Aktywa zabezpieczające i bezpieczne przystanie dla inwestycji na rynkach akcji – zastosowanie teorii perspektywy

Hedge and safe-haven assets for stock markets revisited: Evidence from the prospect theory

V Kongres Statystyki Polskiej
1-3 lipca 2025 roku, Warszawa

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Content

- Motivation and aim
- Methods
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Motivation

- **Safe-haven and hedging instruments definitions** (Baur and Lucey, 2010, 2994 citations)

Hedging instruments are market assets that allow investors to protect their portfolios, safe-haven assets during periods of financial market turbulence, and hedging instruments in terms of average.

Hedge assets are defined as the instruments that are uncorrelated or negatively correlated with the reference asset on average.

Safe-haven instruments are defined as the instruments that are uncorrelated or negatively correlated with the reference asset in times of a market crash.

Motivation

- **Gold as a hedge or safe haven:**

Gold has traditionally been perceived as a shelter during times of increased price volatility (Baur and Lucey, 2010; Baur and McDermott, 2010; Beckmann et al., 2015; Boubaker et al., 2020).

Its negative correlation with financial markets suggests that adding gold to a portfolio can offer diversification advantages (Lucey et al., 2019).

- **Gold weakens to act as a hedge or safe haven:**

The increasing financialization of commodity markets makes investors perceive commodities increasingly for investment purposes (Natoli, 2021), which results in strengthening the interdependence between financial and commodity markets (Cai et al., 2001).

Gold, which was considered a traditional safe haven during the Global Financial Crisis, has weakened its protective property in the face of the COVID-19 crash (Akhtaruzzaman et al., 2021; Cheema et al.,2022; Echaust and Just, 2022).

Motivation

- **Cryptocurrency as a hedge or safe haven:**

Among assets, cryptocurrencies, especially Bitcoin, Ether, and Tether (USDT) have been studied the most intensively. Unlike gold and other instruments, Bitcoin and Ether do not exhibit significant dependence on trends in financial and commodity markets. Moreover, they do not have common fundamental factors that would force joint reactions to economic and geopolitical events.

Many empirical studies report the usefulness of Bitcoin and Ether in a safe-haven or hedging role (Shahzad et al., 2019; Wang et al., 2019; Bouri et al., 2020; Diniz-Maganini et al., 2021).

- **Cryptocurrency fails to act as a hedge or safe haven:**

There are also several studies that critically assess their protective ability (Conlon and McGee, 2020; Ji et al., 2020; Corbet et al., 2020; Goodell and Goutte, 2021; Baur et al., 2022).

Motivation

- **Tether as a hedge or safe haven:**

In contrast to cryptocurrencies, Tether is characterized by exceptionally low volatility being a desirable feature of hedge and safe-haven assets. Echaust and Just (2023) show that stock portfolios with Tether demonstrate the lowest Sharpe ratio among all pair-wise portfolios consisting of stock index and safe-haven candidate, including gold.

Motivation

- **A key limitation of most existing research in this topic is the assumption that risk minimization should be the sole criterion in the evaluation of decisions relative to the safe-haven and hedging allocation**. It means that decision-makers show infinite risk aversion.

- This perspective fails to capture the real motivations of investors who perceive investments as a trade-off between risk and profit.

- **Our study focuses on behavioral aspects of investor decision-making and examines whether candidates for safe-haven or hedge assets offer investors a higher utility of a portfolio in terms of the cumulative prospect theory** (CPT) of Tversky and Kahneman (1992).

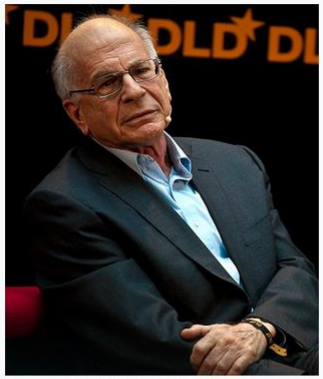
- This approach provides a fresh perspective on this important research problem by incorporating behavioral finance theory.

Prospect Theory (CPT)

Prospect theory (PT), developed by Kahneman and Tversky (1979, 1979 citations), is a concept in behavioral decision-making. The theoretical problems have later been improved in an updated version of PT, known as the cumulative prospect theory (CPT), introduced in (Tversky and Kahneman,1992, 22795 citations).

Daniel Kahneman

דניאל כהנמן



Kahneman in 2009

Born	March 5, 1934 Tel Aviv, Mandatory Palestine
Died	March 27, 2024 (aged 90) Nunningen, Switzerland
Nationality	American, Israeli
Education	Hebrew University (BA) University of California, Berkeley (MA, PhD)
Known for	Cognitive biases Behavioral economics

Nobel prize in 2002

Amos Tversky

עמוס טברסקי

Born	Amos Nathan Tversky March 16, 1937 Haifa, British Mandate of Palestine
Died	June 2, 1996 (aged 59) Stanford, California, U.S.
Nationality	Israeli

https://simple.wikipedia.org/wiki/Daniel_Kahneman
https://en-m-wikipedia-org.translate.goog/wiki/Amos_Tversky?_x_tr_sl=en&_x_tr_tl=pl&_x_tr_hl=pl&_x_tr_pto=sge#:~:text=Amos Nathan Tversky (Hebrew: עמוס,bias and handling of risk.

Cumulative Prospect Theory (CPT)

Portfolio optimization problem in CPT:

$$\max \text{CPT utility} = \max \sum_{i=-m}^{n} \pi_i \, v(z_i) \tag{1}$$

where $v(.)$ is a value function, π_i are weighted probabilities, z_i are losses, for $-m \leq i < -1$ and profits, for $1 \leq i \leq n$, m denotes the number of losses, and n the number of profits, $m+n=N$.

Value function proposed by Tversky and Kahneman (1992):

$$v(z) = \begin{cases} z^a & \text{for} \quad z \geq 0 \\ -\lambda(-z)^b & \text{for} \quad z < 0 \end{cases} \tag{2}$$

where $0 < a \leq b \leq 1$ are related to the curvature of the value function on the positive and negative domains, respectively, and $\lambda \geq 1$ is a loss aversion. The parameters estimated by the authors are $\lambda = 2.25$ and $a = b = 0.88$.

Weighting function proposed by Tversky and Kahneman (1992):

$$w(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{1/\gamma}} \tag{3}$$

where $\gamma > 0$. The authors estimated two gammas, $\gamma+ = 0.61$ and $\gamma- = 0.69$, receiving two specifications of weights $w+$ for gains and $w-$ for losses.

Cumulative Prospect Theory (CPT)

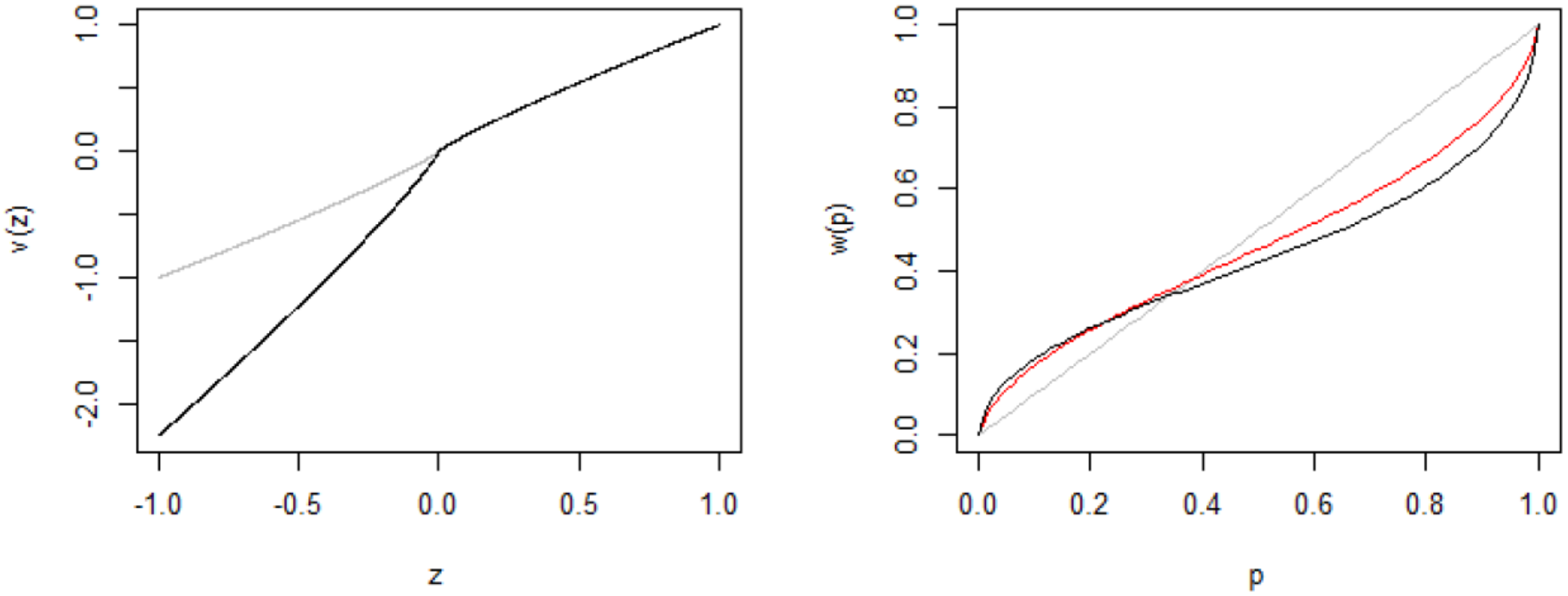


Figure1: Value function (left panel) and weighting function (right panel).

Note: Left panel: value function for λ=2.25 in black and λ=1 in grey; Right panel: weighting function for gains in black, γ+=0.61 and for losses in red, γ−=0.69.

Contribution

- **Safe-haven and hedging instruments definitions proposed**

A hedge is defined as an asset that increases the CPT utility of Tversky and Kahneman (1992) when added to another asset or portfolio on average.

A safe haven is defined as an asset that increases the CPT utility of Tversky and Kahneman (1992) when added to another asset or portfolio in times of market stress or turmoil.

Aim

- **The primary research objective is to assess the ability of cryptocurrencies and gold as hedging or safe-haven assets for stock market investments.**

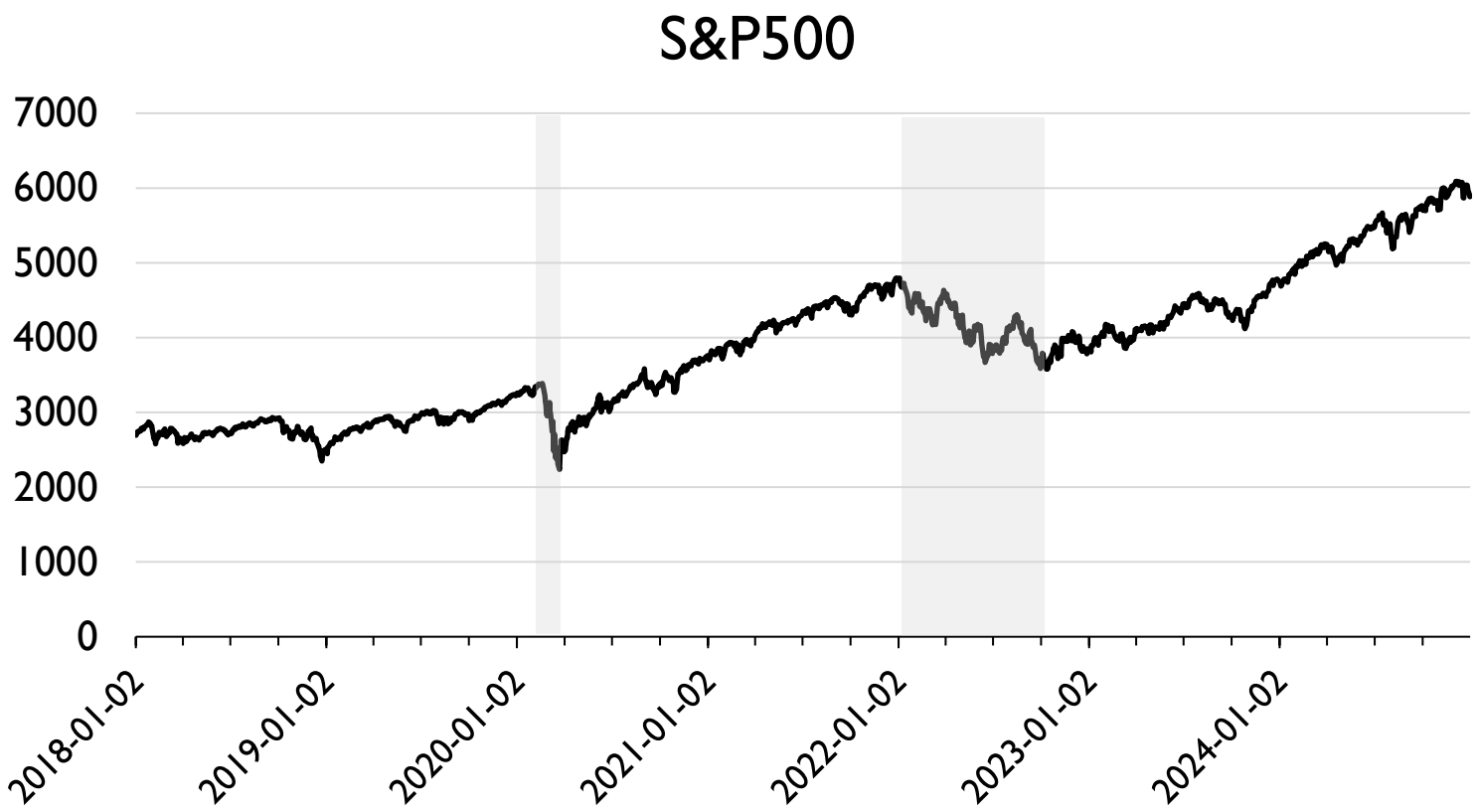
We test gold and three of the biggest in capitalization cryptocurrencies, i.e., Bitcoin, Ether, and Tether, which are the most intensively explored in the literature.

- **The second objective is to compare the standard risk minimization approach with the behavioral finance perspective.**

Data

- The price indices of cryptocurrencies with the highest market capitalization (**Bitcoin**, BTC-USD, **Ether,** ETH-USD, and **Tether,** USDT-USD) and **gold.**
- **Stock markets** from both **developed (G7)** and **emerging (BRICS) economies**:
  - The G7 group includes the United States (S&P500 Index), Canada (S&P/TSX Composite Index), the United Kingdom (FTSE 100 Index), Germany (DAX Index), France (CAC 40 Index), Italy (FTSE MIB Index, MIB), and Japan (NIKKEI 225 Index).
  - From the BRICS group, we selected countries that were members throughout the period under consideration, excluding Russia: Brazil (Bovespa Index, BVSP), India (BSE Sensex Index, BSESN), China (Shanghai SE Composite Index, SSEC), and South Africa (FTSE/JSE SA Top 40 Companies Index, JSE).
- The analysis is based on daily returns of assets **from January 2, 2018, to December 31, 2024**.
- The stock market indices, gold, and cryptocurrency prices were sourced from the Refinitiv Eikon database and investing.com, respectively.

Data



Note: The grey shaded areas indicate the periods of index price declines during the COVID-19 pandemic (February–March 2020) and the war in Ukraine (Q1–Q3 2022).

Results

Table 1: Optimal weights of cryptocurrencies (gold) in CPT portfolios (x)—entire period.

	BTC	ETH	USDT	Gold	BTC	ETH	USDT	Gold
Asset	x	x	x	x	x	x	x	x
	Reference point equal to zero				Reference point equal to mean return			
S&P500	0.0125	0.0000	0.9961	0.6669	0.0131	0.0000	0.9701	0.6628
TSX	0.0014	0.0000	1.0000	0.7857	0.0016	0.0000	0.9908	0.7877
MIB	0.0517	0.0118	0.9964	0.7943	0.0549	0.0125	0.9870	0.7951
DAX	0.0265	0.0000	1.0000	0.7358	0.0255	0.0016	0.9876	0.7387
CAC40	0.0208	0.0000	1.0000	0.7485	0.0226	0.0000	0.9921	0.7499
FTSE100	0.0188	0.0000	1.0000	0.7224	0.0193	0.0000	1.0000	0.7199
NIKKEI	0.0747	0.0451	1.0000	0.7306	0.0747	0.0450	0.9955	0.7307
BVSP	0.1538	0.0763	1.0000	0.9017	0.1529	0.0759	0.9977	0.9017
BSESN	0.0732	0.0325	0.9918	0.6527	0.0742	0.0334	0.9760	0.6550
SSEC	0.0956	0.0575	1.0000	0.6768	0.0956	0.0575	1.0000	0.6768
JSE	0.0725	0.0207	1.0000	0.8906	0.0744	0.0212	1.0000	0.8906

Results

Table 2: Optimal weights of cryptocurrencies (gold) in CPT portfolios (*x*) and hedging effectiveness (*HE*)—entire period.

Asset	BTC	ETH	USDT	Gold	BTC	ETH	USDT	Gold
	x	*x*	*x*	*x*	*HE*	*HE*	*HE*	*HE*
	Reference point equal to zero							
S&P500	0.0125	0.0000	0.9961	0.6669	0.0008	0.0000	0.8233	0.3829
TSX	0.0014	0.0000	1.0000	0.7857	0.0000	0.0000	0.8377	0.3605
MIB	0.0517	0.0118	0.9964	0.7943	0.0090	0.0007	0.8699	0.4750
DAX	0.0265	0.0000	1.0000	0.7358	0.0027	0.0000	0.8443	0.3878
CAC40	0.0208	0.0000	1.0000	0.7485	0.0026	0.0000	0.8466	0.4001
FTSE100	0.0188	0.0000	1.0000	0.7224	0.0028	0.0000	0.8367	0.3726
NIKKEI	0.0747	0.0451	1.0000	0.7306	0.0369	0.0171	0.8538	0.3800
BVSP	0.1538	0.0763	1.0000	0.9017	0.0456	0.0234	0.9093	0.6080
BSESN	0.0732	0.0325	0.9918	0.6527	0.0343	0.0118	0.8387	0.3894
SSEC	0.0956	0.0575	1.0000	0.6768	0.0571	0.0296	0.8370	0.3527
JSE	0.0725	0.0207	1.0000	0.8906	0.0167	0.0024	0.8810	0.5088

Note: Positive hedging effectiveness (*HE*) means an increase in portfolio CPT utility, compared with no hedging.

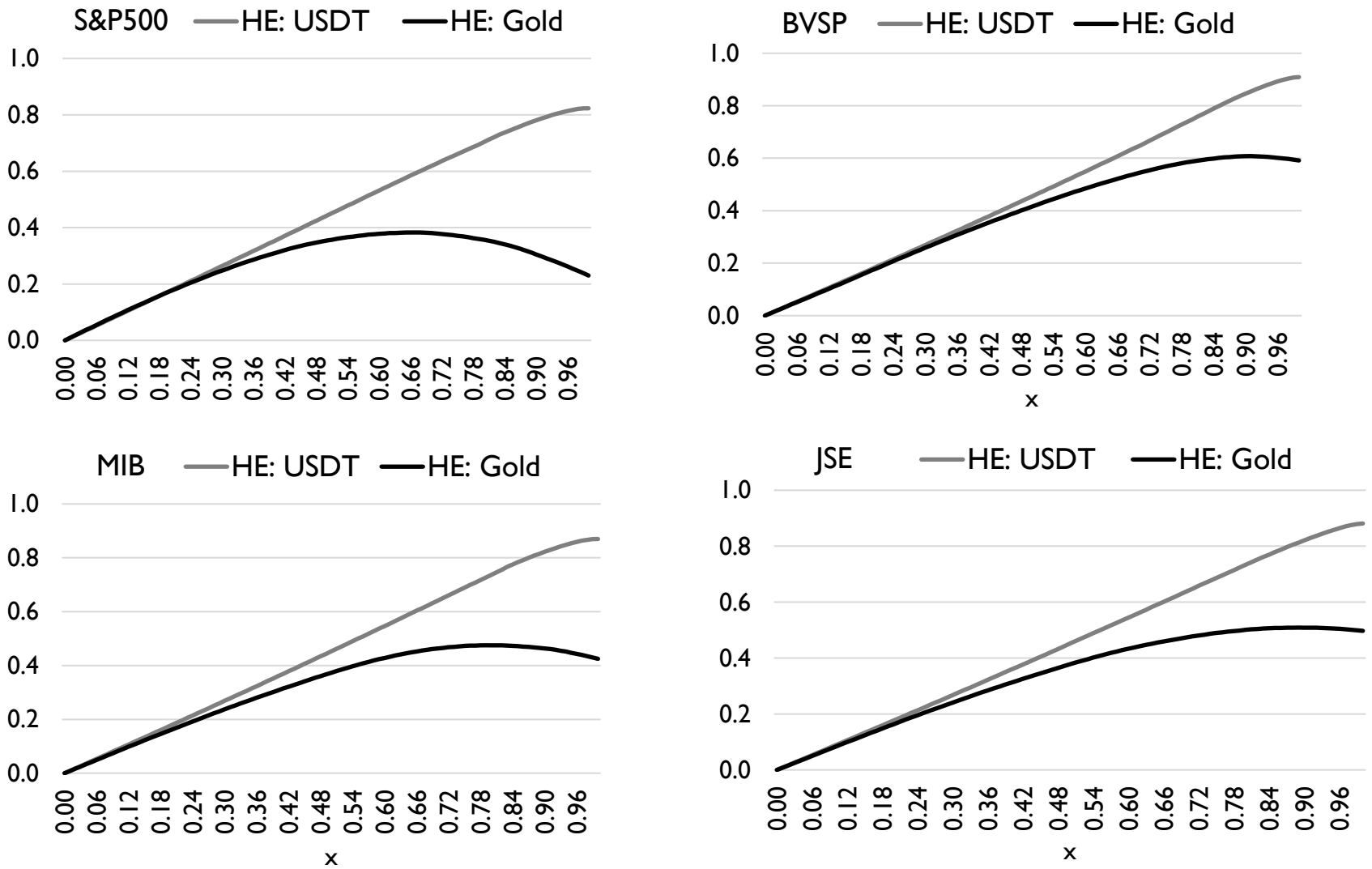
Results

Table 3: Optimal weights of cryptocurrencies (gold) in CPT portfolios (x) vs. optimal weights of cryptocurrencies (gold) in MV portfolios (x)—entire period.

	BTC	ETH	USDT	Gold	BTC	ETH	USDT	Gold
Asset	x	x	x	x	x	x	x	x
	CPT				MV			
S&P500	0.0125	0.0000	0.9961	0.6669	0.0037	0.0000	0.9660	0.6474
TSX	0.0014	0.0000	1.0000	0.7857	0.0007	0.0000	0.9651	0.6915
MIB	0.0517	0.0118	0.9964	0.7943	0.0359	0.0041	0.9713	0.7368
DAX	0.0265	0.0000	1.0000	0.7358	0.0316	0.0013	0.9684	0.7065
CAC40	0.0208	0.0000	1.0000	0.7485	0.0292	0.0012	0.9661	0.6916
FTSE100	0.0188	0.0000	1.0000	0.7224	0.0182	0.0000	0.9578	0.6467
NIKKEI	0.0747	0.0451	1.0000	0.7306	0.0733	0.0369	0.9687	0.6931
BVSP	0.1538	0.0763	1.0000	0.9017	0.1466	0.0730	0.9862	0.8740
BSESN	0.0732	0.0325	0.9918	0.6527	0.0515	0.0157	0.9566	0.6414
SSEC	0.0956	0.0575	1.0000	0.6768	0.0618	0.0251	0.9683	0.6439
JSE	0.0725	0.0207	1.0000	0.8906	0.0832	0.0284	0.9844	0.8608

Results

Figure 2: Hedging effectiveness (HE) for CPT stock portfolios for different weights of Tether and gold (x).



Note: Positive hedging effectiveness (HE) means an increase in portfolio CPT utility, compared with no hedging.

Results

Table 4: Optimal weights of cryptocurrencies (gold) in CPT portfolios (x) and hedging effectiveness (HE)—period of price declines during the COVID-19 pandemic.

Asset	Date	BTC	ETH	USDT	Gold	BTC	ETH	USDT	Gold
		x	*x*	*x*	*x*	*HE*	*HE*	*HE*	*HE*
S&P500	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9744	0.7071
TSX	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9784	0.7523
MIB	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9781	0.7489
DAX	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9750	0.7140
CAC40	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9749	0.7127
FTSE	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9769	0.7359
NIKKEI	20.02–23.03.2020	0.0747	0.0606	1.0000	1.0000	0.0394	0.0240	0.9690	0.6364
BVSP	20.02–13.05.2020	0.6851	0.0883	1.0000	0.9998	0.1304	0.0206	0.9799	0.8099
BSESN	20.02–23.03.2020	0.1020	0.0957	1.0000	1.0000	0.0530	0.0318	0.9784	0.7487
SSEC	20.01–23.03.2020	0.1072	0.0942	1.0000	1.0000	0.0300	0.0344	0.9482	0.5424
JSE	20.02–23.03.2020	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9787	0.7563

Note: Positive hedging effectiveness (*HE*) means an increase in portfolio CPT utility, compared with no hedging.

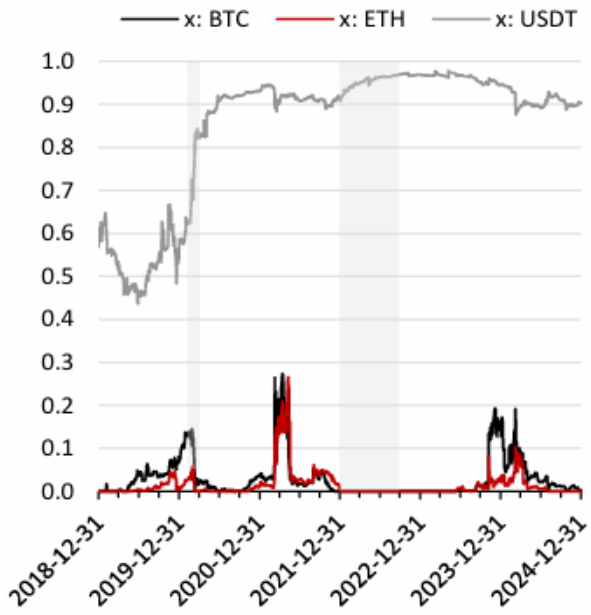
Results

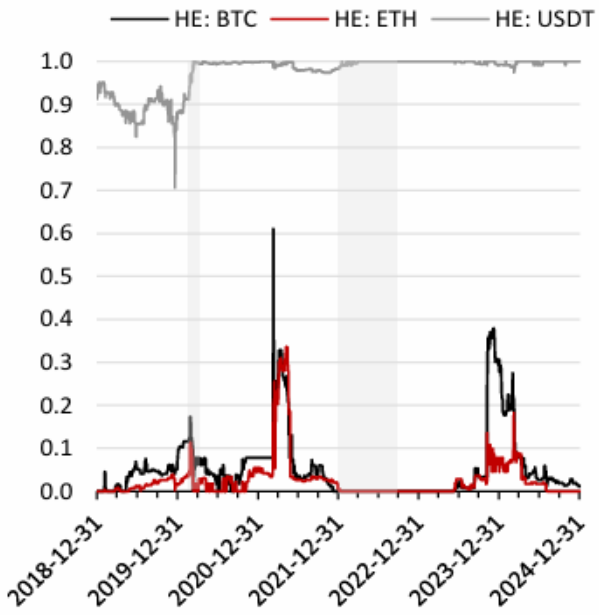
Table 5: Optimal weights of cryptocurrencies (gold) in CPT portfolios (x) and hedging effectiveness (HE)—period of price declines during the war in Ukraine.

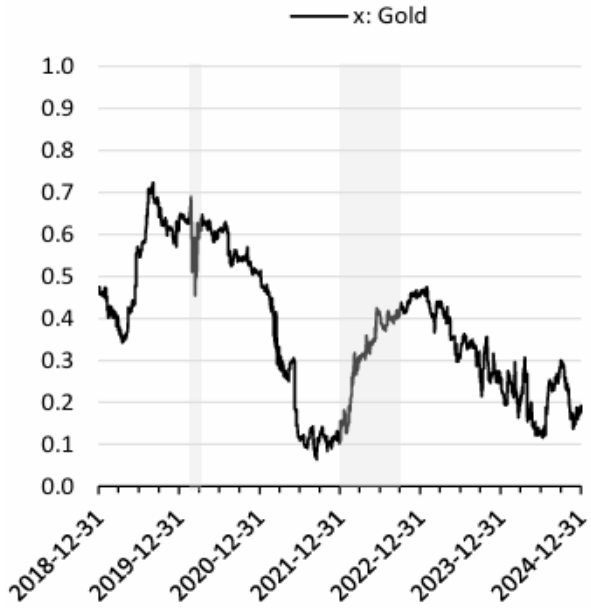
Asset	Date	BTC	ETH	USDT	Gold	BTC	ETH	USDT	Gold
		x	*x*	*x*	*x*	*HE*	*HE*	*HE*	*HE*
S&P500	Q1–Q3 2022	0.0000	0.0000	1.0000	0.8095	0.0000	0.0000	0.9745	0.4425
TSX	Q1–Q3 2022	0.0000	0.0000	1.0000	0.8522	0.0000	0.0000	0.9714	0.3560
MIB	Q1–Q3 2022	0.0000	0.0000	1.0000	0.9400	0.0000	0.0000	0.9789	0.5331
DAX	Q1–Q3 2022	0.0000	0.0000	1.0000	0.9227	0.0000	0.0000	0.9757	0.4677
CAC40	Q1–Q3 2022	0.0000	0.0000	1.0000	0.9193	0.0000	0.0000	0.9753	0.4476
FTSE	Q1–Q3 2022	0.0000	0.0000	1.0000	0.8955	0.0000	0.0000	0.9736	0.4240
NIKKEI	Q1–Q3 2022	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.9729	0.3899
BVSP	Q1–Q3 2022	0.0000	0.0000	1.0000	0.9146	0.0000	0.0000	0.9760	0.4769
BSESN	Q1–Q3 2022	0.0000	0.0000	1.0000	0.6128	0.0000	0.0000	0.9676	0.3560
SSEC	Q1–Q3 2022	0.0521	0.0091	1.0000	0.8738	0.0035	0.0007	0.9719	0.3907
JSE	Q1–Q3 2022	0.0000	0.0000	1.0000	0.9528	0.0000	0.0000	0.9764	0.4752

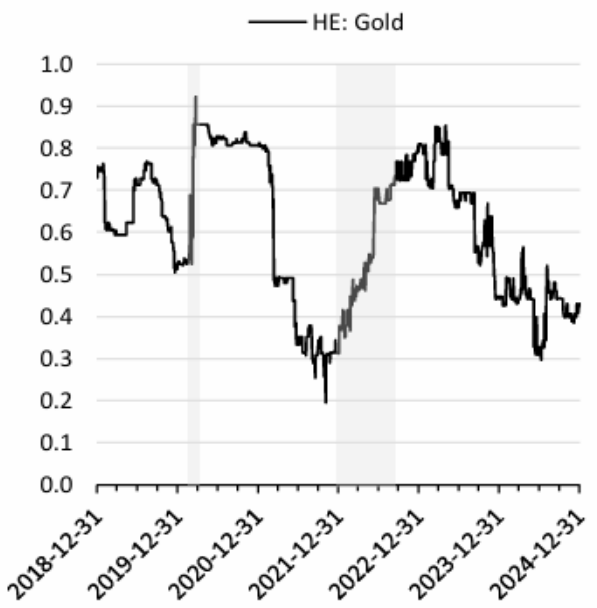
Note: Positive hedging effectiveness (HE) means an increase in portfolio CPT utility, compared with no hedging.

Figure 3: Optimal weights (x) for cryptocurrencies (upper panel) and gold (lower panel) in CPT portfolio with S&P500 and hedging effectiveness (HE).









Note: The grey shaded areas indicate the periods of index price declines during the COVID-19 pandemic and the war in Ukraine.

Conclusions

- Tether and gold can be useful assets in the hedging or safe-haven roles in stock markets.
- Bitcoin and Ether cannot increase CPT utility when included in a stock market portfolio. Moreover, they increase the overall volatility of a portfolio; therefore, they fail to serve in these roles even in the classic definition of hedge and safe haven.
- Tether is the most effective hedge and safe haven compared to the analyzed assets.

Echaust, K., Just, M., Musti, S.: *Hedge and safe-haven assets for stock markets revisited: Evidence from the prospect theory*

Conclusions

- Although traditional risk-based approaches might not fully capture the complexity of investor choices, our findings reveal that the choices based on **prospect theory and variance minimization do not differ significantly**. The optimal portfolio weights are similar in all considered cases. **In volatile times, the differences in the composition of portfolios for both approaches are greater.**

- Finally, our study proves that both assets, **gold and Tether, indicate strong hedge and safe-haven properties for all financial markets from the G7 and BRICS countries.**

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