Presentation:
Raining Cryptos*

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Motivation

- What is not well known:

  The performance of a Bitcoin investor 2014-2020.[1]

$$\underbrace{R_{Bitcoin}}_{3'708.51\%} = \underbrace{\frac{P_{Bitcoin,2020} - P_{Bitcoin,2014}}{P_{Bitcoin,2014}}}_{\text{Price Appreciation} = 3'659.62\%} + \underbrace{\frac{\sum_{i=1}^{N} P_{\text{Hard Fork}_i,2020} + \sum_{j=1}^{M} P_{\text{Airdrop}_j,2020}}{P_{Bitcoin,2014}}}_{\text{Raining Cryptos} = 48.89\%} \quad (1)$$

- Forked and airdropped coins are distributed to holders of the parent coin at a specific date and according to a pre-defined ratio.

[1] E.g. BCH had a price of $343.05 at the end of 2020.

[2] IRS is responsible for collecting taxes and administering the Internal Revenue Code, the main body of the federal statutory tax law.

Motivation

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- Forked and airdropped coins are distributed to holders of the parent coin at a specific date and according to a pre-defined ratio.
- ⚠ >$10 billion have been distributed to Bitcoin investors $\longrightarrow$ Raining Cryptos
- Internal Revenue Service (IRS)[2] released guidance regarding the taxation of hard forks and airdrops $\longrightarrow$ taxpayer must report virtual currency received from a hard fork or airdrop as gross income.

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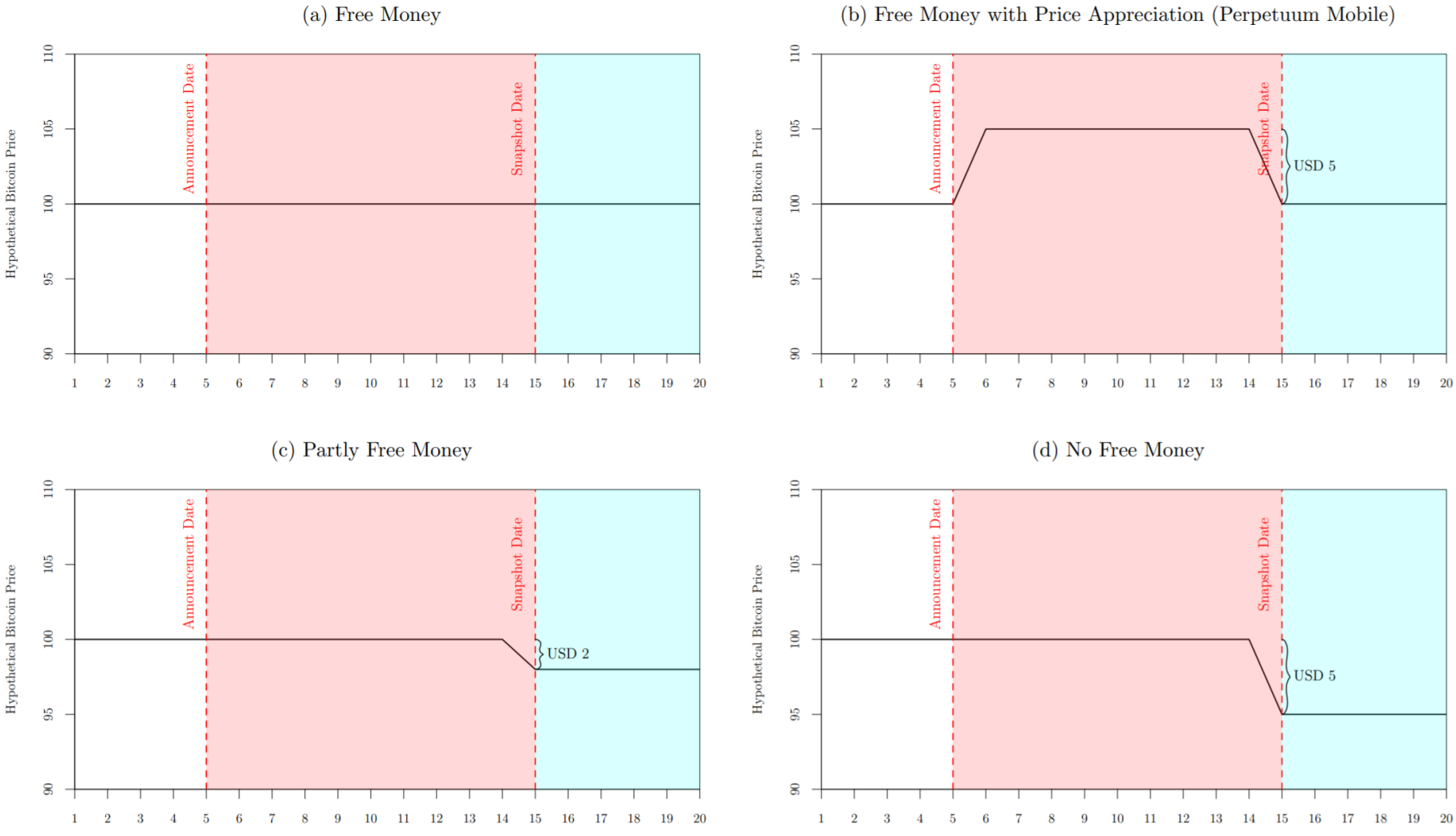
Research Question

- Are hard forks and airdrops free money?
  - i I explore to what extend the announcement of a hard fork or airdrop affects the parent coin.
  - ii I examine the reaction of the parent coin at the payout date.
  - iii I compare the price drop of the parent coin at the payout date to the value of the newly distributed coin.

Free Money

Figure 1: **Hypothetical Price Development of the Parent Coin**



The Case of Bitcoin Cash

- The Bitcoin Cash hard fork was announced on July 22nd, 2017
- Bitcoin Cash forked from Bitcoin at block 478'558. This block was mined on August 1st, 2017, which equals the snapshot date.
- At the snapshot date, the price of a bitcoin fell by 5.5% (price drop of \$157.08). Bitcoin Cash started trading at \$294.60 and closed at \$380.01 on August 1st, 2017.
- ⚠ The price of Bitcoin fell by less then the price of Bitcoin Cash. Elton and Gruber (1970) find that the mean ratio between ex-dividend price drop and the dividend amount equals 0.778. Kalay (1982) investigates the same sample period and documents an average ratio of 0.881.

Spoiler Alert

- Are hard forks and airdrops free money?
  - Yes!

i I explore to what extend the announcement of a hard fork or airdrop affects the parent coin.
  - The price of the parent coin does not react to the announcement of hard forks or airdrops.

ii I examine the reaction of the parent coin at the payout date.
  - This distribution of coins immediately decreases the prices of the parent coin by 4.65%
  - Focusing on successful events, the AAR at the payout date equals -6.7%.

iii I compare the price drop of the parent coin at the payout date to the value of the newly distributed coin.
  - The median ratio between ex-snapshot price drop and price of the distributed coin equals 0.187.

Literature

- Hard forks and airdrops have raised considerable interest by regulators and tax authorities, debating how to tax these profits (Webb (2018), Button (2019), Firth (2020), Cotler (2020), and Sabu (2021))
- Shanaev, Shuraeva, Vasenin, and Kuznetsov (2019) examine the effect of 51% attacks on proof-of-work cryptocurrencies. Civitarese (2018) perform an event study to investigate the effect of protocol efficiency on cryptocurrency prices. Joo, Nishikawa, and Dandapani (2020) conduct an event study on cryptocurrencies, including 60 positive or negative events.
- Kiffer, Levin, and Mislove (2017) explore the hard fork on the Ethereum blockchain that created Ethereum Classic on July 20^{th}, 2016.

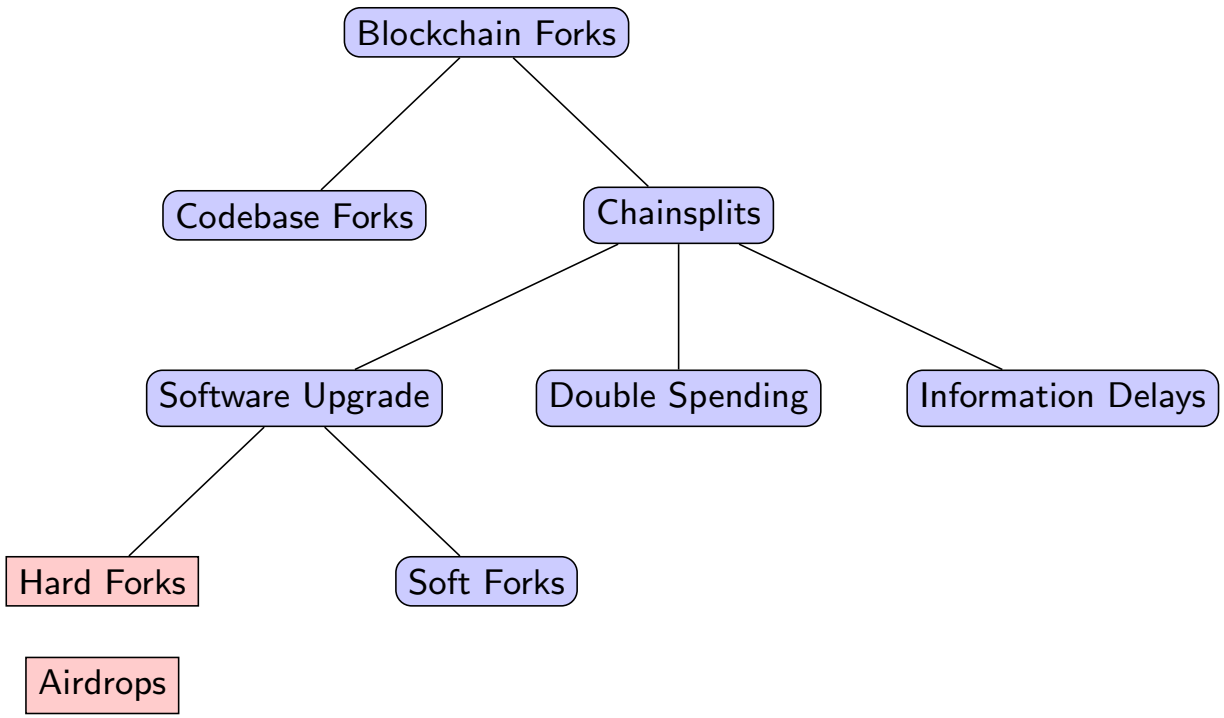
My Contribution

- I am the first to investigate the effect of hard forks and airdrops on parent coin prices.
- I collect data of 67 hard forks and airdrops for 19 different cryptocurrencies from 2014-2020.
- There are no taxes on profits from hard forks and airdrops. Perfect setting to test the EMH in cryptocurrency markets.
- ⚠ My results suggest that hard forks and airdrops are partly free money.
- ⚠ However, not claiming hard forked and airdropped coins erodes the performance of Bitcoin investors $\longrightarrow$ value destruction!
- ⚠ Similarly to Liebi (2020), the results show that cryptocurrency prices are diven by fundamentals (e.g. user base).

Blockchain Forks: a broad Overview

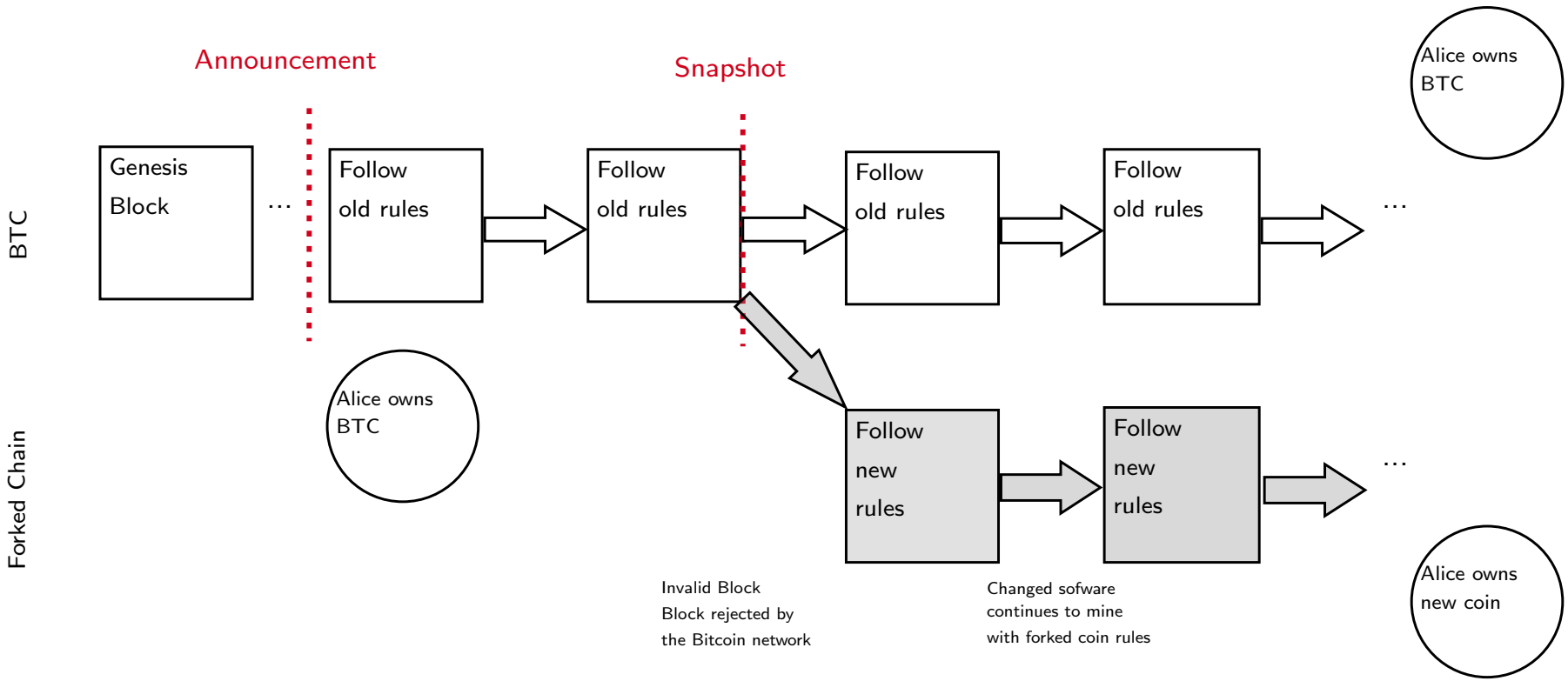
- Codebase forks are frequently confused with hard forks (e.g. Litecoin)

Figure 2: **Classification of Blockchain Forks**



Hard Forks

Figure 3: **Process of a Bitcoin Hard Fork**

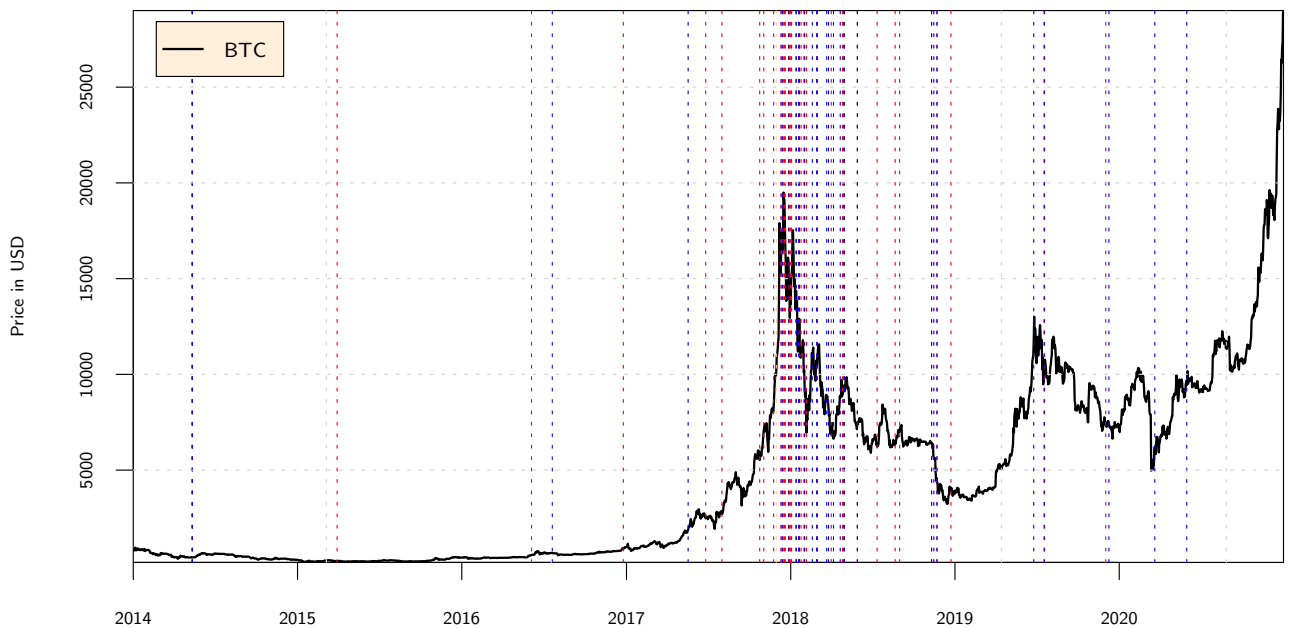


- The announcement post specifies the exact block on which the Unspent Transaction Output (UTXO) snapshot is taken. The UTXO set is duplicated at the snapshot date and updates on two different blockchains following different rules.

Data

- Dataset
  - 67 (hard forks: 51; airdrops: 16) events from 19 different currencies.
  - Only 32 events resulted in the distribution of a valuable coin.
  - Price data obtained from Coinmarketcap.

Figure 4: **Overview of all Snapshot Dates**



Method

- Following Shanaev, Shuraeva, Vasenin, and Kuznetsov (2019) as well as more general event study papers Brown and Warner (1985), Peterson (1989), and Mackinlay (1997),
- I use three models to measure abnormal returns:

$$\text{Market Model: } AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t}) \tag{2}$$

$$\text{Constant Return Model: } AR_{i,t} = R_{i,t} - \bar{R}_i \tag{3}$$

$$\text{Market adj. Model: } AR_{i,t} = R_{i,t} - R_{m,t} \tag{4}$$

where $R_{i,t}$ is the daily return of cryptocurrency i at time t, and $R_{m,t}$ equals the value-weighted market return (3'987 coins).

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \tag{5}$$

$$CAAR_t = \sum_{t=-10}^{t} AAR_t \tag{6}$$

Announcement Date

Table 1: **Average Abnormal Returns around Announcement Date**

	Panel A: Market Model				Panel B: Constant Return Model				Panel C: Market Adj. Model			
Day	AAR	CAAR	t-stat	Boehmer Masumeci Paulsen statistics	AAR	CAAR	t-stat	Boehmer Masumeci Paulsen statistics	AAR	CAAR	t-stat	Boehmer Masumeci Paulsen statistics
-10	1.56	1.56	(1.32)	(0.46)	0.74	0.74	(0.54)	(-0.35)	1.81	1.81	(1.54)	(0.68)
-9	0.96	2.52	(1.23)	(0.38)	1.10	1.84	(1.13)	(1.36)	1.01	2.81	(1.38)	(0.48)
-8	1.05	3.57	(1.19)	(1.42)	1.12	2.96	(1.03)	(0.91)	1.09	3.91	(1.3)	(1.51)
-7	0.71	4.28	(0.75)	(0.62)	1.81	4.78	(1.61)	(2)**	0.88	4.79	(0.97)	(0.9)
-6	1.18	5.46	(0.94)	(1.51)	1.65	6.43	(1.22)	(1.43)	1.23	6.01	(0.99)	(1.55)
-5	-1.28	4.17	(-2.04)**	(-0.64)	-1.43	5.00	(-1.26)	(-0.73)	-1.21	4.81	(-1.86)*	(-0.46)
-4	-0.69	3.48	(-1.39)	(-1.51)	-0.80	4.20	(-0.93)	(-1.3)	-0.41	4.40	(-0.74)	(-1.02)
-3	-0.88	2.60	(-1.98)*	(-1.57)	-0.84	3.36	(-1.16)	(-0.72)	-0.79	3.61	(-1.83)*	(-1.26)
-2	-0.11	2.48	(-0.26)	(0.49)	0.51	3.87	(0.68)	(0.85)	0.08	3.69	(0.18)	(0.56)
-1	0.49	2.97	(0.76)	(1.27)	0.62	4.49	(0.67)	(1.01)	0.66	4.35	(1.06)	(1.29)
0	0.51	3.48	(0.45)	(0.21)	1.84	6.33	(1.4)	(1.55)	0.81	5.16	(0.74)	(0.35)
1	0.66	4.15	(0.46)	(0.12)	0.59	6.92	(0.38)	(0.31)	0.89	6.04	(0.62)	(0.41)
2	0.74	4.89	(0.59)	(-0.02)	0.12	7.04	(0.08)	(0.08)	0.79	6.83	(0.63)	(0.09)
3	-0.41	4.48	(-0.49)	(0.44)	0.07	7.11	(0.06)	(0.14)	-0.22	6.61	(-0.28)	(0.73)
4	2.13	6.61	(1.54)	(0.92)	1.62	8.73	(0.98)	(0.27)	2.37	8.98	(1.75)*	(1.26)
5	0.40	7.01	(0.31)	(-0.35)	0.46	9.20	(0.35)	(0.22)	0.72	9.69	(0.56)	(-0.05)

- I document no significant AR at the announcement date!
- Why should I? We are not in a Perpetuum Mobile world.

Snapshot Date (I/III)

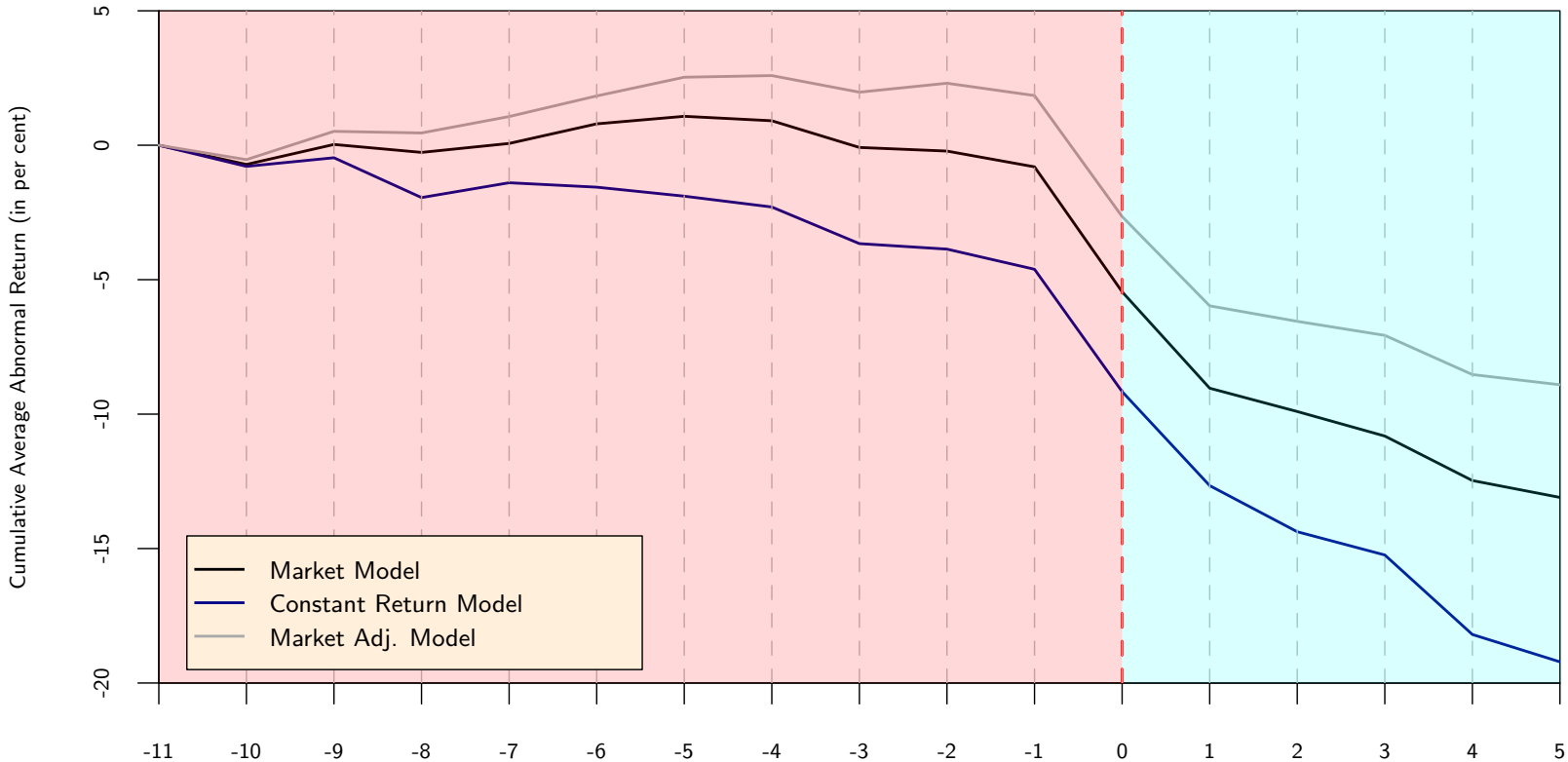
Table 2: **Average Abnormal Returns around Snapshot Date**

	Panel A: Market Model				Panel B: Constant Return Model				Panel C: Market Adj. Model			
Day	AAR	CAAR	t-stat	Boehmer Masumeci Paulsen statistics	AAR	CAAR	t-stat	Boehmer Masumeci Paulsen statistics	AAR	CAAR	t-stat	Boehmer Masumeci Paulsen statistics
-10	-0.71	-0.71	(-1.23)	(-0.66)	-0.79	-0.79	(-1.1)	(-1)	-0.53	-0.53	(-0.95)	(-0.5)
-9	0.74	0.03	(0.61)	(0.35)	0.32	-0.47	(0.23)	(0.06)	1.05	0.52	(0.86)	(0.73)
-8	-0.29	-0.27	(-0.34)	(-0.06)	-1.48	-1.95	(-1.14)	(-1.01)	-0.06	0.46	(-0.07)	(0.28)
-7	0.33	0.07	(0.42)	(-1.09)	0.55	-1.40	(0.53)	(0.47)	0.61	1.07	(0.75)	(-0.62)
-6	0.73	0.79	(1.03)	(0.52)	-0.16	-1.56	(-0.18)	(-0.09)	0.77	1.83	(1.19)	(0.49)
-5	0.28	1.08	(0.4)	(1.5)	-0.34	-1.89	(-0.33)	(0.15)	0.70	2.53	(0.94)	(1.78)*
-4	-0.17	0.91	(-0.23)	(-0.94)	-0.40	-2.30	(-0.39)	(0.14)	0.06	2.59	(0.09)	(-0.67)
-3	-0.99	-0.08	(-1.43)	(-0.77)	-1.36	-3.66	(-1.3)	(-0.84)	-0.62	1.97	(-0.91)	(-0.3)
-2	-0.13	-0.22	(-0.1)	(-0.03)	-0.20	-3.86	(-0.14)	(0.15)	0.33	2.31	(0.26)	(0.61)
-1	-0.59	-0.80	(-0.8)	(-0.12)	-0.75	-4.61	(-0.69)	(-0.17)	-0.46	1.85	(-0.62)	(-0.07)
0	-4.65	-5.45	(-3.19)***	(-3.81)***	-4.55	-9.16	(-2.78)***	(-2.69)***	-4.50	-2.65	(-3.11)***	(-3.54)***
1	-3.59	-9.04	(-2.62)**	(-3.84)***	-3.50	-12.66	(-2.56)**	(-2.16)**	-3.32	-5.97	(-2.63)**	(-3.7)***
2	-0.87	-9.90	(-1.31)	(-1.68)*	-1.72	-14.37	(-1.83)*	(-1.47)	-0.58	-6.55	(-0.9)	(-1.13)
3	-0.91	-10.82	(-1.24)	(-1.24)	-0.86	-15.24	(-0.83)	(-0.09)	-0.52	-7.07	(-0.74)	(-0.8)
4	-1.65	-12.47	(-3.24)***	(-2.72)***	-2.96	-18.20	(-3.56)***	(-2.87)***	-1.46	-8.53	(-3.25)***	(-2.42)**
5	-0.63	-13.10	(-0.87)	(-0.89)	-1.02	-19.21	(-0.97)	(-1.06)	-0.38	-8.91	(-0.52)	(-0.69)

- At the snapshot date (i.e. the payout date), abnormal returns are negative.
- At day 0, the AAR equals -4.65% for the market model.

Snapshot Date (II/III)

Figure 5: **CAAR around Snapshot Date**



Snapshot Date (III/III)

Table 3: **CAAR for Event Windows around Snapshot Date**

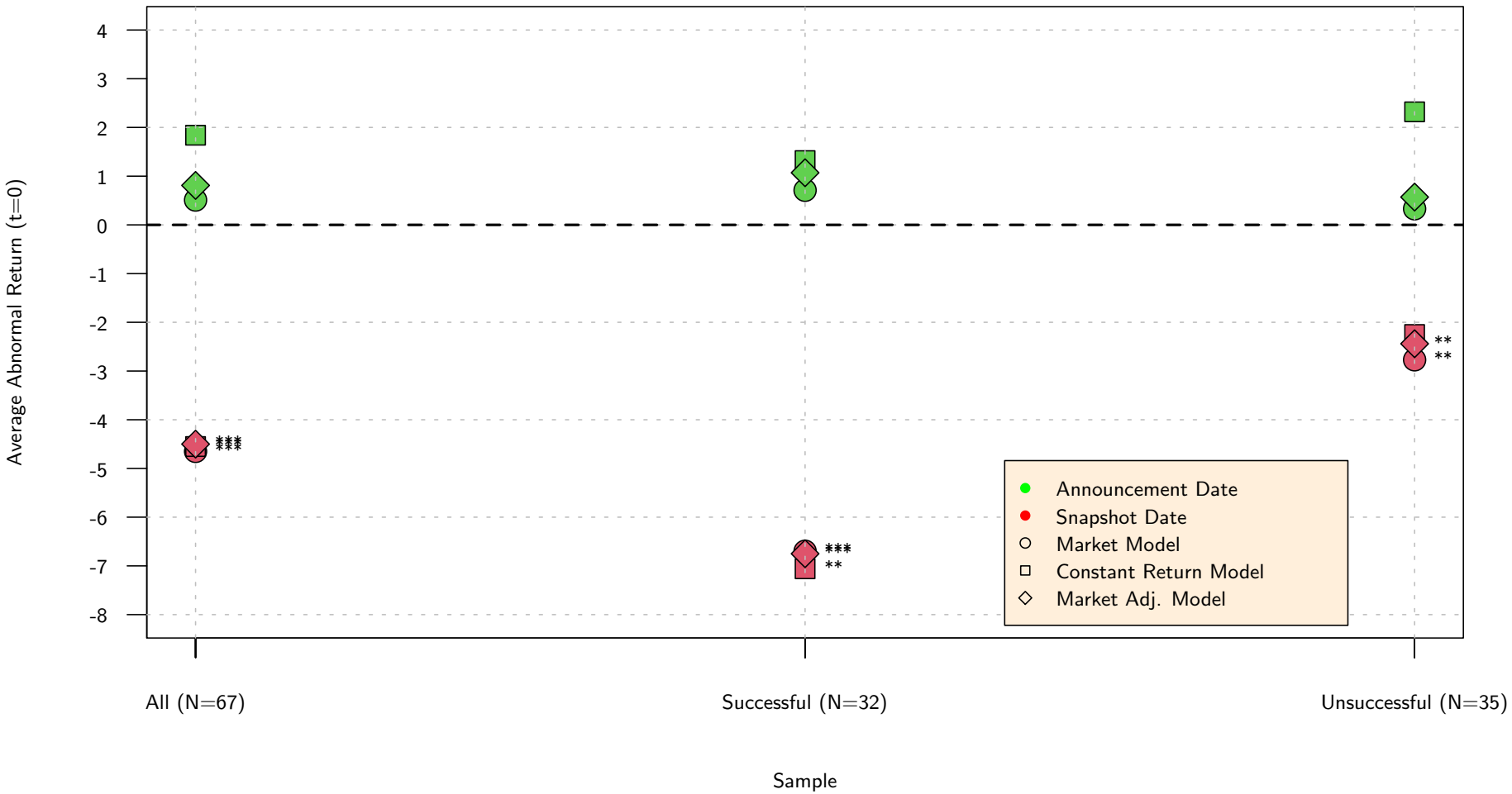
	Event Window	[0;0]	[-10;-1]	[-5;-1]	[0;1]	[0;3]	[0;5]
Market Model	CAR	-4.65***	-0.8	-1.6	-8.23***	-10.01***	-12.29***
	t-stat	(-3.19)	(-0.25)	(-0.79)	(-3.21)	(-3.25)	(-3.37)
	negative	67.16	47.76	56.72	73.13	67.16	70.15
Const. Return Model	CAR	-4.55***	-4.61	-3.05	-8.05***	-10.63***	-14.6***
	t-stat	(-2.78)	(-1.16)	(-1.16)	(-3.04)	(-3.17)	(-3.65)
	negative	59.7	59.7	58.21	59.7	62.69	61.19
Market adj. Model	CAR	-4.5***	1.85	0.01	-7.82***	-8.92***	-10.75***
	t-stat	(-3.11)	(0.61)	(0.01)	(-3.2)	(-3.15)	(-3.29)
	negative	64.18	46.27	44.78	68.66	68.66	70.15

Subsample Analysis: Idea

- Forked or airdropped coins must not necessarily be traded. In fact, it is often the case that they will never be!
- I define successful as the distribution of coins that will be listed ex-post.
- I define unsuccessful as the distribution of coins that will never be listed ex-post.
- The look-ahead bias is on purpose.
- The distribution of successful (unsucessful) coins should (not) affect the parent coin

Subsample Analysis: Results

Figure 6: **Average Abnormal Returns for Subsamples**



Price Drop Analysis

- I compare the price drop of the parent coin to the value of the distributed coin:

$$\text{Price Drop Ratio} = \frac{P_0 - P_1}{P_{\text{Hard Fork/ Airdrop}}}$$

where: P_0 = Closing price one day before the snapshot date.

where: P_1 = Closing price on the snapshot day.

where: $P_{\text{Hard Fork/ Airdrop}}$ = Closing price of the distributed coin. (7)

Price Drop Analysis

Table 4: **Price Drop Analysis**

	Median	St.Dev.	Minimum	Maximum
Panel A: Successful Coins; N=32				
$P_{\text{Hard Fork}}$	1.497	187.739	0.005	942.217
$P_0 - P_1$	0.061	365.923	-1291.8	1321.74
$\frac{P_0 - P_1}{P_{\text{Hard Fork}}}$	0.187	5290.355	-1174.352	29828.134
Panel B: Non-Crisis Sample; N=25				
$P_{\text{Hard Fork}}$	0.602	199.648	0.005	942.217
$P_0 - P_1$	0.111	142.89	-336.6	403.68
$\frac{P_0 - P_1}{P_{\text{Hard Fork}}}$	0.192	5980.855	-1174.352	29828.134

	Median	Mean	St.Dev.
Panel D: $\frac{P_0 - P_1}{P_{\text{Hard Fork}}} \in$ **[0;1]; N=8**			
$P_{\text{Hard Fork}}$	30.562	76.718	127.786
$P_0 - P_1$	8.184	31.897	54.814
$\frac{P_0 - P_1}{P_{\text{Hard Fork}}}$	0.301	0.34	0.249

Conclusion & Implications

- **Announcement Date:** I do not find a positive abnormal return at the announcement date of a hard fork or airdrop.
  - No positive abnormal return of the parent coin at the announcement date is consistent with the efficient market hypothesis.
  - We are not in the Perpetuum mobile world.
- **Snapshot Date:** This distribution of coins immediately decreases the prices of the parent coin by 4.65%.
  - This result is robust across different models, subsamples, and time periods.
  - For successful hard forks and airdrops the AAR at day 0 equals -6.7%.
- **Implications:**
  - Hard forks and airdrops are partly free money.
  - Ironically, value gets destroyed for investors that never claim or know that they have a new coin.
  - Similarly to Liebi (2020), I challenge the view that cryptocurrency prices are solely driven by speculation.

References I

Stephen J. Brown and Jerold B. Warner. "Using daily stock returns: The case of event studies". In: Journal of Financial Economics 14.1 (Mar. 1985), pp. 3–31. ISSN: 0304-405X. DOI: 10.1016/0304-405X(85)90042-X.

Chelsea D. Button. "The Forking Phenomenon and the Future of Cryptocurrency in the Law". In: Review of Intellectual Property Law 1.19 (2019), pp. 1–36. URL: https://heinonline.org/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/johnmars19&section=4.

J Civitarese. "Technical Development, Asset Prices and Market Efficiency in Alternative Cryptocurrencies". In: (2018).

Brett Cotler. "Cryptocurrency Tax Update: If There's a Hard Fork in the Road, Take It (or Not)". In: Journal of Taxation of Investments 37.2 (2020), pp. 43–48. URL: http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=07479115&AN=141227568&h=yqO1%2FZ5C%2BvuTflhqUocLxHMKIhBF%2BWZV2meTh7OO1mE1Jj2U489b6ZrzAAdVHCBB8Fzf3VB9Imu4726FRxSc2A%3D%3D&crl=c.

Edwin J. Elton and Martin J. Gruber. "Marginal Stockholder Tax Rates and the Clientele Effect". In: The Review of Economics and Statistics 52.1 (Feb. 1970), p. 68. DOI: 10.2307/1927599.

Ryan Firth. "Hard forks and airdrops: IRS issues new guidance on virtual currency taxation". In: Journal of Financial Planning 33.1 (2020), pp. 36–37.

Mohammad Hashemi Joo, Yuka Nishikawa, and Krishnan Dandapani. "Announcement effects in the cryptocurrency market". In: Applied Economics 52.44 (Sept. 2020), pp. 4794–4808. DOI: 10.1080/00036846.2020.1745747. URL: https://www.tandfonline.com/doi/abs/10.1080/00036846.2020.1745747.

Avner Kalay. "The Ex-Dividend Day Behavior of Stock Prices: A Re-Examination of the Clientele Effect". In: The Journal of Finance 37.4 (1982), pp. 1059–1070. DOI: 10.1111/J.1540-6261.1982.TB03598.X.

References II

Lucianna Kiffer, Dave Levin, and Alan Mislove. "Stick a fork in it: Analyzing the Ethereum network partition". In: Proceedings of the 16th ACM Workshop (Nov. 2017), pp. 94–100. DOI: 10.1145/3152434.3152449. URL: https://dl.acm.org/doi/abs/10.1145/3152434.3152449.

Luca Liebi. "Is There a Value Premium in Cryptoasset Markets?" In: Available at SSRN 3718684 (Dec. 2020). DOI: 10.2139/ssrn.3718684. URL: https://papers.ssrn.com/abstract=3718684.

A. Craig Mackinlay. "Event Studies in Economics and Finance". In: Journal of Economic Literature 35.1 (1997), pp. 13–39. URL: https://www.jstor.org/stable/2729691.

Pamela P Peterson. "Event Studies: A Review of Issues and Methodology". In: Source: Quarterly Journal of Business and Economics 28.3 (1989), pp. 36–66.

Arvind Sabu. "Realization's Vexations: Taxing Cryptocurrency Hard Forks". In: Forthcoming, Jurimetrics 61.3 (July 2021). URL: https://papers.ssrn.com/abstract=3888713.

Savva Shanaev et al. " Cryptocurrency Value and 51% Attacks: Evidence from Event Studies ". In: The Journal of Alternative Investments 22.3 (Dec. 2019), pp. 65–77. ISSN: 1520-3255. DOI: 10.3905/jai.2019.1.081.

Nick Webb. "A fork in the blockchain: Income tax and the Bitcoin/Bitcoin Cash hard fork". In: North Carolina Journal of Law & Technology 19.4 (2018), p. 283. URL: https://cointelegraph.com/bitcoin-for-beginners/what-are-cryptocurrencies.