

Commodity investing and its role in a portfolio

- Commodities is one of the least understood asset classes. This paper demystifies commodity investing by taking a deep dive into its returns, diversification benefit, and link to inflation.
- Incorporating commodities may improve investors' outcomes and add more resilience to a portfolio. For inflation-hedging portfolios that require exposure to assets with high sensitivity to inflation, commodities can effectively help mitigate inflation risk.
- Commodities can play an important role in a goals-based inflation beta target strategy, an approach that immunizes a strategic portfolio to inflation with a specified inflation beta. For investors who target wealth growth, nonstatic, time-varying portfolios can vary the optimal level of commodities based on the economy and inflation.

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Commodities is one of the oldest and yet least understood asset classes, with which investors have a love-hate relationship. Like the traditional asset classes—equities and bonds—commodities can play a role in investment portfolios as well as personal finances. While we may not consciously think about commodities, we consume them daily, from the gas in our cars to the bread on our tables. This everyday use makes commodities an interesting hedging asset class.

The last decade was not very forgiving to commodities investors, who may have wondered whether it was a bad investment strategy or just an unlucky draw. Can commodities earn a positive real return in the long run? And what is their purpose in a strategic asset allocation?

This paper will address these questions by first introducing the key pillars of commodity investing: return and diversification. We will carry out an analysis of historic drivers and the relationship between commodities and other asset classes. Next, we will link commodities to inflation by taking a deep dive into commodities' inflation-hedging abilities and how this relates to other asset classes.

Finally, we will use Vanguard's proprietary models, the Vanguard Capital Markets Model (VCMM)[®] and the Vanguard Asset Allocation Model (VAAM), to evaluate the role of commodity investing in strategic asset allocation. Given the significant link between commodities and unexpected inflation, we will also evaluate the use of commodities in goals-based asset allocation, or inflation hedging.

Basics of commodity investing: Return and diversification

Mutual funds and ETFs invest in commodities through commodity futures contracts—standardized agreements to buy or sell a specific amount of a commodity at a future date. The contract's return does not necessarily represent

direct exposure to the physical (spot) commodity; it can be broken down into two components: spot return and roll return.

Since commodity futures are derivatives, funds fully collateralize their exposure, which, in turn, produces a collateral return. Therefore, traditional commodity funds' and ETFs' returns are captured by the following components:

- **Collateral return:** usually a 3-month Treasury bill, but commodity futures can be collateralized with many financial instruments ranging from Treasuries to equities.
- **Spot return:** an approximation of a physical commodity price change.¹
- **Roll return:** the price difference between the nearby contract being sold and the distant contract being bought.

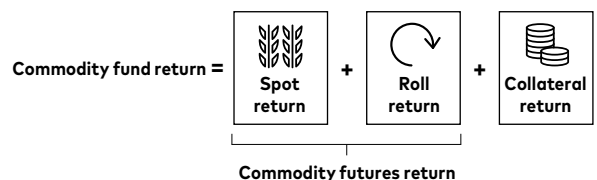
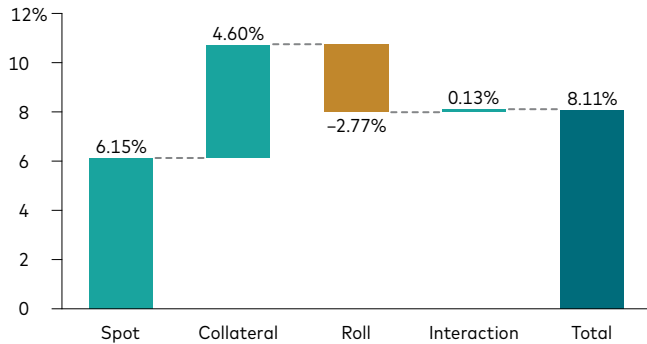


Figure 1 breaks down the components of the Bloomberg Commodity Index (BCOM) return from 1960 through June 2022. To better capture the relationship between the components, we have divided the data into two timeframes: the full period for BCOM backfilled history and the period beginning in 1984, when energy futures were first introduced.² Historically, most positive commodity returns came from spot and collateral returns, while the roll component was negative. Even though the commodity premium has shrunk over the last decade, investors should expect a positive long-term premium between 50 and 300 basis points.

¹ Spot return is not easily observable. We use near-maturity futures as a proxy because we know that futures prices and physical prices converge near the futures' maturity.
² Energy futures is one of the most volatile commodity sectors and one of the major drivers of its relationship with inflation.

FIGURE 1.
Index return components

BCOM total return (1960–2022)



Distribution of commodity returns (spot and roll, annualized geometric)

1960–2022	One-year rolling return
5th percentile	-25.41%
25th percentile	-6.78%
50th percentile	2.98%
75th percentile	14.50%
95th percentile	37.41%

Return components

		BCOM total	Collateral (T-bill)	Spot	Roll	Interaction
1960–2022	Return	8.11%	4.60%	6.15%	-2.77%	0.13%
	Volatility	15.96%	0.96%	16.21%	4.33%	
1984–2022	Return	4.01%	3.41%	4.34%	-3.71%	
	Volatility	14.48%	0.82%	14.76%	3.40%	-0.03%

Source: Vanguard, based on data from BCOM for the period January 1960–June 2022.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

Until 2008, return was one of the main reasons to include commodities as an asset class in an investor’s portfolio, creating the so-called “three-legged stool” along with equities and bonds. This was a consistent argument in seminal academic research such as Gorton and Rouwenhorst (2006) between 1984 and 2007, during which time commodities’ annualized return was 8.2%.³ The

decade that followed that expansion brought capital destruction via a disappointing –6.8% annualized return. This boom-bust supercycle behavior raised a lot of questions in investors’ minds. One of several reasons for the disappointing results was low inflation. We will address the link between commodities and inflation in a later section.

³ We used 1984 as a starting point because we wanted to capture commodity returns including energy contracts, which were introduced in that year.

The theory behind positive commodity returns

An investor might ask why a long-only exposure to commodity futures would produce a positive real return in the long run. If the futures market reflects the unbiased views of all investors, shouldn't the implied return be 0%? Well, it's not that simple. Two economic theories, Normal Backwardation and Theory of Storage, focusing on mechanisms of risk transfer, have been developed to explain the expected positive risk premia associated with investing in commodities.

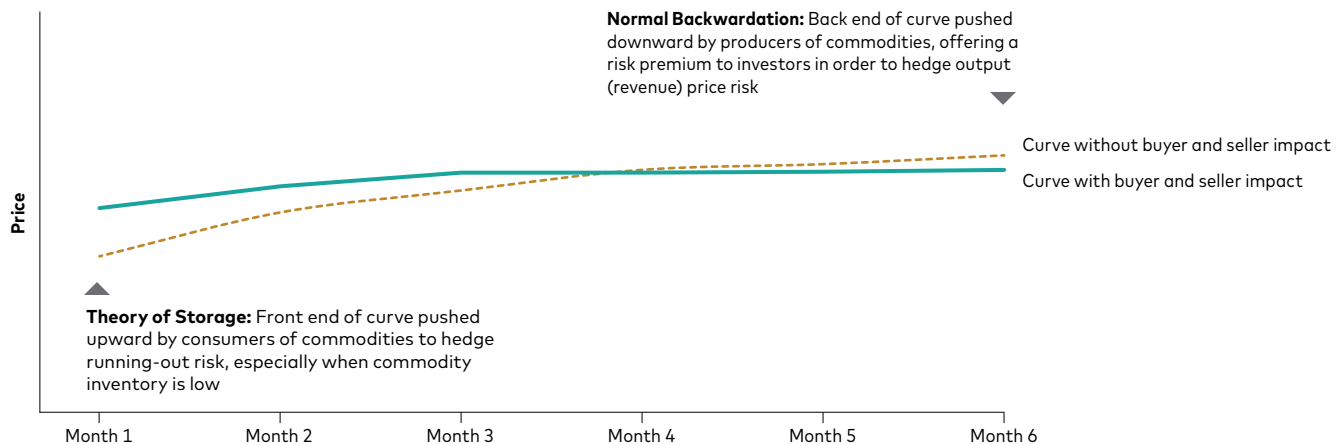
According to the Normal Backwardation theory, put forth by Keynes (1930) and Hicks (1939), producers' revenue is predominantly affected by the commodities that they extract. Therefore, to ensure the future sale price of their commodities, producers hedge pricing through futures sales. This allows them to lock in the future price and pass the uncertainty (risk) to speculators, consumers, and processors for a premium. These are the same mechanics that make insurance companies

profitable: a risk transfer compensated by the premium. Since the majority of hedging is done on the further part of the curve, the expected commodity curve is flatter than normal supply/demand balance would indicate.

In contrast, the Theory of Storage, developed by Kaldor (1939), Working (1949), and Brennan (1958), shifts the spotlight to commodities buyers. Because buyers cannot afford to have their production cycle disrupted by a lack of commodity inventory, they bid up the front end of the commodity curve to ensure that they have raw materials to keep the factory going.

Although they differ in economic rationale, both theories lead to a flatter-than-equilibrium (as it would be without these risk transfers) commodity futures curve and a positive expected premium for commodity investors. **Figure 2** shows how both theories affect the commodity curve.

FIGURE 2.
Impact of Normal Backwardation and Theory of Storage



Source: Vanguard (hypothetical example).

While the return argument may be questioned, the diversification of commodity investing has maintained its benefit and proven itself over time. **Figure 3** shows that commodities diversify both equity (with a correlation of 0.27) and fixed income (with a correlation of -0.07).

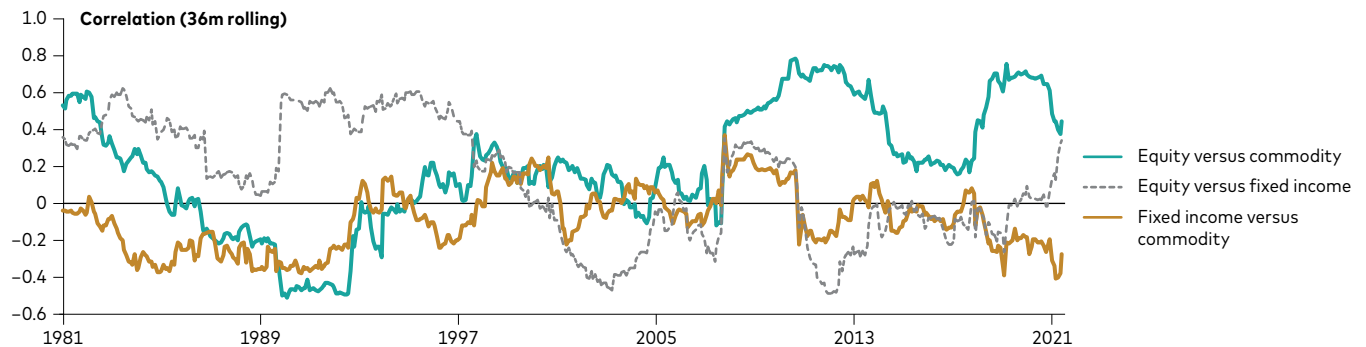
FIGURE 3.
U.S. assets summary statistics correlation

	Commodities	U.S. equity	U.S. fixed income
Commodities	1	0.27	-0.07
U.S. equity	0.27	1	0.19
U.S. fixed income	-0.07	0.19	1

Sources: BCOM Index total return, Russell 3000 Index total return, and Bloomberg U.S. Aggregate Bond Index from January 1979 through June 2022.

High volatility and low correlation are attractive properties for an asset class when weighing allocation decisions. To add more robustness to our low-correlation argument, we evaluated the stability of that correlation through time and found persistent correlation with a few episodic breaks. **Figure 4** captures the rolling correlation among the major U.S. asset classes. We observe that (1) the correlation between commodities and fixed income has been very stable, fluctuating at near or below zero, and (2) the correlation with equity has been less stable, varying between -0.4 and 0.8 .

FIGURE 4.
Rolling three-year correlation



Source: Vanguard, based on data from BCOM Index total return, Russell 3000 Index total return, and Bloomberg U.S. Aggregate Bond Index from January 1979 through June 2022.

Why do commodities show lower correlation with both equities and bonds? We would expect commodities to behave differently than traditional asset classes, especially when commodity price shocks are supply-driven (see call-out box Supply and demand shocks). Commodities is not a capital asset class and is not driven by discounting expected cash flows. Rather, it is directly affected by macro factors and current supply/demand dynamics that reflect the views of all buyers and sellers. As a result, commodities are all about the here and now, while equity and fixed income are indicative of the future.

The benefits of having diversification and positive real return expectations can make commodity investing an attractive component of strategic asset allocation. The historically strong relationship between commodities and inflation makes this asset class even more compelling for goals-based investing, specifically for unexpected inflation hedging.

Supply and demand shocks

Equities and commodities move in the same direction

An example of a demand-based shock is an economic slowdown scenario during which equities would be pressured by expected lower earnings and commodities would be driven down by lower demand.

Only commodities are affected

A recent supply shock is the Russian invasion of Ukraine. Ukraine is known as a breadbasket of Eastern Europe and one of the major wheat producers. The expectation of Ukraine producing less grain drove wheat prices up significantly, whereas equities and bonds were not affected by this micro-commodity event.

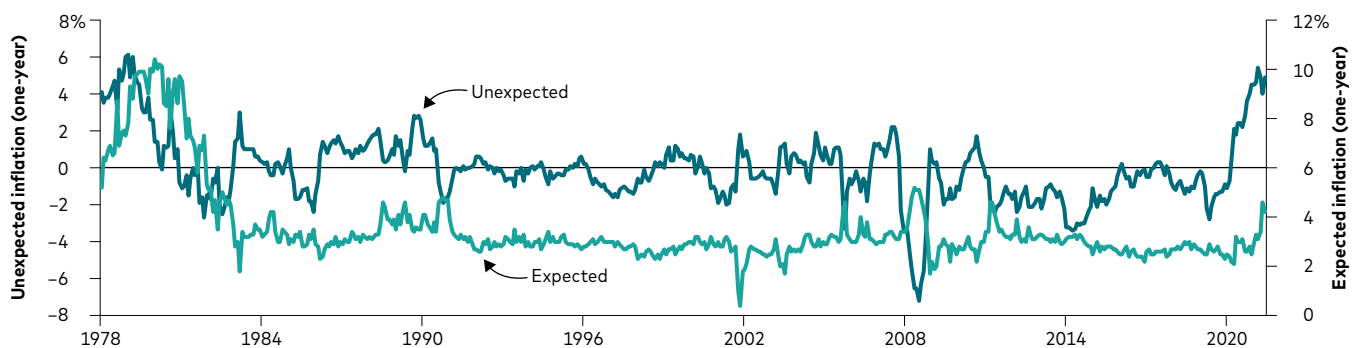
Linking commodities to inflation

To evaluate the impact of inflation on commodities and core asset classes, we first must define what we mean by inflation. As shown in previous academic (Fama and Schwert, 1977; Gorton and Rouwenhorst, 2006) and Vanguard (Bhardwaj, Hamilton, and Ameriks, 2011) research, inflation can be divided into two categories: expected and unexpected. Expected inflation is already priced in by the market, and equity and fixed income assets reflect that level of inflation in their valuations. Unexpected inflation comes as a surprise, and we know that capital markets generally do not like surprises. The rest of this section will concentrate

on unexpected inflation because it can be damaging to an investor portfolio consisting of traditional asset classes.

We have tested several approaches to isolate unexpected inflation and decided on the University of Michigan survey of consumers to anchor inflation expectations. Unexpected inflation is therefore the difference between realized inflation and the survey's expectation. **Figure 5** captures the summary of this interaction. As one would expect, unexpected inflation hovers at about 0%, and expected inflation is somewhat stable at between 2% and 4%.

FIGURE 5.
Expected and unexpected inflation



Sources: Vanguard, based on data from Bloomberg U.S. Consumer Price Index YoY and the University of Michigan survey of consumers, January 1979 through June 2022.

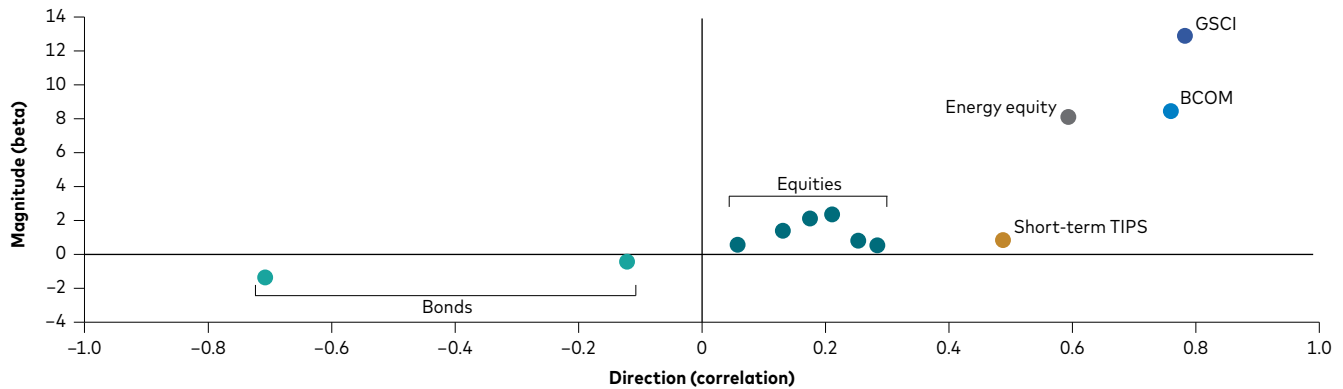
Historic distribution of inflation components

Percentile	Realized inflation (1979–2022)	Expected	Unexpected
5th	0.8%	2.4%	-2.4%
25th	1.8%	2.8%	-1.1%
Mean	3.5%	3.5%	-0.1%
50th	2.8%	3.0%	-0.2%
75th	4.0%	3.4%	0.8%
95th	10.5%	7.8%	3.5%

We chose to concentrate on two statistics to evaluate the impact of inflation on asset classes: correlation (direction) and beta (magnitude).⁴ This simple framework can help to identify and

guide asset allocation decisions. We tested the relationship between expected and unexpected inflation in numerous asset categories and summarize the key findings in **Figure 6**.⁵

FIGURE 6.
Inflation versus key asset classes



Significance of regression versus inflation surprises (unexpected inflation)

	Beta (magnitude)	Relationship*		Beta (magnitude)	Relationship*
BCOM	8.4	Significant	TIPS	0.8	Significant
GSCI	12.9	Significant	Short-term TIPS	0.8	Significant
U.S. equity	1.4	Not significant	REITs	2.1	Borderline
Non-U.S. equity	2.3	Borderline	Gold	0.5	Not significant
U.S. bonds	-0.5	Not significant	Energy equity	8.1	Significant
Non-U.S. bonds	-1.4	Significant**	Cash	0.5	Significant

*Based on Newey-West adjusted T-stat of slope.

**Based on a very short history. With a longer history, we would expect a relationship similar to that of U.S. bonds.

Source: Bloomberg. Data are based on information from BCOM, S&P GSCI, the Russell 3000 Index for U.S. equity, the U.S. Aggregate Bond Index for U.S. bonds, the FTSE REITs Index, BCOM Index Gold, and FTSE 3-Month Treasury Bill Index from January 1984 through June 2022. Non-U.S. equities data are based on the MSCI ACWI ex USA Index from December 1987 through June 2022. Non-U.S. bonds data are based on the Global Aggregate ex-USD Hedged Index from January 2013 through June 2022. U.S. TIPS data are based on the Bloomberg U.S. Treasury Inflation-Protected Securities Index from March 1997 through June 2022, short-term TIPS data on the Bloomberg U.S. 1-5 Year Treasury Inflation-Protected Securities Index from September 2002 through June 2022, and energy equity on the S&P 500 Energy Index from September 1989 through June 2022.

⁴ Beta represents the sensitivity of returns to changes in a specific variable. For example, if unexpected inflation increases by 2%, the return of TIPS, with a beta of 0.8, may rise 1.6%.

⁵ Results of calculations for total inflation were not significantly different because a large amount of total inflation variability is driven by unexpected inflation.

It is clear that bonds do not fare well during inflation shocks as they have a consistently negative correlation to unexpected inflation changes. On the other hand, commodities and energy stocks are very responsive and historically have provided a great buffer against inflation shocks. This is not surprising because commodities are directly linked to the CPI basket. As of May

2022, nearly 43% of the Consumer Price Index for All Urban Consumers' weight was linked directly or indirectly to commodities.⁶

The table below summarizes the findings of the relationship between unexpected inflation and key asset classes. While this paper mainly concentrates on the value of commodities, it would be misleading to not mention other asset classes, such as TIPS, that are known for their inflation-hedging abilities.

Categories	Descriptions
Commodities	The commodity index, represented by BCOM, has nearly always exhibited a positive and significant relationship with unexpected inflation. The volatility of this relationship has fluctuated significantly, with some (early periods) dropping below 0. Investors should be aware that the relationship between commodities and inflation can vary in the short run and, based on empirical observation, should assume a beta of between 6x and 10x. If short-term inflation hedging is the objective, historically, commodities would have been a great choice.
Equities and bonds	Equities do not have a consistent relationship with inflation and spend nearly identical time fluctuating between a positive and negative correlation. While not a great short-term hedge, equity will pass through inflation to consumers, and the risk premium is expected to outperform inflation. If the objective of the portfolio is to beat inflation over the long run, equities would be the preferred choice over commodities. Bonds nearly always suffer from inflation shocks but remain the foundation of stability and should not be ignored.
Real assets and TIPS	REITs are frequently viewed as a real estate proxy, but they carry a significant amount of equity beta. We do not find REITs to be a great or stable inflation hedge. We also do not find gold to be a strong inflation-hedging contender. After testing all individual commodities, gold exhibited one of the weakest betas (below 1) in the BCOM universe. As expected, based on their design, TIPS show a stable beta persistency. They are a solid hedging choice, but they are limiting from the capital efficiency point of view because their relatively low inflation beta means only the TIPS portion of the portfolio is inflation-hedged.
Energy stocks	While we have found a significant relationship between energy stocks and inflation, investors should be careful when using energy stocks for inflation hedging because of several factors: (1) significant beta to the equity market means equity return could be driven by market beta and not inflation, (2) many energy companies hedge their output, potentially muting the risk-transfer to investors, (3) individual companies' capital structure and management quality can be a large driver of returns, and lastly, (4) idiosyncratic company risk can send company stock in the opposite direction from energy return (for example, after an accident on a drilling platform, company stock might go down because of liability while oil might rally because of a temporary shortage).

⁶ As of May 2022, the Consumer Price Index for All Urban Consumers had a commodities weighting of 43%, including 13.4% to food, 8.3% to energy, and 21.4% to other commodities.

Although the perfect anti-inflation instrument does not exist, commodities and TIPS can play a significant role in asset allocation because of their structural linkage to inflation, persistent correlation (direction), and significant beta (magnitude).

The attractive investment properties of commodities outlined thus far provide reasons for their inclusion in strategic asset allocation and goals-based (inflation-hedging) portfolios. The remainder of the paper will focus on considerations for including commodities in investment portfolios and the principal drivers behind that decision.

Constructing strategic portfolios with commodities

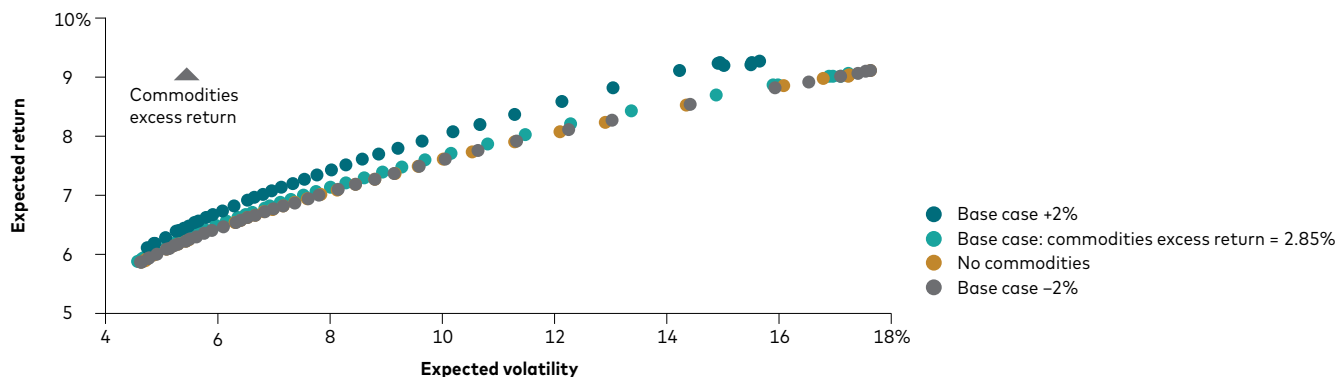
When constructing portfolios that include commodities, the goal is to find the optimal asset allocation among equities, bonds, and commodities that produces the best risk-return trade-off. We aim to determine whether including commodities

can improve investors' outcomes. To do so, we use our utility-based optimized framework, the Vanguard Asset Allocation Model (VAAM) (Aliaga-Díaz et al., 2019), to examine the effects of adding commodities to a strategic balanced portfolio.

Our research shows that the benefit of a commodities allocation depends on the expected excess returns. **Figure 7** shows the shifts in the efficient frontier resulting from the inclusion of commodities using different levels of risk premia.

Adding commodities with the expected excess return of 2.85% (our base case) yields a marginally better risk-adjusted return than a portfolio without commodities. However, the difference is not significant. In the case of positive excess returns (base case +200 bps), the efficient frontier shifts upward with a steeper curve and material commodities loading. In the case of negative excess returns (base case -200 bps), the frontier shifts marginally downward as the model decides not to load commodities.

FIGURE 7.
Efficient frontiers for an unconstrained strategic portfolio with different commodity premia



Notes: U.S. equities are represented by the MSCI US Broad Market Index, global ex-U.S. equities by the MSCI All Country World ex USA Index, U.S. bonds by the Bloomberg U.S. Aggregate Bond Index, global ex-U.S. bonds by the Bloomberg Global Aggregate ex-USD Index, and commodities by the Bloomberg Commodity Index.
Source: Vanguard.

Next, we examine the trade-offs of including commodities in a standard set of strategic portfolios. As shown in **Figure 8**, the optimal allocation of commodities on an absolute basis

varies based on expected excess returns. Weights of commodities increase as we move toward more aggressive allocations.

FIGURE 8.
Stress test on commodities' excess return and impact on allocation

Excess return	Absolute allocation of commodities			
	20/80 portfolio	40/60 portfolio	60/40 portfolio	80/20 portfolio
-250bps	0.0%	0.0%	0.0%	0.0%
-200bps	0.0%	0.0%	0.0%	0.0%
-150bps	0.0%	0.0%	0.2%	0.5%
-100bps	0.1%	0.1%	0.4%	0.7%
-50bps	0.1%	0.8%	1.2%	1.5%
Excess return of 2.85%	0.1%	1.5%	2.4%	3.6%
+50bps	0.3%	2.7%	5.4%	6.4%
+100bps	0.6%	3.4%	6.0%	9.5%
+150bps	2.3%	4.8%	7.8%	12.1%
+200bps	2.8%	5.6%	10.6%	14.4%
+250bps	2.9%	6.0%	11.0%	15.1%

Notes: U.S. equities are represented by the MSCI US Broad Market Index, global ex-U.S. equities by the MSCI All Country World ex USA Index, U.S. bonds by the Bloomberg U.S. Aggregate Bond Index, global ex-U.S. bonds by the Bloomberg Global Aggregate ex-USD Index, and commodities by the Bloomberg Commodity Index.

Source: Vanguard.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of December 31, 2021. Results from the model may vary with each use and over time. For more information, please see p. 18.

Constructing goals-based inflation-hedged portfolios with commodities

Historically, high inflation has often had a significant negative impact on portfolios:

1. It can impair bonds and growth assets such as technology stocks, which will drag down return if a portfolio has a heavy position in those assets.
2. The negative co-movements between bonds and equities could turn positive amid high inflation, and this may reduce bonds' risk mitigation and diversification effects.
3. High inflation can significantly erode investors' purchasing power.

In this section, we examine the use of commodities by investors who seek to hedge their strategic portfolios against inflation as a goals-

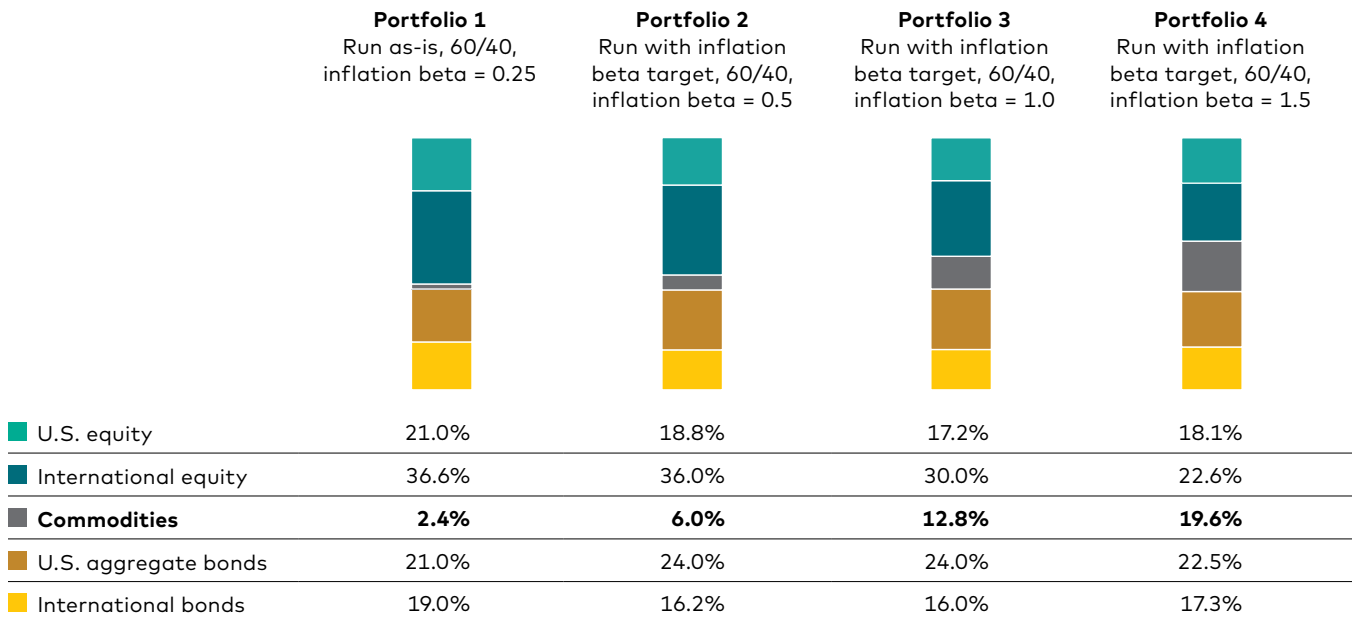
based objective. The VAAM framework targets a portfolio with a specific level of inflation beta because of investors' aversion to inflation (Aliaga-Díaz et al., 2022).

To determine commodities' hedging power against inflation, we examined empirical data and forward-looking return projections for commodities and inflation to calculate inflation beta. Vanguard research (Bosse, 2019) has shown that inflation beta provides the most relevant measure of portfolio sensitivity for investors seeking to hedge inflation. It measures an asset's predicted reaction to a unit of inflation. Over the last three decades, commodities had a beta to inflation of about 6 to 10. This suggests that a small commodity position can offer outsized protection for the overall portfolio.

Using a 60/40 strategic portfolio as an example, we evaluated the changes in commodities allocations as we targeted various inflation beta. As shown in **Figure 9**, Portfolio 1, with an inflation beta of 0.25, is the natural strategic allocation using VCMM steady state forecasts as of December 2021. Portfolios 2 to 4 are goals-based

inflation portfolios. They use the same forecasts but have target inflation beta of 0.5, 1.0, and 1.5 at the portfolio level. The allocation to commodities increases as the beta moves higher. If inflation rises 1%, we expect Portfolio 3's value to rise 1%, helping to preserve wealth.

FIGURE 9.
Asset allocation for a 60/40 strategic portfolio targeting various inflation beta



Note: Data are based on December 2021 steady state Vanguard Capital Markets Model forecasts. U.S. equities are represented by the MSCI US Broad Market Index, global ex-U.S. equities by the MSCI All Country World ex USA Index, U.S. bonds by the Bloomberg U.S. Aggregate Bond Index, global ex-U.S. bonds by the Bloomberg Global Aggregate ex-USD Index, and commodities by the Bloomberg Commodity Index.

Source: Vanguard.

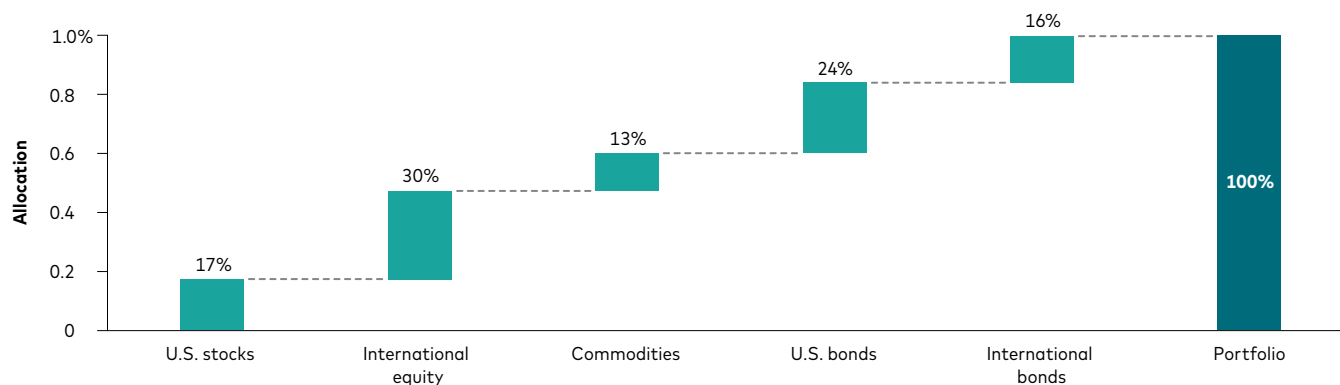
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Figure 10 shows sources of decomposed inflation beta attribution for Portfolio 3, with a total inflation beta of 1.0. As shown, commodities are the dominant contributor. A 12.8% portfolio allocation to commodities contributes 98% of inflation beta.

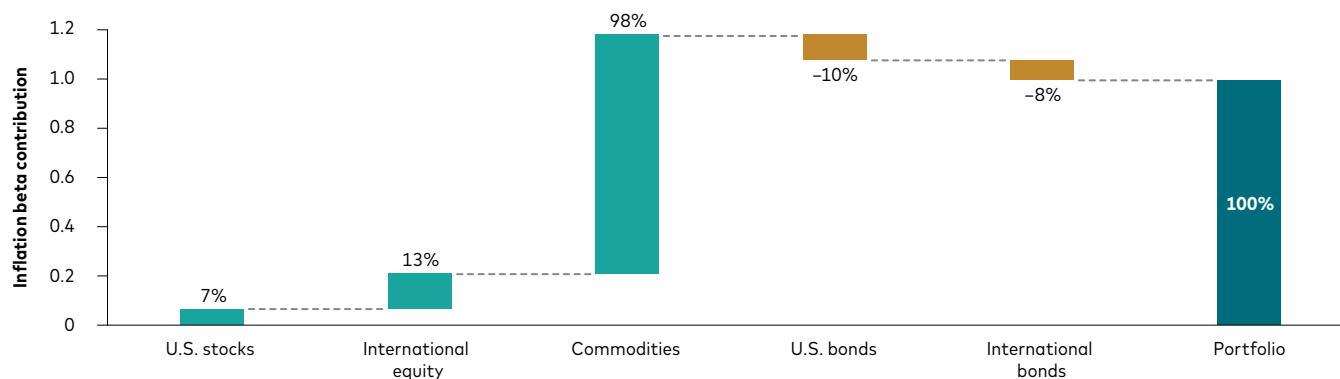
While commodities offer protection against inflation, over the long run they have a lower risk premium than equities. Replacing equities with commodities in a strategic portfolio may result in underperformance compared to a market-capitalized portfolio.

FIGURE 10.
Inflation beta decomposition for Portfolio 3, a 60/40 strategic portfolio with an inflation beta of 1.0

a. 60/40 portfolio asset allocation



b. Inflation beta attribution



Notes: Commodity inflation beta was calculated using the historical total return of the Bloomberg Commodity Index and the historical YoY CPI from 1985 to 2021. U.S. equities are represented by the MSCI US Broad Market Index, global ex-U.S. equities by the MSCI All Country World ex USA Index, U.S. bonds by the Bloomberg U.S. Aggregate Bond Index, global ex-U.S. bonds by the Bloomberg Global Aggregate ex-USD Index, and commodities by the Bloomberg Commodity Index.

Source: Vanguard.

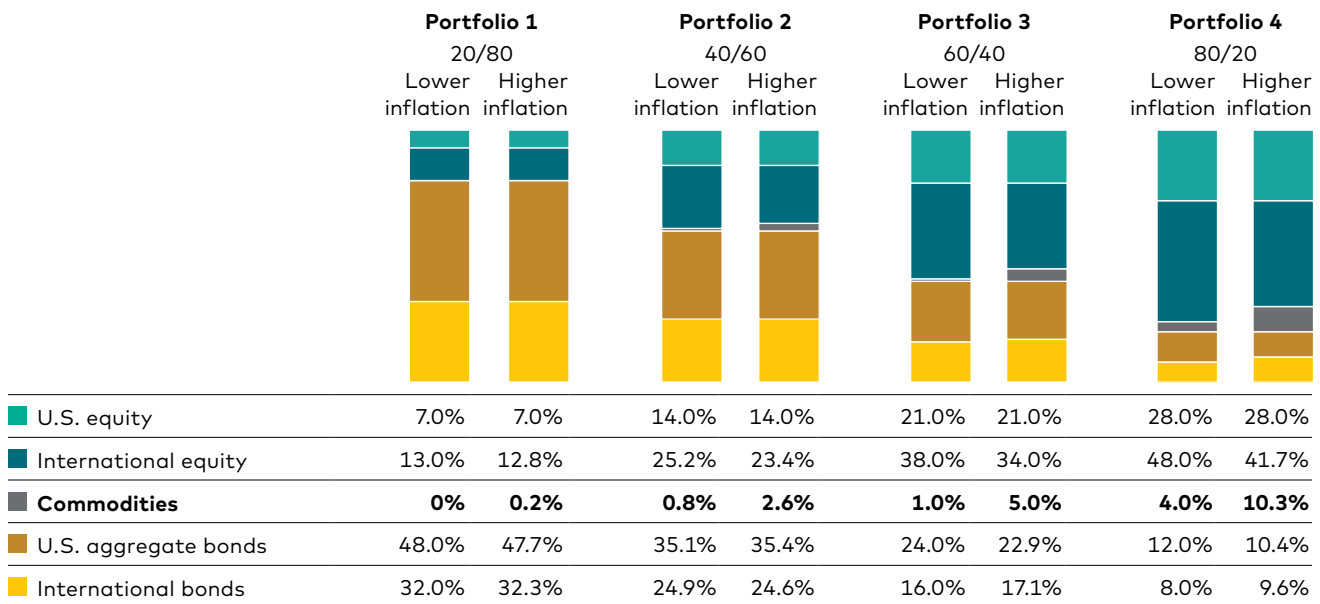
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Constructing time-varying portfolios with commodities

The optimal percentage of commodities in a portfolio will vary based on different inflationary and economic conditions. Investment opportunities change over time, and this affects how allocations respond to changing forecasts for investors who are willing to take on model risk and consider adjusting their asset allocations when market conditions materially change. Changing asset expectations drive what are known as time-varying portfolios.

Figure 11 illustrates two asset allocation solutions with the same set of investor preferences as of September 2018 (a lower-inflation period) and March 2022 (a higher-inflation period). In the higher-inflation scenario, our asset allocation model, in combination with a time-varying asset return expectation generated by the Vanguard Capital Markets Model (VCMM), considers the period's economic conditions and valuation metrics, which leads to an increase in commodities allocation. In the lower-inflation scenario, the asset allocation model chooses to load a lower percentage of commodities. As expected, high(er) inflation leads to commodity allocation.

FIGURE 11.
Commodities allocation for various risk levels and inflation conditions



Notes: U.S. equities are represented by the MSCI US Broad Market Index, global ex-U.S. equities by the MSCI All Country World ex USA Index, U.S. bonds by the Bloomberg U.S. Aggregate Bond Index, global ex-U.S. bonds by the Bloomberg Global Aggregate ex-USD Index, and commodities by the Bloomberg Commodity Index.
Source: Vanguard.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of September 30, 2018, and March 31, 2022, for inflation conditions. Results from the model may vary with each use and over time. For more information, please see p. 18.

A change in asset allocation is driven by forces including the forward-looking expectations for individual assets, correlation, and underlying factors such as valuation that provide an important anchor for forecasts. If inflation trends continue, valuations for bonds and equities may

become attractive and will counter commodity premia. VCMM would expect rates to normalize and drop and inflation to revert to its equilibrium level. On the other hand, a commodity risk premium could be realized so that the long-term expected return reverts over time.

Commodity asset location: Beware of the tax impact

Investors no longer have to worry about K-1 tax forms, but commodity tax concerns are still with us. For U.S. tax purposes, all commodity gains are treated as ordinary income and can cause a tax surprise. Worse, capital losses are not carried to a subsequent year, and investors need to sell investments to get long-term loss recognition.

Let's use a simple example to explain: An investor buys \$1,000 of a commodity fund. The value of the investment drops to \$700 in the first year and rebounds to \$1,200 the following year. Since the investor keeps the commodity exposure, year one

has no impact, but the following year the investor ends up with a \$500 (\$1,200-\$700) distribution of ordinary income. Because commodities are rebased, the loss below the \$1,000 mark cannot be used to offset the distribution unless the investor sells the fund and recognizes a \$300 (\$700 ex-div - \$1,000) long-term capital loss.

Bottom line: When investing in commodities, be mindful of potential tax impacts and use appropriate asset location. Tax-advantaged accounts can be a preferable place for commodities to avoid tax shocks.

Conclusion

This paper addressed the most common investor questions about commodities investment: What drives commodities futures returns, why adding commodities to a balanced portfolio can potentially improve investment outcomes, especially in inflationary periods, and how to incorporate commodities into strategic portfolios.

We began by demystifying commodity investing—we explained the three components of commodity futures returns and the theoretical underpinnings of positive commodity risk premia. Our analysis indicates that incorporating commodities can provide diversification benefits to a strategic balanced portfolio as well as outsized protection against unexpected inflation.

With the aid of Vanguard's Asset Allocation Model (VAAM), we illustrated two systematic approaches to incorporating commodities into strategic portfolios: a goals-based, inflation-beta-targeting methodology to immunize a strategic portfolio with a specific inflation beta and a time-varying portfolio construction approach in which the optimal level of commodities adapts to economic and inflation conditions.

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