Cryptocurrencies as a potential safe-haven asset against oil and gas market risks

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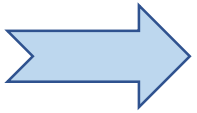
Cryptocurrency

1)Decentralized

2)Crypto - secured

- Similar to gold
  (Kyriazis, 2020)



Can be a safe haven?

against oil and gas

Literature review

Cryptocurrency is a safe-haven against oil and gas:

Almeida and Goncalves (2023)

Corbet et al. (2020)

Naeem et al. 2020

is not a safe-haven:

Wen et al. (2022)

Ghorbel and Jeribi (2021)

Long et al. (2021)

Literature review

SH-properties of cryptocurrencies strongly depend on market conditions

Almeida and Goncalves (2023)

Summarising the related studies

SH-properties

1. $R_t(SH) = \beta_0 + \beta_1 R_t\,(A_1) + \epsilon_t$

   $where\ R_t(\dots) - return, \epsilon_t - error$

2. $\sigma^2[R_t(A_1)] - extreme$

Table 1: Summary of estimating the assets' variance in related studies

Article	SH/A_1	Model	Properties
(2005) Capie et al.	Gold/Currencies	EGARCH	+ (hedge)
(2010) Baur et al.	Gold/Stocks	GARCH	+ (strong)
(2020) Corbet et al.	BTC/Oil	Copula	+ (strong)
(2020) Naeem et al.	ETH/Gas	GARCH	+ (strong)
	ETH/Oil	GARCH	–
	LTC/Gas	GARCH	+ (strong)
	LTC/Oil	GARCH	–
	BTC/Oil, Gas	GARCH	–
(2022) Wen et al.	Gold/Oil	Random walk	+ (strong)
	BTC/Oil	Random walk	–
(2021) Long et al.	Gold/Oil	GEPU index	+ (strong)
	BTC/Oil	GEPU index	–
(2022) Syuhada et al.	Gold/Oil	GARCH	+ (strong)
	BTC/Oil	GARCH	–
(2021) Ghorbel et al.	BTC/Oil, Gas	MSBEKK-GARCH	–
	Gold/Oil, Gas	MSBEKK-GARCH	+ (strong)
(2023) Omura et al.	BTC/Gas	HAR-RV	relation

Data & Methodology

Source: https://www.finam.ru/

Jan 2018 - Feb 2023 :1588 observations

time	Bitcoin	Bitcoin Cash	Litecoin	Ether	Oil (Brent)	Natural Gas
10:00	P_0^*	…	…	…	…	…
10:05	P_1	…	…	…	…	…
10:10	P_2	…	…	…	…	…

*measured in USD

Data & Methodology

Released Variance

$$RV = \sum_{t=1}^{T} {r_t}^2$$

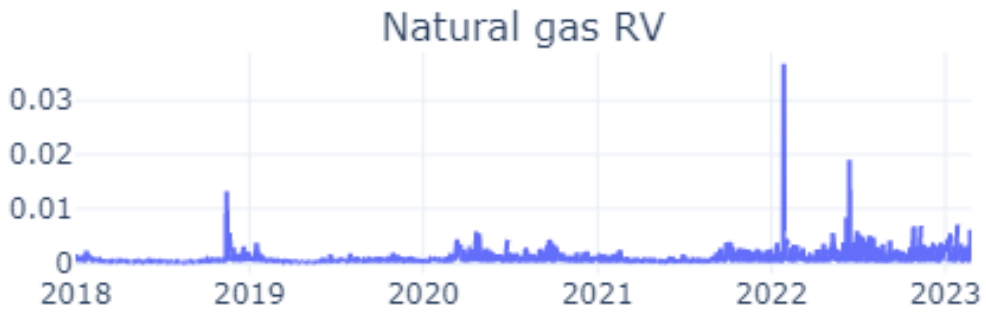
$where\ r_t\ - log - return$
$in\ a\ moment\ t$

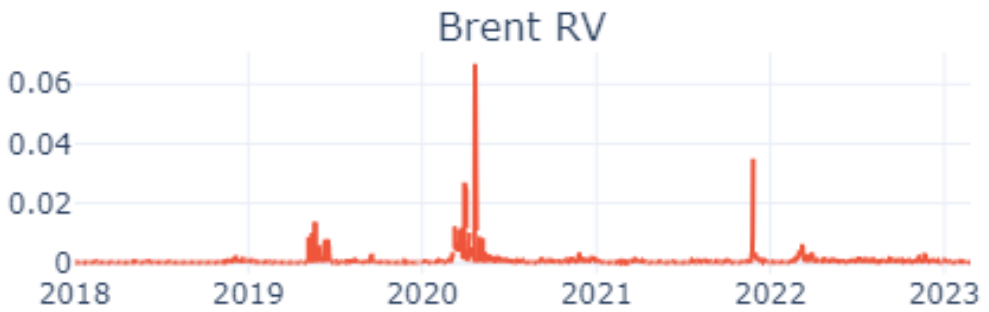
Continuous

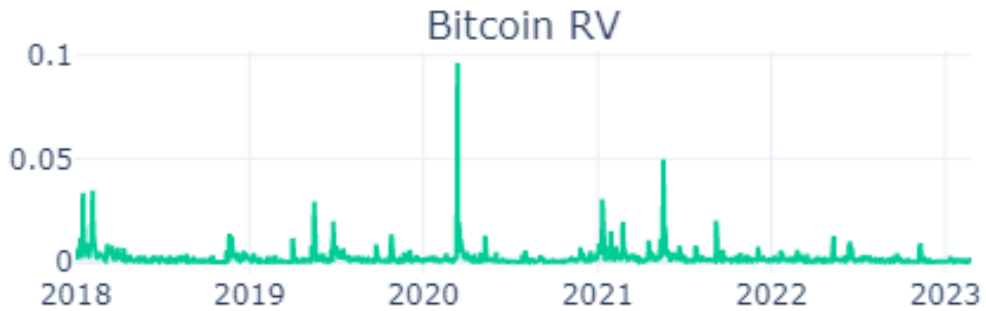
$$C = \sum_{t=1}^{T} |r_{t-1}||r_t|$$

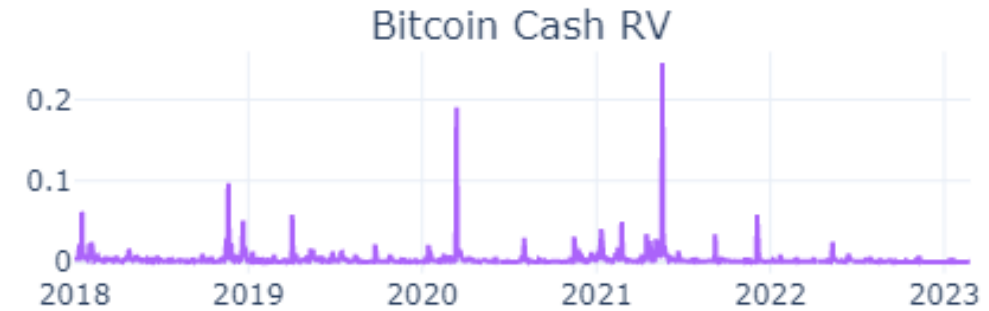
Jump

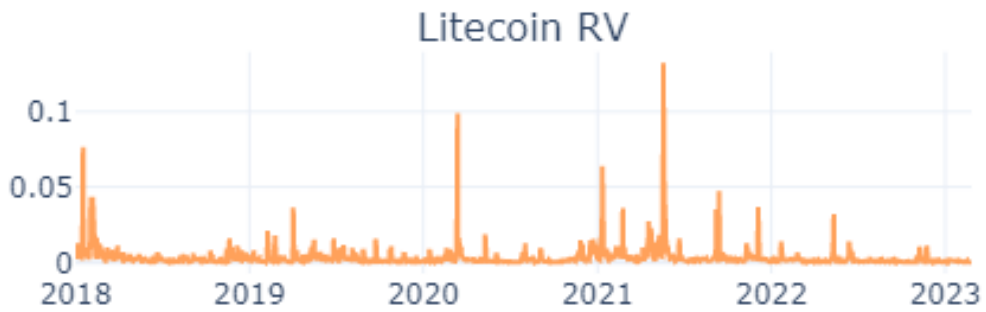
$$J = \max[0, RV\ - C]$$

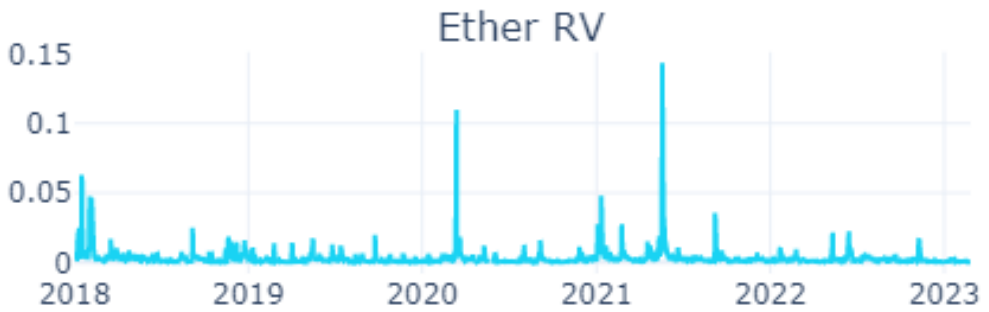

Natural gas RV
0.03
0.02
0.01
0
2018
2019
2020
2021
2022
2023


Brent RV
0.06
0.04
0.02
0
2018
2019
2020
2021
2022
2023


Bitcoin RV
0.1
0.05
0
2018
2019
2020
2021
2022
2023


Bitcoin Cash RV
0.2
0.1
0
2018
2019
2020
2021
2022
2023


Litecoin RV
0.1
0.05
0
2018
2019
2020
2021
2022
2023


Ether RV
0.15
0.1
0.05
0
2018
2019
2020
2021
2022
2023

Specification (Bitcoin)

$$RV_t(BTC) = \beta_0 + \sum_{lag=d,w,m} (\beta^{(C)}_{lag,BTC} C_{lag}(BTC) + \beta^{(J)}_{lag,BTC} J_{lag}(BTC) +$$

$$+ \beta^{(C)}_{lag,OIL} C_{lag}(OIL) + \beta^{(J)}_{lag,BTC} J_{lag}(OIL) +$$

$$+ \beta^{(C)}_{lag,GAS} C_{lag}(GAS) + \beta^{(J)}_{lag,BTC} J_{lag}(GAS)) + is\_sunday_t + \epsilon_t$$

t-test

At a level $\alpha = 0.05$

Testing weak SH:

$$H_0: \beta_{d,GAS}^{(C)} + 6 * \beta_{w,GAS}^{(C)} + 24 * \beta_{m,GAS}^{(C)} = 0$$

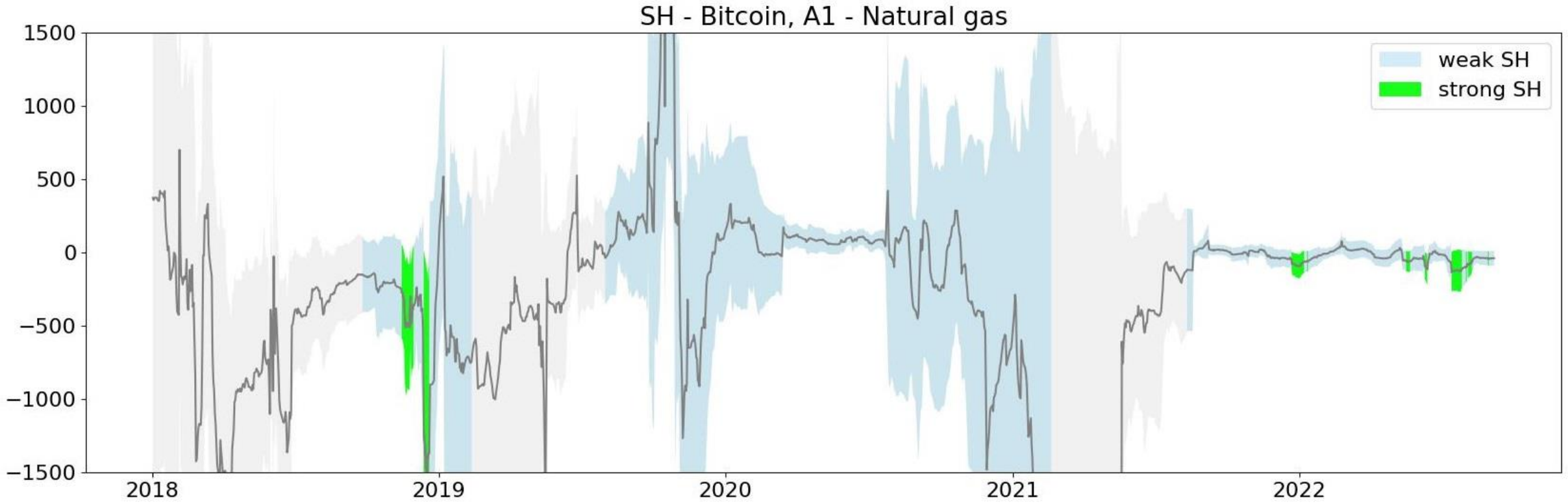
$$H_a: \beta_{d,GAS}^{(C)} + 6 * \beta_{w,GAS}^{(C)} + 24 * \beta_{m,GAS}^{(C)} \neq 0$$

Testing strong SH:

$$H_0: \beta_{d,GAS}^{(C)} + 6 * \beta_{w,GAS}^{(C)} + 24 * \beta_{m,GAS}^{(C)} = 0$$

$$H_a: \beta_{d,GAS}^{(C)} + 6 * \beta_{w,GAS}^{(C)} + 24 * \beta_{m,GAS}^{(C)} < 0$$

95 % confidence interval for the sum of betas



Resistance of the SH-properties

Coin	Mean $\hat{\beta}^{(C)}_{d,GAS} + 6 \cdot \hat{\beta}^{(C)}_{w,GAS} + 24 \cdot \hat{\beta}^{(C)}_{m,GAS}$	resistance (strong)	resistance (weak)	SH
Bitcoin	-124.9	47.7	97.4	+(weak)
Bitcoin Cash	-1077.5	44.9	96.9	+(weak)
Litecoin	-236.5	46.5	97.2	+(weak)
Ether	-193.3	37.6	98.1	+(weak)

Coin	Mean $\hat{\beta}^{(C)}_{d,OIL} + 6 \cdot \hat{\beta}^{(C)}_{w,OIL} + 24 \cdot \hat{\beta}^{(C)}_{m,OIL}$	resistance (strong)	resistance (weak)	SH
Bitcoin	-128.3	41.1	56.5	–
Bitcoin Cash	-926.2	81.1	42.3	+(strong)
Litecoin	115.7	37.5	56.1	–
Ether	7.8	63.8	51.9	–

Discussion and conclusion

LTC and ETH - weak SH/GAS	Naeem et al., 2020
BTC - weak SH/GAS	Naeem et al., 2020 Omura et al., 2023
BTC - not weak SH/OIL	Naeem et al.,2020 Wen et al.,2022 Long et al.,2021 Syuhada et al.,2022 Corbet et al.,2020

Discussion and conclusion

Limitations:

- lags as the regressors
- MOSUM-based detection

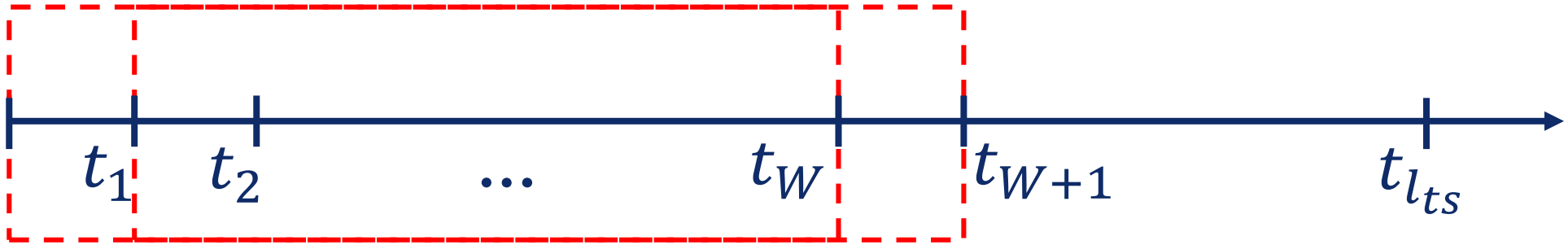
Prospects:

- adopt MOSUM test
- dummy: holidays
- overnight information
- Log-RV and volatility

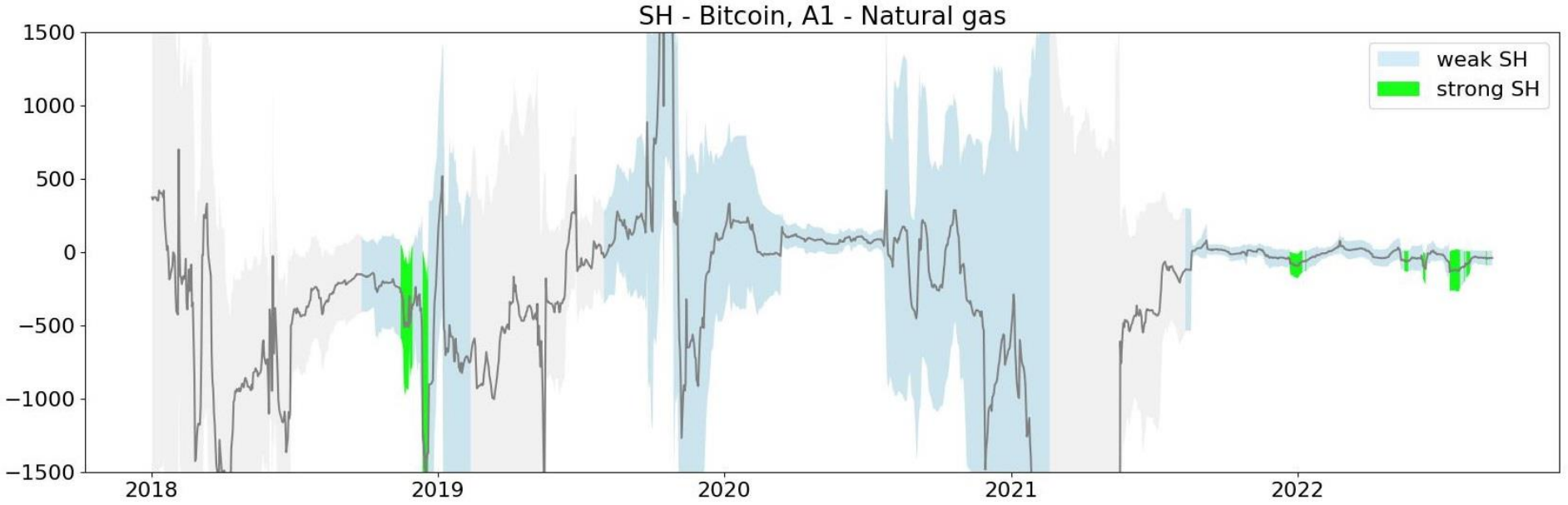
See code and estimates of the models:

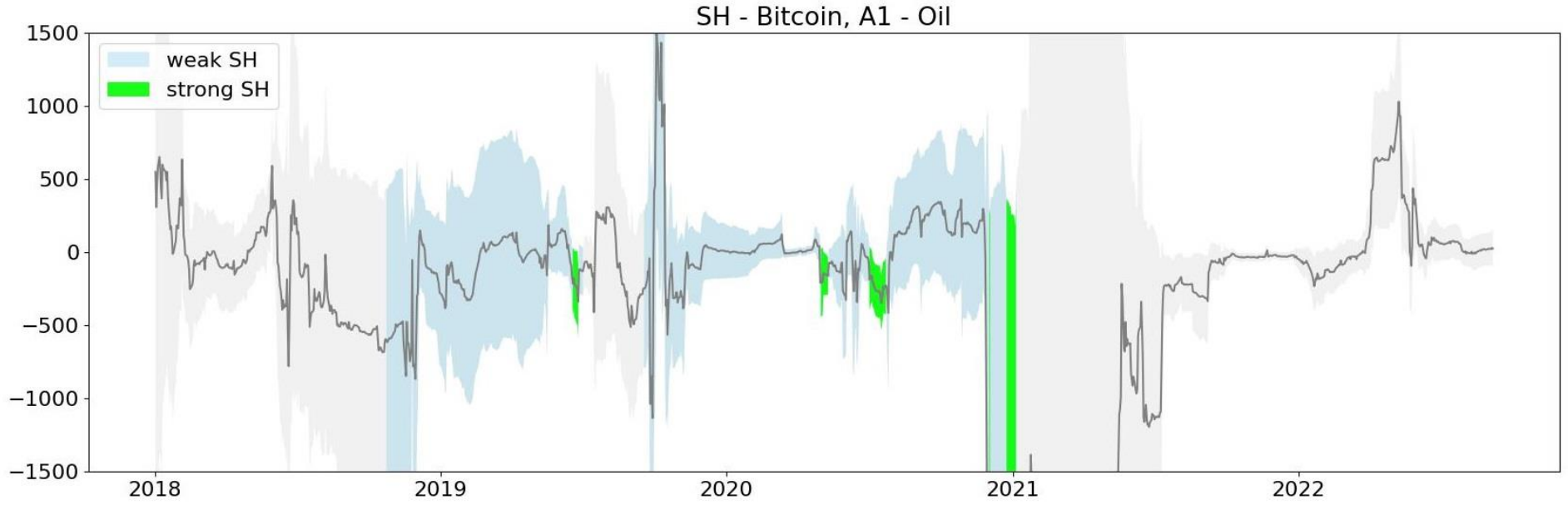
Appendix

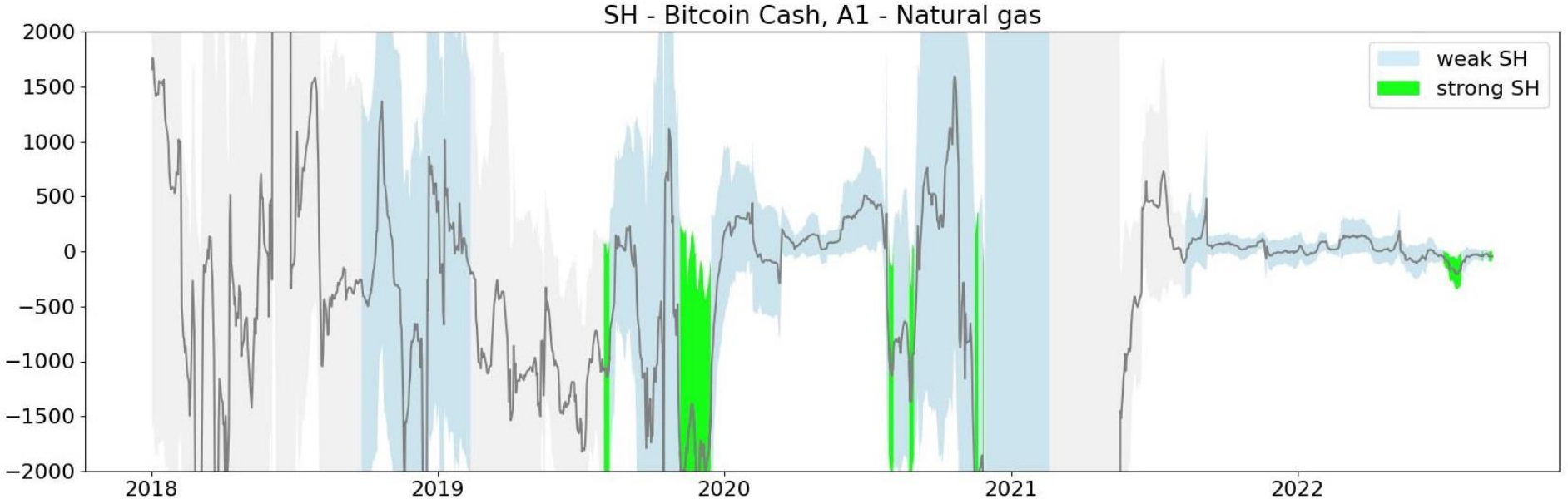
Rolling-window analysis

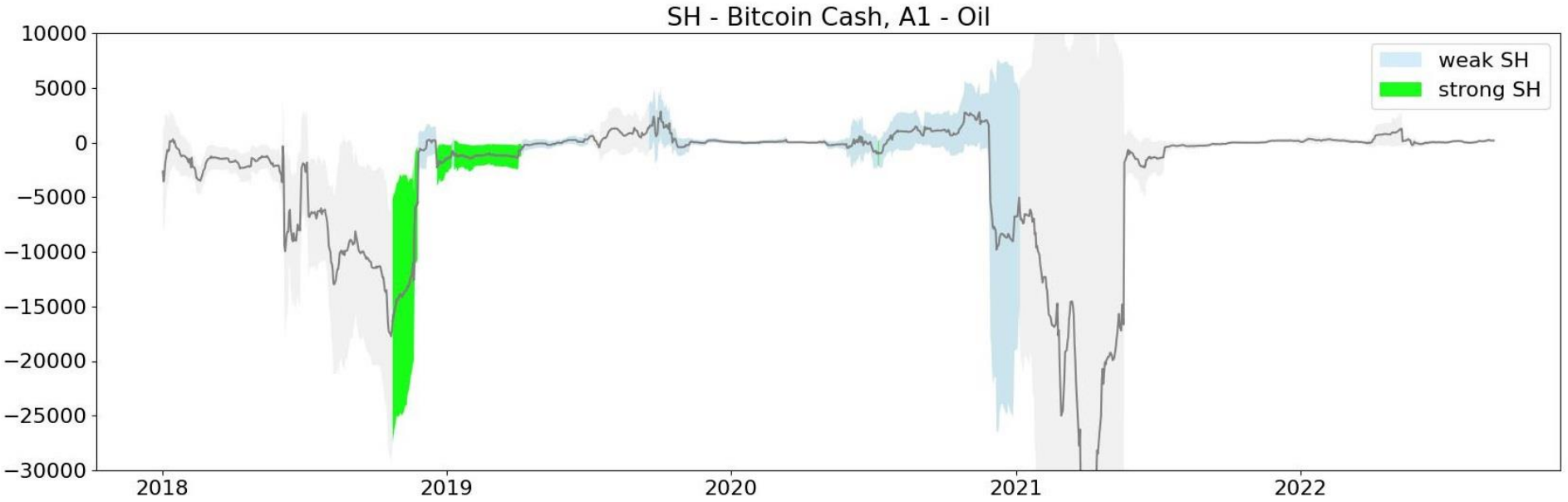


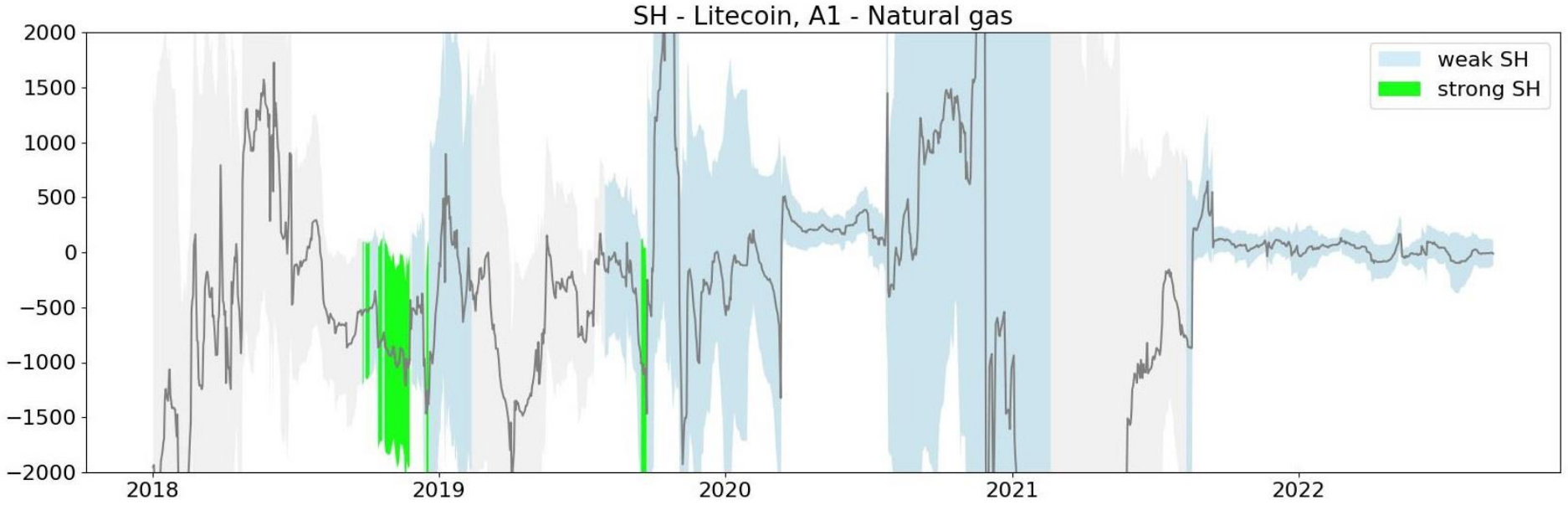
- «window» of W days
- regression for every «window»

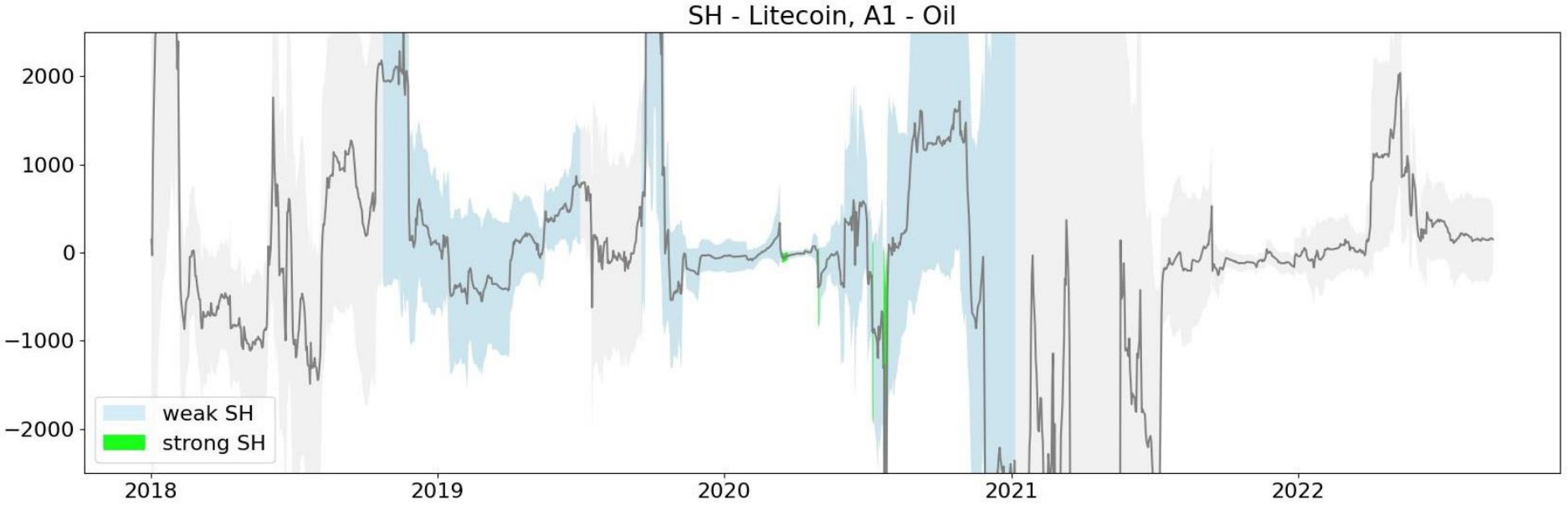

SH - Bitcoin, A1 - Natural gas
weak SH
strong SH
1500
1000
500
0
−500
−1000
−1500
2018
2019
2020
2021
2022

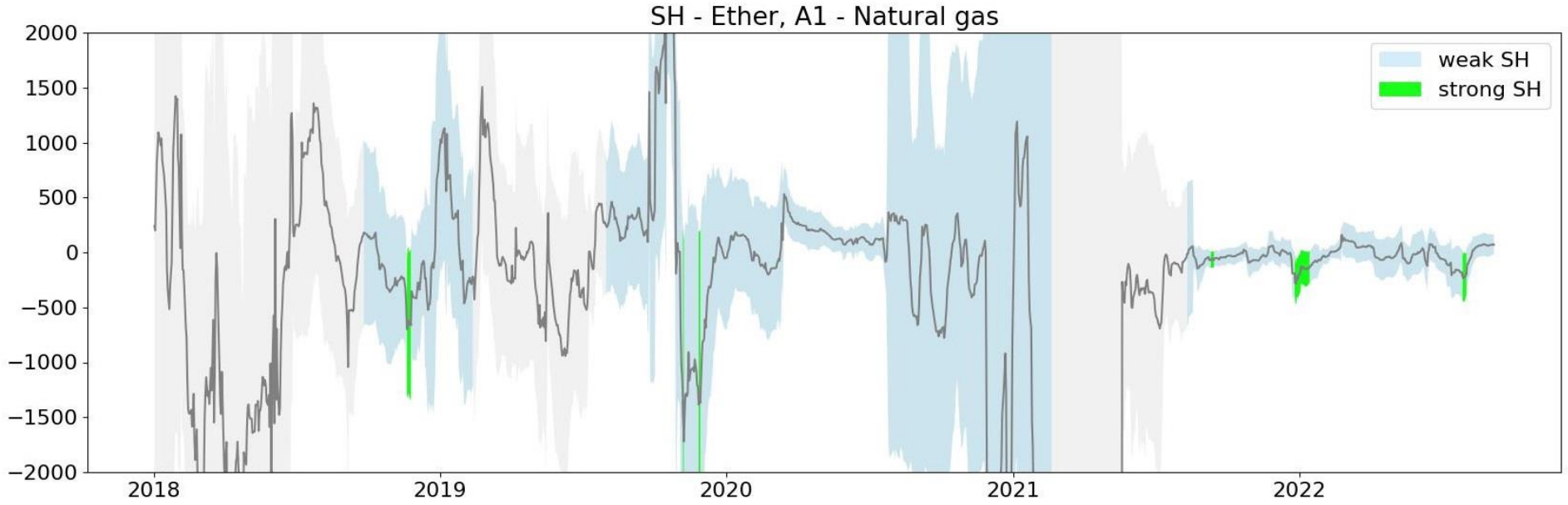

SH - Bitcoin, A1 - Oil
weak SH
strong SH
1500
1000
500
0
−500
−1000
−1500
2018
2019
2020
2021
2022


SH - Bitcoin Cash, A1 - Natural gas
2000
1500
1000
500
0
−500
−1000
−1500
−2000
2018
2019
2020
2021
2022
weak SH
strong SH


SH - Bitcoin Cash, A1 - Oil
10000
5000
0
−5000
−10000
−15000
−20000
−25000
−30000
2018
2019
2020
2021
2022
weak SH
strong SH


SH - Litecoin, A1 - Natural gas
2000
1500
1000
500
0
−500
−1000
−1500
−2000
2018
2019
2020
2021
2022
weak SH
strong SH


SH - Litecoin, A1 - Oil
2000
1000
0
−1000
−2000
2018
2019
2020
2021
2022
weak SH
strong SH


SH - Ether, A1 - Natural gas
2000
1500
1000
500
0
−500
−1000
−1500
−2000
2018
2019
2020
2021
2022
weak SH
strong SH

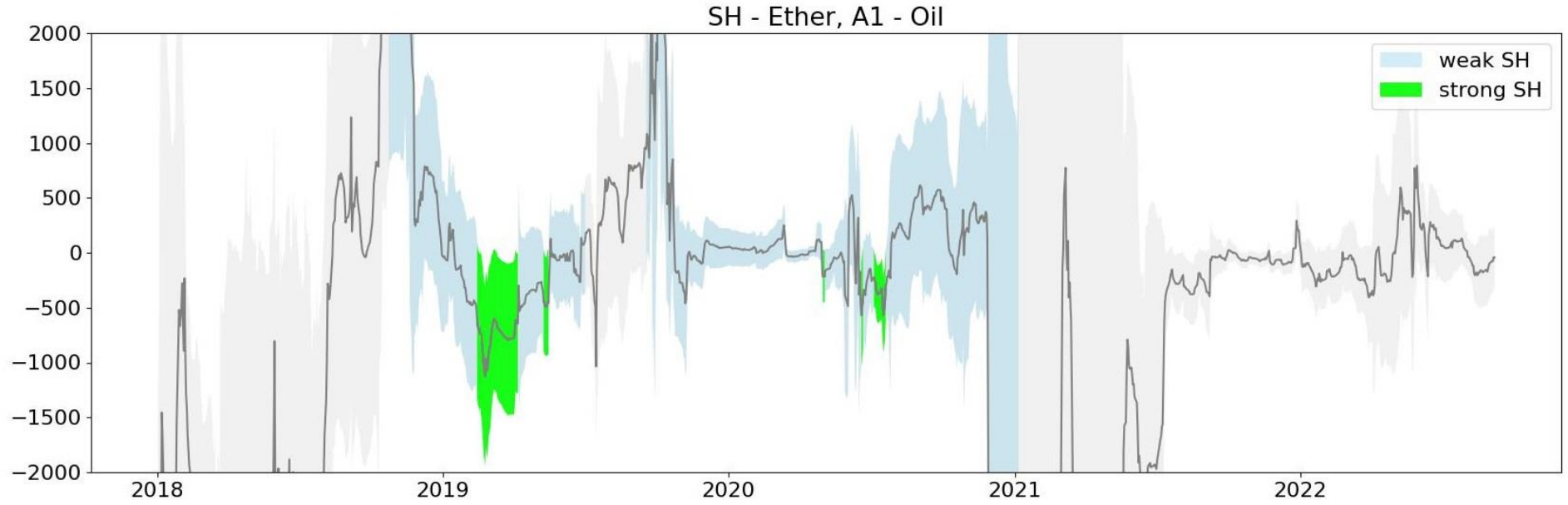
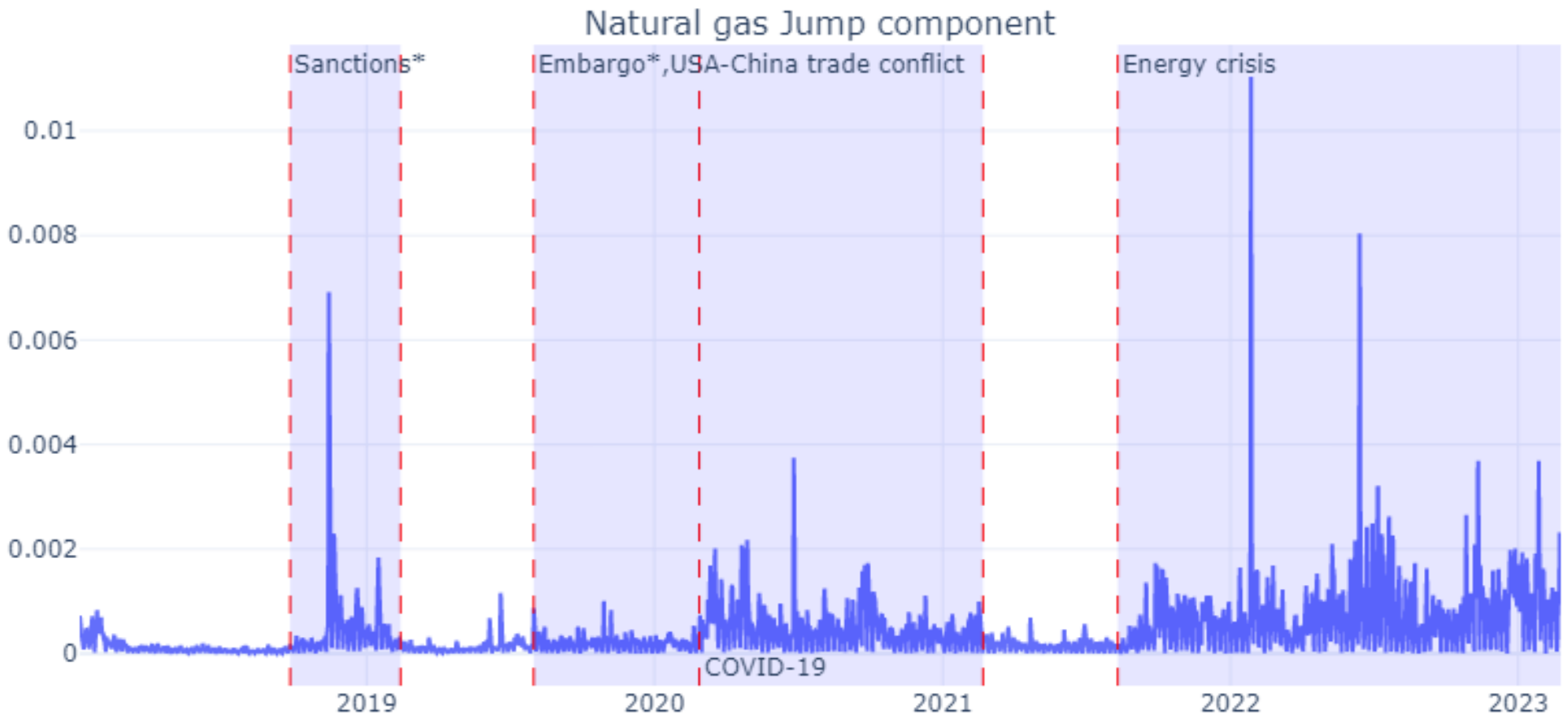
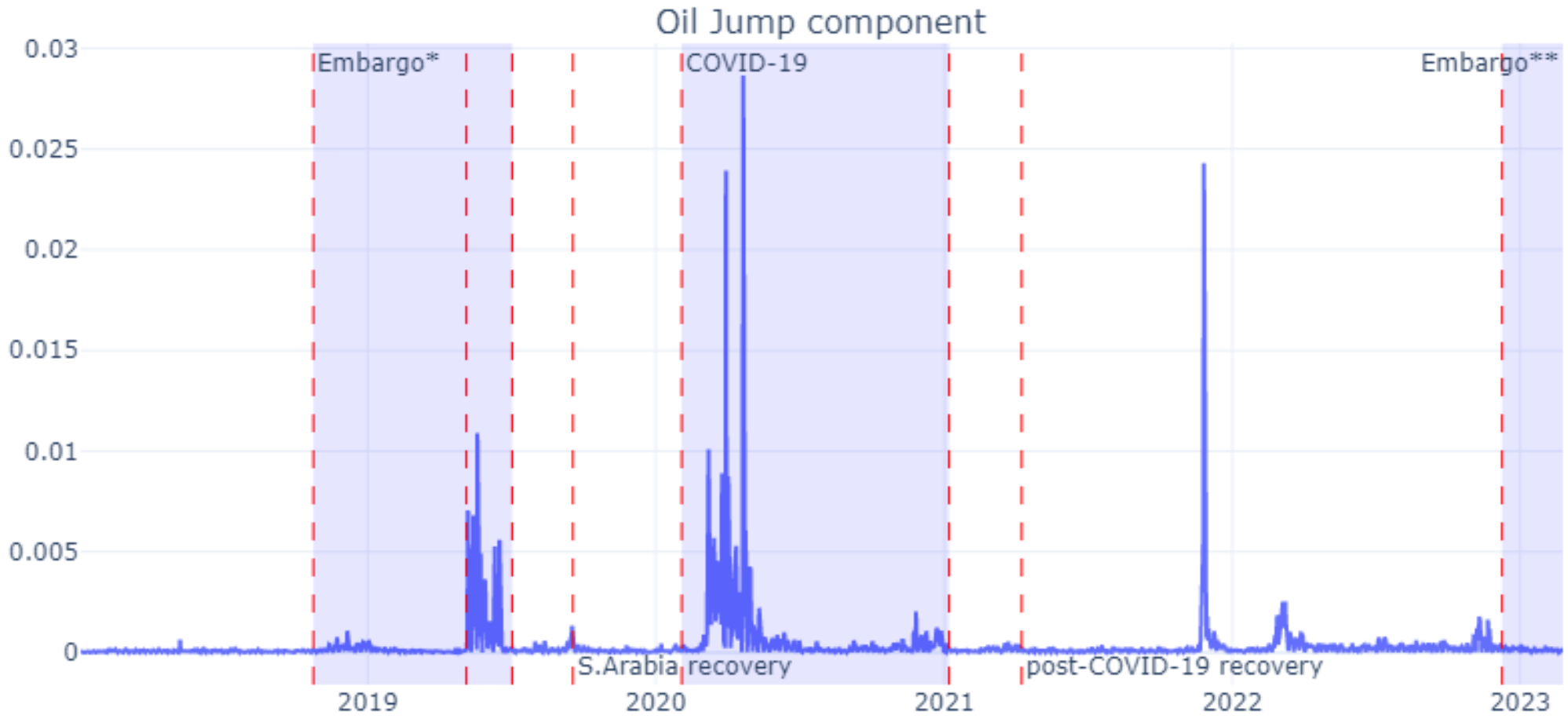

SH - Ether, A1 - Oil
2000
1500
1000
500
0
−500
−1000
−1500
−2000
2018
2019
2020
2021
2022
weak SH
strong SH

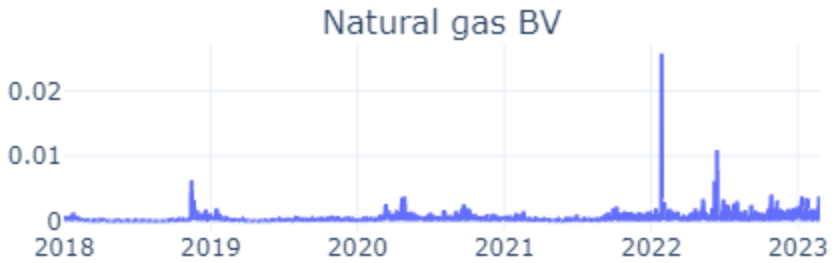
Table 4: Cover* (values of the table) and Parameters of resistance (rp*) to the length of window

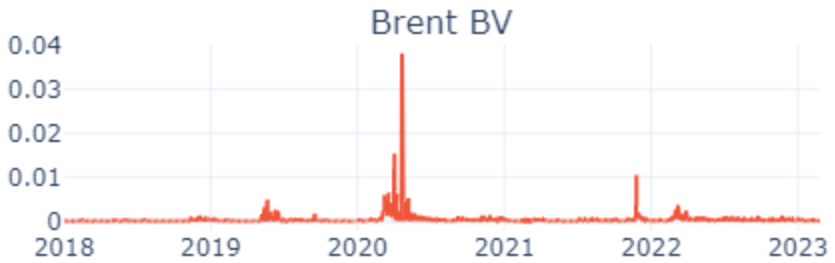
	SH	120	126	132	138	150	156	162	168	rp
BTC										
GAS	strong	28.2	30.9	59.1	70.4	64.8	54.9	40.8	32.4	47.7
OIL	strong	27.3	27.3	31.2	56.8	72.3	59.1	27.3	27.3	41.1
GAS	weak	98.3	98.4	98.6	99.1	98.1	96.3	94.7	92.6	97.1
OIL	weak	53.4	54.4	56.2	57.1	58.2	57.9	58.1	56.9	56.5
BCH										
GAS	strong	22.5	33.7	43.8	55.1	68.5	49.4	46.0	40.4	44.9
OIL	strong	87.4	95.8	98.3	98.3	85.7	73.1	63.0	47.1	81.1
GAS	weak	97.8	98.6	99.3	98.9	97.5	96.0	94.4	92.9	96.9
OIL	weak	39.8	40.6	40.6	41.4	43.6	44.6	44.0	44.0	42.3
LTC										
GAS	strong	11.3	16.9	39.6	47.2	71.7	60.4	64.2	60.4	46.5
OIL	strong	52.9	52.9	58.8	58.8	29.4	23.5	11.8	11.8	37.5
GAS	weak	97.7	98.7	98.7	98.7	97.6	96.8	95.8	94.1	97.2
Oil	weak	56.3	56.8	55.9	55.6	55.8	55.8	55.9	56.4	56.1
ETH										
GAS	strong	12.2	26.8	36.6	51.2	73.2	51.2	34.1	17.1	37.8
OIL	strong	66.7	71.0	68.1	85.5	82.6	60.9	44.9	30.4	63.8
GAS	weak	99.6	99.3	99.3	99.3	97.8	96.7	96.1	96.5	98.1
Oil	weak	51.2	51.2	51.6	51.6	52.3	52.5	52.3	52.5	51.9

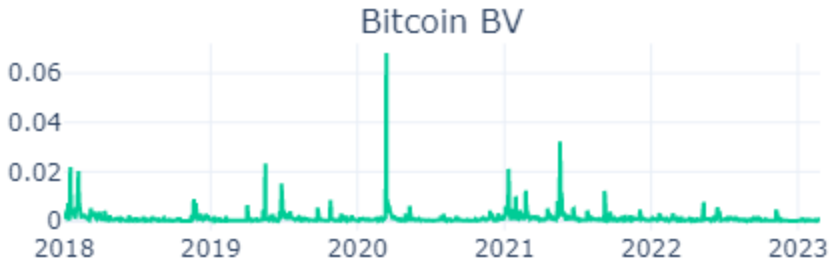
* see page 15

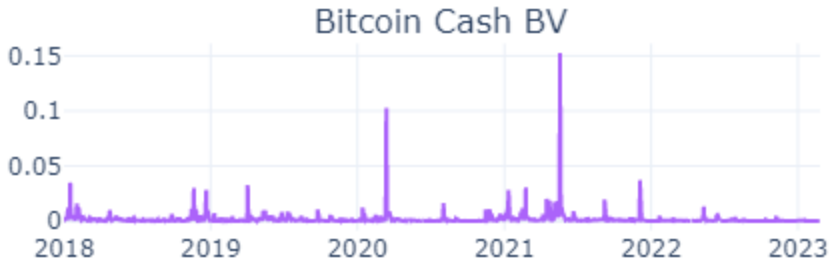

Natural gas Jump component
Sanctions*
Embargo*,USA-China trade conflict
Energy crisis
COVID-19
0.01
0.008
0.006
0.004
0.002
0
2019
2020
2021
2022
2023

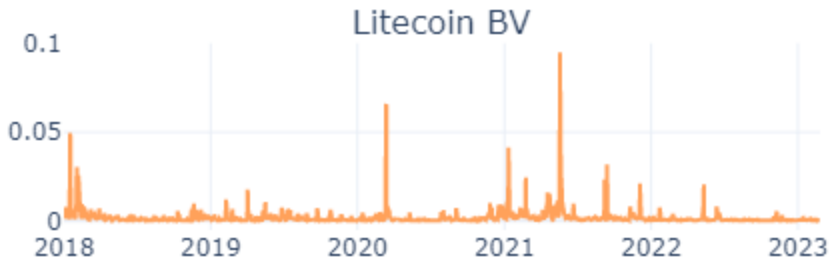

Oil Jump component
0.03
0.025
0.02
0.015
0.01
0.005
0
Embargo*
COVID-19
Embargo**
S.Arabia recovery
post-COVID-19 recovery
2019
2020
2021
2022
2023

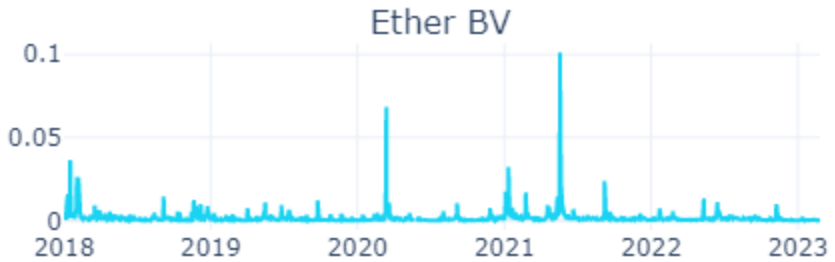

Natural gas BV
0.02
0.01
0
2018
2019
2020
2021
2022
2023

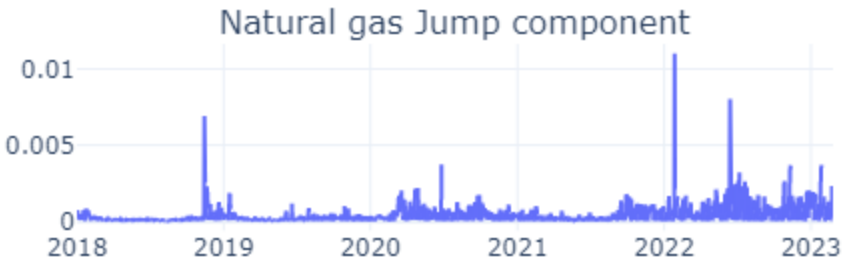

Brent BV
0.04
0.03
0.02
0.01
0
2018
2019
2020
2021
2022
2023

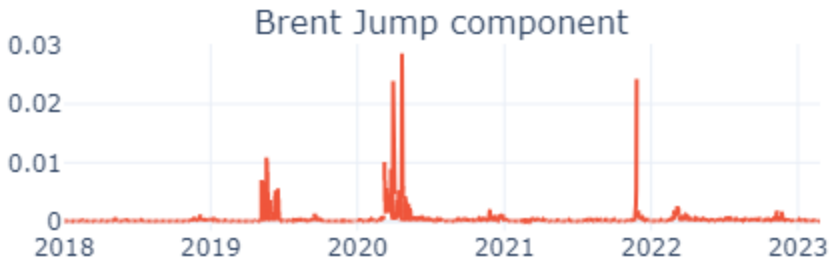

Bitcoin BV
0.06
0.04
0.02
0
2018
2019
2020
2021
2022
2023


Bitcoin Cash BV
0.15
0.1
0.05
0
2018
2019
2020
2021
2022
2023


Litecoin BV
0.1
0.05
0
2018
2019
2020
2021
2022
2023

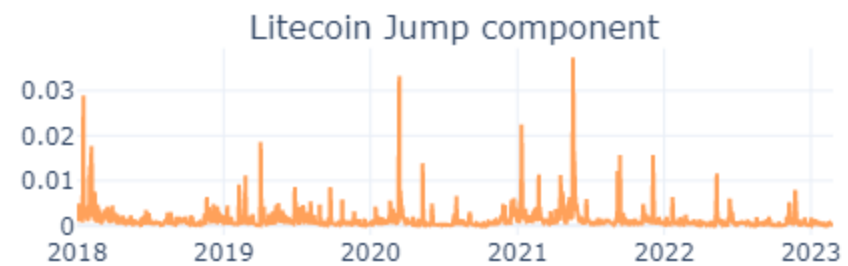

Ether BV
0.1
0.05
0
2018
2019
2020
2021
2022
2023

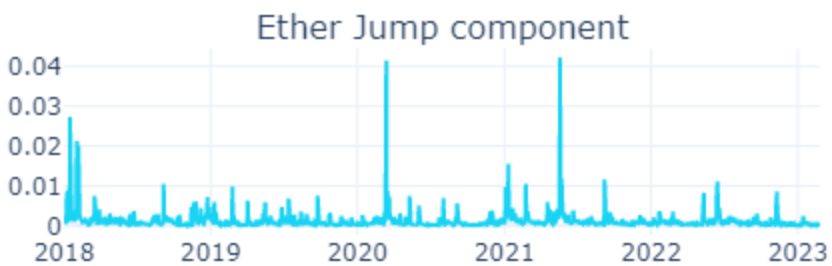

Natural gas Jump component
0.01
0.005
0
2018
2019
2020
2021
2022
2023


Brent Jump component
0.03
0.02
0.01
0
2018
2019
2020
2021
2022
2023


Bitcoin Jump component
0.02
0.01
0
2018
2019
2020
2021
2022
2023


Bitcoin Cash Jump component
0.05
0
2018
2019
2020
2021
2022
2023


Litecoin Jump component
0.03
0.02
0.01
0
2018
2019
2020
2021
2022
2023


Ether Jump component
0.04
0.03
0.02
0.01
0
2018
2019
2020
2021
2022
2023