.

[5] Interested readers are invited to consult our academic paper, 'Tail protection for long investors: Convexity at work' and whitepaper, 'The Convexity of Trend Following. Protecting your assets but perhaps not as much as you would like!', both available on our website, by following the respective links

Moreover, the rate of change in inflation, which, as discussed in our previous paper, can be considered akin to an 'inflationary shock', is not unlike what the world is experiencing now. It is worth noting that the impact of accelerating periods of inflation is likely not symmetrical with deceleration, i.e. markets are likely to react more during an upside shock (this, typically, generated by a supply-side shock, feeding into rapidly rising inflation) again, not unlike the current environment.

Conclusion

Inflation in the US is at a 40-year high. Globally, the picture is not much different. The advent of geopolitical tension to the east of Europe, Covid cases picking up in China, and record-level labour shortages in the US are all likely to keep prices high. The US Fed, as is widely believed by analysts, is poised to unleash a string of 50 basis point interest rate hikes, and while this is certain to cool demand, the Fed lacks the tools to address supply shocks – those that have been largely driving inflation higher.

In this environment, where markets are fretting about higher inflation, and mulling over the possibility of a recession, investors are looking at alternatives beyond equity and bonds for returns and to protect against inflation.

In this paper, we extended our previous study and demonstrated that trend following has proven to be a very effective hedge against high levels of inflation, but, especially so during periods of accelerating and decelerating inflation. Trend following as such shows a distinct convexity when changes of inflation are large.

Much of the performance of trend following during high and accelerating (decelerating) inflationary periods is driven by commodities, with the performance superior to just holding a long basket of commodities. Divergent performance, however, of commodity subsectors is explained by commodities' different sensitivities – historically – to inflation. The sensitivity of commodities as an asset class, as well as individual commodities, is not static, so, it is not as simple as gaining exposure to the same commodities in all inflationary periods, because it is dynamic.

On average, commodities perform well in high inflationary periods, but a trend following strategy performs as well, if not better on average, and significantly outperforms during periods of inflationary shocks. Scaling commodity exposure up or down during inflationary/deflationary periods is not a trivial decision as timing the market is always tricky. Trend following on commodities, and other asset classes, negates this, because the strategy is designed to adapt.

Moreover, trend following, as we illustrated in a previous paper[6], has also demonstrated, over a very long history, an immunity to business cycle fluctuations, showing robust and consistent performance irrespective of the macroeconomic environment.

We have shown the robustness of trend following strategies and systematic macro hedge fund performance irrespective of inflationary regime, with these strategies performing particularly well during periods of inflationary shocks.

[6] See 'On business cycles…and when trend following works' available on our website by following this link

Appendix

Benchmark asset class proxies

Asset Class	Ticker	Description	First Observation
S&P 500	_SPXTRD	S&P 500 Total Return Index (w/GFD extension)	1900-02
EM Equities	TRGFDEM	GFD Indices Emerging Markets Return Index	1926-01
DM Equities	TRWLDM	GFD Indices Developed World Return Index	1926-01
AW Equities	TRWLDAM	GFD Indices All World Return Index	1926-01
Commodities (Equal Weighted)	_TRCCID	Thompson Reuters Core Commodity Equal Weighted Index	1914-09
Bloomberg Commodity	BCOM Index	Bloomberg Commodity Index	1960-02
CTA (Barclay Hedge)	BARCCTA Index	Barclay Hedge CTA Trend Following Index	1980-01
US Dollar	XRNUSAM	United States Dollar Nominal Effective Exchange Rate	1964-02
US REITS	USWILLREITIND	Wilshire US Real Estate Investment Trust Total Market Index	1978-01
Hedge Funds	HFRIFWI Index	Hedge Fund Research HFRI Fund Weighted Composite Index	1990-01
Hedge Funds (Macro)	HFRIMI Index	Hedge Fund Research HFRI Macro Total Index	1990-01
Hedge Funds (Macro Systematic)	HFRIMTI Index	Hedge Fund Research HFRI Macro Systematic Diversified Index	1990-01
US 10Y Nominal TR	TRUSG10M	GFD Indices USA 10-year Government Bond Total Return Index	1900-02
US 10Y TIPS TR	CFM[7]	US 10-year TIPS Total Return	1971-10

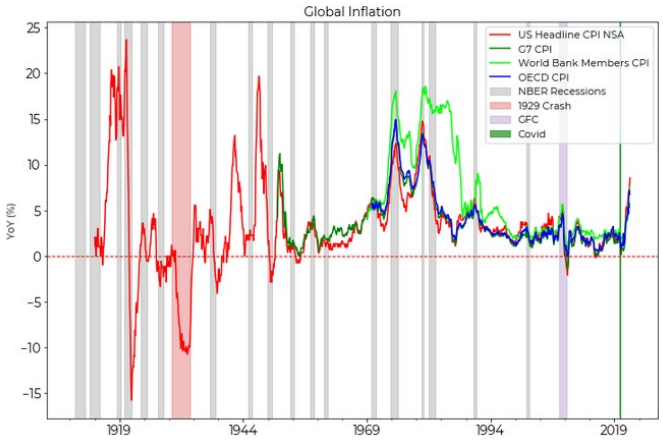
Commodity spot proxies

Sub-sector	Commodity	Ticker	Description	First Observation
Base-Metals	Tin	__SN_NYD	Tin (Straits, Pigs) Prices (US Cents/Pound)	1950-01
	Copper	__CU_NYD	High Grade Copper (US Cents/Pound)	1977-11
	Aluminium	CMALSD	Aluminum Spot Price (USD/Ton)	1986-10
	Nickel	CMNISD	Nickel Spot Price (US Dollars/Ton)	1980-01
	Zinc	CMZNSD	Zinc Spot Price (LME US$/Ton)	1969-12
Agricultural	Cocoa	_CO1599D	Cocoa Spot Price (USD/Metric Ton)	1950-01
	Coffee	__COFSAD	Brazil Santos Arabica Spot Price (Cents/Pound)	1950-01
	Corn	__C_US2D	Chicago Yellow Corn No. 2 Spot Price (US$/Bushel)	1950-01
	Soybean Oil	_BO1599D	Soybean Oil Cash Price (Cents/Pound)	1950-01
	Sugar	_SU1599D	Sugar #11 Spot Price (US Cents/Pound)	1950-01
	Wheat	__W_USSD	Wheat #2 Cash Price (US Dollars/Bushel)	1950-02
	Cotton	COT_AFRD	Cotton Spot Price (Cents/Pound)	1950-01
Precious-Metals	Gold	__XAU_D	Gold Bullion Price-New York (US$/Ounce)	1950-01
	Platinum	__PL_NYD	Platinum Cash Price (US$/Ounce)	1985-05
	Silver	__XAG_HD	Silver Cash Price (US$/Ounce)	1967-07
Energy	Heating Oil	HO_NYHD	Heating Oil Price NY FOB (US Cents/Gallon)	1978-11
	Gasoline	RU_USGD	Regular Unleaded Gasoline Gulf Coast (Cents/Gallon)	1986-06
	Oil	__WTC_D	West Texas Intermediate Oil Price (US$/Barrel)	1973-02
	Heating Oil No. 2	HO_USGD	Heating Oil No. 2 Gulf Coast FOB (Cents/Gallon)	1973-01

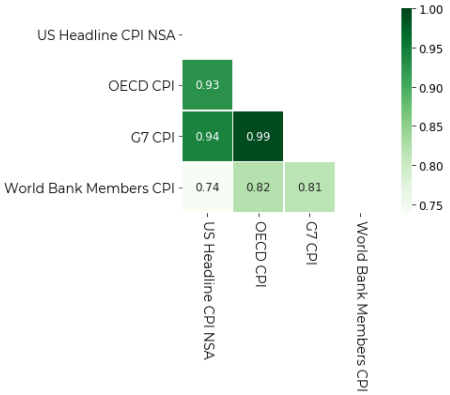
[7] We construct a US 10-year TIPS Total Return Index using 'backcasted' breakeven rate data from the Fed, by converting the back-casted data into a 10-year TIPS yield (TIPS = US Nominal – Breakeven), and then converting the yield into a total return series as per Swinkels et al. US TIPS only started trading in the late 1990s, which limits the performance assessment of this asset class over a longer look-back period.

Exhibit 1. Global Inflation

For the purposes of identifying inflationary regimes we chose to use Headline US CPI (NSA). One could argue that a global inflation proxy be used, given that especially commodities, but also other asset classes like emerging market equities could have different sensitivities depending on the inflationary measure used. However, the choice of US inflation has the benefit of a longer, more reliable history, and the correlation between other, geographically broader measures of inflation is very high during those periods where alternative measures are available. The correlation of YoY percentage changes between the US and e.g. OECD is 93%.



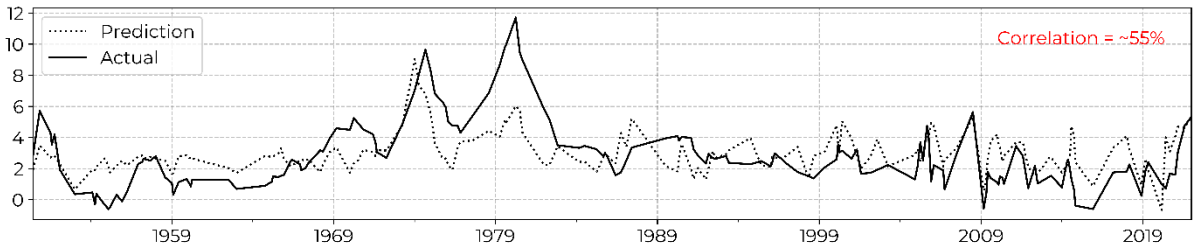
Source: Bloomberg, GFD, NBER, CFM



Source: Bloomberg, GFD, CFM

Exhibit 2. Inflation and Commodities

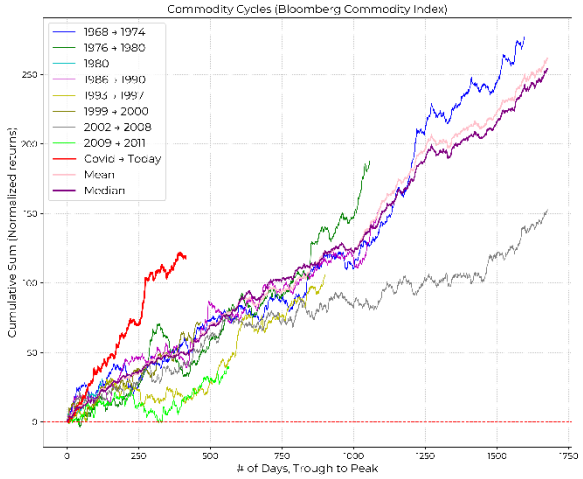
Much of the variance in headline inflation can be explained by changes in the prices of commodities. The correlation of e.g. an equally weighted commodity index (using monthly prices since 1950) to inflation is ~25%. We perform a regression, using both commodities and financials as independent variables and find that the correlation of a regression with realised inflation is ~55%. However, while many commodities have a positive and statistically significant coefficient, financials are far less correlated with inflation and do not contribute much to the regression.



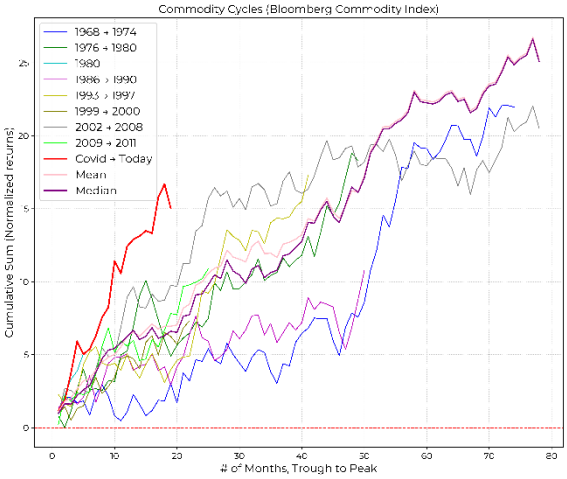
Source: GFD, CFM

Exhibit 3. Commodity Cycles

We used the Bloomberg Commodity Index to isolate, using a simple peak to trough method, all the major commodity cycles since the early 1960s. This to put into perspective the most recent commodity rally since the nadir of the Covid crisis. We identify 9 'cycles' over this past 60 years. In the left-hand plot we show the cumulative sum, using normalised daily returns, of each of these 9 rallies, from peak to trough in number of days. The current post-Covid rally, in red, has been the biggest at its current stage, even outpacing the rally in the early 1970s. In the right-hand plot we show the same results, but using monthly data and adjusting for inflation. The current rally, even taking this adjustment into account, still outpaces every cycle hitherto, including the 1970s.



Source: Bloomberg, CFM



Source: Bloomberg, CFM

Disclaimer

ANY DESCRIPTION OR INFORMATION INVOLVING MODELS, INVESTMENT PROCESSES OR ALLOCATIONS IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY.

ANY STATEMENTS REGARDING CORRELATIONS OR MODES OR OTHER SIMILAR BEHAVIORS CONSTITUTE ONLY SUBJECTIVE VIEWS, ARE BASED UPON REASONABLE EXPECTATIONS OR BELIEFS, AND SHOULD NOT BE RELIED ON. ALL STATEMENTS HEREIN ARE SUBJECT TO CHANGE DUE TO A VARIETY OF FACTORS INCLUDING FLUCTUATING MARKET CONDITIONS, AND INVOLVE INHERENT RISKS AND UNCERTAINTIES BOTH GENERIC AND SPECIFIC, MANY OF WHICH CANNOT BE PREDICTED OR QUANTIFIED AND ARE BEYOND CFM'S CONTROL. FUTURE EVIDENCE AND ACTUAL RESULTS OR PERFORMANCE COULD DIFFER MATERIALLY FROM THE INFORMATION SET FORTH IN, CONTEMPLATED BY OR UNDERLYING THE STATEMENTS HEREIN.

CFM has pioneered and applied an academic and scientific approach to financial markets, creating award winning strategies and a market leading investment management firm.

Contact us

Capital Fund Management S.A.
23, rue de l'Université, 75007
Paris, France
T +33 1 49 49 59 49
E cfm@cfm.fr

CFM International Inc.
The Chrysler Building, 405 Lexington Avenue - 55th Fl.,
New York, NY, 10174, U.S.A
T +1 646 957 8018
E cfm@cfm.fr

Capital Fund Management LLP
2nd Floor, Bank Building, Smithson Plaza, 26 St James's Street,
London SW1A 1HA, UK
T +44 207 659 9750
E cfm@cfm.fr