

	BTC	ETH	ADA	LTC	XRP	BITX	CRIX	BITW100	BITW20	BITW70
Mean %	0.3915	0.6819	0.9467	0.3227	0.2987	0.4308	0.4602	0.4683	0.6249	0.6353
Std %	4.4023	6.0103	6.699	6.4781	7.9843	4.5676	4.542	4.6174	5.5021	5.8155
MD %	-25.9965	-32.0144	-26.8528	-37.5913	-52.7652	-27.022	-27.1385	-27.2694	-31.0092	-32.3453
MD date	2020-03-12	2020-03-12	2020-03-12	2021-05-19	2020-12-23	2020-03-12	2020-03-12	2020-03-12	2020-03-12	2021-05-19
Mean %	0.0215	0.2823	0.5617	-0.0871	-0.0123	0.0561	0.0812	0.0855	0.2429	0.2706
Std %	0.3221	3.8741	5.2722	3.9052	7.1537	0.9954	0.9183	1.1986	3.5846	3.8838
MD %	-1.4393	-17.7421	-13.8687	-28.3029	-52.5236	-7.7567	-7.1025	-11.3866	-21.468	-23.9984
MD date	2020-11-30	2021-05-19	2021-01-08	2021-05-19	2020-12-23	2021-05-19	2021-05-19	2021-05-19	2021-05-19	2021-05-19
Mean %	0.0176	0.2977	0.5562	-0.0852	0.0352	0.0593	0.0738	0.0823	0.2499	0.2788
Std %	0.327	3.9132	5.3466	4.1503	7.1658	1.0178	0.9695	1.2338	3.621	3.9257
MD %	-1.5689	-18.6061	-15.4795	-29.0915	-52.5727	-8.0299	-7.0185	-11.8752	-21.6634	-24.5294
MD date	2020-11-30	2021-05-19	2021-05-19	2021-05-19	2020-12-23	2021-05-19	2021-05-19	2021-05-19	2021-05-19	2021-05-19
Mean %	0.0253	0.3084	0.5726	-0.0742	0.0208	0.0562	0.0863	0.0846	0.2728	0.2847
Std %	0.3294	3.8944	5.2204	3.9145	7.152	0.993	0.9151	1.198	3.594	3.9133
MD %	-1.5347	-19.175	-14.6974	-28.3672	-52.5667	-7.5639	-6.9744	-11.2582	-22.0733	-24.6513
MD date	2020-11-30	2021-05-19	2021-05-19	2021-05-19	2020-12-23	2021-05-19	2021-05-19	2021-05-19	2021-05-19	2021-05-19
Mean %	0.0148	0.308	0.5016	-0.1029	-0.02	0.0598	0.0835	0.0781	0.2538	0.266
Std %	0.3476	3.8954	5.404	4.1581	7.2887	1.0312	0.9461	1.264	3.6323	3.932
MD %	-1.6225	-18.7625	-15.4481	-29.1727	-52.57	-7.7424	-7.0203	-11.9263	-21.9866	-24.4764
MD date	2020-11-30	2021-05-19	2021-05-19	2021-05-19	2020-12-23	2021-05-19	2021-05-19	2021-05-19	2021-05-19	2021-05-19
Mean %	0.0204	0.3082	0.5525	-0.0808	0.0176	0.0591	0.0777	0.0848	0.2608	0.2785
Std %	0.3234	3.889	5.2673	3.9829	7.1533	1.0065	0.9207	1.2125	3.6115	3.9157
MD %	-1.5629	-18.7819	-14.9647	-28.4608	-52.5698	-7.6211	-6.9894	-11.1357	-21.543	-24.3474
MD date	2020-11-30	2021-05-19	2021-05-19	2021-05-19	2020-12-23	2021-05-19	2021-05-19	2021-05-19	2021-05-19	2021-05-19
Mean %	0.0223	0.3117	0.5722	-0.0512	0.0155	0.059	0.084	0.0853	0.2564	0.2818
Std %	0.3221	3.8679	5.359	3.8812	7.1579	1.0078	0.9087	1.2032	3.6009	3.9074
MD %	-1.5242	-18.8729	-14.3885	-28.0879	-52.5689	-7.8581	-7.053	-11.1846	-21.592	-24.525
MD date	2020-11-30	2021-05-19	2021-01-08	2021-05-19	2020-12-23	2021-05-19	2021-05-19	2021-05-19	2021-05-19	2021-05-19

	Mean %	Std %	Skew	Kurt	MD %	MD date	ERM k=10
Individual Cryptos							
BTC	0.0223	0.3221	-1.0008	3.4153	-1.5242	2020-11-30	0.0057
ETH	0.3117	3.8679	1.0345	7.5751	-18.8729	2021-05-19	0.0491
ADA	0.5722	5.3590	1.4203	4.6970	-14.3885	2021-01-08	0.0700
LTC	-0.0512	3.8812	-0.2929	7.7022	-28.0879	2021-05-19	0.0616
XRP	0.0155	7.1579	1.1244	19.8583	-52.5689	2020-12-23	0.0787
Crypto Indices with BTC Constituent							
BITX	0.0590	1.0078	-0.4427	13.0839	-7.8581	2021-05-19	0.0127
CRIX	0.0840	0.9087	0.0488	14.5501	-7.0530	2021-05-19	0.0100
BITW100	0.0853	1.2032	-1.6522	20.5562	-11.1846	2021-05-19	0.0153
Crypto Indices without BTC Constituent							
BITW20	0.2564	3.6009	-0.3446	4.2152	-21.5920	2021-05-19	0.0503
BITW70	0.2818	3.9074	-0.6952	4.8745	-24.5250	2021-05-19	0.0557

Table 1: Summary statistics of out-of-sample daily returns of hedged portfolios that minimize ERM $k = 10$.

	Mean %	Std %	Skew	Kurt	MD %	MD date	ES 5%
Individual Cryptos							
BTC	0.0204	0.3234	-1.0150	3.4423	-1.5629	2020-11-30	0.0101
ETH	0.3082	3.8890	1.0119	7.4077	-18.7819	2021-05-19	0.0782
ADA	0.5525	5.2673	1.2557	4.2423	-14.9647	2021-05-19	0.0984
LTC	-0.0808	3.9829	-0.4957	7.2302	-28.4608	2021-05-19	0.0962
XRP	0.0176	7.1533	1.1411	19.9176	-52.5698	2020-12-23	0.1354
Crypto Indices with BTC Constituent							
BITX	0.0591	1.0065	-0.3453	12.1335	-7.6211	2021-05-19	0.0215
CRIX	0.0777	0.9207	0.0164	13.5608	-6.9894	2021-05-19	0.0173
BITW100	0.0848	1.2125	-1.6397	19.7472	-11.1357	2021-05-19	0.0274
Crypto Indices without BTC Constituent							
BITW20	0.2608	3.6115	-0.3555	4.2016	-21.5430	2021-05-19	0.0804
BITW70	0.2785	3.9157	-0.6949	4.8047	-24.3474	2021-05-19	0.0908

Table 2: Summary statistics of out-of-sample daily returns of hedged portfolios that minimize ES 5%.

	Mean %	Std %	Skew	Kurt	MD %	MD date	ES 1%
Individual Cryptos							
BTC	0.0148	0.3476	-0.8354	3.3054	-1.6225	2020-11-30	0.0234
ETH	0.3080	3.8954	0.9840	7.4947	-18.7625	2021-05-19	0.1299
ADA	0.5016	5.4040	1.1008	3.9607	-15.4481	2021-05-19	0.1463
LTC	-0.1029	4.1581	-0.7757	7.4375	-29.1727	2021-05-19	0.1647
XRP	-0.0200	7.2887	1.1121	18.8732	-52.5700	2020-12-23	0.2516
Crypto Indices with BTC Constituent							
BITX	0.0598	1.0312	-0.4410	11.5863	-7.7424	2021-05-19	0.0411
CRIX	0.0835	0.9461	-0.0361	12.4047	-7.0203	2021-05-19	0.0350
BITW100	0.0781	1.2640	-1.9645	21.8836	-11.9263	2021-05-19	0.0593
Crypto Indices without BTC Constituent							
BITW20	0.2538	3.6323	-0.4086	4.4462	-21.9866	2021-05-19	0.1282
BITW70	0.2660	3.9320	-0.7598	5.0050	-24.4764	2021-05-19	0.1535

Table 3: Summary statistics of out-of-sample daily returns of hedged portfolios that minimize ES 1%.

	Mean %	Std %	Skew	Kurt	MD %	MD date	VaR 5%
Individual Cryptos							
BTC	0.0253	0.3294	-0.9725	3.4373	-1.5347	2020-11-30	0.0063
ETH	0.3084	3.8944	1.0243	7.4297	-19.1750	2021-05-19	0.0514
ADA	0.5726	5.2204	1.2981	4.2544	-14.6974	2021-05-19	0.0769
LTC	-0.0742	3.9145	-0.3836	7.5384	-28.3672	2021-05-19	0.0622
XRP	0.0208	7.1520	1.1269	19.8930	-52.5667	2020-12-23	0.0683
Crypto Indices with BTC Constituent							
BITX	0.0562	0.9930	-0.3117	12.4780	-7.5639	2021-05-19	0.0128
CRIX	0.0863	0.9151	0.0718	13.7915	-6.9744	2021-05-19	0.0092
BITW100	0.0846	1.1980	-1.6592	21.3725	-11.2582	2021-05-19	0.0164
Crypto Indices without BTC Constituent							
BITW20	0.2728	3.5940	-0.3721	4.4896	-22.0733	2021-05-19	0.0546
BITW70	0.2847	3.9133	-0.6580	4.7874	-24.6513	2021-05-19	0.0626

Table 4: Summary statistics of out-of-sample daily returns of hedged portfolios that minimize VaR 5%.

	Mean %	Std %	Skew	Kurt	MD %	MD date	VaR 1%
Individual Cryptos							
BTC	0.0176	0.3270	-1.0405	3.3742	-1.5689	2020-11-30	0.0134
ETH	0.2977	3.9132	0.9547	7.2414	-18.6061	2021-05-19	0.1026
ADA	0.5562	5.3466	1.1362	3.9334	-15.4795	2021-05-19	0.1106
LTC	-0.0852	4.1503	-0.7234	7.3208	-29.0915	2021-05-19	0.1030
XRP	0.0352	7.1658	1.1582	19.8506	-52.5727	2020-12-23	0.1387
Crypto Indices with BTC Constituent							
BITX	0.0593	1.0178	-0.5331	13.3100	-8.0299	2021-05-19	0.0247
CRIX	0.0738	0.9695	-0.4729	13.6500	-7.0185	2021-05-19	0.0245
BITW100	0.0823	1.2338	-1.9365	23.1938	-11.8752	2021-05-19	0.0347
Crypto Indices without BTC Constituent							
BITW20	0.2499	3.6210	-0.3866	4.3396	-21.6634	2021-05-19	0.0988
BITW70	0.2788	3.9257	-0.7635	5.1288	-24.5294	2021-05-19	0.1147

Table 5: Summary statistics of out-of-sample daily returns of hedged portfolios that minimize VaR 1%.

	Mean %	Std %	Skew	Kurt	MD %	MD date	VaR 1%
Individual Cryptos							
BTC	0.0176	0.3270	-1.0405	3.3742	-1.5689	2020-11-30	0.0134
ETH	0.2977	3.9132	0.9547	7.2414	-18.6061	2021-05-19	0.1026
ADA	0.5562	5.3466	1.1362	3.9334	-15.4795	2021-05-19	0.1106
LTC	-0.0852	4.1503	-0.7234	7.3208	-29.0915	2021-05-19	0.1030
XRP	0.0352	7.1658	1.1582	19.8506	-52.5727	2020-12-23	0.1387
Crypto Indices with BTC Constituent							
BITX	0.0593	1.0178	-0.5331	13.3100	-8.0299	2021-05-19	0.0247
CRIX	0.0738	0.9695	-0.4729	13.6500	-7.0185	2021-05-19	0.0245
BITW100	0.0823	1.2338	-1.9365	23.1938	-11.8752	2021-05-19	0.0347
Crypto Indices without BTC Constituent							
BITW20	0.2499	3.6210	-0.3866	4.3396	-21.6634	2021-05-19	0.0988
BITW70	0.2788	3.9257	-0.7635	5.1288	-24.5294	2021-05-19	0.1147

Table 6: Summary statistics of out-of-sample daily returns of hedged portfolios that minimize VaR 1%.

	Var	ES5	ES1	VaR5	VaR1	ERM
BTC	99.31 (98.40, 99.86)	99.25 (98.34, 99.82)	99.27 (98.12, 99.86)	99.25 (98.46, 99.78)	99.28 (98.28, 99.86)	99.30 (98.23, 99.86)
CRIX	95.02 (85.98, 98.52)	95.04 (87.00, 98.86)	95.22 (83.30, 97.91)	95.04 (86.04, 98.67)	95.07 (85.40, 98.62)	95.01 (84.14, 98.70)
BITX	94.84 (84.37, 98.28)	94.70 (73.72, 98.14)	94.67 (82.33, 97.78)	94.77 (83.14, 97.77)	94.77 (77.69, 97.98)	94.80 (78.11, 98.48)
BITW100	92.07 (73.32, 98.54)	92.60 (73.45, 97.38)	92.93 (77.25, 97.29)	92.61 (69.38, 97.66)	92.98 (76.04, 97.52)	92.98 (76.85, 97.33)
BITW20	43.55 (-30.18, 79.60)	45.23 (-68.19, 82.07)	44.97 (-85.52, 83.94)	44.96 (-31.97, 73.62)	45.23 (-48.61, 80.95)	45.03 (-8.90, 77.35)
BITW70	56.04 (0.15, 88.03)	50.02 (24.05, 85.20)	50.62 (15.39, 79.82)	51.53 (26.59, 82.52)	55.96 (0.33, 87.92)	51.08 (15.67, 85.45)
ADA	25.68 (-28.78, 77.79)	24.84 (-16.57, 66.57)	23.64 (-29.80, 69.98)	31.36 (-7.76, 66.96)	29.82 (-9.47, 63.61)	29.52 (-20.61, 73.02)
ETH	52.37 (-3.42, 77.97)	50.11 (-33.27, 79.83)	52.18 (-31.37, 76.85)	51.37 (-20.98, 79.51)	51.96 (-10.88, 77.82)	52.01 (-22.41, 77.25)
LTC	63.44 (13.20, 79.49)	63.98 (24.15, 78.81)	62.60 (-4.69, 82.24)	62.66 (17.31, 80.70)	61.91 (20.63, 77.07)	61.56 (10.01, 77.70)
XRP	8.74 (-96.85, 64.17)	9.77 (-59.11, 58.79)	7.93 (-138.77, 67.92)	13.31 (-32.20, 65.09)	15.75 (-60.90, 62.55)	17.47 (-37.66, 66.10)

Table 7: BTCF’s Hedging Effectiveness to various assets generated by variance as risk reduction objectives.

	Var	ES5	ES1	VaR5	VaR1	ERM
BTC	89.53 (76.12, 96.61)	89.61 (74.80, 96.50)	90.06 (72.73, 96.08)	89.28 (72.48, 97.00)	89.56 (76.06, 97.11)	89.70 (76.21, 96.82)
CRIX	82.86 (17.60, 94.06)	83.88 (28.77, 96.97)	82.61 (17.49, 93.35)	83.00 (17.42, 94.86)	83.88 (17.68, 98.17)	83.87 (17.64, 96.71)
BITX	79.13 (14.24, 94.51)	79.43 (12.27, 95.93)	79.06 (7.56, 95.92)	80.48 (15.20, 97.22)	79.66 (17.52, 95.62)	79.09 (14.24, 94.82)
BITW100	76.72 (-16.03, 96.39)	76.93 (-13.96, 97.50)	77.19 (5.03, 95.69)	77.01 (-14.42, 97.38)	76.98 (-12.81, 97.04)	78.02 (43.40, 97.40)
BITW20	33.23 (-38.83, 118.59)	33.88 (-33.00, 92.83)	35.32 (-34.89, 130.64)	31.88 (-20.74, 104.16)	33.11 (-35.13, 86.43)	39.18 (0.14, 83.71)
BITW70	38.80 (-66.27, 99.80)	34.20 (-32.09, 90.66)	34.52 (-36.15, 91.29)	32.31 (-25.36, 83.22)	33.95 (-25.07, 91.86)	34.20 (-32.02, 88.59)
ADA	24.94 (-63.48, 60.88)	24.39 (-55.58, 52.86)	22.17 (-69.28, 59.55)	25.83 (-69.95, 54.54)	24.59 (-74.04, 68.74)	18.41 (-124.65, 75.89)
ETH	35.67 (-81.90, 74.46)	36.95 (-122.44, 69.69)	36.61 (-40.06, 70.90)	37.17 (-104.62, 73.28)	36.44 (-161.21, 71.94)	37.07 (-135.54, 72.57)
LTC	45.22 (-33.52, 68.60)	44.53 (-15.71, 65.71)	41.72 (-41.54, 64.15)	43.75 (-17.77, 64.35)	45.08 (-35.28, 67.23)	43.84 (-22.45, 63.83)
XRP	11.98 (-46.99, 48.36)	5.62 (-61.93, 46.20)	30.89 (-41.34, 54.99)	13.41 (-34.40, 47.49)	17.99 (-49.67, 47.69)	16.35 (-40.29, 46.29)

Table 8: BTCF's Hedging Effectiveness to various assets generated by ES5 as risk reduction objectives.