

# Illinois State Board Of Investment: Introducing Novell Asset Classes

FINM 35900 – Macro Finance  
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## Abstract

This proposal examines the potential benefits of incorporating Bitcoin into the asset allocation strategy of the Illinois State Board of Investment (ISBI). With over \$25 billion in assets under management and a significant responsibility for managing pension plans for State of Illinois employees, ISBI's investment policy warrants periodic review and adjustment to optimize returns and manage risk. This study suggests initializing a 1% allocation of the fund's assets to Bitcoin as part of a diversified portfolio, alongside current assets.

## Introduction

The ISBI manages a substantial portfolio that serves as the defined benefit pension plan for many State of Illinois employees. Given the evolving landscape of financial markets, it is prudent for ISBI to explore new asset classes to enhance portfolio performance while maintaining adequate risk. Among new asset classes, cryptocurrencies, particularly Bitcoin, have gained prominence as an attractive investment opportunity.

## Methodology

- **Policy Targets:** The ISBI's investment policy targets<sup>1</sup> have historically included allocations to various asset classes, with adjustments made over time to reflect market dynamics and strategic objectives. By introducing Bitcoin into the fund's investment universe, we aim to enhance portfolio risk adjusted returns.
- **Composite Benchmark:** The fund's performance is benchmarked against a composite index<sup>2</sup> consisting of diverse asset classes. However, a traditional benchmark may not fully capture emerging assets like Bitcoin. We propose expanding the composite benchmark to include either a cryptocurrency basket index or Bitcoin-specific metrics to accurately capture the impact of adding Bitcoin into the fund's portfolio. This addition is essential for accurately evaluating the performance impact of Bitcoin within the fund's portfolio and ensuring alignment with the established benchmarks.

## Arguments for Allocating to Bitcoin

- **Diversification Benefits:** Bitcoin has demonstrated low correlation with traditional asset classes like stocks and bonds, making it an attractive asset for portfolio diversification. Allocating a portion of the fund's assets to Bitcoin can help improve risk adjusted returns without taking on substantial risks.
- **Inflation Hedge:** Bitcoin's finite supply and decentralized nature make it a potential hedge against inflationary pressures. As central banks continue to implement accommodative monetary policies, the value proposition of Bitcoin as a store of value becomes increasingly compelling due to its finite supply and the ability to safeguard the purchasing power of the fund's assets over the long term.
- **Long-Term Growth Potential:** Bitcoin has exhibited robust long-term growth even despite high volatility, outperforming many traditional assets over extended periods. With growing institutional adoption and further developing ecosystem, Bitcoin's role as a legitimate asset class is solidifying and presenting an opportunity for investors to capture significant upside potential.
- **Strategic Positioning:** ISBI has a responsibility to explore innovative investment opportunities that align with its long-term objectives. By initiating an investment in Bitcoin, ISBI will demonstrate its commitment to strategic diversification and proactive risk management, thereby enhancing its ability to achieve its investment goals in a dynamic market environment.

1. See appendix A for policy target history.  
2. See appendix B for composite benchmark index history.

## Bitcoin Risks

- **Volatility:** Bitcoin is known for its extreme price volatility, with significant drawdowns over short periods of time. This higher level of volatility can lead to increased risk of the portfolio.
- **Regulatory Risks:** Government regulation of cryptocurrencies is still evolving and future changes in regulation around the world could influence the value of Bitcoin.
- **Liquidity Risk:** Bitcoin still lacks the liquidity of traditional assets like stocks and bonds and during periods of high volatility liquidity may dry up.
- **Security Risks:** Ownership of crypto assets requires safeguarding private keys and using secure storage solutions. Another option is to explore Bitcoin ETFs; however, etfs also carry counterparty risks.
- **Diversification Risks:** While current correlations are low with other assets, future correlations may change over time and may not exhibit the same diversification benefits within a portfolio.
- **Technology Risks:** Bitcoin is built on blockchain technology which is still evolving. There is a risk of technological obsolescence, security vulnerabilities, or protocol changes that could impact the usability, scalability, or security of Bitcoin.
- **Environmental Risks:** With an increasing shift towards more eco-friendly cryptocurrencies, these environmental factors could affect the value of Bitcoin.

## Results Overview

Starting with an analysis using Mean Variance Optimization, we generated an efficient frontier portfolio for existing ISBI portfolio and another frontier for ISBI portfolio with Bitcoin. In this model, we permitted the allocation weights of each asset to fluctuate between 1% and 20%. It's clear from our findings that the ISBI portfolio with Bitcoin allocation exhibits higher returns, increased volatility, and a higher Sharpe ratio compared to the portfolio without Bitcoin.

	Expected Return	Expected Volatility	Sharpe Ratio
MVO Without BTC	0.068	0.057	1.199
MVO With BTC	0.113	0.080	1.409

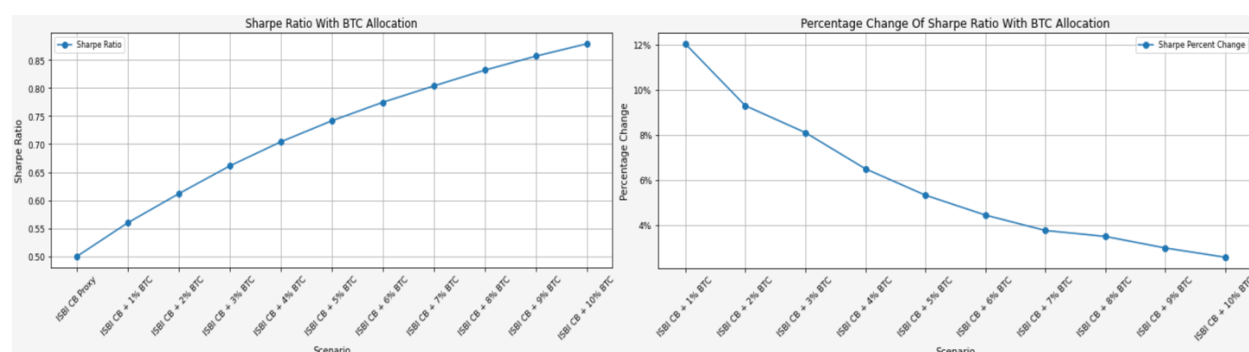
The below comparative analysis of various ISBI portfolios, each with a different allocation to Bitcoin, showcases the Compound Annual Growth Rate (CAGR), Volatility, Sharpe Ratio, and Maximum Drawdown. As the allocation to Bitcoin increases, so does the Sharpe ratio. However, it's crucial to note that alongside the rise in Sharpe ratio, returns, volatility, and max drawdown metrics also escalate with higher Bitcoin exposure. Returns are indeed improved, but the pension fund must be cognizant about higher risk exposure.

	CAGR	Mean Annual Volatility	Sharpe Ratio	Max Drawdown
ISBI CB Proxy	0.055	0.110	0.499	-0.140
ISBI CB + 1% BTC	0.065	0.116	0.559	-0.142
ISBI CB + 3% BTC	0.085	0.129	0.661	-0.146
ISBI CB + 5% BTC	0.106	0.143	0.742	-0.158
ISBI CB + 10% BTC	0.154	0.175	0.879	-0.185

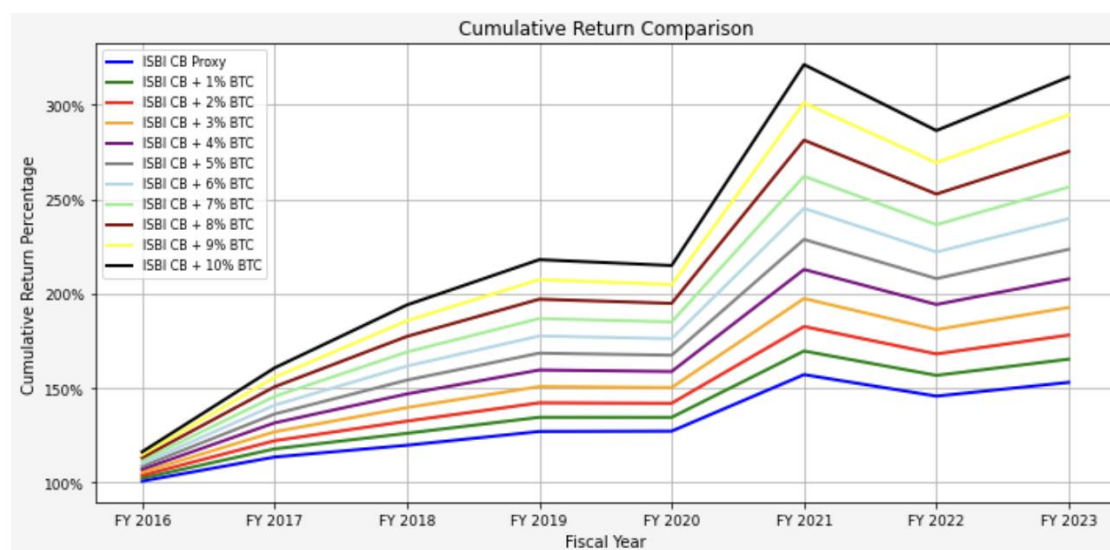
In addition to increased Sharpe Ratio with allocation to Bitcoin, we can also note low bitcoin correlation with other assets in ISBI's portfolio. Such low correlation and enhanced risk adjusted returns make Bitcoin an attractive asset for portfolio diversification.

1. See appendix A for policy target history.
2. See appendix B for composite benchmark index history.

Upon examining the percentage change in Sharpe ratios, a noteworthy observation emerges: the most significant improvement arises when transitioning from no Bitcoin allocation to a 1% allocation. However, as Bitcoin allocation climbs towards 10%, the incremental increase in Sharpe ratio diminishes, suggesting diminishing returns in proportion to the additional risk undertaken.



A pension fund has a priority on generating a stable return stream and limiting downside exposure within its diversified portfolio. Based on the below results we can suggest starting with at least 1% exposure to BTC and increase it towards 3%. This specific allocation has the most benefit per unit of risk while also maintaining a maximum drawdown below the 15% level.



## Conclusion

Incorporating Bitcoin into the asset universe of the ISBI presents a strong opportunity to improve portfolio diversification, hedge against inflation, and capitalize on the long-term growth potential of cryptocurrencies. With careful consideration of returns, risks, and strategic objectives, we advise allocating between 1-3% of the fund's assets to Bitcoin to position ISBI for continued success in achieving its investment goals while prudently managing downside risk.

## References

<https://www.isbinvestment.com/>

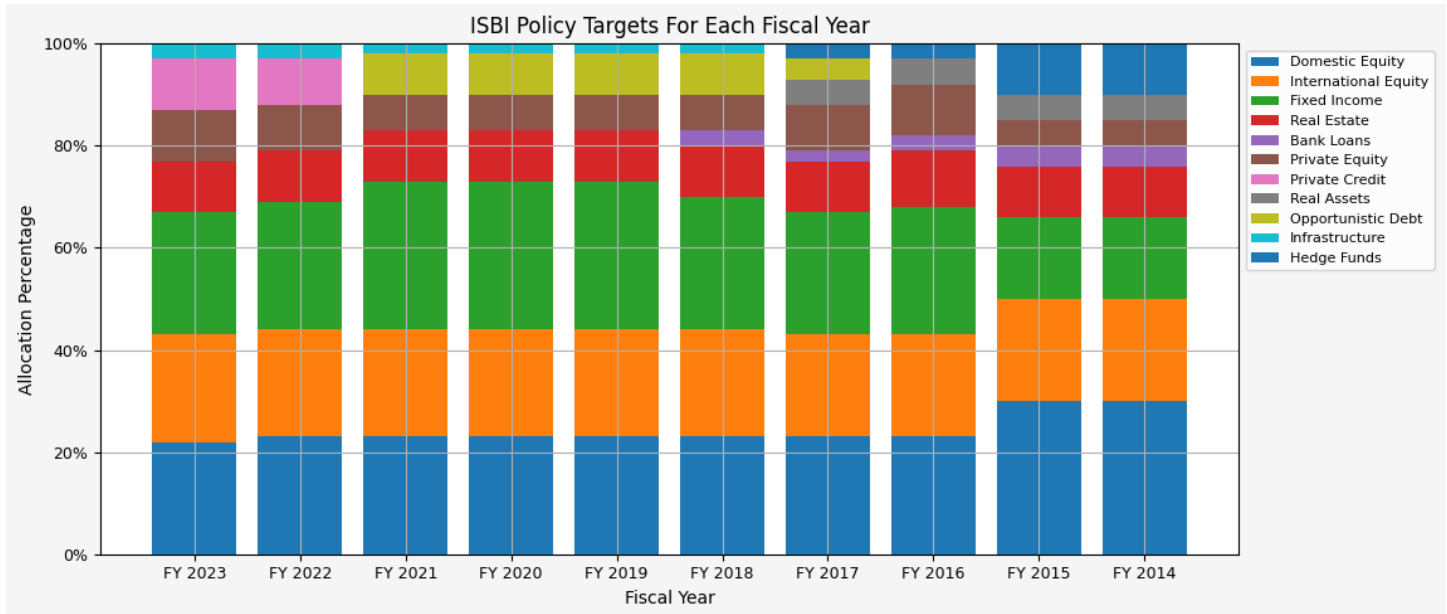
1. See appendix A for policy target history.
2. See appendix B for composite benchmark index history.

## Appendix A: Policy Targets

ISBI sets policy targets annually to guide their investment decisions. As follows are the policy targets broken out by fiscal year. Note that the fiscal year ends at the end of June annually:

Asset Class / Fiscal Year	FY 2023	FY 2022	FY 2021	FY 2020	FY 2019	FY 2018	FY 2017	FY 2016	FY 2015	FY 2014
Domestic Equity	22%	23%	23%	23%	23%	23%	23%	23%	30%	30%
International Equity	21%	21%	21%	21%	21%	21%	20%	20%	20%	20%
Fixed Income	24%	25%	29%	29%	29%	26%	24%	25%	16%	16%
Real Estate	10%	10%	10%	10%	10%	10%	10%	11%	10%	10%
Bank Loans	0%	0%	0%	0%	0%	3%	2%	3%	4%	4%
Private Equity	10%	9%	7%	7%	7%	7%	9%	10%	5%	5%
Private Credit	10%	9%	0%	0%	0%	0%	0%	0%	0%	0%
Real Assets	0%	0%	0%	0%	0%	0%	5%	5%	5%	5%
Opportunistic Debt	0%	0%	8%	8%	8%	8%	4%	0%	0%	0%
Infrastructure	3%	3%	2%	2%	2%	2%	0%	0%	0%	0%
Hedge Funds	0%	0%	0%	0%	0%	0%	3%	3%	10%	10%
Total =	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Overall, the policy targets vary over time, but the allocations to domestic and international equities have remained relatively consistent over the past 10 years.



Source: ISBI

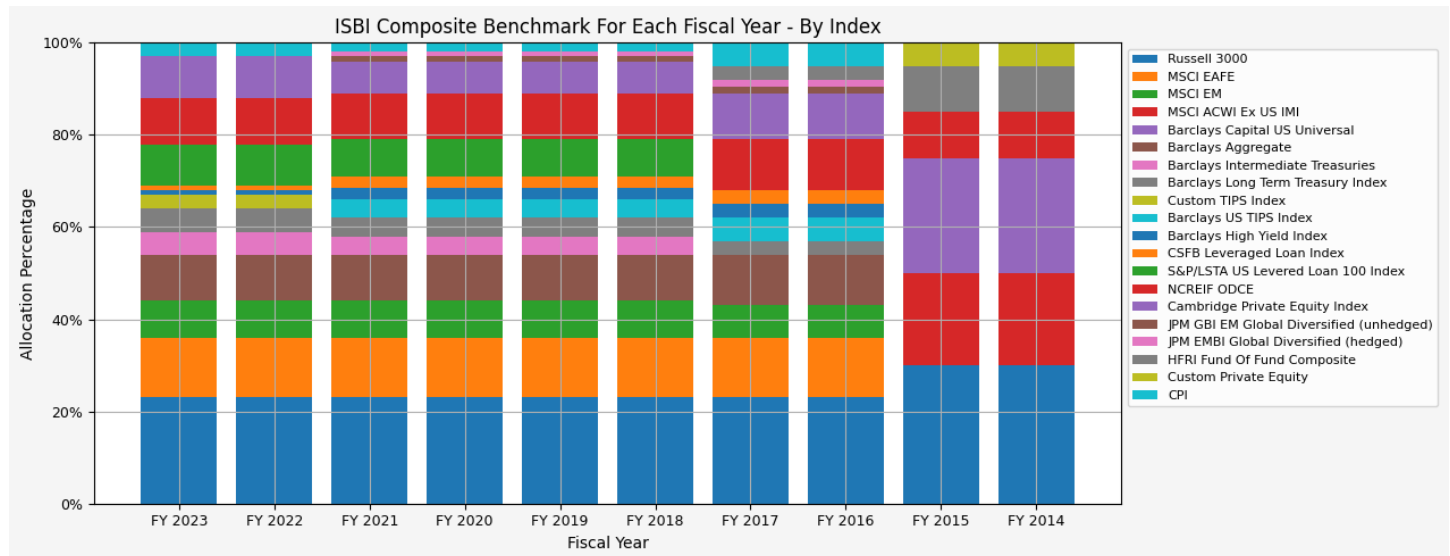
Analysis: REDACTED, Szajkowski, REDACTED

## Appendix B: Composite Benchmark Funds and Asset Classes

As follows is the composite benchmark history, broken out by fiscal year, asset class, and index:

Asset Class	Fund Index	FY 2023	FY 2022	FY 2021	FY 2020	FY 2019	FY 2018	FY 2017	FY 2016	FY 2015	FY 2014
Domestic Equity	Russell 3000	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%	30.0%	30.0%
International Equity	MSCI EAFE	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	13.0%	0.0%	0.0%
International Equity	MSCI EM	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	7.0%	7.0%	0.0%	0.0%
International Equity	MSCI ACWI Ex US IMI	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	20.0%
Fixed Income	Barclays Capital US Universal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	25.0%
Fixed Income	Barclays Aggregate	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	11.0%	11.0%	0.0%	0.0%
Fixed Income	Barclays Intermediate Treasuries	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	0.0%	0.0%	0.0%	0.0%
Fixed Income	Barclays Long Term Treasury Index	5.0%	5.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	0.0%	0.0%
Fixed Income	Custom TIPS Index	3.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fixed Income	Barclays US TIPS Index	0.0%	0.0%	4.0%	4.0%	4.0%	4.0%	5.0%	5.0%	0.0%	0.0%
Fixed Income	Barclays High Yield Index	1.0%	1.0%	2.5%	2.5%	2.5%	2.5%	3.0%	3.0%	0.0%	0.0%
Private Credit	CSFB Leveraged Loan Index	1.0%	1.0%	2.5%	2.5%	2.5%	2.5%	3.0%	3.0%	0.0%	0.0%
Private Credit	S&P/LSTA US Levered Loan 100 Index	9.0%	9.0%	8.0%	8.0%	8.0%	8.0%	0.0%	0.0%	0.0%	0.0%
Real Estate	NCREIF ODCE	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	11.0%	11.0%	10.0%	10.0%
Private Equity	Cambridge Private Equity Index	9.0%	9.0%	7.0%	7.0%	7.0%	7.0%	10.0%	10.0%	0.0%	0.0%
Fixed Income	JPM GBI EM Global Diversified (unhedged)	0.0%	0.0%	1.0%	1.0%	1.0%	1.0%	1.5%	1.5%	0.0%	0.0%
Fixed Income	JPM EMBI Global Diversified (hedged)	0.0%	0.0%	1.0%	1.0%	1.0%	1.0%	1.5%	1.5%	0.0%	0.0%
Hedge Fund	HFRI Fund Of Fund Composite	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%	3.0%	10.0%	10.0%
Private Equity	Custom Private Equity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	5.0%
Other	CPI	3.0%	3.0%	2.0%	2.0%	2.0%	2.0%	5.0%	5.0%	0.0%	0.0%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

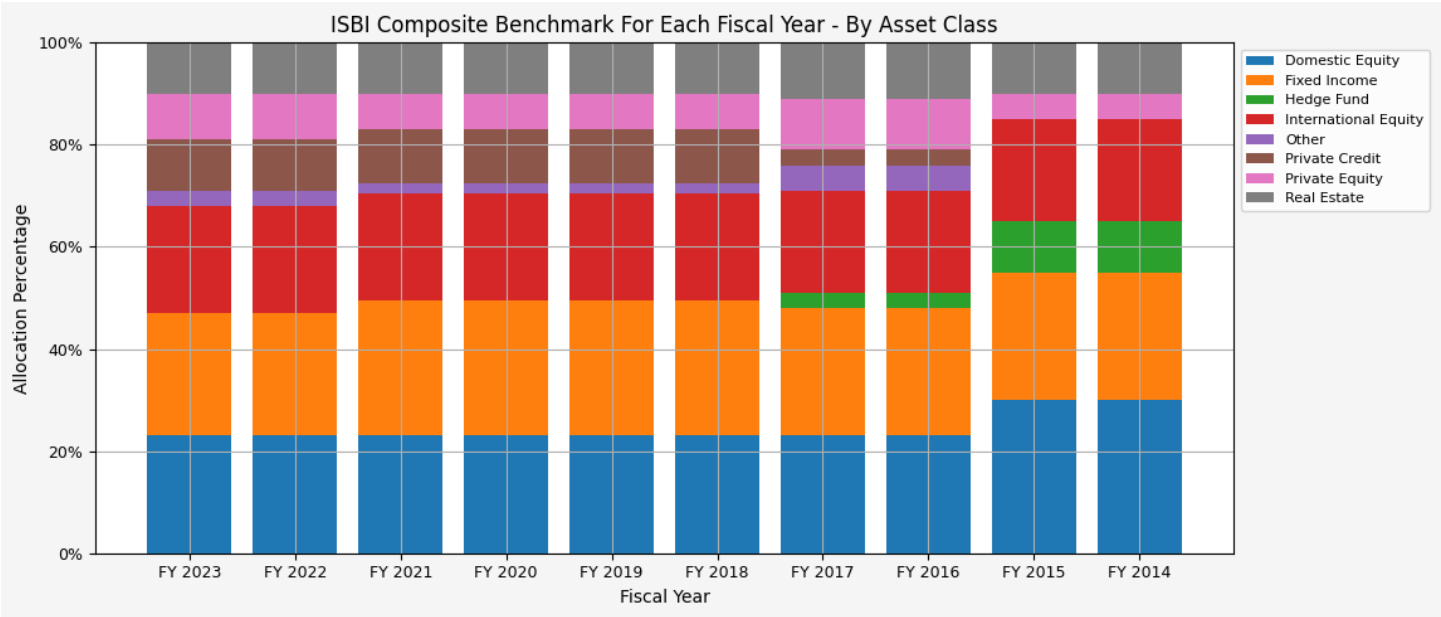
From the plot, we can see that the benchmark indices have changed over the past decade and become much more granular.



Source: ISBI

Analysis: REDACTED, Szajkowski, REDACTED

Appendix C: Composite Benchmark By Asset Class



Source: ISBI  
Analysis: REDACTED, Szajkowski, REDACTED

## Appendix D: Composite Benchmark Funds, Asset Classes, and Proxy Funds

As follows is the comparison between the composite benchmark funds and the proxy funds:

Asset Class	Fund Index	Proxy Index
Domestic Equity	Russell 3000	iShares Russell 3000 ETF (IWV)
International Equity	MSCI EAFE	iShares MSCI EAFE ETF (EFA)
International Equity	MSCI EM	iShares MSCI Emerging Markets ETF (EEM)
International Equity	MSCI ACWI Ex US IMI	iShares MSCI ACWI ex U.S. ETF (ACWX)
Fixed Income	Barclays Capital US Universal	US Aggregate Bond (AGG)
Fixed Income	Barclays Aggregate	US Aggregate Bond (AGG)
Fixed Income	Barclays Intermediate Treasuries	SPDR Series Trust - SPDR Portfolio Intermediate Term Treasury ETF (SPTI)
Fixed Income	Barclays Long Term Treasury Index	Vanguard Long-Term Treasury ETF (VGLT)
Fixed Income	Custom TIPS Index	iShares TIPS Bond ETF (TIP)
Fixed Income	Barclays US TIPS Index	iShares TIPS Bond ETF (TIP)
Fixed Income	Barclays High Yield Index	Bloomberg US Corp HY TR Index (LF98TRUU)
Private Credit	CSFB Leveraged Loan Index	Morningstar LSTA US Leveraged Loan 100 Index (SPBDLLB)
Private Credit	S&P/LSTA US Levered Loan 100 Index	Morningstar LSTA US Leveraged Loan 100 Index (SPBDLLB)
Real Estate	NCREIF ODCE	NCREIF Fund Index Open End Diversified Core (NPPI0DIV)
Private Equity	Cambridge Private Equity Index	LPX Listed Private Equity Index TR (LPX50TR)
Fixed Income	JPM GBI EM Global Diversified (unhedged)	iShares J.P. Morgan USD Emerging Markets Bond ETF (EMB)
Fixed Income	JPM EMBI Global Diversified (hedged)	iShares J.P. Morgan USD Emerging Markets Bond ETF (EMB)
Hedge Fund	HFRI Fund Of Fund Composite	ProShares Hedge Replication ETF (HDG)
Private Equity	Custom Private Equity	Invesco Global Listed Private Equity ETF (PSP)
Other	CPI	CPI

Exchange traded funds (ETFs) were selected for proxy funds when available, due to their high liquidity and data accuracy.

Source: ISBI, Bloomberg, Nasdaq Data Link  
 Analysis: REDACTED, Szajkowski, REDACTED

## Appendix E: Fund Returns

The fund releases the returns as part of the annual report. Here is the comparison for the most recent period, FY 2023 ending 6/30/2023:

											(Annualized)		
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	3 Yrs.	5 Yrs.	10 Yrs.
<b>Total Fund</b>	%	%	%	%	%	%	%	%	%	%	%	%	%
Composite Benchmark**	6.2	(6.3)	25.8	4.6	7.1	7.6	12.3	(0.8)	4.7	17.9	7.8	7.0	7.6
Consumer Price Index	6.3	(5.9)	21.9	4.9	7.0	7.4	12.0	0.7	4.0	16.3	6.9	6.2	7.0
	3.0	9.1	5.4	0.7	1.6	2.9	1.6	1.0	0.1	2.1	5.8	3.9	2.7
<b>Domestic Equities</b>													
Russell 3000 Index	17.7	(14.9)	43.4	6.4	10.3	14.3	18.7	(1.7)	6.4	24.1	12.8	11.0	11.4
	19.0	(13.9)	44.2	6.5	9.0	14.8	18.5	2.1	7.3	25.2	13.9	11.4	12.3
<b>International Equities</b>													
MSCI-ACWI ex US Index	11.9	(18.5)	39.2	(2.9)	1.2	7.6	22.1	(7.1)	(1.0)	23.8	8.3	4.5	6.3
	12.5	(19.9)	37.2	(4.7)	0.3	7.7	20.5	(9.2)	(4.6)	22.8	7.3	3.4	4.9
<b>Fixed Income</b>													
BBG US Universal	0.5	(6.9)	5.0	7.8	7.5	0.9	0.9	1.6	(1.4)	6.5	(0.6)	2.6	2.1
	0.0	(10.9)	1.1	7.9	8.1	(0.3)	0.9	5.8	1.6	5.2	(3.4)	1.0	1.8
<b>Real Estate</b>													
Real Estate CB	(6.0)	26.3	13.7	2.3	5.4	7.3	7.1	12.0	16.3	14.5	10.5	7.8	9.3
	(9.7)	27.3	1.5	3.9	6.6	7.1	6.9	10.8	13.4	11.7	5.3	5.2	7.6
<b>Infrastructure</b>													
Infrastructure CB	9.7	12.7	11.6	8.0	13.6	13.3	13.5	13.9	7.5	19.1	11.3	11.1	12.3
	6.6	12.9	9.1	4.2	5.2	6.5	0.9	5.8	1.6	5.2	9.5	7.5	5.7
<b>Private Equity</b>													
Private Equity CB	2.4	21.7	54.9	7.9	19.8	20.6	17.9	7.9	21.5	24.7	24.5	20.0	18.8
	(1.8)	26.7	53.2	3.3	13.5	16.1	17.3	—	—	—	24.0	17.4	15.3

Source: ISBI



## Appendix F: Fund Returns, Composite Benchmark Returns, and Composite Benchmark Proxy Returns

The following is the comparison between the fund returns, the composite benchmark returns, and the composite benchmark proxy returns that was developed for purposes of analysis:

	ISBI Fund Returns	ISBI CB Returns	ISBI CB Proxy Returns	ISBI CB Proxy Volatility	ISBI CB Proxy Drawdown
<b>FY 2016</b>	-0.008	0.007	0.008	0.104	-0.063
<b>FY 2017</b>	0.123	0.120	0.127	0.055	-0.026
<b>FY 2018</b>	0.076	0.074	0.055	0.059	-0.044
<b>FY 2019</b>	0.071	0.070	0.061	0.115	-0.073
<b>FY 2020</b>	0.046	0.049	0.001	0.174	-0.140
<b>FY 2021</b>	0.258	0.219	0.235	0.096	-0.037
<b>FY 2022</b>	-0.063	-0.059	-0.072	0.108	-0.130
<b>FY 2023</b>	0.062	0.063	0.050	0.164	-0.088
<b>CAGR</b>	0.067	0.065	0.055		

Here we can see that the composite benchmark proxy is able to reproduce the returns within 1% of the composite benchmark returns.

## Appendix G: Modified Composite Benchmark Returns

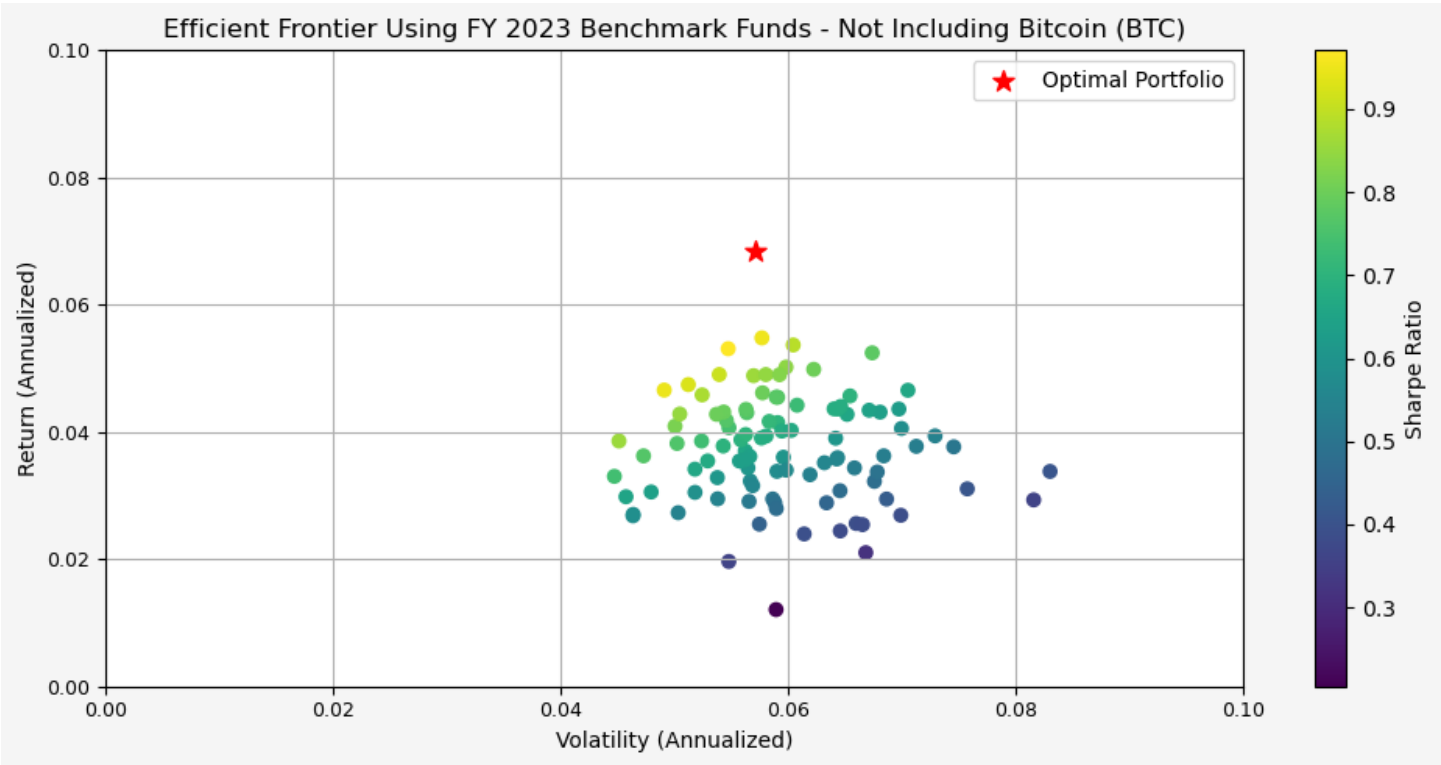
The following is the comparison between the composite benchmark proxy returns and the modified composite benchmark proxy returns with varying weights of Bitcoin:

	CAGR	Mean Annual Volatility	Sharpe Ratio	Max Drawdown	CAGR Percent Change	Volatility Percent Change	Sharpe Percent Change
ISBI CB Proxy	0.055	0.110	0.499	-0.140	NaN	NaN	NaN
ISBI CB + 1% BTC	0.065	0.116	0.559	-0.142	0.187	0.060	0.120
ISBI CB + 2% BTC	0.075	0.122	0.611	-0.144	0.153	0.055	0.093
ISBI CB + 3% BTC	0.085	0.129	0.661	-0.146	0.142	0.056	0.081
ISBI CB + 4% BTC	0.096	0.136	0.704	-0.152	0.121	0.052	0.065
ISBI CB + 5% BTC	0.106	0.143	0.742	-0.158	0.104	0.049	0.053
ISBI CB + 6% BTC	0.116	0.149	0.775	-0.163	0.092	0.045	0.045
ISBI CB + 7% BTC	0.125	0.155	0.804	-0.168	0.082	0.042	0.038
ISBI CB + 8% BTC	0.135	0.162	0.832	-0.174	0.080	0.044	0.035
ISBI CB + 9% BTC	0.145	0.169	0.857	-0.179	0.072	0.041	0.030
ISBI CB + 10% BTC	0.154	0.175	0.879	-0.185	0.065	0.038	0.026

Source: ISBI, Bloomberg, Nasdaq Data Link  
 Analysis: REDACTED, Szajkowski, REDACTED

## Appendix H: Mean Variance Optimization Without Bitcoin

The following is the Mean Variance Optimization (MVO) analysis for the FY 2023 benchmark funds. This MVO allows for allocations between 1% and 20% for each of the funds:



These are the weights for each of the funds, along with the returns:

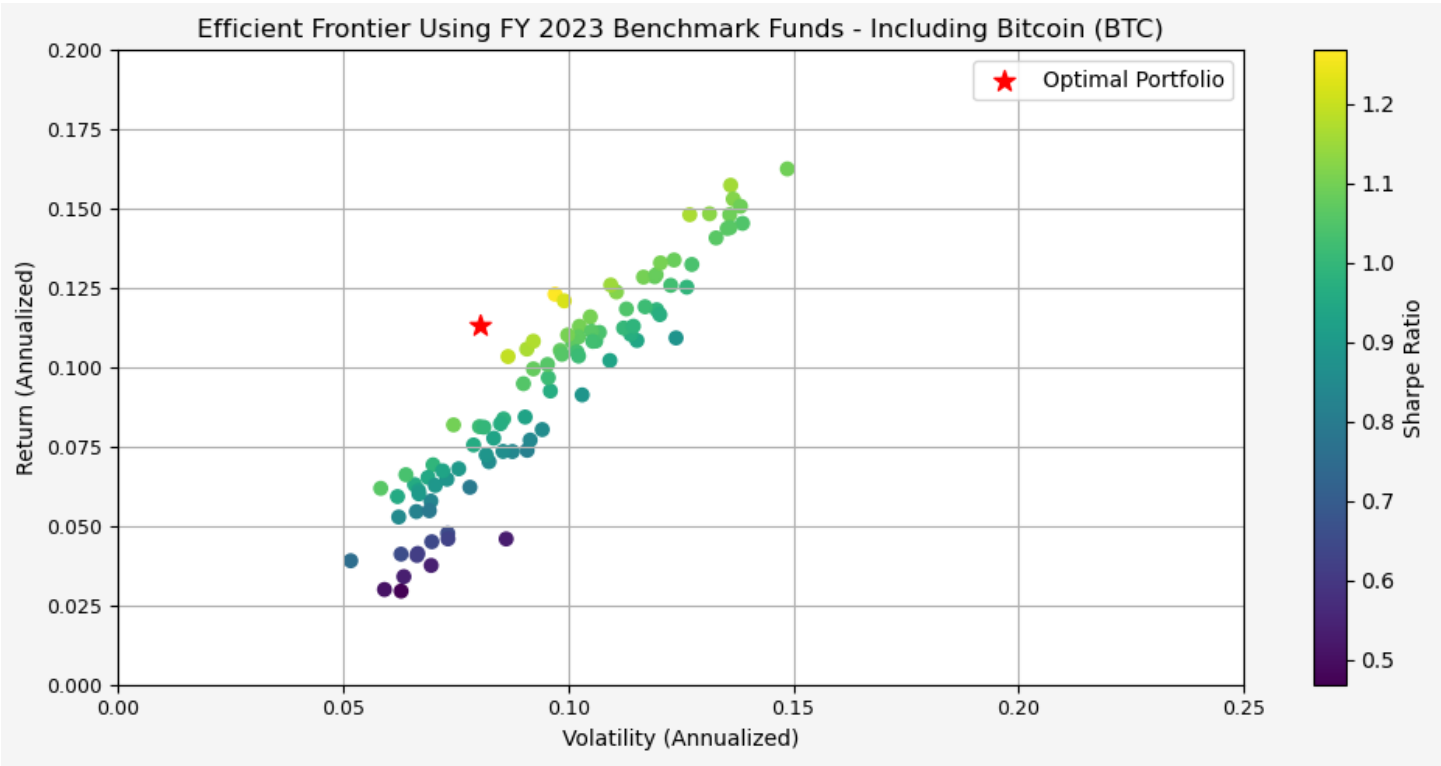
MVO Weights	
IWV	0.200
EFA	0.010
EEM	0.010
AGG	0.200
SPTI	0.010
VGLT	0.010
TIP	0.108
LF98TRUU	0.065
SPBDLLB	0.010
NPPIODIV	0.200
LPX50TR	0.177
CPI	0.000

Expected Annual Return: 6.8%  
Expected Annual Volatility: 5.7%

Source: ISBI, Bloomberg, Nasdaq Data Link  
Analysis: REDACTED, Szajkowski, REDACTED

## Appendix I: Mean Variance Optimization With Bitcoin

The following is the Mean Variance Optimization (MVO) analysis for the FY 2023 benchmark funds. This MVO allows for allocations between 1% and 20% for each of the funds, and includes an allocation to Bitcoin:



These are the weights for each of the funds, along with the returns:

MVO Weights	
IWV	0.193
EFA	0.010
EEM	0.010
AGG	0.200
SPTI	0.010
VGLT	0.010
TIP	0.089
LF98TRUU	0.010
SPBDLLB	0.010
NPPIODIV	0.200
LPX50TR	0.200
CPI	0.000
BTC	0.058

Expected Annual Return: 11.3%  
Expected Annual Volatility: 8.0%

Source: ISBI, Bloomberg, Nasdaq Data Link  
Analysis: REDACTED, Szajkowski, REDACTED