RESEARCH NOTE

25 October 2021

CANE ISLAND DIGITAL RESEARCH

Proof of *Altseason*

Executive Summary

- **Bitcoin exhibits seasonality consistent with that found in equities.** Through the causes behind seasonality in general are varied and still debated, almost all researchers agree the phenomenon is real and recurring.
- **Altcoins, proxied by Ethereum, also exhibit statistically significant and predictably recurring seasonal trends on both absolute and relative bases.** This season–termed "altseason"–begins in January and ends in May. It is the epitome of the January / Sell in May and Go Away effect.
- **Altseason typically means larger gains and smaller losses for Ethereum relative to bitcoin.** Otherwise, Ethereum tends to experience smaller gains and larger losses, especially during bitcoin bear markets.
- **A hypothetical back-tested portfolio that switches between Ethereum and cash based on season would have outperformed both buy-and-hold bitcoin and buy-and-hold Ethereum since 2015.** Such a portfolio offers greater downside risk protection and favorable risk-adjusted performance.
- **A hypothetical back-tested portfolio that dynamically allocates between Ethereum and bitcoin based on season would have outperformed buy-and-hold Ethereum by 5× and outperformed buy-and-hold bitcoin by over 500×.** In just the past 3 years, a dynamic allocation based on seasonality would have outperformed buy-and-hold bitcoin by 3×. Such a portfolio offers exceptional absolute performance and favorable risk-adjusted performance.

Seasonality

Seasonality is an annually recurring event that is often predictable. It is a subset of the broader group of market anomalies often associated with behavioral finance. In financial markets, *anomalies* refer to situations when an investment asset performs contrary to what rational behavior and academic theory would expect [Canady, 2021].

Seasonality differs from cyclical events which occur at intervals other than annual [Kenton, 2020]. One of the most cited examples of seasonality is the *January Effect*, an increase in stock prices during the month of January. Analysts generally attribute this rally to an increase in buying, which follows the drop in price that typically happens in December [Chen, 2021]. The January Effect is often explained by tax-loss harvesting, where investors sell stocks with a loss late in the year so that they can use those losses to offset capital gains taxes [Simpson, 2021]. However, other research suggests that this simple tax-year explanation is incomplete at best, and incorrect at worst, hence the classification as an anomaly.

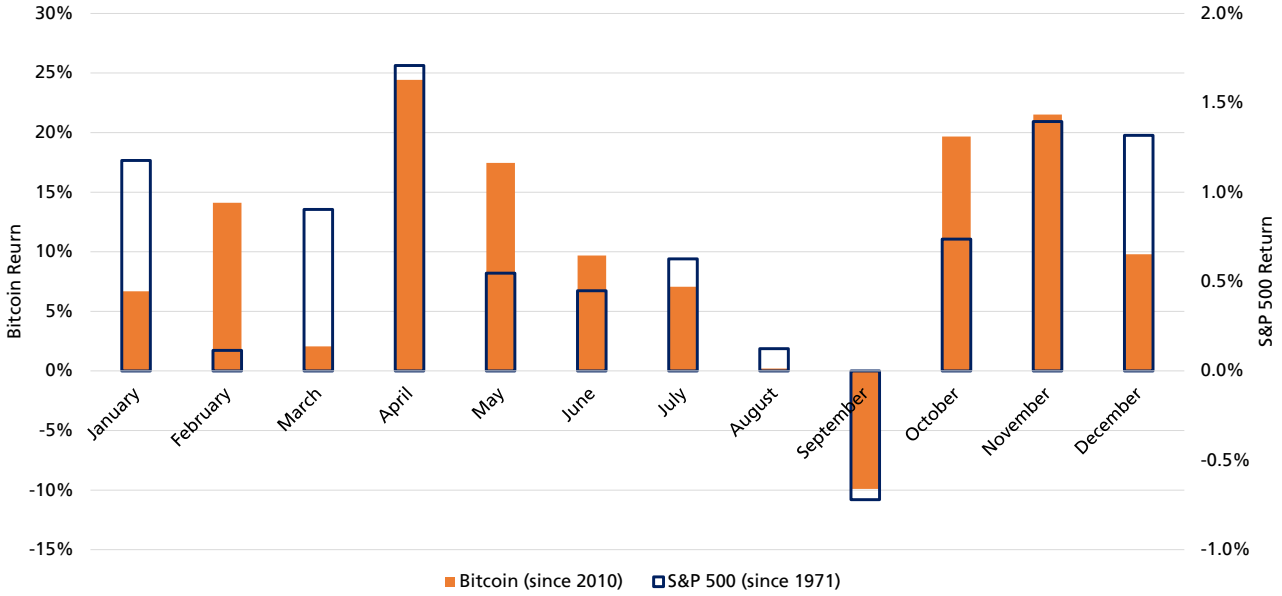
Nobody likes to produce an investment report with a bunch of losers in it. The practice of selling losers just before the end of an annual reporting period for reputational considerations, known as "window dressing," has been examined since at least the early 90's [Lakonishok, 1991].

Some research has indicated that an investor's emotional mood–optimistic in warm spring weather and pessimistic in cold winter weather–influences money flows [Quick, 2018].

An examination of newspaper articles for sentiment bias for the period 1986-2010 gives an indication of the nature and prevalence of market mood. Researchers concluded that investor psychology is skewed to optimism in the first half of the calendar year and pessimism in the latter [Katsuhiko, 2014].

Further, market seasonality is not limited to a few markets or only some years. It appears that financial market seasonality occurs everywhere, all the time [Zhang, 2020].

FIGURE 1
Seasonality in Bitcoin and US Equity Returns
Correlation = 70%



Seasonality in the U.S. Equity Markets

In the United States and Europe, the seasonal effect in market returns has taken on several monikers, including "Sell in May and Go Away" and "The Halloween Indicator" [Bouman, 2002]. The holiday effect is one of the most perplexing of all seasonal anomalies. Based on evidence using 90 years of equity returns, this anomaly has been shown to be responsible for somewhere between 30 to 50% of the total return on the market while exhibiting below average variances [Lakonishok, 1988].

There is evidence that fund managers often start the year by buying small, risky stocks in order to beat benchmarks. Once targets are met, they adjust toward visible, less risky stocks to lock in returns, providing them with a seasonal returns pattern and "safe-looking" portfolio at year-end [Ackert, 2021].

The truth is stocks do not perform well in summer. Barry Bannister, head of institutional equity strategy at Stifel describes the mantra concisely: "It is a very good adage with a long history. It is related to business and investor psychology. Toward year-end, investors grow concerned about the next year's growth and sell stocks. Most years don't feature a recession, so there is often a first quarter relief rally," [Root, 2019].

Seasonality in Bitcoin

Investors, for whatever reason, alternate between "risk on" and "risk off" postures on an annual cycle. This behavior extends to investments in bitcoin. The strength and consistency of bitcoin's performance in October has spawned the phrase "Uptober" among bitcoin investors.

The evidence is that bitcoin behaves like and is treated as a risky investment as opposed to a "safe" one. Bitcoin's higher returns are accompanied by greater variance, which meets the classic definition of a risky asset.

This tradeoff is not one-for-one, however. Figure 2 shows that while bitcoin has offered 15× greater returns than the S&P 500, it has only come with 9× greater risk. The Sharpe ratio for U.S. Equities is about 1.1.

FIGURE 2
Bitcoin Risk and Return since 2010

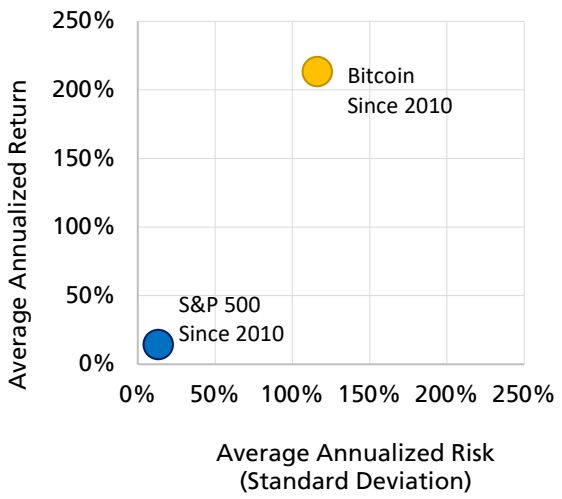
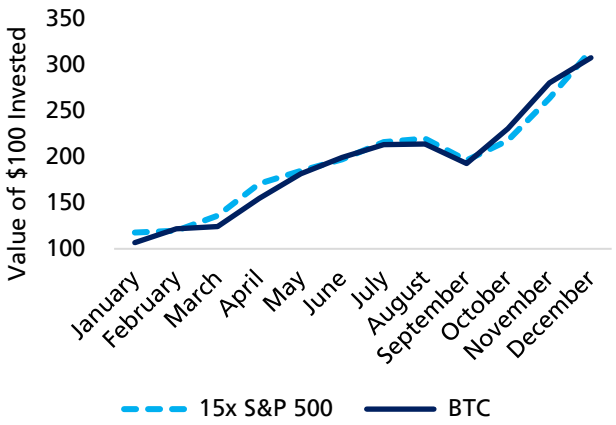


FIGURE 3
Bitcoin Risk and Return since 2010
Growth of $100 Invested in an "Average" Year
using average monthly returns since 2010



The Sharpe ratio for bitcoin is a more favorable 1.8.[1] This favorable risk/reward characteristic holds even when only downside deviation is considered.

On a seasonal basis, bitcoin behaves almost exactly like a 15× leveraged S&P 500 fund. When the average monthly return is calculated, the resulting one-year trend can be applied to grow a hypothetical $100. In the graph at Figure 3, this is done for bitcoin and 15×S&P 500. The pattern is nearly identical, a statistical 98% match.

Mining Seasonality and Bitcoin

There has been speculation that the heavy concentration of mining operations in China affects bitcoin price because China experiences seasonal patterns in weather. The theory is that during the rainy season miners use cheap hydroelectric power, and during the dry season they relocate to more expensive coal-powered centers. Expensively mined bitcoin is held until market prices make its public sale profitable. This creates temporary supply-demand imbalances which appear as seasonal price fluctuations. There is weak evidence to support seasonality in bitcoin hash rate.

However, because bitcoin's seasonally adjusted price history is so highly correlated to that of U.S. equities, it is doubtful that China's mining operations have the suspected influence on price. In 2021, China banned mining operations and much of the hashing power moved to the United States; bitcoin's price and hash rate recovered, but it remains to be seen if the historically reliable seasonal behavior will persist. If it does, it strengthens the assertion that supply-based and cost-based measures of bitcoin's value only weakly influence bitcoin's price, and investor behavior (demand) is the primary driver.

Seasonality in Altcoins

There is a hypothesis promoted by cryptocurrency enthusiasts that a subset of tokens–*altcoins*[2]–perform

[1] The Sharpe ratio is one of the most widely used methods for calculating risk-adjusted return. See https://www.investopedia.com/terms/s/sharperatio.asp

[2] An *altcoin* is a digital coin or token perceived as an alternative to bitcoin. Each has a market capitalization less than that of bitcoin. Historically, these assets have usually collectively comprised a minority of the investible cryptocurrency universe.

FIGURE 4
Major Cryptoassets By Market Share
Source: Coinmarketcap.com

better than bitcoin in the first half of the year and worse than bitcoin in the second half of the year. To test this hypothesis, we look to Ethereum, which is the largest altcoin, to identify seasonal patterns.

Ethereum as a Proxy for the Altcoin Market

Ethereum[3] is often considered the leading altcoin, though some are starting to believe that its classification as an *alt*, due to its size and widespread adoption, is no longer appropriate.

TABLE 1
Correlation among various cryptocurrencies
Oct 2018 – Sept 2021

	BTC	*ETH*	*XRP*	*LINK*	*XLM*	*ADA*	*DOGE*	*LTC*	*XMR*
ETH	0.73								
XRP	0.33	0.65							
LINK	0.55	0.68	0.49						
XLM	0.55	0.76	0.81	0.54					
ADA	0.55	0.66	0.42	0.40	0.72				
DOGE	0.33	0.67	0.66	0.38	0.64	0.49			
LTC	0.84	0.79	0.48	0.56	0.63	0.63	0.45		
XMR	0.76	0.65	0.40	0.46	0.51	0.59	0.43	0.82	
ZEC	0.69	0.76	0.66	0.64	0.74	0.67	0.53	0.81	0.77

Ethereum has consistently shown high correlation to most altcoins. When bitcoin, Ethereum, and stablecoins are excluded from the universe, the seven coins shown in Table 1 make up a over 20% of the remaining market capitalization of nearly 10,000 tokens.

Table 2 shows monthly returns for Ethereum. Visual inspection shows an apparent seasonal effect from December through May.

TABLE 2
ETHEREUM HEATMAP

	December	January	February	March	April	May	June	July	August	September	October	November
2021	20.5%	78.3%	8.2%	34.5%	44.5%	-2.6%	-15.8%	12.0%	34.9%	-12.5%		
2020	-15.5%	40.2%	22.2%	-39.3%	55.0%	20.4%	-9.4%	53.4%	26.0%	-17.5%	7.4%	58.7%
2019	17.2%	-19.2%	27.4%	4.8%	13.2%	66.7%	9.4%	-25.2%	-21.1%	4.3%	1.6%	-16.7%
2018	69.2%	47.7%	-22.3%	-53.7%	69.1%	-13.7%	-21.5%	-4.4%	-34.6%	-17.7%	-15.2%	-43.3%
2017	-5.6%	31.7%	46.2%	219.6%	60.9%	184.6%	20.8%	-27.5%	93.6%	-22.4%	1.0%	43.9%
2016	7.8%	136.4%	182.4%	79.7%	-22.5%	59.3%	-11.3%	-4.1%	-2.8%	14.2%	-17.2%	-21.6%
2015										-45.4%	24.6%	-1.1%
Average	12.8%	45.0%	32.5%	14.7%	32.2%	40.4%	-5.7%	-2.6%	8.7%	-15.8%	-0.6%	-2.9%

This seasonality is also evident in the relative return of Ethereum to bitcoin. Table 3 shows the monthly geometric difference between Ethereum and Bitcoin. In this case, seasonality is more pronounced, and occurs from January through May. This is literally and precisely the "January" / "Sell in May and Go Away" effect described by numerous studies over the past 30 years.

TABLE 3
ETHEREUM RELATIVE RETURN HEATMAP
Ethereum monthly returns relative to Bitcoin monthly returns

	December	January	February	March	April	May	June	July	August	September	October	November
2021	-18.4%	56.1%	-20.9%	3.8%	120.3%	3.6%	-29.4%	-0.9%	45.5%	-12.5%		
2020	-10.2%	7.4%	33.2%	-28.7%	30.7%	10.4%	-6.5%	23.7%	22.3%	-10.5%	-16.2%	11.4%
2019	29.8%	-10.0%	15.3%	-2.7%	-10.0%	3.7%	-24.2%	-6.9%	-21.0%	20.6%	-8.1%	1.0%
2018	28.1%	92.0%	-27.4%	-27.7%	22.9%	9.9%	-6.9%	-27.2%	-23.3%	-12.9%	-11.0%	-16.1%
2017	-28.1%	37.6%	12.7%	267.7%	23.0%	78.3%	3.1%	-33.0%	16.0%	-14.3%	-31.4%	-10.1%
2016	-5.9%	166.9%	146.0%	88.5%	-30.0%	36.5%	-25.9%	-6.6%	10.6%	8.7%	-28.4%	-25.1%
2015										-47.3%	-10.0%	-12.6%
Average	-3.2%	48.3%	16.1%	23.9%	18.3%	21.2%	-15.8%	-10.3%	5.6%	-12.2%	-18.0%	-9.3%

All that remains is to confirm the pattern with a test for statistical significance.

(continued)

[3] Ethereum is a blockchain platform with its own cryptocurrency, called Ether (ETH) or colloquially and collectively, "Ethereum". Ethereum describes itself as "the world's programmable blockchain." It distinguishes itself from bitcoin as a programmable network that serves as a marketplace for financial services, games, and apps, all of which can be paid for in Ether cryptocurrency and are safe from fraud, theft, or censorship [Frankenfield, 2021].

Methodology

To test for the existence of a seasonal effect in Ethereum, we use the methodology in Equation 1 of Bouman (2002). *Altseason* is defined as December through May. The data period is 58 months from January 2017-September 2021.

We incorporated an altseason dummy variable S_t in a regression of lognormal monthly returns:

$$r_t = \alpha + \beta S_t + \varepsilon_t$$

where

$$\varepsilon_t = r_t - E_{t-1}[r_t]$$

For Ethereum (Table1), we have

TABLE 4

	Coef.	*S.E.*	*t Stat*	*P-value*
α	0.0222	0.09	0.25	0.80
β	0.3281	0.12	2.66	0.01

For Ethereum relative to bitcoin (Table 2), we have

TABLE 5

	Coeff.	*S.E.*	*t Stat*	*P-value*
α	-0.0830	0.04	-1.97	0.05
β	0.1882	0.06	2.96	0.00

In both cases, the *t* and *P* statistics indicate significance at the 95% confidence level, confirming a seasonal effect.

It should be noted that this effect is weaker for the most recent 29 months than it was for the first 29. This is less likely because of an arbitraging of the opportunity and more likely attributable to diminished marginal returns: as the altcoin market grows over time, and the impact of switching into and out of altcoins is reduced each season. This tautology is explained in the next section.

Mechanics of the Seasonal Effect in Ethereum

The effect is quantified in segmented up-market and down-market capture ratios[4] of Ethereum vs. bitcoin. Periods are segmented into altseason and non-altseason periods.

TABLE 6
ETH Up and Down Capture Relative to Bitcoin

	ETH Up Capture	ETH Down Capture
Altseason	204%	7%
Other	71%	262%

To summarize Table 6, altseason means larger gains and smaller losses for Ethereum. Otherwise, Ethereum experiences smaller gains and larger losses.

Ethereum earns about twice bitcoin's positive return on average during January – May. When bitcoin falls, ETH holds steady during these periods.

From June – December, Ethereum only gains 71% of what bitcoin gains, and loses 2.6 times as much as bitcoin loses.

The net capture difference for altseason is 2.04 – 0.07 = 1.97. The net capture difference for other periods is 0.71 – 2.62 = -1.91. This nearly 2:1 relationship in both seasons is not a coincidence and has roots in Metcalfe's law, described in the next section.

Disproportionate Network Effects

Ethereum's seasonality, and therefore volatility, is more pronounced than that of bitcoin. The most likely explanation for this is the relative size of the networks and the impact of the money flows between them. This dynamic is explained in detail in Peterson [2019] and summarized here for convenience.

Linear (Money Flow) Example

Suppose there are two investments, A and B. A is 100 units and B is 60 units. 20 units are withdrawn from

[4] https://www.investopedia.com/terms/u/up-market-capture-ratio.asp

A and invested in B. A loses 20%, whereas B gains 33%.

Network (User Flow) Example

For network-based assets, these impacts are non-linear. Network A has 100 users and network B has 60 users. Using Metcalfe's law[5]:

> The value of network A is approximately (100 × 99) ÷ 2 = 4,950.
>
> The value of network B is approximately (60 × 59) ÷ 2 = 1,770.

If 20 users leave Network A and join Network B, then the value changes accordingly:

> Network A: [(100 - 20) × 79] = 3,160
>
> Network B: [(60 + 20) × 79] = 3,160

The change in value is:

> Network A: 3,160 ÷ 4,950 – 1 = -36.2%
>
> Network B: 3,160 ÷ 1,770 – 1 = 78.5%

Notice the percentage gain in Network B is twice the loss in Network A. With Metcalfe's law, this is always the case. Peterson [2019] illustrates several real-world examples of this occurring in bitcoin vs. altcoin markets. Because altcoins are usually a smaller percentage of the market, the impacts of user and money flows are more pronounced, resulting in higher returns and higher volatility relative to bitcoin. But as altcoins have grown relative to bitcoin, the relative impact over time has lessened.

A Back-tested Altcoin Rotation Strategy

With the above information we can construct for ex-post hypothetical portfolios[6] from August 1, 2015 through September 30, 2021.

ETH Only: This is a buy-and-hold Ethereum portfolio.

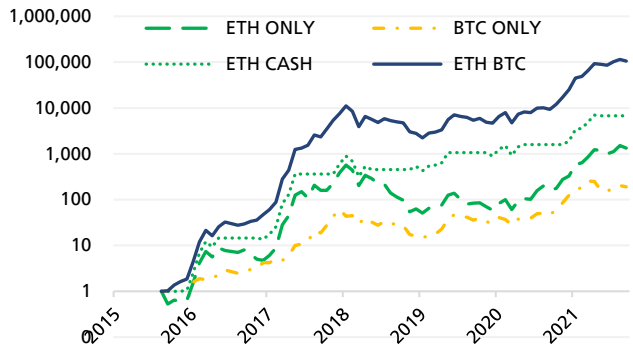
BTC Only: This is a buy-and hold bitcoin portfolio. This portfolio also serves as the reference benchmark portfolio when calculating risk statistics and risk-adjusted performance.

ETH+Cash: This portfolio holds Ethereum from December through May and cash (earning 0%) all other times.

ETH+BTC: This portfolio holds Ethereum from January through May and bitcoin all other times.

A hypothetical growth of $1 since inception is shown in Figure 5.

FIGURE 5
Growth of $1



ETH-BTC portfolio outperforms buy-and-hold Ethereum by 80× and outperforms buy-and-hold bitcoin by over 500×. Though not shown, recreation of this methodology for the most recent 36 months (October 2018 – September 2021) produces similar results, with ETH-BTC outperforming bitcoin by 3× and outperforming Ethereum by 2×.

Summary portfolio statistics are shown in Table 7.

(continued)

[5] https://en.wikipedia.org/wiki/Metcalfe%27s_law

[6] See the important disclosures at the end of this document.

TABLE 7
Back-tested Portfolio Statistics

	ETH ONLY	BTC ONLY	ETH+ CASH	ETH+ BTC
Annualized ROR	226%	137%	327%	570%
Annualized σ	160%	84%	128%	136%
ρ to BTC	0.49	1.00	0.31	0.58
β to BTC[7]	0.93	1.00	0.47	0.95
Sharpe[8]	1.42	1.64	2.55	4.19
Treynor[9]	2.43	1.37	6.97	6.02
α[10]	-74%	0%	262%	441%
Information Ratio[11]	0.28	0.00	0.61	1.70

Conclusion

Bitcoin has a seasonal pattern remarkably similar to that of U.S. equity with the only substantive difference being order of magnitude. This seasonality extends to other cryptoassets like Ethereum.

Because altcoins have a minority of the market share, the impacts of money flows and user growth are magnified. This magnification is apparent in the seasonal effects found in Ethereum, which are persistent over time and statistically significant.

Unlike other mispricing anomalies, seasonal effects in financial markets are likely a combination of human psychology and recurring temporal conditions. The workings of the human brain are not easily altered, and the earth's orbit around the sun is fixed. This means that seasonal effects are inherent in the way our society works and cannot be arbitraged away.

The extraordinary conclusion is that even rational investors should choose to hop on the bandwagon of seasonal investing, or risk trailing their peers in performance. Such behavior would only serve to reinforce and perpetuate the effect. It is very likely that a cryptoasset investor who modifies their asset allocation to capture seasonal effects will outperform a buy-and-hold strategy.

[7] https://www.investopedia.com/terms/b/beta.asp
[8] https://www.investopedia.com/terms/s/sharperatio.asp
[9] https://www.investopedia.com/terms/t/treynorratio.asp
[10] https://www.investopedia.com/terms/a/alpha.asp
[11] https://www.investopedia.com/terms/i/informationratio.asp

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The hypothetical back-tested performance data is derived from actual cryptoasset price data obtained by coinmetrics.io. The monthly data series begins with data on August 1, 2015.

Hypothetical strategies are rebalanced according to the strategy design on the first of each month. The data shown is hypothetical and is provided to illustrate historical risk and return performance had these portfolios been in existence over the relevant time period shown. CIAA does not offer or manage cryptoasset portfolios.

The hypothetical back-tested performance was achieved with the benefit of hindsight; it does not represent actual investments in any investment strategies.

There are certain limitations inherent in hypothetical model results like those portrayed, particularly that such hypothetical model returns do not reflect trading in actual client accounts and do not reflect the impact that material economic and market factors may have had on the adviser's decision-making had the adviser actually been managing client funds. Unlike an actual performance record, hypothetical back-tested performance results do not represent actual trading. These types of simulated trading programs, in general, benefit compared to actual performance results because such simulated programs are designed with the benefit of hindsight. In addition, simulated trading does not involve or consider financial risk and does not take into account that material and market factors may have impacted a manager's decision making, all of which can adversely affect actual trading results and performance. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can also adversely affect markets in general or the implementation of any specific trading program. Hypothetical back-tested performance does not represent actual performance, trading costs or the impact of taxes and should not be interpreted as an indication of such performance.

Hypothetical back-tested performance also differs from actual performance because it is achieved through the retroactive application of model index portfolios designed with the benefit of hindsight. As a result, the portfolios described may be changed from time to time and the effect on hypothetical performance results could be either favorable or unfavorable.

Hypothetical back-tested performance results shown do include the reinvestment of dividends and capital gains but do not incorporate any other fees such as commissions, custody fees, or advisory fees. The impacts of trading costs are not included in the performance results and will reduce actual performance.

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