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This research note is a response to the many client questions we have received about rising inflation and its potential impact on portfolio performance. It follows our recent note, *Inflation: Is It Coming and Should We Care?*[1], which explored the history of inflation in the US, why the inflation situation may be changing, and what impact inflation may have on asset prices.

Asset owners are well aware that inflation has an impact on performance. However, the extent of the impact and even the direction depend on several factors. Accordingly, Meketa developed a quantitative tool to assist decision-makers in their consideration of the potential impacts of a range of inflationary scenarios upon investment portfolios. This note explores the most influential variables — from the source of inflation, whether it was anticipated, and the length of the inflationary period, among other factors — and outlines how these considerations can be expected to affect performance across asset classes.

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[1] https://meketa.com/leadership/inflation-is-it-coming-and-should-we-care/

Current drivers of inflation

The COVID-19 pandemic disrupted both the demand and supply side of the global economy, causing short-term inflationary pressures. On the demand side, extraordinary fiscal and monetary stimulus have combined with pent-up savings to elevate consumer spending. The magnitude of these actions is difficult to overstate. US debt-to-GDP rose steadily between 2010 and 2020, with typical quarterly growth ranging from -1% to +3%. However, in 2020-Q3 it rose 28%, nearly five times the previous high mark (2008-Q4) of 5.9%.

Monetary policy tells a similar story of swift and aggressive intervention. The expansion of the Federal Reserve's balance sheet was both quicker and larger following March 2020 than the similar "Quantitative Easing" of 2008. The range of action to support financial assets also spanned a broader range as the Federal Open Market Committee instructed its trading desk to purchase not only US Treasuries but corporate debt as well.

Further on the demand-side, the pandemic induced major reductions in consumer activity: in each of the 12 months between April 2020 and April 2021, the personal savings rate was over 10%, with a peak of 33.7% in April 2020. In the 85 months

preceding the pandemic, the savings rate never eclipsed 10%. While not all the foregone consumption will necessarily be made up for as economies re-open, the force of consumers resuming economic activity after a year of subdued spending is surely inflationary.

The pandemic has similarly disrupted supply chains as manufacturers face unanticipated challenges to resume normal activities. Supply chains for semi-conductors, oil, and lumber are among the most impacted. The semi-conductor shortage began in the used automobile market as suppliers of used cars slashed chip orders, correctly anticipating a halt in transportation activity, while technology producers increased purchases as lockdown measures ushered in a year of virtual living. Now, as countries and economies re-open, car manufacturers cannot get the chips they need to meet demand. The lumber industry braced for a slump in the housing market that never came. Sawmills slowed production, but housing market demand remained strong, perhaps as many elected to relocate from cities to suburban locales in the face of global lockdowns and the drop in interest rates made financing a mortgage attractive. At its recent peak, lumber futures hit a record high of $1,615, a staggering 7x multiple of its April 2020 lows.

The availability of human capital has also become a supply side issue as low-wage employers report widespread difficulty hiring workers even while unemployment rates remain well above their pre-pandemic levels. Reasons for this include: shifts in employer preferences induced by the pandemic, unsatisfactory wages, and bolstered unemployment benefits. A University of Chicago study found that 42% of those on benefits receive more than they did in their previous jobs. Basic economic analysis suggests that to overcome the gap between labor demand and supply, the price of labor (wages) must rise, or the price at which labor is willingly supplied must fall. The former would occur if employers increase wages, which would be inflationary for the economy. The latter might happen if unemployment benefits return to lower levels, forcing a return to the workforce at current wage offerings; this would be disinflationary.

The case for short-term inflation

Despite the inflationary forces on both the supply and demand sides, there is little reason to believe these factors will cause high long-term inflation. We expect pent-up demand, monetary intervention, fiscal stimulus, and supply chain disruptions to subside in the near-term and relieve the current inflationary pressures. After these economic shocks subside, the long-term disinflationary trends of the US's aging population, disruptive technology, and low borrowing costs will still be in place.[2] Fixed-income markets seem to reflect this view as well, as the 30-year Treasury rate is virtually unchanged from its pre-pandemic level of around 2%. For reference, 10-year breakeven[3] rates remain at a modest 2.25%, on par with its pre-pandemic range.

[2] The literature on the relationship between the average age of a country's citizens and inflation implies a negative correlation, with Japan being the most notable example.

[3] Breakeven inflation expectation rates, as measured by the difference in yields between a nominal Treasury and a Treasury Inflation Protection Security (TIPS) across the same maturity points, are a typical method by which market participants assess inflation expectations.

Globally, the US's high year-over-year inflation (5.0%) seems to be the exception rather than the rule. Inflation rates in other major economies are mostly lower: Eurozone (2%), Australia (1.1%), China (1.3%), Canada (3.4%), UK (1.5%), and Japan (-0.4%). To the extent that the relatively high inflation in the US is driven by relatively strong US fiscal and monetary stimulus, we equivalently expect US inflation to come in line with that of comparable peer nations as fiscal and monetary interventions subside. The wildcard situation for more persistent inflation is the uncertainty around continued stimulus. Specifically, 1) will additional spending be forthcoming from Congress, and if so, how large and for how long will it be, and 2) what actions might the Fed take to reverse its simulative course, and when?

Inflation scenario analysis: three inflationary regimes

Although we expect the current inflationary forces to be transitory, we believe that accurately forecasting future events is extremely difficult as current trends may quickly change and new, unforeseen variables may arise.

To this end, we developed a quantitative tool that analyzes asset class performance under various inflation scenarios. This Inflation Scenario Analysis tool allows investors to "experience" an array of potential outcomes to better inform portfolio construction decisions. Further, it enables us to help our clients better understand the risk that inflation poses to their portfolios and to help them structure their portfolios to mitigate this risk.

The core of this model considers the long-held investment theory that equity assets are negatively correlated with expected and unexpected inflation. On the other hand, tangible assets such as commodities and gold have historically performed well in periods of rising inflation and may offset inflation's drag on a portfolio's performance. Our Inflation Scenario Analysis tool examines these theories under a range of inflationary regimes while examining the relationship between assets and inflation[4] and controlling for the economic environment.

[4] Please see Appendix B: Model Methodology for an explanation of non-linear asset inflation relationships.

The Scenario Analysis tool estimates average, annualized returns for a broad array of asset classes under different kinds of inflationary scenarios. Please refer to Appendix A and Appendix B for a detailed explanation on the regression models and expected returns calculation.

Scenario 1: Inflation Above Expectation

The Inflation Above Expectation scenario estimates average, annualized asset returns when realized inflation is above expected inflation (i.e., when there is "surprise" inflation).

Table 1 shows that at low levels, surprise inflation has a small, negative impact on equity assets and long-term bonds (less than 220 bp decline), and the negative returns

grow as surprise inflation increases - reinforcing the belief that equity assets and long-term bonds perform poorly in inflationary periods, particularly when inflation is much higher than expected. TIPS provide only a modest hedge as their returns are slightly negative. Commodities and gold provide the best hedge at varying surprise inflation levels but even these represent only modest gains, illustrating how damaging unexpected inflation can be to even a well-diversified portfolio of assets.

Asset Class	Inflation Slightly Higher than Expected	Inflation Moderately Higher than Expected	Inflation Meaningfully Higher than Expected
US Equity	-1.0	-4.2	-12.8
Global Equity	-0.7	-3.6	-12.3
Long-term Government Bonds	-2.2	-5.8	-11.4
TIPS	-0.5	-1.4	-3.7
Short-term TIPS	0.1	0.0	-0.4
Commodities	1.7	3.1	1.2
Gold	0.9	1.9	2.6

TABLE 1

Inflation Above Expectation Scenario: Average, Annualized Asset Returns

Note: Please see Appendix B: Model Methodology for detailed descriptions of each inflation scenario.

Scenario 2: Inflation in a High/Low Growth Environment

The Inflation and High Growth Environment scenario estimates average, annualized asset returns when realized inflation varies in an environment with high economic growth.

As expected, equities experience the highest returns in each of the high growth scenarios. However, equity returns decline modestly as inflation increases (Table 2). Gold seems to perform poorly in high growth environments generally, while the returns of TIPS are relatively flat. On the other hand, commodities' returns increase as inflation grows, suggesting they are a good inflation hedge during periods of strong economic growth.

Asset Class	High Growth and Low Inflation	High Growth and Moderate Inflation	High Growth and High Inflation
US Equity	18.6	16.9	14.3
Global Equity	27.7	23.1	18.2
Long-term Government Bonds	3.3	-0.4	-2.5
TIPS	0.9	0.5	1.1
Short-term TIPS	-0.3	-0.2	0.1
Commodities	6.1	10.6	12.1
Gold	-10.2	-8.5	-4.0

TABLE 2

Inflation and High Growth Environment Scenario: Average, Annualized Asset Returns

Scenario 3: Inflation and Low Growth Environment

The Inflation and Low Growth Environment scenario estimates average, annualized asset returns when realized inflation varies in an environment with low economic growth.

Equities and long-term government bonds perform poorly in low growth economic environments, and their performance worsens as inflation increases. Commodities are the best hedge in low growth and moderate-to-high inflation periods – the expected return for commodities is positive in all scenarios and returns increase with higher inflation. Gold provides a small hedge only when inflation is high, while TIPS are not a great hedge during periods of low growth.

Asset Class	Low Growth and Low Inflation	Low Growth and Moderate Inflation	Low Growth and High Inflation
US Equity	-9.3	-10.6	-12.6
Global Equity	-12.1	-15.4	-18.9
Long-term Government Bonds	-4.4	-7.9	-9.8
TIPS	-1.6	-2.0	-1.4
Short-term TIPS	-0.6	-0.5	-0.2
Commodities	2.2	6.5	8.0
Gold	-4.2	-2.4	2.4

TABLE 3
Inflation and Low Growth Environment Scenario: Average, Annualized Asset Returns

Scenario 4: Moderate Inflation Period

Meketa also analyzed the effect of the length of the inflation period on asset returns under "moderate" inflation and "extreme" inflation.

The Moderate Inflation Period scenario estimates expected asset returns for short, medium and long-term periods when the realized inflation level is moderate.

Equities have slightly negative expected returns in moderate inflation periods, and the returns grow more negative with longer inflation periods (Table 4). Commodities are a very strong hedge for short- to long-term inflation periods, while gold is the second-best hedge and experiences its highest returns in long-term inflation periods.

Asset Class	Very Brief, Moderate Inflation Spike	Brief, Moderate Inflation Spike	Extended, Moderate Inflation Spike
US Equity	-1.5	-3.1	-9.9
Global Equity	-3.3	-5.0	-11.9
Long-term Government Bonds	-6.1	-6.3	-5.8
TIPS	-0.1	0.0	0.7
Short-term TIPS	0.4	0.4	0.2
Commodities	14.8	15.5	14.6
Gold	5.2	8.6	23.6

TABLE 4
Moderate Inflation Period Scenario: Average, Annualized Asset Returns

Scenario 5: Extreme Inflation Period

The Extreme Inflation Period scenario estimates expected asset returns for short, medium and long-term periods when the realized inflation level is very high, similar to levels experienced in 1971-1972.

Table 5 shows that the patterns observed in the Moderate Inflation Period scenario continue for the Extreme Inflation Period case. For example, at extreme levels of inflation, gold is a very strong inflation hedge in all scenarios and performs best in long-term inflation periods. Commodities are also a very strong hedge, but their returns decline modestly as the length of the inflation period grows. Equities perform very poorly during these periods.

Asset Class	Very Brief, Extreme Inflation Spike	Brief, Extreme Inflation Spike	Extended, Extreme Inflation Spike
US Equity	-11.4	-14.2	-18.7
Global Equity	-13.5	-16.2	-20.5
Long-term Government Bonds	-6.0	-5.5	-4.3
TIPS	0.8	1.1	1.6
Short-term TIPS	0.2	0.2	0.0
Commodities	15.3	14.0	11.4
Gold	27.4	34.6	47.2

TABLE 5
Extreme Inflation Period Scenario: Average, Annualized Asset Returns

Conclusion

The current drivers of inflation are real and warrant careful consideration. However, we believe that they are likely to remain short-term. Pent-up demand and supply chain issues are direct consequences of the now-receding pandemic, particularly in the US. Monetary and fiscal stimulus are direct policy responses.

As pandemic-related risks continue to decline and economies re-open, it stands to reason that these short-term drivers of inflation will similarly subside. The core structural dis-inflationary realities of global demographics (e.g., an aging US population) and low borrowing costs should continue to dominate the long-term inflation view, which we hold as low to moderate.

Although rising prices will likely subside in the near-term, there is still considerable uncertainty about the outcome. Moreover, inflation still has a sizeable impact on asset prices, and the impact varies based on the type of inflationary environment. Understanding inflation's effect on different asset classes can help investors develop a portfolio that is well-positioned to hedge against inflation risk.

Appendix A: Model approach and limitations

The Inflation Scenario Analysis tool is based on a multivariate regression model that estimates the effects of realized and surprise inflation on monthly asset returns, controlling for the economic environment. Quadratic independent variables are added to the regression model to account for potential non-linearity between an asset class and inflation. Estimated returns are then calculated as the expected value of asset class returns, conditional on the inflation scenario.

The reasons for this model approach are detailed below.

Control for the economic environment. Meketa wanted to control for the economic environment when looking at an asset's inflation hedging ability. Economic theory holds that inflation and growth are tightly related – low levels of inflation tend to spur economic activity, but when economic activity heats up too quickly, inflation grows. A regression model allowed us to estimate how much an asset's performance is due to the economic environment compared to its actual inflation-hedging ability.

Avoid mis-specification. An asset class' inflation hedging ability is typically measured through the correlation of asset performance and inflation levels in historical periods. However, the real relationship between inflation and many asset classes is likely non-linear. Hence, inferring the relationship of inflation and asset returns with linear correlations could mis-specify their real relationship.

Small sample size. Meketa was limited to using regression models to identify the relationship between inflation and asset performance due to the small sample size. Non-parametric models require large sample sizes to perform well, but our sample size was 576 months.

Easy interpretation. The estimated coefficients in a regression model are easy to interpret and validate with theory. Linear regression coefficients are interpreted as elasticities – the effect of Y given one unit increase in X holding all else constant.

As with all regression models, the results of our multivariate regressions depend on the following assumptions to be true:

→ The linear functional form represents the true data-generating process.
→ The covariance between the error term and independent variables are 0.
→ The error term is normally distributed around 0 and has a finite variance.
→ The residuals are homoscedastic and are not correlated.

The assumptions need to hold true for our estimators to be unbiased. In addition, by using a model with historical data, Meketa assumes that future asset behavior is similar to past asset behavior.

Appendix B: Model Methodology

Inflation above expectation

The model examines the effect of surprise inflation on asset returns, controlling for the economic environment and realized inflation:

$$Asset\ Returns = \beta_0 + \beta_1\ Unemployment + \beta_2\ Unemployment^2 + \beta_3\ Inflation +$$
$$\beta_4\ Inflation^2 + \beta_5\ Surprise\ Inflation + \beta_6\ Surprise\ Inflation^2$$

where Asset Returns is the monthly asset class return from 1973 to 2020, unemployment is the 3-month rolling average unemployment rate, inflation is the monthly change in CPI from the 3-month rolling average CPI, and surprise inflation is the difference between this month and last month's inflation rate. Unemployment and inflation data are taken from the St. Louis Federal Reserve Bank's FRED database. The independent variables $Unemployment^2$, $Inflation^2$ and Surprise $Inflation^2$ capture the non-linear effects of realized inflation, surprise inflation, and the economic environment on asset returns. For example, the relationship between Long-term Government Bonds and realized inflation may be an upside-down U shape in periods of high economic growth – Long-term Government Bond returns are positive when monthly inflation is low at .2%, but returns turn negative when monthly inflation reaches higher levels, such as 0.5%.

The estimate is the annualized return of:

$$\beta_5 * E[Surprise\ Inflation\,|\,Scenario] + \beta_6 * E[Surprise\ Inflation^2\,|\,Scenario]$$

where the scenarios are low (.05%, 25th percentile), medium (.15%, median), and high (.3%, 75th percentile) surprise inflation.

Inflation and high/low growth

The model examines the combined effect of inflation and GDP Growth on asset returns:

$$Asset\ Returns = \beta_0 + \beta_1\ GDP\ Growth + \beta_2\ GDP\ Growth^2 + \beta_3\ Inflation + \beta_4\ Inflation^2$$

where Asset Returns is the monthly asset return from 1973 to 2020, GDP Growth is the percent change in GDP from the previous quarter, and inflation is the monthly change in CPI from the 3-month rolling average CPI. GDP Growth and inflation data are taken from the St. Louis Federal Reserve Bank's FRED database. Since GDP data is only quarterly, the regression was run on quarterly asset return, GDP and inflation observations.

The estimate is the annualized return of:

$$\beta_1 * E[GDP\ Growth\,|\,Scenario] + \beta_2 * E[GDP\ Growth^2\,|\,Scenario] +$$
$$\beta_3 * E[Inflation\,|\,Scenario] + \beta_4 * E[Inflation^2\,|\,Scenario]$$

where the GDP Growth scenarios are high growth rate of 1% (75th percentile) and low growth rate of .3% (25th percentile). The inflation scenarios are low (.07%, 25th percentile), medium (.25%, median), and high (.5%, 75th percentile) realized inflation.

Inflation duration

The model examines the effect of inflation duration on asset return, controlling for the economic environment:

$$Asset\ Returns = \beta_0 + \beta_1\ Unemployment + \beta_2\ Unemployment^2 +$$
$$\beta_3\ Inflation + \beta_4\ Inflation^2$$

where Asset Returns is the monthly asset return from 1973 to 2020, unemployment is the 3-month rolling average unemployment rate, and inflation is the monthly change in CPI from the 3-month rolling average CPI. Unemployment and inflation data are taken from the St. Louis Federal Reserve Bank's FRED database.

The estimate is the annualized return of:

$$\beta_3 * E[Inflation\,|\,Scenario] + \beta_4 * E[Inflation^2\,|\,Scenario]$$

where the scenarios are short (1-2 months), medium (4-8 months) or long-term (12+ months) inflation duration.

Appendix C: Benchmarking

The following table lists the benchmarks used for each asset class.

Asset Class	Benchmark
US Equity	Russell 3000
Global Equity	MSCI ACWI
Long-term Government Bonds	Bloomberg Barclays US Treasury: Long Index
TIPS	Bloomberg Barclays Global Inflation-Linked: US Tips
Short-term TIPS	Bloomberg Barclays US Treasury Tips 1-5 Years Index
Commodities	Bloomberg Commodity Index
Gold	LBMA Gold Price PM USD

TABLE 6
Asset Class Benchmarks

References

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