

The Case for Bitcoin



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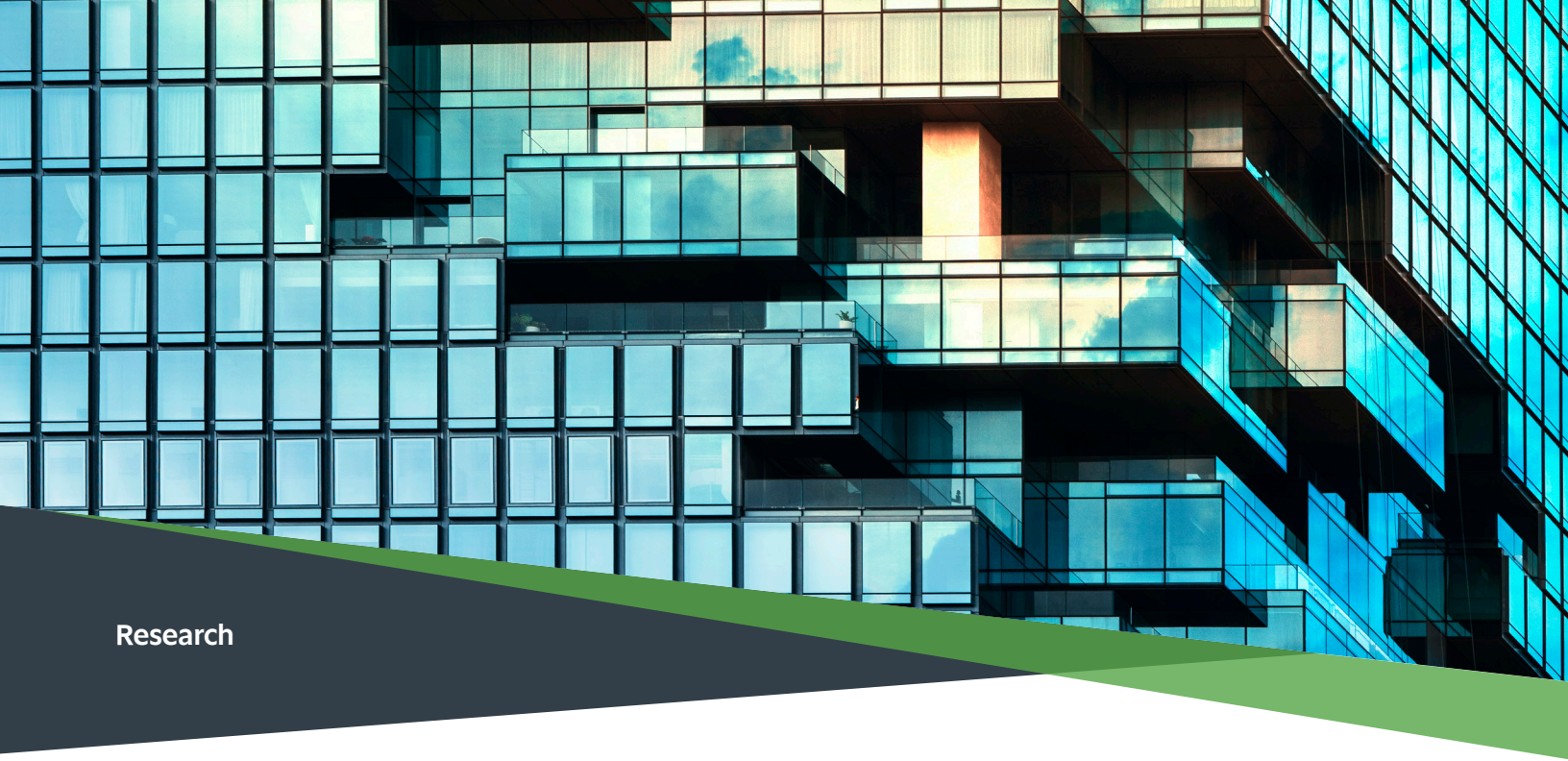
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Research

Institutional Insights

The case for bitcoin

A research-based framework may help investors understand bitcoin's unique features and risk/return characteristics as an alternative investment within a multi-asset class portfolio, and the potential role of a small allocation.

2025 research update

This research uses historical data and quantitative methods; past performance is no guarantee of future results. The digital assets market is constantly evolving and our findings may change over time. Some investors may want to allocate to bitcoin and are comfortable with the risks it entails, including the possibility it could lose all its value. Please see Appendix on page 17 for the methodology, assumptions, and risks.

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KEY TAKEAWAYS OF THE AUTHORS

- Bitcoin is a fixed-supply digital bearer asset that provides the medium of exchange for a potentially transformative technology. It has certain characteristics similar to gold, venture investments, and other network goods. Its future price path will thus depend on the adoption rate and the robustness of the network that it underlies.
 - A research-based framework with small hypothetical allocation ranges may help determine an appropriate path to investing in bitcoin. We provide a macroeconomic foundation and quantitative analysis to explore the key investment theses that one must believe to invest, considerations about sizing and sourcing, and how to think about risk.
 - Our analysis suggests portfolio allocations of 2%–5% (7.5% for young investors) could have an outsized positive impact in an optimistic adoption scenario, allowing annual retirement spending to increase 1%–4%, while limiting the loss to annual retirement income to less than 1% if bitcoin were to lose all its value.
 - Investors have several options to gain exposure, including a direct investment and spot/futures-based investments. The 2024 regulatory approval of spot exchange-traded products (ETPs) as registered investment products in the United States has opened the door to a broader group of investors—enabling easier access for advisors and their clients.
 - Fidelity defines digital assets as a category of alternative investments. Less-correlated assets, such as alternative investments, may make sense in an environment where the traditional 60/40 portfolio has been struggling due to regime change defined by higher inflation, higher interest rates, and heightened volatility.
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Introduction

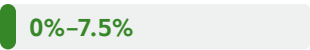
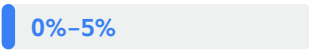
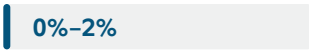
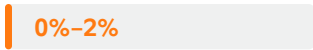
Bitcoin is the oldest and largest digital asset by market capitalization in an industry that has surpassed \$3.5 trillion.¹ Some investors may want to allocate to bitcoin and are comfortable with the many risks it entails, including the possibility an investment in it could lose all its value. We believe bitcoin is a unique asset because it has both the adoption curve of a disruptive technology and the supply characteristics of gold; e.g., built-in scarcity. (See the Appendix on page 17 for a list of risks, including the differences with gold). Understanding the case for bitcoin requires a recognition that it has at times exhibited many different dimensions—a venture asset that trades 24/7, a buy-and-hold investment, or a gold-like inflation hedge and aspirational money.

We also view bitcoin as a category of alternative investments, and believe that such less-correlated

assets may merit consideration in an environment where the traditional 60/40 portfolio has struggled. In periods of higher inflation and heightened volatility where stock and bond correlations are relatively high, some investors might consider an allocation to bitcoin within an alternatives sleeve, either replacing gold or as a complement to it. The 2024 regulatory approval of spot bitcoin exchange-traded products (ETPs) in the United States has opened the door to a broader group of investors, enabling easier access in particular for advisors and their clients. Alternatives, including digital assets, offer the potential for an expanded universe, enhanced returns and income, and diversification. We thus offer a research-based framework for those investors who want to invest, and who understand the risks. Such investors may want to consider very small allocations as part of an alternatives sleeve within a multi-asset class portfolio (Exhibit 1).

EXHIBIT 1: A hypothetical allocation framework for those who want to invest in bitcoin and understand the risks.

Allocations that may limit reductions in projected retirement income to 1% based on proprietary quantitative analysis.

 30-YEAR-OLD Young investor	 40-YEAR-OLD Mid-career	 50-YEAR-OLD Middle age	 65-YEAR-OLD Retiree
Allocation scenarios 			
Low starting wealth limits the potential benefit of bitcoin in an optimistic scenario, while a long investment horizon moderates worst-case losses. But due to the maturation of bitcoin, young investors may invest up to 7.5% while limiting loss to 1%.	Even with a low portfolio exposure, investors with a large wealth base may see greater gains in an optimistic scenario than young investors with low wealth levels. All of the older investors would see higher annual spending gains than the 30-year-old, with higher potential risks in a worst-case scenario.		

Across all ages, potential losses to annual retirement income in a worst-case scenario were lower than the potential gains.*

Research assumptions

Investors aged 30 to 65, with varying savings rates, retirement at 65, and Social Security; bitcoin weightings of 0%–10% in a target asset mix of stocks, bonds, and cash; optimistic to worst-case scenarios for bitcoin and its potential volatility. See Appendix on page 17 for more.

* Based on proprietary analysis and past performance, which is no guarantee of future results. Digital assets are speculative and highly volatile, can become illiquid at any time, and are for investors with a high risk tolerance. Investors in digital assets could lose the entire value of their investment. Source: Fidelity Investments.

Our hypothetical framework, outlined in this article, is based on proprietary quantitative analysis about the potential impact to retirement income, using a traditional target asset mix (TAM) and optimistic and worst-case scenarios about bitcoin.

Understanding the case for bitcoin

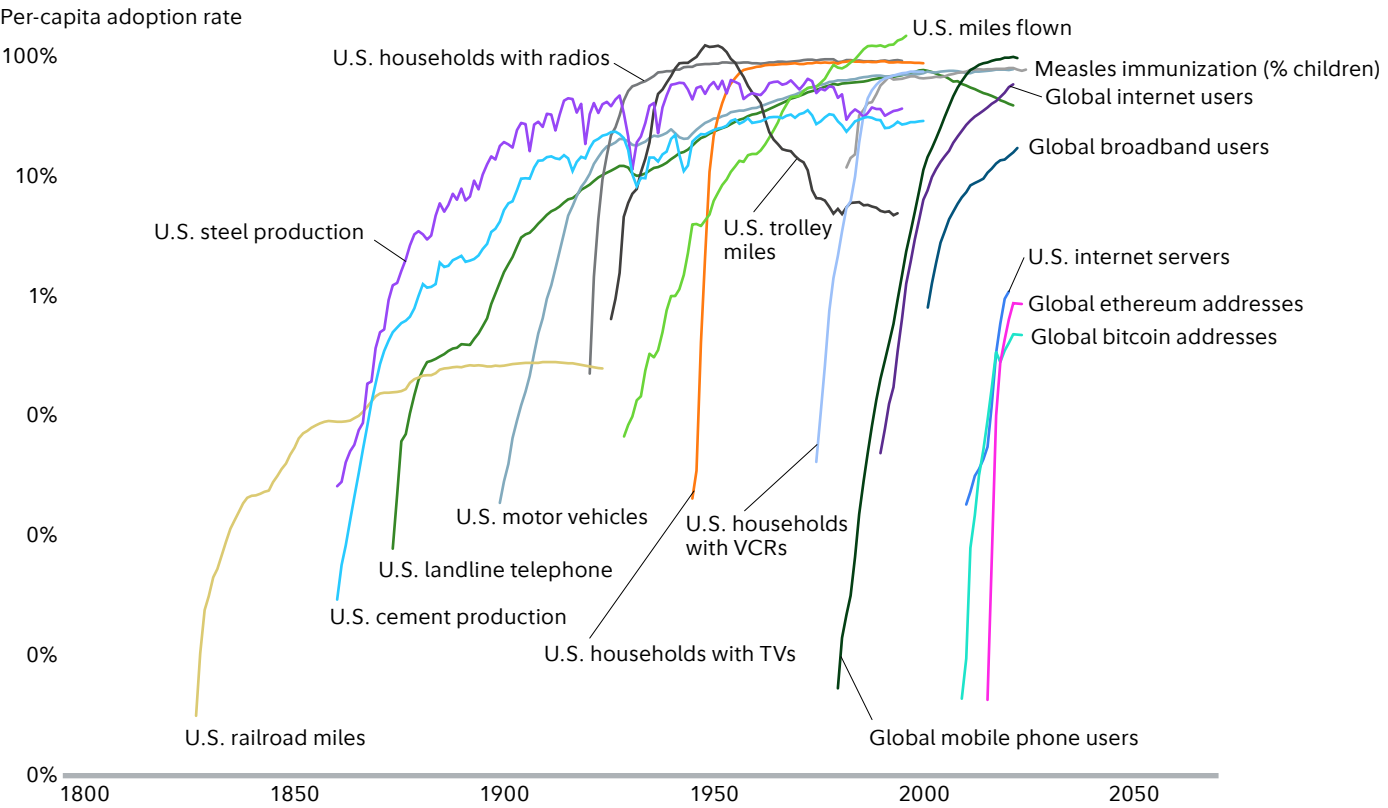
More than 15 years after it was invented by the pseudonymous Satoshi Nakamoto, bitcoin has endured bouts of extreme volatility as well as persistent skepticism about its potential investment merits and aspirations as a digital currency.² It has been around long enough, and survived enough existential threats, that for many investors it may be on the menu of assets to consider. Those who want to invest in bitcoin should understand the key drivers of its price, how it may

compare to gold within the context of a multi-asset class portfolio, as well as how it compares to other asset classes on correlation, risk-adjusted relative returns, and other traditional measures.

Bitcoin’s adoption curve and the drivers of growth

Like any asset, bitcoin’s price has been influenced by many factors over the years, but in our view its price has been driven primarily by two factors: its adoption curve and monetary and fiscal policy. The traditional law of demand determines the trajectory of any emerging network technology, whether it is mobile phones, personal computers, television sets, or Internet access (Exhibit 2). A demand curve that shows a new technology’s adoption illustrates its potential value proposition as its use becomes more pervasive.

EXHIBIT 2: S-curves are exponential growth curves that are attributes of technological innovations; they go back several hundred years, from railroad miles to radios to cell phones.



Source: Fidelity Investments, Haver Analytics, and International Monetary Fund, as of Dec. 31, 2024. Logarithmic scale. Some curves shown are U.S. while others are global.

(Of course, demand curves can move in the other direction, as seen in what happened with fax

A second important driver of bitcoin's price has been the influence of monetary and fiscal policy, creating environments of financial repression and fiscal dominance. Sometimes Fed policies to lower interest rates and purchase assets, combined with fiscal stimulus, supported both bitcoin and gold prices. Such periods of monetary/fiscal coordination are rare (see sidebar on page 6 for more on the interplay between fiscal and monetary action over the years). More recently, fiscal debt and deficit levels have grown so high that monetary policy has become less effective in controlling inflation, enabling both gold and bitcoin to be potential hedges.

Bitcoin non-zero addresses (millions)

Non-zero bitcoin addresses

Bitcoin price

Bitcoin ETP assets: **\$92.6 billion**
Compound annual growth rate: **160%**

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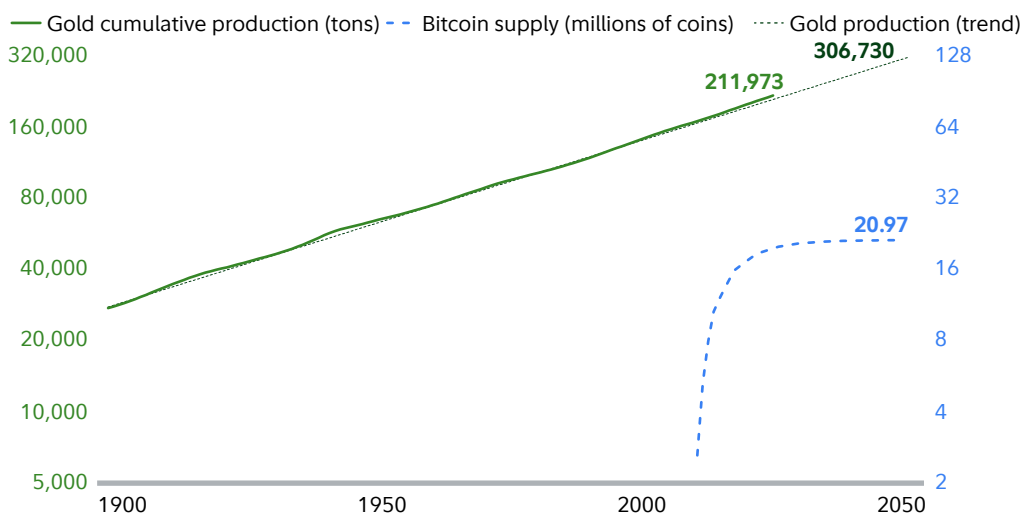
Bitcoin, gold, and the asset allocation perspective

From an asset allocation perspective, we believe bitcoin is a digital alternative to gold with a venture component due to its recent invention. In other words, we view it as exponential gold; we describe it as “exponential” given its increased scarcity and potentially high-octane demand curve. (See the Appendix starting on page 17 for more on bitcoin’s risks, including its differences from gold.)

In a regime of high monetary inflation, you need assets that will hold their value. Gold has thousands of years as a stable store of value, whereas bitcoin’s use case as a medium of exchange and store of value are not yet proven in so short of a history. At the same time, we view bitcoin as an aspirational store of value—it was designed with gold-like characteristics, and we think the potential is there for bitcoin to be “on the team” with gold (that is, become a proxy for gold in an asset allocation framework). Thus far, it has been too volatile to be used as a medium of exchange, but its scarcity and adoption curve create the potential for it to be a high-powered inflation hedge. Bitcoin has held up well over the past five years of higher inflation, but with just 15 years of data versus gold’s thousands of years of data, it cannot be proven as such, in our view.

Why bitcoin for some investors? We believe it is a commodity currency, and as such, one of its main features is its supply cap of 21 million coins, similar to gold as a commodity currency with limited supply. Exhibit 4 shows the cumulative supply of both gold and bitcoin. While gold is scarce, the supply does grow every year as new supply of the metal is mined (by a few percent). Bitcoin’s supply came flying out of the gate in 2008, but its supply curve is now well into the asymptotic stage. As a result, bitcoin’s “stock-to-flow” or S2F is higher than gold (after the halving in 2024). The traditional S2F³ assumes scarcity drives value, and has been used to value gold over the long term.

EXHIBIT 4: As a commodity currency, one of the main features of bitcoin is built-in scarcity, similar to gold.



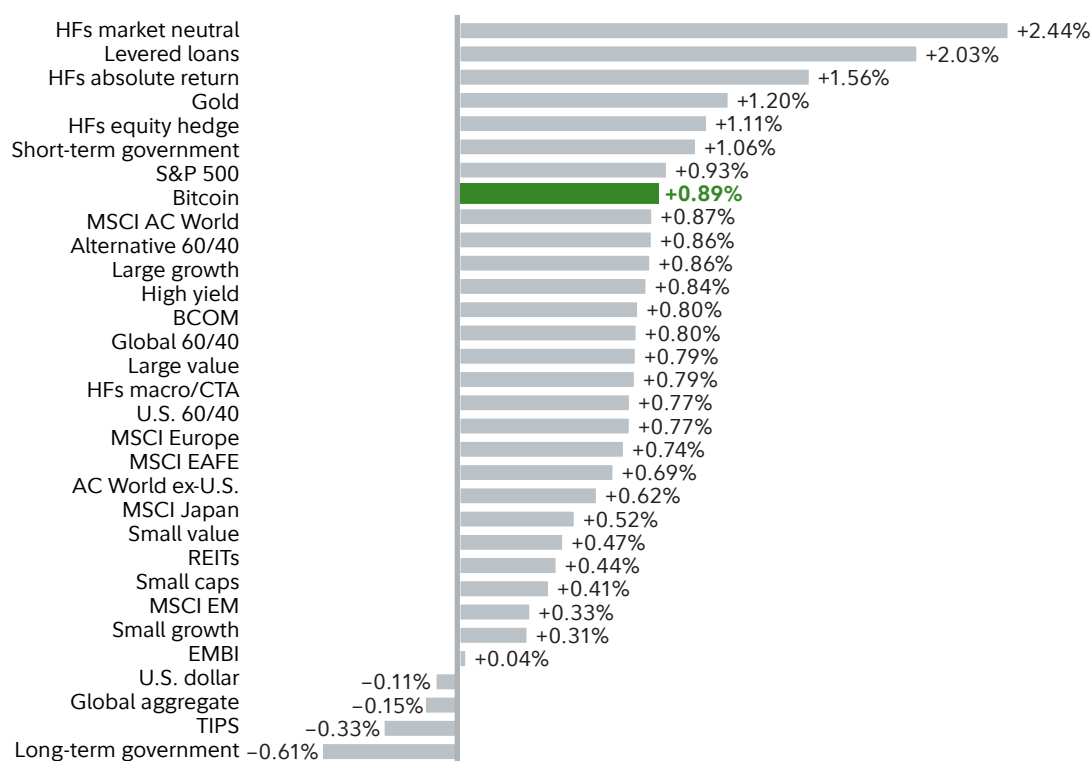
Bitcoin supply (starting January 1, 2010) and gold supply (starting January 1, 1900), through Dec. 31, 2024. Gold Y-axis: gold cumulative production in tons. Bitcoin Y-axis: total number of coins that have been “mined” and are in circulation. Source: Fidelity Investments, Bloomberg Finance LP, and Global Financial Data.

Bitcoin and gold in varying policy environments

Following the 2008 financial crisis, the Fed entered a sustained period of financial repression to aggressively lower interest rates, resulting in negative real rates and growth in the money supply that supported gold as well as bitcoin prices. Fiscal and monetary stimulus starting in 2020 to support the economy during the COVID-19 epidemic made the case for both bitcoin and gold straightforward. Now we have been in a period of fiscal dominance, where debt and deficit levels are so high that monetary policy is becoming less effective in controlling inflation. With the Fed’s efforts to raise rates and reverse the bubble in monetary inflation, the value proposition for both gold and bitcoin is less urgent today than it was a few years ago. Both gold and bitcoin have performed well during this period, but bitcoin as a venture asset with higher volatility may follow a different path over the long term. However, it bears keeping in mind that fiscal and monetary drivers have the potential to influence bitcoin’s path over time.

To explore the thesis of bitcoin as exponential gold, we can look at its risk-adjusted returns relative to gold and other asset classes. Bitcoin's Sharpe ratio, which is the five-year compound annual growth rate (CAGR) divided by the five-year annualized volatility, shows that it has been competitive to gold as well as many other traditional asset classes (Exhibit 5).

EXHIBIT 5: Bitcoin's Sharpe ratio shows that it has been competitive to gold as well as many other traditional asset classes over the past five years.



Past performance is no guarantee of future results. Source: Fidelity Investments, Bloomberg Finance LP, HFR Inc., www.HFR.com, © 2025 HFR, Inc. All rights reserved, Haver Analytics, as of Mar. 31, 2025. See Appendix starting on page 17 for indexes and definitions shown above.

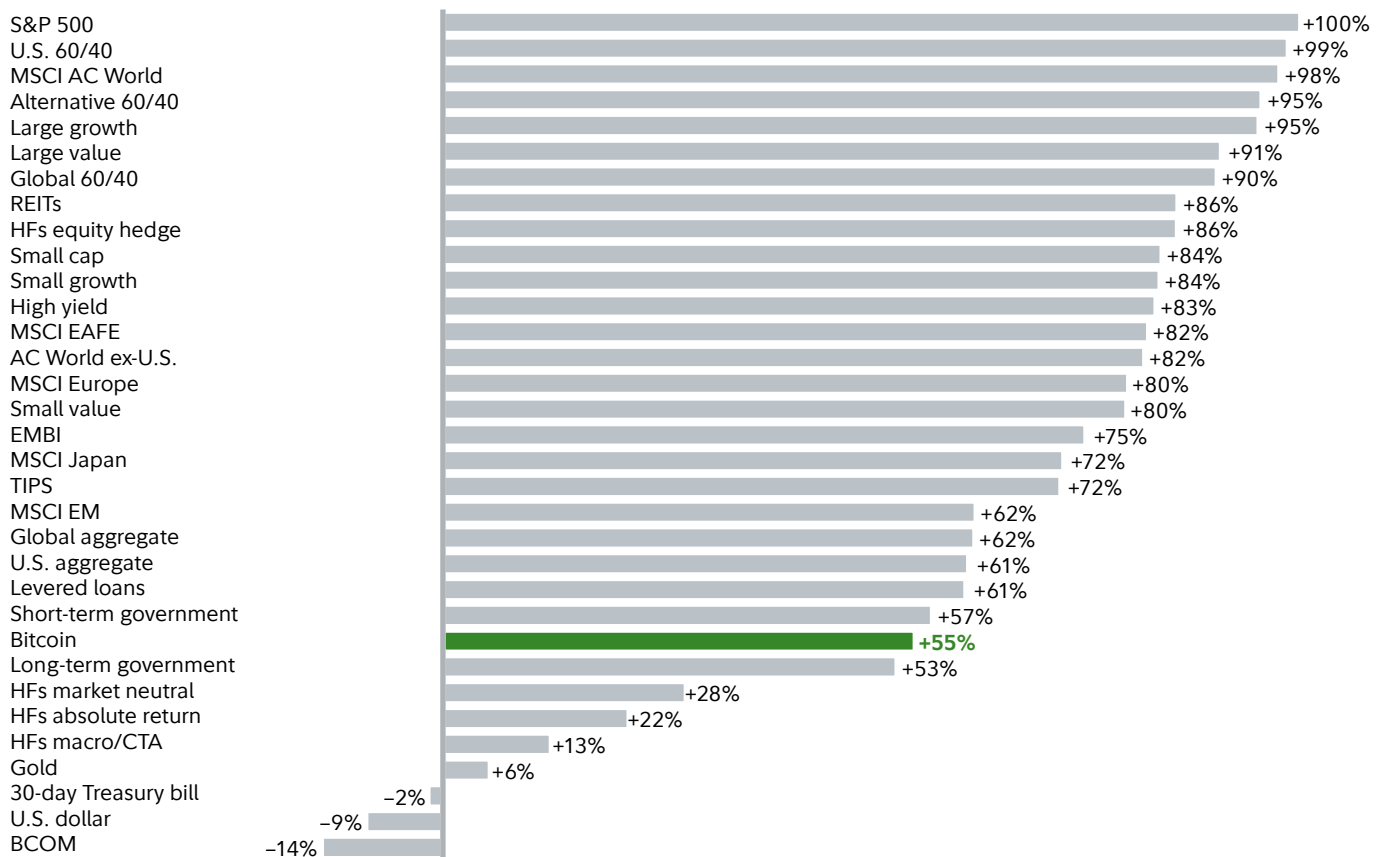
Rising correlations make the case for alternative asset classes

Correlations between asset classes have undergone a shift due to higher interest rates and inflation. It has resulted in positive correlations between stocks and bonds, leaving investors to consider non-correlated assets such as alternative investments, including bitcoin as well as gold. Bitcoin's correlation to stocks is higher than gold over the past five years (55% vs. 6%) and has been rising⁴ but is still lower than many other asset classes (Exhibit 6).

Interestingly, the most negatively correlated asset to bitcoin as of this writing is gold,⁵ perhaps not what

one might expect to see given bitcoin's aspirations as a store of value asset. While gold is hard money and nothing else, bitcoin is aspirational hard money but also a speculative asset. Therefore, while we always know which gold is going to show up for the party, with bitcoin we are never quite sure if it will be Dr. Jekyll or Mr. Hyde. It may be as good a reason as any to own both when it comes to stores of value. With bonds now positively correlated to equities and rising geopolitical risks challenging U.S. exceptionalism, many investors are looking beyond the traditional 60/40 stock/bond portfolio. (For more, see "A call to action for building resilient portfolios.")

EXHIBIT 6: Bitcoin's correlation to stocks is higher than gold over the past five years and has been rising, but is still lower than other asset classes.



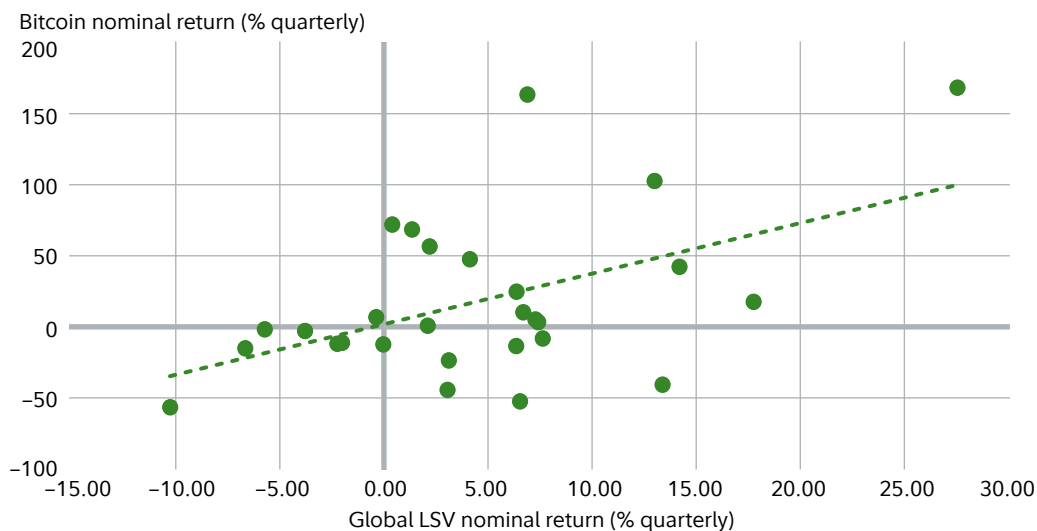
Past performance is no guarantee of future results. Source: Fidelity Investments, Bloomberg Finance LP, HFR Inc., www.HFR.com, © 2023 HFR, Inc. All rights reserved, Haver Analytics. See Appendix starting on page 17 for indexes and definitions shown above. As of Mar. 31, 2025.

Volatility: the known unknown

Bitcoin's volatility story over the years is not new, and volatility is a common feature of any emerging asset. Part of its uniqueness is that it has venture-like components but at the same time is liquid and trades 24/7, albeit with the potential for flash price changes in either direction—versus a limited partnership that has a lockup of five years or more. It is well known that bitcoin has venture characteristics. It is the medium of exchange for a potentially transformative technology that can revolutionize global finance. In addition, bitcoin and its network form the foundation for a variety of layer-2 applications that can potentially improve world output growth. Based on this thesis, bitcoin's return distribution should have venture properties—positive skew but also sensitivity to market drawdowns and changes in expectations about the long-term viability of the venture. Exhibit 7 provides some empirical evidence for this hypothesis: its nominal quarterly returns versus global late-stage venture (LSV) funds over the past five years, with the dotted trend line representing the positive relationship. Given that bitcoin had already been in existence for a decade by 2018, the positive relationship between its return and that of LSV is not surprising. In fact, bitcoin appears to have had the return properties of a levered LSV investment with easier access and 24/7 liquidity, a much better liquidity profile than traditional venture investments.

For those investors who do not reach the thresholds of an accredited investor or qualified purchaser, bitcoin may potentially serve in a similar capacity in a multi-asset class portfolio, in our view. Any investor should expect it to be very volatile, and its personas as both venture and network asset amplify a “boom/bust dynamic.”

EXHIBIT 7: The positive correlation of nominal quarterly returns of bitcoin and global late-stage venture funds (over the past five years) illustrates bitcoin's venture-like characteristics.



Past performance is no guarantee of future results. Bitcoin represented by the daily price of one coin per U.S. dollar using data from January 2018 through December 2024. Late-stage venture funds represented by quarterly returns from MSCI Private Assets. Sources: Fidelity Investments, MSCI Private Assets.

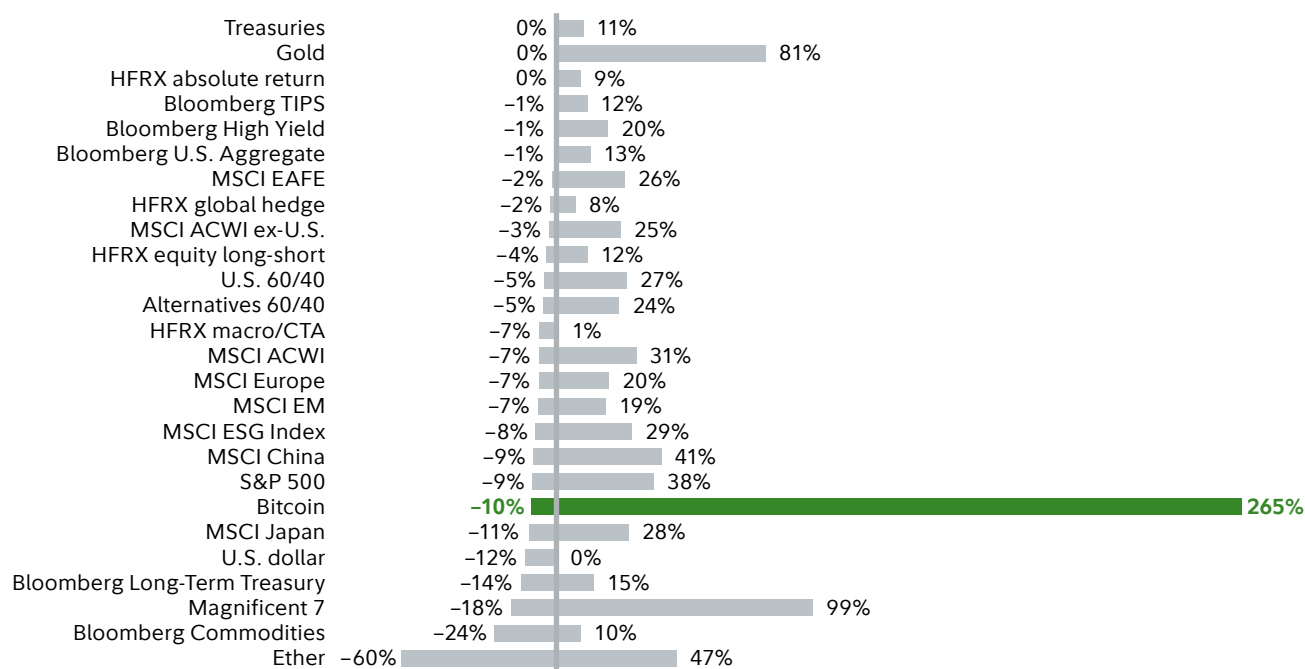
Historically, it has not been a good tail hedge in a 60/40 portfolio,⁶ perhaps due to its speculative component that could change as it matures. In fact, there is a strong conceptual argument that in a long-run equilibrium, the expected real return of bitcoin should approximately equal the real growth rate of world output, on the order of about 2%.⁷ This is because for commodity money, value is determined by the interplay of its penetration for supporting transactions in the world economy (medium of exchange) and its use as a store of value (velocity). In the long-run, penetration and velocity tend to equilibrate, and with the fixed supply of bitcoin, its real purchasing power should be expected to grow with the rate of world output. This reasoning holds even if bitcoin does not become the dominant medium of exchange.⁸

Not surprisingly, given its volatile path, bitcoin has been highly correlated to equities. The volatility has been episodic in big swings and sometimes triggered by momentum traders who step in and out, causing bitcoin to exhibit these boom-bust dynamics—again, similar to many venture assets.

Bitcoin’s volatility also cuts both ways. Its volatility was 10% below its two-year high (as of March 31, 2025), but 265% above its two-year low (Exhibit 8). That kind of volatility is not for the faint of heart, and important to keep in mind in terms of position sizing. Bitcoin has been far out on the risk-return spectrum so a little may go a long way. Its volatility story is among the reasons why investors should only consider small allocations in multi-asset class portfolios.

EXHIBIT 8: Bitcoin’s volatility was 10% below its two-year high, but 265% above its two-year low, highlighting that its volatility can cut both ways.

Drawdowns and rallies (from two-year highs/lows)



Past performance is no guarantee of future results. Drawdowns measured from two-year highs. Rallies measured from two-year lows. Source: Fidelity Investments, Bloomberg Finance LP, HFR Inc., www.HFR.com, © 2025 HFR, Inc. All rights reserved. See Appendix starting on page 17 for indexes and definitions shown above. As of Mar. 31, 2025.

Investors should keep in mind that as bitcoin matures, we believe its volatility profile should moderate. In fact, three-year annualized monthly volatility has declined from 72% to 60% over the last three years, a reduction of about 4 percentage points per year. And if bitcoin becomes established as commodity money, its volatility profile could, in the long run, resemble that of gold. The Coefficient of Variation for gold, or the volatility of the real return divided by the average real return ($\text{Volatility}/E[\text{Return}]$) has been around 10 over the last century. Assuming a long run equilibrium real return of about 2% gives a steady state volatility for bitcoin of about of 20%, which will bring its Coefficient of Variation to 10, in line with other established commodity money like gold.

In the next section we will discuss our research of small hypothetical allocations for different types of investors over a long-term investment time horizon—depending on different scenarios about bitcoin’s future path. Our research evaluates small allocations of bitcoin within a target asset mix (TAM), a common investment strategy that changes over time.

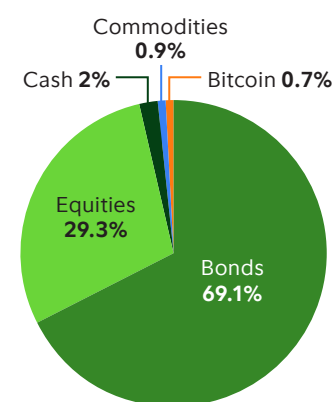
Exploring bitcoin’s potential impact on a portfolio

Determining the impact of a bitcoin allocation is challenging given its short track record relative to traditional asset classes that have decades or more of data. Traditional financial analysis typically explores asset classes over the longest possible time horizon, to test their mettle through many business cycles and investment backdrops—recession, high inflation, COVID, and so on. However, quantitative research methods can help to bridge the gap by illustrating some possible hypothetical scenarios of a small allocation within a multi-asset portfolio. These methods are not forecasts but provide a decision-making lens for investors who believe in bitcoin’s potential.

In this research, we started with a foundational mindset with bitcoin as a potential investable asset class as part of a traditional portfolio construction process. We developed modeled returns for equities, bonds, and bitcoin, with assumptions for volatility and other variables, and an investment strategy of a hypothetical target asset mix (TAM) rolldown where the asset class weightings change over time. We also looked at bitcoin from the perspective of a pessimistic to optimistic view: e.g., bitcoin goes immediately to zero (certainly a worst-case scenario), or bitcoin fulfills its path on the demand curve. The risk of bitcoin going to zero is assumed to be a possibility at any point in time. A 45-year-old could look at the results for a 65-year-old to consider the possible effects of bitcoin going to zero in 20 years when they themselves are 65.

Bitcoin vs. other asset classes

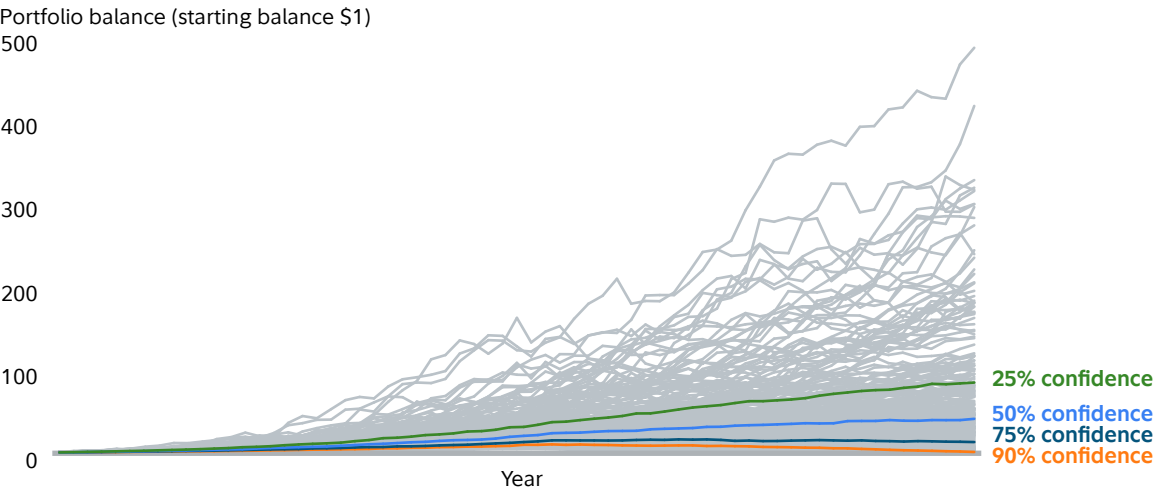
In the past, investors typically started with bitcoin’s share of global asset class market capitalization when considering an allocation. A research-based framework may provide another dimension for decision-making.



Sources: World Federation of Exchanges (WFE), Securities Industry and Financial Markets Association, Bank for International Settlements (BIS), Bloomberg. Global bonds include sovereign bonds and corporate investment-grade debt. As of July 10, 2025.

As part of this work, we used a Monte Carlo simulation to analyze the potential impact to annual spending that can be supported by the hypothetical portfolios for our four investor types outlined in Exhibit 1 (investors at ages 30, 40, 50, or 65), with an assumed retirement age of 65 and a life span to age 95. We also used conservative and optimistic confidence levels (90%, and 50%) for the probability with which a given level of income can be sustained in retirement (Exhibit 9). The Appendix starting on page 17 outlines the full details of the methodology and rationale for all of the assumptions.

EXHIBIT 9: Varying statistical levels of confidence—two of which are used in this research—result in different hypothetical portfolio outcomes.



For illustrative purposes only. Source: Fidelity Investments.

Exhibits 10 and 11 show the hypothetical percentage gain or loss to annual retirement spending based on bitcoin allocations of 2% or 5%. Understandably, it may be difficult to gauge what would be considered a significant impact to retirement spending, but certainly any decrease must be weighed seriously, and knowing the potential range of outcomes may help investors decide on whether to invest in bitcoin (and by how much). Our hypothetical allocation ranges are based on limiting potential annual reductions in retirement income to 1%.

A 2% allocation to bitcoin

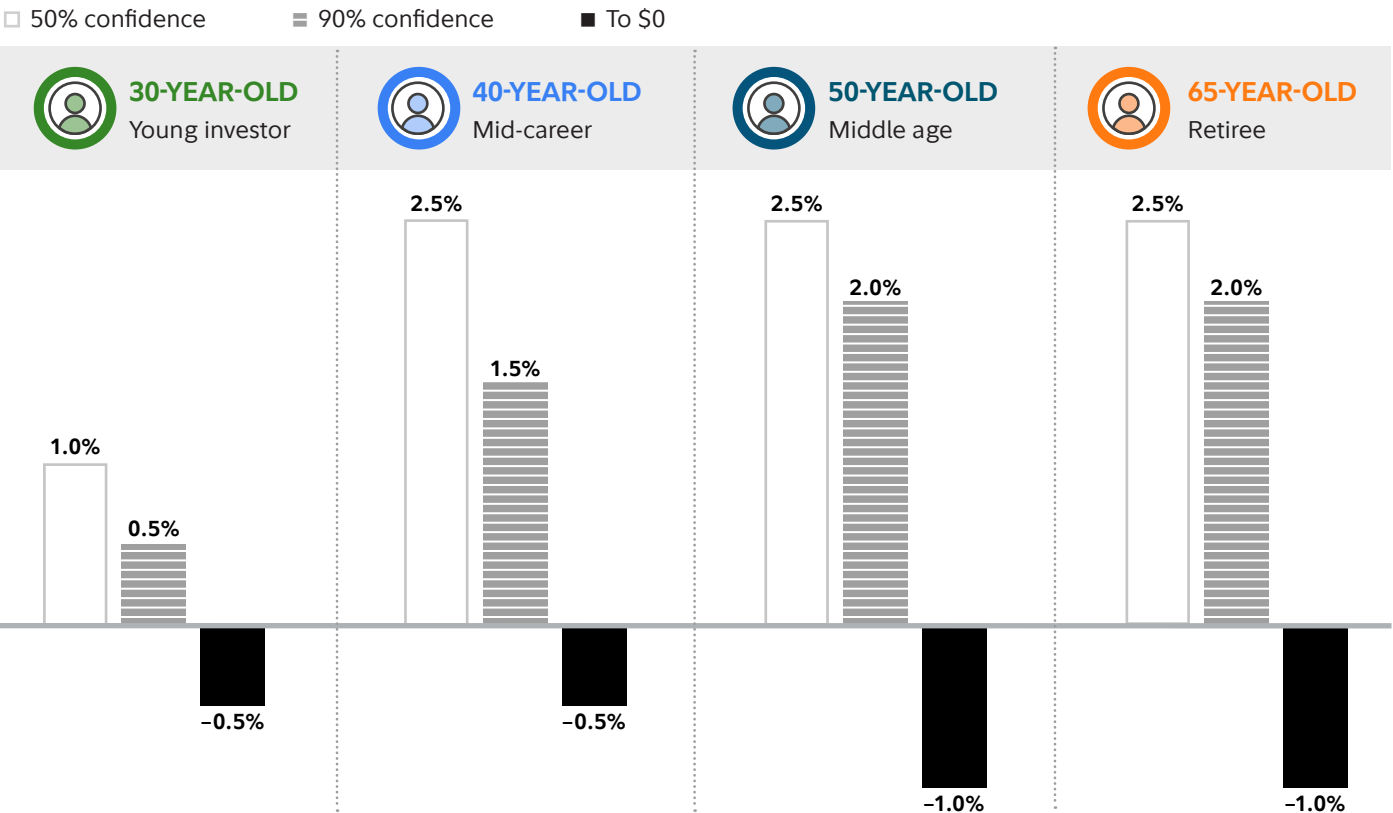
In our first scenario with a hypothetical weight of 2%, Exhibit 10 outlines the four investor personas and the range of possible outcomes. The black bars show

bitcoin losing all its value, going immediately to zero. The gray and white bars show bitcoin fulfilling its path on the demand curve with conservative (90%) and optimistic (50%) estimates, respectively, of the potential impact to retirement income. A 90% confidence level essentially means that when an investor is mapping a future path, they dictate that with 90% confidence, the increase in spending would be at least a given percentage. A less conservative assumption, at 50% confidence, means that the investor is less confident in a given percent outcome (and therefore the results may be higher, as seen in Exhibits 9, 10, and 11).

Interestingly, Exhibit 10 shows that those in the middle cohorts saw wider-ranging results under the conservative and optimistic scenarios—even wider

EXHIBIT 10: A 2% allocation to bitcoin could allow for an increase in annual spending ranging from 1% to 3%, and potential losses of up to -1% in a worst-case scenario.

Change in retirement spending due to a 2% bitcoin allocation for various ages retiring at 65 and living to 95



Past performance is no guarantee of future results. Source: Fidelity Investments. Based on Monte Carlo simulation analysis. Results are rounded to the nearest 0.5%. For illustrative purposes only to depict the probability and range of results based on simulations, historical analysis, and research. This is not meant to be exhaustive of all possible options or analysis an institution may wish to consider, and will not necessarily come to pass. See Appendix starting on page 17 for full details on assumptions, asset classes, and methodology.

than the 30-year-old. For example, 40-, 50-, and 65-year-olds would see hypothetical annual spending gains of 1.5% to 2.5%, but the worst-case losses with bitcoin going to zero would be no more than 1%.

This result is somewhat counterintuitive. Young investors (30-year-olds) have long investment horizons so it's not surprising that the reduction in projected retirement income if bitcoin goes to \$0 may be limited to less than 1% even at a portfolio weight of 5% or 7.5%, as discussed in the following section. Because of their low wealth base, however, these investors do not benefit as much along the exponential part of the S-curve in the optimistic scenario. By the time their wealth base is large enough to impact retirement income, bitcoin's adoption would have already largely matured, muting the future expected return. On the

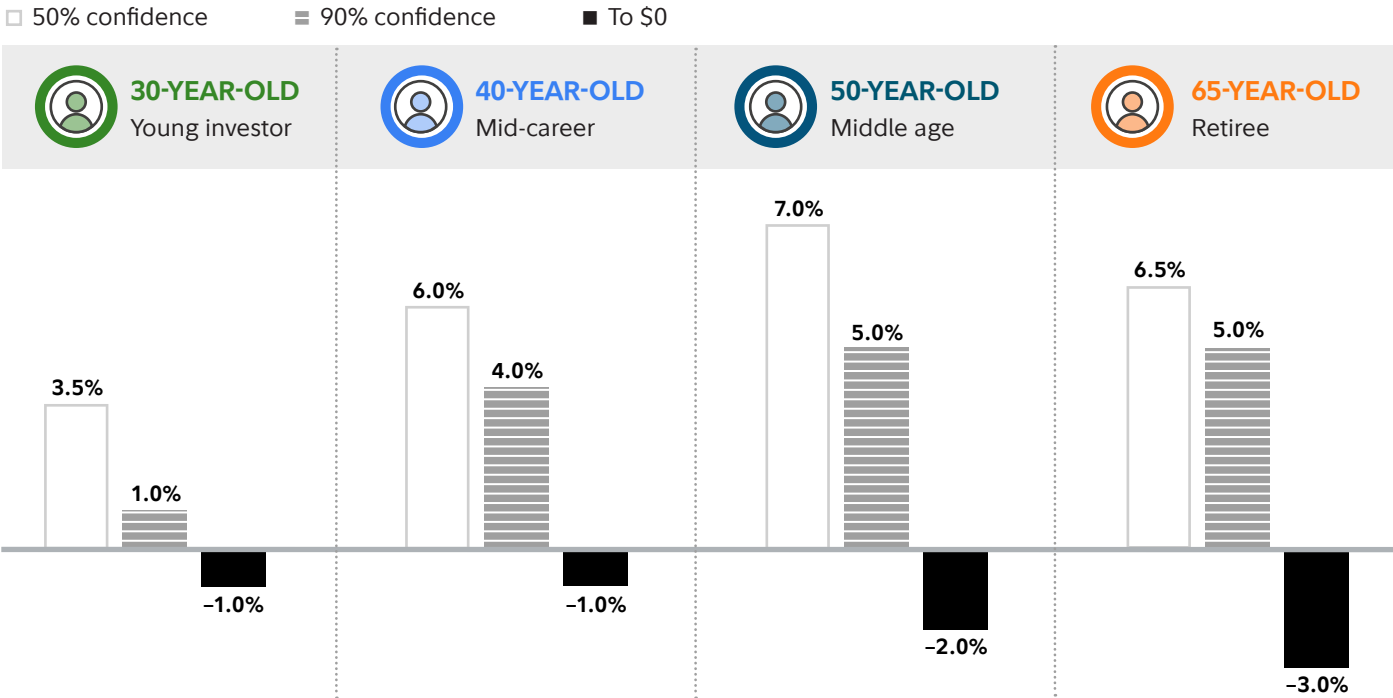
other hand, older investors (40-, 50-, and 65-year-olds) have large wealth bases, and even a small allocation can have a nontrivial impact on retirement income due to the compounding effect of higher expected returns along the exponential part of the S-curve.

Implications of 5% or higher allocations to bitcoin

At a higher bitcoin weighting of 5%, however, the older personas also see a larger increase in potential risks (Exhibit 11). For example, a 65-year-old investor could potentially gain 6.5% in annual spending, but if bitcoin were to go to zero, the investor could see a reduction in annual spending of 3%. By contrast, young investors would see an annual spending gain of up to 3.5%, but with a more contained reduction to annual spending of 1% if bitcoin went immediately to zero.

EXHIBIT 11: A 5% bitcoin allocation could allow for an increase in annual spending by as much as 7% for older investors, but with much steeper potential losses of up to 3% in a worst-case scenario.

Change in retirement spending due to a 5% bitcoin allocation for various ages retiring at 65 and living to 95



Past performance is no guarantee of future results. Source: Fidelity Investments. Based on Monte Carlo simulation analysis. Results are rounded to the nearest 0.5%. For illustrative purposes only to depict the probability and range of results based on simulations, historical analysis, and research. This is not meant to be exhaustive of all possible options or analysis an institution may wish to consider, and will not necessarily come to pass. See Appendix starting on page 17 for full details on assumptions, asset classes, and methodology.

While Fidelity’s investment framework sought to limit annual retirement income losses to 1%, our research tested allocations of up to 10% to get a broad view of the implications of various weightings. In the most optimistic scenario, a 30-year-old investor with a 7.5% weighting could limit annual income loss to 1%, with gains of 2.5% to 5% in annual spending under conservative and optimistic scenarios, respectively. Older investors with allocations of 7.5% would have gains of 6% to 11% in those same scenarios, but in the worst case their losses to annual income would be 2% to 4.5%—a painful shortfall that would be tough to recoup with shorter time horizons. See the appendix for more details on the scope of the research.

Investing in bitcoin and why spot-based ETPs may be a game-changer

Investors today have multiple avenues to gain exposure to bitcoin, ranging from direct ownership to registered investment products offering direct or indirect exposure to the price of bitcoin (Exhibit 12). However, the robust growth of spot bitcoin exchange-traded products (ETPs) has contributed to the democratization of access to cryptocurrencies and is a sign of maturation in the digital assets landscape more broadly, in our view.

Owning bitcoin directly involves purchasing the cryptocurrency and holding it in a digital wallet, which can be accomplished through self-custody or through a relationship with a hired custodian. Investing in a bitcoin futures-based ETF provides investors with the advantage of trading on traditional exchanges that offer oversight, accessibility, and liquidity compared to some cryptocurrency exchanges. Futures-based ETFs allow one to express investment views on both rising and falling bitcoin prices.

Direct ownership requires careful consideration about liquidity, security, and integration into a traditional investor experience. Futures-based ETFs entail structural complexity and potential for tracking error when roll costs are incurred when funds shift between expiring and new contracts.

EXHIBIT 12: Investors today have multiple avenues to gain exposure to bitcoin, ranging from direct ownership to registered investment products.

HOW TO ACCESS BITCOIN				
	SELF-CUSTODY	HIRED CUSTODIAN	FUTURES ETF	SPOT BTC ETP
Spot price tracking	Yes	Yes	No	Yes
Transfer of assets	Yes	Yes/no*	No	No
Portfolio integration	No	Yes/no**	Yes	Yes
Trading hours	24/7	Varies	Stock market hours	Stock market hours

* Depends on the custodian and if they allow a transfer of assets (TOA), when an investor transfers all or part of an account from one financial firm to another without selling holdings.

** Depends on the custodian and if they have API connection (software interface) to data aggregators.

Source: Fidelity Investments, as of Mar. 31, 2025.

Among some key takeaways of this research:

- A 2% weighting would result in reductions to retirement income of no more than 1% for all personas in a worst-case scenario.
- With a 5% allocation to bitcoin, a 40-year-old could see an annual retirement income gain of 6% and a loss of less than 1% in a worst-case scenario.
- All of the older investors would see higher annual spending gains than the 30-year-old.

Past performance is no guarantee of future results.

Source: Fidelity Investments, as of Mar. 31, 2025.

Increasing options to invest in bitcoin

Alternatives include private equity, private credit, real assets, liquid alternatives, and digital assets (e.g., bitcoin, the oldest and largest by market share).

- Bitcoin self-custody
- Hired custodian
- Futures-based ETF
- Spot-based ETP

Spot bitcoin ETPs have simplified the investor experience by enabling direct price exposure to bitcoin through a registered vehicle that tracks actual price movements of bitcoin. They provide capital accessibility that allows investors to seamlessly integrate digital assets alongside traditional and alternative investments. Spot bitcoin ETPs generally offer low or no investment minimums and low fees, for institutions, wealthy individuals, or retail investors. They also eliminate the costs and complexities associated with futures contracts and reducing (though not eliminating) tracking error.

Further, spot bitcoin ETPs can be held in a variety of investment accounts, including some retail retirement accounts, offering the potential in some cases for tax-deferred growth. But institutional investors such as hedge funds have utilized spot bitcoin ETPs to hedge certain exposures or access arbitrage opportunities, showing their versatility for investors of all types.

Conclusion

As an emerging asset class, bitcoin offers a unique combination of features. It has the adoption curve of a disruptive technology and the supply characteristics of gold given its built-in scarcity. Its many dimensions span a venture asset that trades 24/7, a buy-and-hold investment, or a gold-like inflation hedge and aspirational money. Bitcoin may merit consideration as part of an alternative sleeve within a multi-asset class portfolio. Our framework, outlined in this article, is based on our proprietary research about the macroeconomic backdrop and quantitative analysis about the potential impact to retirement income, using a traditional target asset mix and optimistic and worst-case scenarios about bitcoin. Small weightings, as outlined above, may increase annual retirement spending while limiting the worst-case reduction in retirement spending to 1%.

For more information on alternatives, including bitcoin and the broader digital assets ecosystem, please contact your Fidelity representative.

Spot bitcoin ETPs are for investors with a high risk tolerance. They invest in a single asset, bitcoin, which is highly volatile and can become illiquid at any time.

A spot bitcoin ETP is not an investment company registered under the Investment Company Act of 1940 (the "1940 Act") and is not subject to regulation under the Commodity Exchange Act of 1936 (the "CEA"). As a result, shareholders do not have the protections associated with ownership of shares in an investment company registered under the 1940 Act or the protections afforded by the CEA.

The performance of a spot bitcoin ETP will not reflect the specific return an investor would realize if the investor actually purchased bitcoin. Investors will not have any rights that bitcoin holders have and will not have the right to receive any redemption proceeds in bitcoin.

Appendix: general assumptions, methodology, and risks

(Important differences between bitcoin and gold; Bitcoin methodology and Monte Carlo simulation, pages 17 and 18; indexes used, pages 20 and 21; risks on pages 21 and 22).

Bitcoin vs. gold

Digital assets (e.g., bitcoin) are speculative and highly volatile, can become illiquid at any time, and are for investors with a high risk tolerance. Investors in digital assets could lose the entire value of their investment. When considering bitcoin's gold-like characteristics, it is important to keep in mind the many differences, including the significant risk and speculative nature of investing in cryptocurrencies, and the risks associated with distributed ledger technology.

General assumptions

To gauge the impact of bitcoin, we started with the macroeconomic backdrop and the mindset of a traditional portfolio construction framework. We used a target asset mix (TAM) investment strategy where the allocations of stocks and bonds change over time. To create a straightforward construct for the portfolios over time, we assume bitcoin is sourced equally from stocks and bonds held in the portfolio and all of the assets are rebalanced annually (pro rata). We would note actual portfolios would likely contain many other asset classes, and investors may not necessarily rebalance their bitcoin allocation every year.

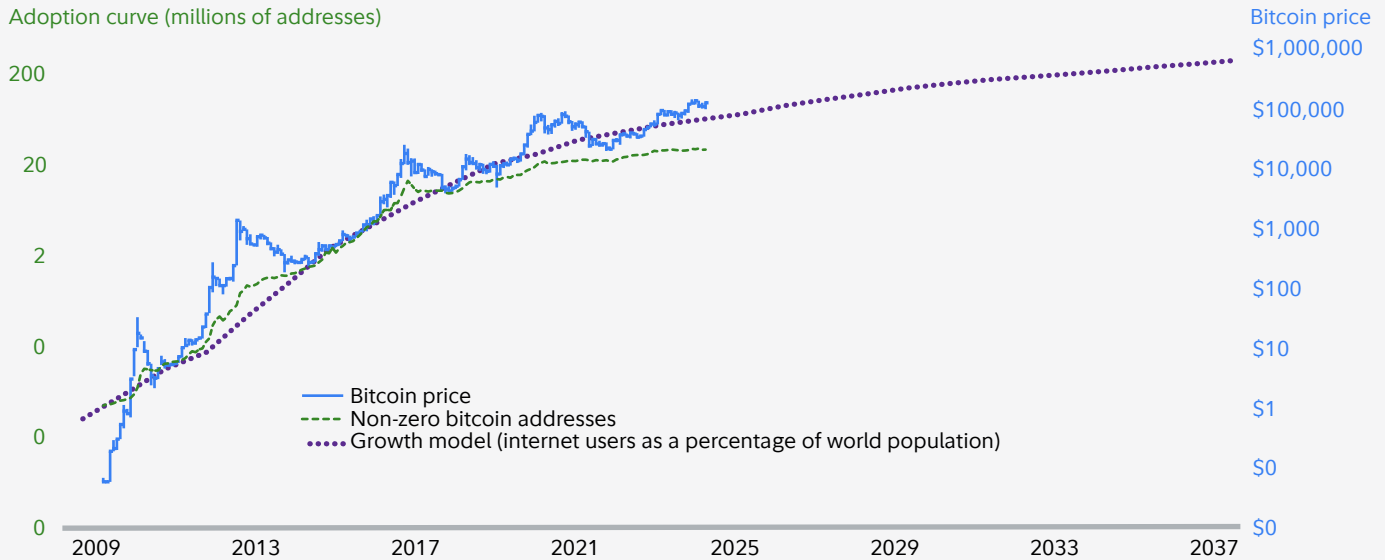
As part of this work, we used a Monte Carlo simulation to analyze the potential positive or negative impacts to annual retirement spending. Monte Carlo simulations are mathematical methods used to estimate the likelihood of a particular outcome based on selected asset allocations for hypothetical portfolios. In this case, we used four investor personas (at ages 30, 40, 50, or 65 years old), with varying savings assumptions, retirement at 65, and a life expectancy to 95 years old.

We also used one conservative and one optimistic statistical confidence levels (90% and 50%, respectively), which result in different probability outcomes and underscore the different hypothetical results that occur under different positive/negative thinking.

- A 90% confidence level, which we consider "conservative" market performance, means that in 90% of the historical market scenarios run, the selected target asset mix performed at least as well as the results shown. Conversely, in 10% of the historical market scenarios run, the target asset mix failed to reach the results shown.
- A 50% confidence level, which we consider more optimistic, means that in 50% of the historical market scenarios run, the selected target asset mix performed at least as well as the results shown, and in 50% of the scenarios, the target asset mix fails to reach the results shown.

Bitcoin methodology

For bitcoin's hypothetical path, we decided to show an extreme worst-case scenario and a more optimistic view. First, that it goes immediately to zero on the hypothetical same day. In a more optimistic scenario, we consider bitcoin's world adoption curve.



Monthly and annual data. Source: Fidelity Investments, Bloomberg Finance LP, Haver Analytics, Coin Metrics, as of Mar. 31, 2025.

Monte Carlo simulation

For the optimistic scenario for bitcoin, we sample real returns from log-normal distributions. The expected (continuously compounded) real returns for U.S. Equity, Nominal Bonds, and Cash are set to their historical averages over the period from 1927 to the present. The expected real return to bitcoin is time-varying and is calibrated using the S-curve for World Internet adoption, starting from its price as of the end of December 2024. We assume that as the adoption curve levels off, the expected return for bitcoin converges to a long-run value of 2% real, annualized.

The projections or other information generated by the Monte Carlo simulations regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results.

For the Covariance matrix, we use a historical estimate based on the period from January 2018 to April 2022. There are two reasons behind this choice: (i) over this period, the realized Covariance for U.S. Equity, Nominal Bonds, and Cash is very similar to the long run Covariance estimated using the period 1927–present; (ii) by the beginning of 2018, there was already a futures market for bitcoin, which we believe is a much better reflection of bitcoin’s Covariance with major asset classes than the period prior to 2018.

Finally, the volatility of bitcoin is also time-varying. It starts at 69% (its annualized volatility over the period January 2018–March 2025) and declines by 4 percentage points per annum until it converges to a long-run value of 20%.

CHANGE IN SPENDING AT 90% CONFIDENCE—BITCOIN WORLD CURVE						
Bitcoin/Age	30	40	45	50	60	65
0.5%	0.0%	1.0%	0.5%	0.5%	1.0%	0.5%
1.0%	0.0%	1.0%	1.5%	1.0%	1.5%	1.0%
2.0%	0.5%	1.5%	2.0%	2.0%	3.0%	2.0%
3.0%	0.5%	2.5%	3.0%	3.0%	4.5%	3.5%
4.0%	1.0%	3.0%	3.5%	4.0%	5.5%	4.5%
5.0%	1.0%	4.0%	4.5%	5.0%	7.0%	5.0%
7.5%	2.5%	6.0%	7.0%	8.0%	8.0%	5.5%
10.0%	3.5%	7.5%	9.0%	10.0%	8.5%	6.5%
CHANGE IN SPENDING AT 50% CONFIDENCE—BITCOIN WORLD CURVE						
Bitcoin/Age	30	40	45	50	60	65
0.5%	0.0%	0.5%	0.5%	0.5%	0.5%	0.5%
1.0%	0.5%	1.0%	1.5%	1.0%	1.5%	1.0%
2.0%	1.0%	2.5%	2.0%	2.5%	3.0%	2.5%
3.0%	2.5%	3.5%	3.0%	4.0%	5.0%	4.0%
4.0%	2.5%	5.0%	4.5%	5.0%	7.0%	5.5%
5.0%	3.5%	6.0%	5.5%	7.0%	8.5%	6.5%
7.5%	5.0%	10.0%	8.0%	11.5%	12.0%	9.5%
10.0%	7.0%	12.0%	12.5%	15.5%	16.5%	12.5%
CHANGE IN SPENDING AT 90% CONFIDENCE—BITCOIN GOES IMMEDIATELY TO ZERO (WORST-CASE)						
Bitcoin/Age	30	40	45	50	60	65
0.5%	0.0%	0.0%	0.0%	0.0%	-0.5%	-0.5%
1.0%	0.0%	0.0%	-0.5%	-0.5%	-0.5%	-0.5%
2.0%	-0.5%	-0.5%	-0.5%	-1.0%	-1.0%	-1.0%
3.0%	-0.5%	-0.5%	-1.0%	-1.5%	-1.5%	-1.5%
4.0%	-0.5%	-1.0%	-1.5%	-1.5%	-2.0%	-2.5%
5.0%	-1.0%	-1.0%	-1.5%	-2.0%	-2.5%	-3.0%
7.5%	-1.0%	-2.0%	-2.5%	-3.0%	-3.5%	-4.0%
10.0%	-1.5%	-2.5%	-3.0%	-4.0%	-5.0%	-5.5%

Source: Fidelity Investments, as of Mar. 31, 2025.

Indexes used in Exhibits 5, 6, and 8:

Exhibit 5—(Bitcoin Sharpe vs. other asset classes): HFRX Market Neutral Index; Morningstar Leveraged Loan Index; HFRX Absolute Return Index; Gold: New York U.S. dollar spot price; HFRX Equity Hedge Index; Bloomberg Short-Term Treasury Index; S&P 500; bitcoin, price of one coin per US dollar; MSCI AC World Index; Alternative 60/40: 40% S&P 500 Index; 20% Bloomberg U.S. Aggregate Bond Index; 20% MSCI EAFE Index; 4% gold; 2% HFRX Equity Hedge Index; 2% HFRX Macro/CTA Index; 2% HFRX Market Neutral Index; 2% HFRX Absolute Return Index; 2% Bloomberg High Yield Index; 2% Bloomberg US Treasury Bill Index; 2% Bloomberg TIPS Index; 1% Bloomberg Commodity Index; 1% bitcoin. Large growth: Russell 1000 Index; Bloomberg High Yield Index; Bloomberg Commodity Index; Global 60/40: 60% MSCI ACWI Index and 40% Bloomberg Global Aggregate Bond Index; Large value: Russell 1000 Value Index; HFRX Macro/CTA Index; US 60/40: 60% S&P 500 and 40% Bloomberg US Aggregate Bond Index; 2% HFRX Macro/CTA Index; Small value, Russell 1000 Value Index; REITs, Dow Jones Equity REIT Index; Small caps: Russell 2000 Index; MSCI Emerging Market Index; EMBI: JPMorgan Emerging Markets Bond Index; Bloomberg Global Aggregate Bond Index; Bloomberg TIPS index; Bloomberg Long-Term Treasury Index.

Exhibit 6—5 Yr correlation vs. S&P: S&P 500; U.S. 60/40: 60% S&P 500 and 40% Bloomberg U.S. Aggregate Bond Index; MSCI AC World Index; Alternative 60/40: 40% S&P 500 Index; 20% Bloomberg U.S. Aggregate Bond Index; 20% MSCI EAFE Index; 4% gold; 2% HFRX Equity Hedge Index; 2% HFRX Macro/CTA Index; 2% HFRX Market Neutral Index; 2% HFRX Absolute Return Index; 2% Bloomberg High Yield Index; 2% Bloomberg US Treasury Bill Index; 2% Bloomberg TIPS Index; 1% Bloomberg Commodity Index; 1% bitcoin. Large Growth: Russell 1000 Growth Index; Large Value: Russell 1000 Value Index; Global 60/40: 60% MSCI ACWI Index and 40% Bloomberg Global Aggregate Bond Index; Dow Jones Equity REIT Index; HFRX Equity Hedge Index; Small Cap: Russell 2000 Index; Small Growth: Russell 2000 Growth Index; Bloomberg High Yield Index; MSCI EAFE Index; MSCI AC World ex US Index; MSCI Europe Index; Small value, Russell 2000 Value Index; EMBI: JPM Emerging Markets Bond Index; MSCI Japan Index; Bloomberg TIPS Index; MSCI Emerging Markets Index; Bloomberg Global Aggregate Bond Index; Morningstar Leveraged Loan Index; Bloomberg Short-Term Government Bond Index; Bitcoin, price of 1 coin per US dollar; Bloomberg Long-Term Government Bond Index; HFs Market Neutral: HFRX Market Neutral Index; HF abs return: HFRX Absolute Return Index; HFRX Macro/CTA Index; Gold: New York U.S. dollar spot price; Bloomberg 30-day Treasury Bill Index; US dollar; Bloomberg Commodity Index.

Exhibit 8—drawdowns and rallies. Treasuries: Bloomberg Treasury Bill Index; Gold: NY US Dollar spot price; HFRX Absolute Return Index; Bloomberg TIPS Index; Bloomberg High Yield Index; Bloomberg US Aggregate Bond Index; MSCI EAFE Index; HFRX Global Hedge Index; MSCI ACWI ex US Index; HFRX Equity Long Short Index; US 60/40: 60% S&P 500 and 40% Bloomberg US Aggregate Bond Index; Alternative 60/40: Alternative 60/40: 40% S&P 500 Index; 20% Bloomberg U.S. Aggregate Bond Index; 20% MSCI EAFE Index; 4% gold; 2% HFRX Equity Hedge Index; 2% HFRX Macro/CTA Index; 2% HFRX Market Neutral Index; 2% HFRX Absolute Return Index; 2% Bloomberg High Yield Index; 2% Bloomberg US Treasury Bill Index; 2% Bloomberg TIPS Index; 1% Bloomberg Commodity Index; 1% bitcoin. HFRX Macro/CTA Index; MSCI ACWI Index; MSCI Europe Index; MSCI ESG Index; MSCI China Index; S&P 500; Bitcoin; MSCI Japan Index; US dollar; Bloomberg Long-Term Treasury Index; Magnificent 7 Total Return Index; Bloomberg Commodity Index; Ether: price of one coin per US dollar.

Index definitions

HFRX Market Neutral Index: Equity market neutral strategies employ sophisticated quantitative techniques of analyzing price data to ascertain information about future price movement and relationships between securities, select securities for purchase and sale. These can include both factor-based and statistical arbitrage/trading strategies. Factor-based investment strategies include strategies in which the

investment thesis is predicated on the systematic analysis of common relationships between securities. In many but not all cases, portfolios are constructed to be neutral to one or multiple variables, such as broader equity markets in dollar or beta terms, and leverage is frequently employed to enhance the return profile of the positions identified. Statistical arbitrage/trading strategies consist of strategies in which the investment thesis is predicated on exploiting pricing anomalies which may occur as a function of expected mean reversion inherent in security prices; high frequency techniques may be employed and trading strategies may also be employed on the basis of technical analysis or opportunistically to exploit new information the investment manager believes has not been fully, completely or accurately discounted into current security prices. Equity market neutral strategies typically maintain characteristic net equity market exposure no greater than 10% long or short. **HFRX Macro/CTA Index:** Macro strategy managers trade a broad range of strategies in which the investment process is predicated on movements in underlying economic variables and the impact these have on equity, fixed income, hard currency, and commodity markets. Managers employ a variety of techniques, both discretionary and systematic analysis, combinations of top down and bottom up theses, quantitative and fundamental approaches, and long- and short-term holding periods. Although some strategies employ RV techniques, macro strategies are distinct from RV strategies in that the primary investment thesis is predicated on predicted or future movements in the underlying instruments, rather than realization of a valuation discrepancy between securities. In a similar way, while both macro and equity hedge managers may hold equity securities, the overriding investment thesis is predicated on the impact movements in underlying macroeconomic variables may have on security prices, as opposed to EH, in which the fundamental characteristics on the company are the most significant and integral to investment thesis. **Bloomberg Short-Term Treasury Index:** measures U.S. dollar-denominated, fixed-rate, nominal debt issued by the U.S. Treasury. Treasury bills are excluded by the maturity constraint, but are part of a separate Short Treasury Index. STRIPS are excluded from the index because their inclusion would result in double-counting. **Russell 1000 Index:** a market capitalization-weighted index designed to measure the performance of the large cap segment of the U.S. equity market. **Morningstar Leveraged Loan Index:** designed to deliver comprehensive, precise coverage of the U.S. leveraged loan market. **S&P 500 Index:** a market capitalization-weighted index of 500 common stocks chosen for market size, liquidity, and industry group representation to represent U.S. equity performance. **Bloomberg U.S. Aggregate Bond Index:** a broad base, market capitalization-weighted bond market index representing intermediate term investment-grade bonds traded in the United States. **Bloomberg Commodity Index:** a broadly diversified commodity price index that tracks prices of futures contracts on physical commodities on the commodity markets. **HFRX Absolute Return Index:** designed to be representative of the overall composition of the hedge fund universe. It is comprised of all eligible hedge fund strategies; including but not limited to convertible arbitrage, distressed securities, equity hedge, equity market neutral, event driven, macro, merger arbitrage, and relative value arbitrage. As a component of the optimization process, the index selects constituents that characteristically exhibit lower volatilities and lower correlations to standard directional benchmarks of equity market and hedge fund industry performance. **Bloomberg High Yield Index:** measures the USD-denominated, high yield, fixed-rate corporate bond market. Securities are classified as high yield if the middle rating of Moody's, Fitch and S&P is Ba1/BB+ or below. **Bloomberg TIPS Index:** measures the performance of the U.S. Treasury Inflation Protected Securities (TIPS) market. **HFRX Equity Hedge Index:** maintains positions both long and short in primarily equity and equity derivative securities. A wide variety of investment processes can be employed to arrive at an investment decision, including both quantitative and fundamental techniques; strategies can be broadly diversified or narrowly focused on specific sectors and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. Equity Hedge managers would typically maintain

at least 50%, and may in some cases be substantially or entirely invested in equities, both long and short. **MSCI All Country World Index** is a stock index designed to track broad global equity-market performance. Maintained by Morgan Stanley Capital International (MSCI), the index comprises the stocks of nearly 3,000 companies from 23 developed countries and 25 emerging markets; **MSCI ACWI ex U.S. Index** excludes the United States. **Bloomberg Global Aggregate Bond Index** is a measure of global investment-grade debt from 28 local currency markets. This multi-currency benchmark includes treasury, government-related, corporate, and securitized fixed-rate bonds from both developed- and emerging-market issuers. There are four regional aggregate benchmarks that largely comprise the Global Aggregate Index: the U.S. Aggregate, the Pan-European Aggregate, the Asian-Pacific Aggregate, and the Canadian Aggregate Indices. **MSCI Europe Index**: captures large and mid cap representation across 15 Developed Markets (DM) countries in Europe. **Russell 1000 Value Index**: a market capitalization-weighted index designed to measure the performance of the large-cap value segment of the U.S. equity market. It includes those Russell 1000 Index companies with lower price-to-book ratios and lower expected growth rates. **MSCI EAFE Index** is a stock market index that measures the performance of large and mid cap companies across 21 developed markets countries around the world. Canada and the USA are not included. **MSCI Japan Index**: a free float-adjusted market capitalization-weighted index designed to measure the performance of the large and mid cap segments of the Japanese market. **Russell 2000 Index**: a market capitalization-weighted index designed to measure the performance of the small cap segment of the U.S. equity market. It includes approximately 2,000 of the smallest securities in the Russell 3000 Index. **Russell 2000 Value Index**: is a market capitalization-weighted index designed to measure the performance of the small cap value segment of the U.S. equity market. It includes those Russell 2000 Index companies with lower price-to-book ratios and lower forecasted growth rates. **Russell 2000 Growth Index**: is constructed to provide a comprehensive and unbiased barometer for the small cap growth segment. **Dow Jones Equity REIT Index**: is designed to measure all publicly traded real estate investment trusts in the Dow Jones U.S. stock universe classified as equity REITs according to the S&P Dow Jones Indices REIT Industry Classification Hierarchy. **MSCI Emerging Markets Index**: captures large and mid cap representation across 24 Emerging Markets (EM) countries. With 1,441 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country. **JPMorgan Emerging Markets Bond Index**: is a market value-weighted index of U.S. dollar-denominated sovereign restructured debt issues. **Bloomberg Long-Term Treasury Index**: measures the performance of U.S. dollar-denominated, fixed-rate, nominal debt issued by the U.S. Treasury with a maturity greater than 10 years. **Bloomberg Short-term Bond Index**: Bloomberg U.S. 1-5 Year Government/Credit Bond Index is a market value-weighted index of fixed-rate investment-grade debt securities with maturities from one to five years from the U.S. Treasury, U.S. Government-Related, and U.S. Corporate Indexes. **MSCI China Index**: captures large and mid cap representation across China A shares, H shares, B shares, Red chips, P chips, and foreign. **Bloomberg Magnificent 7 Total Return Index**: an index tracking the performance of seven major tech companies: Alphabet, Amazon, Apple, Meta Platforms, Microsoft, Nvidia, and Tesla. **The Bloomberg U.S. Treasury Bill Index**: tracks the market for treasury bills issued by the U.S. government. U.S. Treasury bills are issued in fixed maturity terms of 4, 8, 13, 17, 26 and 52 weeks. **The Bloomberg 30-day Treasury Bill Index**, also known as the Bloomberg 1-3 Month U.S. Treasury Bill Index, tracks the performance of U.S. Treasury bills with a remaining maturity of at least one month and less than three months.

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Risks:

Diversification and asset allocation do not ensure a profit or guarantee against a loss.

Investing involves risk, including risk of total loss.

Crypto as an asset class is speculative, highly volatile, can become illiquid at any time, and is for investors with a high risk tolerance. Crypto may also be more susceptible to market manipulation than securities.

Digital assets are not insured by the Federal Deposit Insurance Corporation (FDIC) or protected by the Securities Investor Protection Corporation (SIPC).

When considering bitcoin's gold-like characteristics, it is important to keep in mind the many differences, including the significant risk and speculative nature of investing in cryptocurrencies, and the risks associated with distributed ledger technology. Notwithstanding bitcoin's gold-like characteristics, there are many obvious differences between bitcoin and gold.

Investors must make their own determination whether an investment in any particular digital asset/cryptocurrency is consistent with their investment objectives, risk tolerance, financial situation, and evaluation of the digital asset. **Neither Fidelity nor any of its affiliates are recommending or endorsing these assets by making them available.**

Bitcoin exchanges may suffer from operational issues, such as delayed execution. Digital asset exchanges have been closed due to fraud, failure, or security breaches. Assets that reside on an exchange that shuts down or suffers a breach may be lost.

Several factors may affect the price of bitcoin, including, but not limited to: supply and demand, investors' expectations with respect to the rate of inflation, interest rates, currency exchange rates or future regulatory measures (if any) that restrict the trading of bitcoin or the use of bitcoin as a form of payment. There is no assurance that bitcoin will maintain its long-term value in terms of purchasing power in the future, or that acceptance of bitcoin payments by mainstream retail merchants and commercial businesses will continue to grow. Bitcoin is created, issued, transmitted, and stored according to protocols run by computers in the bitcoin network. It is possible the bitcoin protocol has undiscovered flaws that could result in the loss of some or all assets. There may also be network-scale attacks against the bitcoin protocol, which result in the loss of some or all of assets. Advancements in quantum computing could break bitcoin's cryptographic rules.

Stock markets are volatile and can fluctuate significantly in response to company, industry, political, regulatory, market, or economic developments. Foreign markets can be more volatile than U.S. markets due to increased risks of adverse issuer, political, market, or economic developments, all of which are magnified in emerging markets. These risks are particularly significant for investments that focus on a single country or region.

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Thought leadership vice president Martine Costello Duffy provided editorial direction to this article.



Endnotes

1. As of 5/14/25, the cryptocurrency industry was \$3.46 trillion, with bitcoin at \$2.055 billion. Source: CoinMarketCap. **2.** For the purposes of this article, we will assume readers have a general understanding of bitcoin's features and functionality, potential benefits, and risks. **3.** The stock-to-flow ratio (stock divided by flow) is commonly used to quantify the scarcity of gold and other commodities. **4.** For example, bitcoin's 12-month rolling correlation to the S&P 500 was 0.68 as of December 2020, and 0.42 as of December 2023. Bloomberg Finance LP. **5.** The 5-year correlation of gold to bitcoin was -11% as of 5/11/25, the most negative of 32 asset classes. Source: Fidelity Investments, Bloomberg Finance LP, Haver Analytics. **6.** Based on an analysis of bitcoin's three-year correlation to a 60/40 portfolio: bottom-, middle-, and top-quartile monthly real returns (as of 8/31/22). **7.** "Secular outlook for global growth, the next 20 years." Fidelity Asset Allocation Research Team. **8.** Using Quantity Theory of money logic, $Mv = sPQ$, where M is total supply of bitcoin (fixed in the long run), v is bitcoin's velocity, PQ is world output denominated in bitcoin and s is bitcoin's penetration as money in the world economy. In a long-run equilibrium, $d\ln(v)/dt = d\ln(s)/dt$, and given that $d\ln(M)/dt = 0$ once no new bitcoin can be mined, we obtain $d\ln(1/P)/dt = d\ln(Q)/dt$. That is, asymptotically, the price of bitcoin ($1/P$) grows at the growth rate of world output (Q).

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