Decisions in Economics and Finance manuscript No.
(will be inserted by the editor)

The Rise and Fall of Cryptocurrency Coins and Tokens

Neil Gandal · JT Hamrick · Tyler Moore · Marie Vasek

Received: 14 April 2020 / Accepted: 12 April 2021

Abstract Since Bitcoin's introduction in 2009, interest in cryptocurrencies has soared. One manifestation of this interest has been the explosion of newly created coins and tokens. In this paper, we analyze the dynamics of this burgeoning industry. We consider both cryptocurrency coins and tokens. The paper examines the dynamics of coin and token creation, competition and destruction in the cryptocurrency industry. In order to conduct the analysis, we develop a methodology to identify peaks in prices and trade volume, as well as when coins and tokens are abandoned and subsequently "resurrected". We also study trading activity. Our data spans more than four years: there are 1 082 coins and 725 tokens in the data. While there are some similarities between coins and tokens regarding dynamics, there are some striking differences as well. Overall, we find that 44% of publicly-traded coins are abandoned, at least temporarily. 71% of abandoned coins are later resurrected, leaving 18% of coins to fail permanently. Tokens experience abandonment less frequently, with only 7% abandonment and 5% permanent token abandonment at the end of the data. Using linear regressions, we find that market variables such as the bitcoin price are not associated with the rate of introducing new coins, though they are positively associated with issuing new tokens. We find that for both coins and tokens, market variables are positively associated with resurrection. We then examine the effect that the bursting of the Bitcoin bubble in December 2017 had on the dynamics in the industry. Unlike the end of the 2013 bubble, some alternative cryptocurrencies continue to flourish after the bursting of this bubble.

Keywords Cryptocurrency

We gratefully acknowledge support from the following research grants: US-Israel Binational Science Foundation grant No. 2016622, US National Science Foundation Award No. 1714291, a Blavatnik Interdisciplinary Cyber Research Center at Tel Aviv University grant, an Intel academic grant for basic research, and a grant from the Sapir Center for Development at Tel Aviv University. We are especially grateful to the editor, Gianna Figa' Talamanca, and two referees for comments and suggestions that significantly improved the paper. We are grateful to Hadar Fuchs and Arghya Mukherjee for their support in data collection.

Authors listed in alphabetical order.

Neil Gandal
Berglas School of Economics
Tel Aviv University, Israel
E-mail: gandal@tauex.tau.ac.il

JT Hamrick
Tandy School of Computer Science
The University of Tulsa, USA
E-mail: jth563@utulsa.edu

Tyler Moore
Tandy School of Computer Science
The University of Tulsa, USA
E-mail: tyler-moore@utulsa.edu

Marie Vasek
Department of Computer Science
University College London, UK
E-mail: m.vasek@ucl.ac.uk

1 Introduction

The market capitalization for the cryptocurrency ecosystem exploded from 2014 to 2018. It soared from $12 billion in February 2014 all the way up to $831 billion in January 2018.[1] Furthermore, the number of coins increased ten fold in the same period.

It is important to examine the dynamics in the cryptocurrency industry, because, in addition to the meteoric growth and innovation, in the industry, the potential for fraud in such an unregulated marketplace is significant. Fraud comes from actors deliberately manipulating prices to their own benefit and hucksters creating new coins and tokens promising benefits that deceive investors. This is not merely a theoretical risk. Gandal et al. (2018) have shown that the massive rise in the bitcoin price in 2013 from approximately $150 to more than $1 000 in one three month period was likely due to price manipulation in the market. At the beginning of 2014, the "bubble" burst and the price of bitcoin fell dramatically.

Another reason to study the market dynamics is because Bitcoin's dominance of the industry is being challenged by other coins. Currently Bitcoin has "only" 64 percent of the market, while Ethereum has 8 percent and Ripple has another 4 percent. Ethereum has been able to challenge Bitcoin based on its extensibility – 19 of the top 20 tokens are built on top of Ethereum. Ripple has been able to attract over 100 banks as well as Western Union to its platform Popper (2018a). This is a stark comparison to the earlier days of Bitcoin: from its inception through 2016, Bitcoin had more than 90 percent of the market.

In this paper, we analyze the dynamics of this burgeoning industry. We consider both cryptocurrency coins and tokens. The difference between coins and tokens are as follows: Coins are essentially a method of payment while tokens typically give access to a product or service. On the one hand, this means that tokens are more likely to capture (potential) real economic activity in the sector, while coins are more likely to pick up speculative and criminal activity.[2] On the other hand, tokens have the lucrative opportunity to raise funds from investors through confusingly named initial coin offerings (ICOs). This creates short-term incentives to create new tokens rather than sustain existing ones.

In order to examine cryptocurrency coin and token dynamics, we first develop a methodology to define volume peaks, price peaks, coin abandonment, and coin/token "resurrections." We then examine the association between entry and exit and other key variables such as price, volume, market capitalization, and trade in order to analyze and provide intuition underpinning the fundamentals in this market.

We break our first set of results into two categories: (I) Similarities between coins and tokens (II) Differences between coins and tokens. The results regarding similarities are as follows:

- Most coins and tokens are not steadily traded, and these are more likely to be abandoned than their larger counterparts.
- Several of the indicators we examine suggest that many of the entrants and resurrected coins and tokens are riding "the wave" created by the huge increase in the market.
- There is a high correlation between abandonment and "creation" for both coins and tokens.

The results regarding differences between coins and tokens are as follows:

- Overall, we find that 44% of publicly-traded coins are abandoned, at least temporarily. 71% of abandoned coins are later resurrected, leaving 18% of coins to fail permanently.
- Tokens experience abandonment much less frequently, with only 7% abandonment and 5% permanent token abandonment at the end of the data.
- In the case of tokens, the correlation between creation and trade volume is very high (0.71) while the same correlation is very small (0.10) for coins.
- In the case of tokens, the correlation between abandonment and trade volume is relatively high (0.35) while the same correlation is much smaller (0.07) for coins.

The first set of results suggests that this "young" industry is characterized by a great deal of entry and exit, but winners and losers emerge even in early stages.

[1] Although the market capitalization dropped following the last Bitcoin bubble it sits around $195 billion at the time of writing, which puts cryptocurrencies just below the market capitalization of Wells Fargo & Co.

[2] Foley, Karlsen and Putnins (2019) find that approximately one-quarter of bitcoin users are involved in illegal activity. They estimate that 46% of bitcoin transactions involve illegal activity. Based on their estimates, the illegal use of bitcoin generates approximately $76 billion of illegal activity per year. In terms of comparison, the scale of the US and European markets for illegal drugs is only slightly larger (Foley et al., 2019).

Regarding the second set of results, one possible interpretation of these results is that that "product" or "service" innovation (via tokens) has less churn (fewer abandonments and resurrections) than innovation in coins. Further this "product" or "service" innovation occurs when there is a lot of economic (trade) activity. In the case of coins, this effect is absent. Additionally, we find that in the case of coin creation, market variables do not drive the issuance of new coins. On the other hand, market variables are significant drivers in the case of token creation. This makes sense since tokens are associated with utility in a platform, while coins are more of a speculative instrument.

We also examine the dynamics following the second bursting of the "Bitcoin" bubble. We do this part of the analysis for coins because Bitcoin (which) is a coin is the dominant force in the cryptocurrency industry. The dynamics following the bursting of the bubble in early 2018 are very different than the after-effects of the "Bitcoin" bubble that burst in 2014. Following the bursting of the 2014 bubble, other major cryptocurrencies fell by more than Bitcoin did. See Gandal and Halaburda (2016) Bitcoin's dominance, which was already significant, grew even more following the bursting of the 2013 bubble, reaching a 94 percent market share (based on market capitalization.) Following the bursting of the second bubble in early 2018, we show that Ethereum and Ripple and other top cryptocurrencies held on to some of their market share gains during the price rise. Thus Bitcoin's dominance has generally remained below 70 percent since the bursting of the bubble. This may represent a potentially game-changing period, in which other cryptocurrencies will be able to challenge Bitcoin's dominance.

The rest of the paper proceeds as follows: In section 2, we provide some background on the cryptocurrency ecosystem. Section 3 is a literature review. In section 4, we detail the methodology we developed to identify peaks in trading volume and price, as well as how to determine when coins/tokens are"abandoned" and "resurrected." Section 5 shows our main results regarding both coins and tokens. In section 6, we examine the dynamics that took place during and following the Bitcoin bubble in early 2018. Section 7 provides brief conclusions.

2 Background

Bitcoin (BTC), the first cryptocurrency, was founded in 2009. While the market took off slowly, a massive spike in the price of bitcoin in late 2013 led to wider interest in what had been until then a niche industry. The value of Bitcoin increased from around $150 in mid 2013 to over $1 000 in late 2013. The fall was dramatic as well and by 2016, one bitcoin was worth approximately $200. Despite the bursting of the bubble, cryptocurrencies were on the map and massive entry (as well as non-trivial exit) has occurred in the industry during the last four years.

While Bitcoin dominated the market through most of the 2009-2016 period, in 2013, a few other cryptocurrencies competed with Bitcoin. These coins began appreciating much more quickly than Bitcoin during the price rise. Gandal and Halaburda (2016) analyzed how network effects affected competition in the cryptocurrency market during the price spike and subsequent fall in the price of bitcoin in these early days (Gandal and Halaburda, 2016). Their analysis suggests that there were strong network effects and winner-take-all dynamics following the fall in the price of bitcoin in early 2014. From July 2014 to February 2016, bitcoin's value was essentially constant against the USD, while the other currencies depreciated dramatically against the USD. Litecoin, the number two coin in the market, declined by 70% in value, while other "main" coins declined by more than 90% in value. In early 2016, Bitcoin accounted for 94% of the total market capitalization, while Litecoin (the number two cryptocurrency) accounted for 2%. Despite its shortcomings, Bitcoin had emerged at that point as the clear winner and beneficiary of network effects.

In 2017, things changed dramatically. Bitcoin began rising again and by early 2017, the value of bitcoin was again more than $1 000. It had taken more than three years for the value of bitcoin to return to the 2013 peak level, but that was only the beginning. The price of bitcoin exploded from approximately $1 000 in early 2017 to more than $19 000 in December 2017 and back down to just over $6 800 at the time of writing (early April 2020). The percent increase in 2017 (approximately 1 900 percent) is even greater than the percent increase that bitcoin experienced during 2013 (approximately 500 percent). Concern abounds that price manipulation still exists in the industry today Popper (2018b). Griffin and Shams provided evidence that the backers of a leading token, Tether, may have deliberately propped up the price of Bitcoin and other coins Griffin and Shams (2020).

The market capitalization of cryptocurrency grew stunningly in the past few years as well. In February 2014, the market capitalization of all cryptocurrencies was approximately $14 Billion. As of January 2018, the total market capitalization was approximately $831 Billion. Despite a spectacular fall in 2018, the total as of April 2020 remains high, at $192 billion.

3 Literature Review

Our paper straddles two literatures. The first is an economics literature on emerging industries. A common theme in the theoretical literature on the topic is that both "learning by doing" (supply side) and "learning by using" (demand side) play a key role in the evolution of new industries.[3] There is also a theoretical literature on the dynamics in industries with network effects. See Gandal (2002) for a selective review.

In addition to the theoretical literature, there is also a large empirical literature in Economics on the dynamics of entry and exit.[4] One particular focus in this literature is on the post-entry performance of firms. These studies typically examine the entry and exit rates over time, the number of firms in the industry over time, the survival rate of new firms, and the evolution of firm size over time.[5] One particularly robust finding in this literature is that entry into new markets generally occurs in waves. This seems to be the case in the cryptocurrency industry as well, as we show in our analysis. The empirical literature in economics has also examined and measured the strength of network effects. A key question is whether first-mover advantages and large networks can be overcome by improvements in quality by late entrants. Our analysis suggests that quality advantages of later entrants may eventually overcome Bitcoin's first-mover advantages in the cryptocurrency market - and provide competition to Bitcoin.

Our paper also adds to a nascent literature on Bitcoin and the financial sector.[6] Within the finance literature, there is growing interest in discovering what drives a "value-less" currency. Li and Wang investigate the bitcoin exchange rate in an effort to expand our understanding of the motivation behind the rise and fall of cryptocurrency values (Li and Wang, 2017). Corbet et al. expanded upon that, finding that shocks to traditional financial assets did not affect cryptocurrencies (Corbet et al., 2018). However the shocks to the price of the three cryptocurrencies they studied (Bitcoin, Ripple, and Litecoin) did affect each other. Xie et al. analyze the effects of social activity on the Bitcoin forum on the price of Bitcoin (Xie et al., 2017). They find that during periods of time when users are highly connected, the price of Bitcoin is highly likely to rise. Bolt and van Oordt build a theoretical model to examine the exchange rate of virtual currencies (Bolt and van Oordt, 2020). Additionally, Hayes constructs a model for determining the value of a "bitcoin-like" cryptocurrency by calculating its cost of production.

Our work adds to the current understanding of the altcoin and initial coin offering (ICO) ecosystem. Huang et al. examine 917 ICOs to determine which country level offerings facilitate ICO growth Huang et al. (2019). They found that more ICOs are started in countries offering a clear regulatory framework as well as a well-developed financial market. Others have researched factors that have determined success of ICOs. Adhami et al. found that most of the token sales were successful and that the secondary market was quite liquid (Adhami et al., 2018). Lyandres et al. take a step further and develop five indicators of ICO success and failure Lyandres et al. (2019). The authors also develop methods to determine source and record level data quality, which is very useful for combining ICO data sources. Amsden and Schweizer studied features that caused tokens to trade on currency exchanges (Amsden and Schweizer, 2018), finding that features like quality token operators increased the likelihood of trading. However, Momtaz finds that 40% of all ICOs destroy investor value on the first day of trading Momtaz (2018). Of these, highly visionary projects are abandoned at a higher rate than other projects and make up a majority of the 21% of tokens that are delisted from exchanges. Given that, Benedetti and Kostovetsky find that tokens are averaging returns of 179% after only 16 days Benedetti and Kostovetsky (2018).

Others have investigated market trading dynamics in the alternative currency ecosystem. Krafft et al. did an experimental study of 271 "penny cryptocurrencies" (similar to penny stocks) using the currency exchange, Cryptsy (Krafft et al., 2018). They found that when their bots bought a "penny cryptocurrency," the result was a two percentage point increase in buying activity from others. A number of people have studied fraudulent currency manipulation in the form of pump and dump groups (Xu and Livshits, 2019; Hamrick et al., 2018). Markarov and Schoar use the rise and fall of cryptocurrencies to study cross-exchange arbitrage on cyrptocurrency markets (Makarov and Schoar, 2020).

[3] Rob developed a theoretical model that shows that under uncertainty regarding the size of the market, entry will occur in waves Rob (1991). Vettas obtained similar results in an extension of the Rob model to a setting with uncertainty on both sides of the market (Vettas, 1998).

[4] For a good summary of early work, see the Audretsch and Mataon the post-entry performance of firms (Audretsch and Mata, 1995).

[5] See Geroski and the references cited within for a survey of the literature (Geroski, 1995).

[6] For an in-depth overview of how the Bitcoin ecosystem works, see Böhme et al. (Böhme et al., 2015).

Finally, this work is relevant to literature in cybersecurity and finance investigating fraud. Currently, cryptocurrency markets are largely unregulated. As such, they are highly susceptible to price manipulation: by small scale traders, such as Krafft et al. trading penny cryptocurrencies (Krafft et al., 2018), by wayward insiders, such as the bots run by the operators of the Mt. Gox exchange (Gandal et al., 2018), or by hucksters running Ponzi schemes (Vasek and Moore, 2015). Financially motivated actors have been shown to manipulate over-the-counter stock markets Aggarwal and Wu (2006) and use email spam to tout pump-and-dump stock schemes (Böhme and Holz, 2006; Frieder and Zittrain, 2007; Hanke and Hauser, 2008). Also, we analyze currency abandonment, analogous to the Bitcoin exchange closures that have wreaked havoc on the ecosystem (Moore and Christin, 2013). Note that in this work, we do not try to investigate the motives behind the market dynamics and identify fraudulent activity. Rather, we expect that our contribution of characterizing peaks, abandonments, and the overall dynamics of the market might spur further investigations in this vein.

4 Methodology

We first describe the data sources used to investigate cryptocurrencies. Next, we describe how we identify peaks in trading volume and price, as well as when coins are abandoned and resurrected.

4.1 Data Sources

To examine the dynamics in the cryptocurrency industry, we gather publicly available data on coins and tokens from `coinmarketcap.com`. The website lists all cryptocurrencies that reports pricing and 24-hour trading volume via a public API.[7] The available data for each cryptocurrency includes daily summary values for the open, high, low, and close prices, trading volume, exchanges, and market capitalization. All monetary values reported by `coninmarketcap.com` are given in USD. We collected data on 1 082 coins and 725 tokens spanning from February 2013 through February 2018. This is, of course, an unbalanced panel.

Even though coins and tokens appear to be interchangeable, the number and types of differences that exist warrant separate analysis and data collection efforts. The large body of cryptocurrency coins have a singular purpose and that is to replace fiat currency as a store of value. These coins can be bought, sold, and traded for goods or services. These transactions typically occur on a cryptocurrency exchange. Similar to coins, tokens can be bought and sold on a cryptocurrency exchange. Unlike coins, the primary use of a token is to provide funding for a blockchain-based project. This funding typically occurs through a pre-sale referred to as an initial coin offering (ICO)[8]. Because of this link to a project, tokens typically provide additional utility to its holders in the form of early access, platform rewards, or financial incentives based on project performance. The additional utility might make tokens more useful and therefore less prone to abandonment. Because of this extra utility, we split the data analysis by coins and tokens.

4.2 Identifying Early-Stage Coins and Tokens

Because currencies appearing on `coinmarketcap.com` are already being traded, this data excludes cryptocurrencies that have been announced but not yet traded. In order to identify when coins fail prior to public launch, we gather supplemental data from the altcoin announcements forum on `bitcointalk.org`. Historically, new coins were announced here. We crawl the forum and consider all announcements which had the term "coin" in them and did not reference a token platform such as Bitcoin, Waves, or Ethereum. We also throw out posts referring to coins that appear on lists of tokens. We consider the timestamp of the first post for a given coin as the announcement date.

After crawling 12 794 posts on bitcointalk, we find 2 361 different cryptocurrencies announced on the altcoin announcements section from January 2014 through September 2017. Of these currencies, only 346 later appeared on `coinmarketcap.com`. A whopping 85% of announced currencies on bitcointalk fail before ever becoming publicly traded. Figure 7 shows this trend over time. Many new currencies were introduced on the Bitcoin forums during 2014, however most never made it to be publicly traded. Note that in 2014, it was easy to create your own alternative currency using the now-defunct `coingen.io`. This service, which was less than

[7] This is true as long as at least one such API reports positive trade volume.

[8] This term is particularly confusing because only tokens have ICOs, not coins.

$100, created clones of Bitcoin's code with a few changed parameters. However, as many of these currencies failed to trade publicly, this fad died off.

To provide a complete view of tokens that do not reach the stage of trading on exchanges, we gathered token ICO data from four sources: FoundICO, ICORating, ICObench, and TokenData. Through the examination of a combined 8 305 ICO records, we found that most tokens, like coins, never make it to `coinmarketcap.com`. Only 11% of the tokens in the data were eventually listed on an exchange.

Therefore, the analysis in this paper can be interpreted as studying the rise and fall of the most successful cryptocurrency coins and tokens.

4.3 Identifying Peaks, Abandonments, and Resurrections

In order to say something about exits we need to identify peaks in volume. This is because trade in marginal cryptocurrencies can be dormant for many months only to increase again when investment surges in the industry. We are also interested in identifying price peaks since they indicate the potential profits or losses that may result from trading.

We begin by identifying "candidate" price and volume peaks for each cryptocurrency. We define a candidate peak as a day in which the 7-day rolling average value is greater than any value 30 days before or after. In order to identify only those peaks with sudden jumps in value, we define a candidate as a peak that satisfies two additional criteria:

- The candidate peak value must be greater than or equal 50% of the minimum value in the 30 days prior to the candidate peak.
- The candidate peak value must be at least 5% as large as the currency's maximum peak.

We then use our resulting peak data to define cryptocurrency abandonment. We compare each of the peak values to all of the succeeding daily volume values for each cryptocurrency. We define abandonment as follows:

- If the daily average volume for a given month is less than or equal to 1% of the peak volume, the currency is considered *abandoned*.

Unlike other industries, where exit is a "one-way road," currencies don't necessarily stay "dead" when they are abandoned. If the average daily trading volume for a month following a peak is greater than ten percent of the peak value and that currency is currently abandoned, then its status changes to *resurrected*.

Two examples of currency abandonment and then resurrection are shown in Figure 1. VeriCoin was established in mid-2014, reached an early peak volume of $1.5 million, but then was promptly abandoned within a few months. Nearly two years later, in mid-2016, volume jumped slightly, but to less than 10% of the prior peak value. Then, in the spring of 2017, the currency was resurrected, eventually reaching a trading volume more than 15 times greater than its first peak volume of $1.6 million.

MaxCoin began trading in early 2014 and quickly reached a peak volume of $2.7 million before becoming abandoned less than four months later. The cryptocurrency was resurrected during the 2017 period of massive growth. During this period peak trading volume did not reach its initial peak value, however, it came close at $1.8 million at its highest point. It was once again abandoned in October of 2017. The last abandonment of the currency appears to be a permanent abandonment as it has not yet been resurrected in 2018.

5 Results

In Section 5.1, we discuss summary measures of peaks for both coins and tokens, followed by abandonment and resurrection in Section 5.2. We then analyze coin market dynamics over time in Section 5.3 and token dynamics in Section 5.4. We identify similarities and differences between coin and token dynamics in Section 5.5.

5.1 Coin and Token Peaks

Nearly all currencies had at least one price and volume peak. 1 068 (out of 1 082 total) coins had price peaks, yielding a total of 3 508 peaks across all currencies. Furthermore, 1 076 (out of 1 082 total) coins experienced volume peaks, yielding a total 3 828 total peaks across all currencies. Applying the peak algorithm to the token

data reveals 1 299 price peaks involving 701 tokens, and 1 426 volume peaks covering 706 tokens. Consistent with coins, nearly all of the 725 tokens in the dataset saw at least one price and volume peak.

In a constantly-expanding environment with so many coins and tokens, it is no surprise that only a small number attract large numbers of transactions, while many never catch on. In order to study characteristics of the entire ecosystem while recognizing vast differences in popularity, we binned the coins and tokens into different size groups based on total transaction volume.

Table 1 reports summary statistics on many key measures reported throughout this section, listing both overall measures and figures split by these size groups. In the first row, we can see that just 57 coins report total transaction volume exceeding $1 billion. Most coins are much less popular: 374 have traded less than $1 million total, while another 344 have traded between $1–$10 million. In other words, two thirds of coins report less than $10 million in total trading volume.

Unsurprisingly, these smaller coins account for the majority of observed price and volume peaks, as indicated in the table. However, the number of volume and price peaks per coin is quite consistent regardless of coin size. The median number of price and volume peaks is each 3, and this number varies only between 2 and 4 for each size category.

We see a slight difference for tokens: whereas most coins had trading volume under $1 million, tokens had consistently higher trading volumes. The single largest group was tokens between $1–$10 million, but the trend persisted across larger categories, all the way to the top. 71 tokens have an aggregate trading volume over 1 billion USD, compared to 57 coins.

What more can we say about these peaks? The first peak after launching is important because it represents what early backers of coins stand to gain by getting behind the coins before the general public can participate. The median time to the first peak in trade volume is just 40 days, and the median increase in trade volume from the first trading day to the first peak is 3 714%. For price peaks, the median jump in price from a coin's launch to the first peak is 749%. This means that half of coin backers see at least a seven-fold rise in price by the time the first peak is reached.

For tokens, the time to the first volume peak is longer (59 days) and smaller than for coins (though still an impressive 1 399% increase). Likewise the price jump is also lower for tokens – a median first price rise of "just" 279%.

Breaking down the initial price and volume peaks by coin size is quite telling. Smaller coins experience a much smaller price and volume rise than larger coins. For coins under $1 million total trade volume, the median price jump is "only" 418%. For the 57 coins with eventual trading volume of more than $1 bilion, the median price rise for the first peak is 3 441%! The median jumps in volume are even more extreme, with a 90 530% rise for the biggest coins compared to 917% for the smallest coins. We of course recognize that the biggest coins are more likely to also be the ones with the bigger jumps, these figures do quantify just how extreme these differences are. It also points to the possibility that investors may be attracted to coins experiencing bigger initial increases.

Figure 2 (top) examines the relationship between when a coin is launched and the magnitude of the initial peak after launch. The top left graph plots the median percent price rise based on the coin's launch year. Overall, coins launched in 2015 enjoyed a median initial price jump of over 1 700%. This fell steadily, to 1 075% in 2015 and 370% for coins launched in 2017. Coins with higher transaction volume fared even better, with the median initial price rise peaking at over 9 000% in 2016.

The initial volume jumps shown in Figure 2 (top right) show a slightly different story. Median percentage jumps for the first volume peak were consistently higher than for prices, but stayed relatively level for coins launched in 2014–16. The median initial volume rise fell sharply in 2017, however. Taken together, these figures indicate that jumps in trading volume are very high, while initial price peaks have moderated somewhat.

The bottom plots in Figure 2 repeat the analysis for tokens. The effect is similar to coins but attenuated. Initial price and (to a lesser extent) volume increases for tokens launched later on have decreased slightly compared to those launched earlier. This suggests that for both coins and tokens, the financial opportunities become a bit less lucrative as more participation grows.

We now more closely examine the distribution of the size of both the rise and fall surrounding all peaks. Recall from our definition that a peak must be at least 50% of the minimum value of the 30 days prior to the peak. We now consider just how big those rises tend to be, as well as the magnitude of the resulting fall after the peak.

Table 1 Summary statistics on coin and token peaks, broken down by total trading volume per coin.

	overall	<$1M	$1–10M	$10–100M	$100M-1B	>$1B
# coins	1 082	374	344	183	124	57
# tokens	725	126	191	176	161	71
# coin price peaks (total)	3 508	1 426	1 022	531	376	153
# coin price peaks (median)	3	4	3	2	3	3
% coin price increase 1st peak (median)	749	418	583	999	1 936	3 441
# token price peaks (total)	1 304	246	331	294	295	138
# token price peaks (median)	2	2	2	1	1	2
% token price increase 1st peak (median)	279	233	281	201	295	608
# coin volume peaks (total)	3 828	1 734	1 064	468	406	156
# coin volume peaks (median)	3	4	2	2	3	3
% coin volume increase 1st peak (median)	3 714	917	1 561	6 915	24 992	90 530
# token volume peaks (total)	1 423	284	390	312	307	130
# token volume peaks (median)	2	2	2	1	1	2
% token volume increase 1st peak (median)	1 427	405	663	689	2 964	8 442

Figure 3 (top left) plots the 10th to 90th percentiles of the peak's percent price increase relative to the smallest price in the month prior.[9] The percentiles are further divided by coin size. For example, we can see that the median price rise during peaks ranges from 200 to 300%. While this is lower than those reported for the initial price rise in Table 1, this can be attributed to the fact that here we are computing the rise over just 30 days prior to the peak. The top 10% of price rises range from 1 100% for coins traded between $100M-$1B to nearly 3 000% for coins with $1-10M in trading volume. In fact, this trend is consistent throughout, with the second-smallest category rising fastest and the second-largest category rising slowest.

Figure 3 (top right), meanwhile, examines what happens after the peak. Since by definition the price must go down during the entire 30 days following the peak, we can quantify just how far prices fall. While there are differences across coin size (smaller coins fall farther), the most striking result is just how deep the falls are across the board. 9 out of 10 coins lose at least 40–50% of their value in the month following a peak. Half lose at least 60-75%. Even 10% of the biggest coins lose around 80% of their value within a month of reaching a peak.

The bottom two graphs in Figure 3 look at the distribution of the rises associated with peaks in trading volume. The bottom left graph clearly indicates that smaller currencies experience consistently bigger percentage increases in trading volume around peaks. This is unsurprising, given the lower starting base of trading volume in these smaller coins. Nonetheless the percentage increases are quite staggering. Note that the graph uses a logarithmic scale. The median volume jump ranges from around 1 500% for the most frequently traded coins to more than 100 times that for the coins with the lowest trading volume. For the coins with less than $1 million in total trading volume, more than 30% of the time, there were days with zero trading within a month of hitting a new peak volume level.

Finally, the decrease in volume after a peak is extreme. For all but the biggest coins, trading volume regularly falls more than 90% in the month following a peak.

Figure 4 examines the rise and subsequent fall surrounding all of the peaks discovered. Recall that for a point to be a peak the value must be, at a minimum, 50% greater than the lowest value in the previous 30 days. The top two plots show the distribution of the rise and fall associated with the peak's trading price.

[9] For this analysis we exclude any price or volume rises from peaks occurring in the first week of a coin's operation, as well as any falls within the last week of its operation. This is to deal with edge effects from the 7-day rolling average used to compute peaks.

Beginning with the top left plot, the 10th to 90th percentiles of the peak's percent increase relative to the smallest value in the previous 30 days is shown[10]. To better understand movements of tokens with different popularity, data was further divided by the same coin size used in Table 1. The top 10% of price increases range from 812% for tokens with a total trading volume between 100 million USD and 1 billion USD to 1904% for tokens with a total trading volume less than 1 million USD. Within the coin data the second smallest group always grew the fastest within each subset, and the second largest group grew the slowest; the same cannot be said for tokens. For a majority of the data the smallest group realizes the largest increases, and the middle group sees the slowest growth.

The top right plot in Figure 4 shows the fall that occurs following a peak. It can be seen that the smallest tokens always fall farther than the other groups. Nine out of 10 tokens lost more than 40% of their value in the 30 days following a peak. Furthermore half of all coins lost 60-70% of their value shortly after a peak.

The bottom row of plots in Figure 4 shows the movements around volume peaks instead of price. The plot on the left shows that the group with the smallest total trading volume almost always experiences the largest volume increase leading up to a peak. Median increases range from 248% for the middle subset of total trading volume to over 1 000 times that for the tokens with the second highest aggregate trading volume. Only 2% of the tokens in the dataset saw their volume drop to zero following a volume peak.

Finally, similar to the percentage price decreases following a peak, volume decreases post peak are extreme. For almost every coin group, trading volume falls more than 80% in the 30 days following a peak.

5.2 Coin and Token Abandonment and Resurrection

Despite huge price and volume rises, interest in many coins is not sustained. As shown in Table 2, we found that 475 coins, or 44% of the total listed on `coinmarketcap.com`, were abandoned at least once according to our definition of average daily trading volume falling below 1% of the coin's peak level in a given month. Of those 475 coins, 336 were "resurrected", that is, a previously abandoned currency's average daily trading volume rises to 10% of a prior peak value.

By contrast, only 7% of tokens experienced an abandonment. Of the 54 tokens abandoned, 41% (22) were resurrected. The low number of abandonments and resurrections per coin suggests that large token price movements occur over a much longer period of time ($>$ 30 days) instead of rapidly as seen within the coin dataset.

There were a total of 642 cases of coins being abandoned and 452 resurrections. That is, some coins were abandoned or resurrected more than once. Figure 5 shows the number of abandonments (left) and resurrections (right) per coin based on trading volume. Most coins are abandoned just once, but a few are abandoned more often. Most multiple resurrections occur with smaller coins. Overall, tokens experience fewer abandonments and resurrections.

A coin's total trading volume is associated with its potential for abandonment. As shown in Table 2, 64% of coins with less than $1 million trading volume are subsequently abandoned, compared to just 26% for those coins with trading volume between $100 million and $1 billion. Notably, no coins with total trading volume in excess of $1 billion have been abandoned. Similar trends follow for resurrection. Lower-volume coins are more likely to be resurrected than higher-volume ones.

On average, abandoned coins disappear within 7.5 months of reaching their first peak (4 month median). Tokens are abandoned a bit faster, within 5 months of reaching their peak value with a 2 month median. So when coins and tokens fail, it can happen quickly. Resurrection takes a bit longer, with a 6 month median overall. In addition to being less likely to resurrect, higher volume coins take longer to do so. The median time to resurrection for coins with more than $100 million in trading volume is 19 months.

For a closer look at the time to abandonment and resurrection, we compute survival probabilities using Kaplan Meier estimators, as shown in Figure 6. This enables us to empirically estimate the time from launch to abandonment using the duration of all coins, even those that have not been abandoned. Overall, the median time to abandonment for coins is 547 days. The time to abandonment varies considerably with the coin's total trading volume. For lightly-traded coins under $1 million, the median time from launch to abandonment is just 242 days. By contrast, for coins traded between $100 million and $1 billion, the median time to abandonment

[10] For this analysis we exclude any price or volume rises from peaks occurring in the first week of a coin's operation, as well as any falls within the last week of its operation. This is to deal with edge effects from the 7-day rolling average used to compute peaks

Table 2 Summary statistics on coin and token abandonment and resurrection, broken down by total trading volume per coin.

	overall	<$1M	$1–10M	$10–100M	$100M-1B	>$1B
# coins	1 082	374	344	183	124	57
# tokens	725	126	191	176	161	71
# coins abandoned	475	239	154	50	32	0
% coins abandoned	44	64	45	27	26	0
# abandonments	642	347	192	62	41	0
days abandoned (median)	182	153	184	242	426	—
# tokens abandoned	53	22	21	6	3	1
% tokens abandoned	7	17	11	3	2	1
# abandonments	57	25	22	6	3	1
days abandoned (median)	328	341	300	288	390	182
# coins resurrected	336	183	103	25	25	—
% coins resurrected	71	38	27	13	19	—
# resurrections	452	261	135	30	26	—
months to resurrection (median)	6	5	6	10	19	—
# tokens resurrected	22	7	10	3	1	1
% tokens resurrected	42	5	5	2	1	1
# resurrections	23	8	10	3	1	1
months to resurrected (median)	3	3	3	2	3	2
# coins permanently abandoned	190	86	57	32	15	0
% coins permanently abandoned	18	23	17	17	12	0
# tokens permanently abandoned	34	17	12	3	2	0
% tokens permanently abandoned	5	13	6	2	1	0

is 1 249 days, or around 3.5 years. Note, once again, that no coins with trading volume in excess of $1 billion have been abandoned.

While fewer tokens are abandoned than coins, when tokens are abandoned, it happens more quickly. The median time to abandonment for tokens is a much shorter 184.1 days, about a year faster than for coins. We see a similar trend of variation by token trading volume, with lower-volume coins abandoned more quickly than higher-volume ones.

The right graphs in Figure 6 shows the estimated time to resurrection. A few trends are apparent. First, the time to resurrection is shorter than the time to abandonment for both coins and tokens. Overall, the median time from abandonment to resurrection is 6 months for coins, but 3 months for tokens. While there is variation between coin and token sizes, these differences are smaller in magnitude and not statistically significant.

Ultimately, 190 coins (18% of the total) and 34 tokens (4.7%) were abandoned at the end of our inspection period. In fact, these figures understate considerably the ultimate rate of failure. In April 2020, we checked all coins and tokens to determine whether `coinmarketcap.com` had subsequently marked them as inactive, which they do whenever the coin or token is no longer traded at a reputable exchange. 547 coins (48%) and 187 tokens (26%) were now labeled as inactive. That is a strikingly high abandonment rate, especially for coins.

5.3 Coin Dynamics

During 2017 the combined market cap of all cryptocurrencies increased very significantly due to the meteoric rise in the prices of virtually all cryptocurrencies, as shown in Figure 10. During this meteoric rise, others have

tried profiting off the increased interest in cryptocurrencies by issuing their own coins. Some improved existing protocol's deficiencies as they saw them (such as the Turing-complete Ethereum and the anonymous ZCash), while others simply tried to "ride the wave" of its success, providing an entrance to the ecosystem. This has led to an explosion of new currencies being minted. Furthermore, interest in altcoins (as measured by coin price and trading volume) also fluctuates with broader interest in Bitcoin.

This trend picks up when there is a significant increase in the price of Bitcoin and other major cryptocurrencies. This is most visible during the price hike of bitcoin at the end of 2013, when it reached more than $1 000. When prices went back down, the pace of coins being added and invested in went down with it. The same is true for the bull market in 2017 which continues until Bitcoin's peak of more than $19,000 in December 2017: prices, trading volume and the rate of new coins increased substantially.

Figure 8 plots the number (top) and proportion (bottom) of active coins (i.e., those not abandoned) that experience a price or volume peak each month over time. Unsurprisingly, the graph shows significant correlation between the number of price and volume peaks. In any given month between 2014 and 2016, 10–20% of coins reported a peak in volume or price. In 2017, the trend accelerated significantly, with 60% of coins reaching a peak in June 2017, and over 90% of coins peaking in January 2018.

The relationships between bitcoin price, coin creation, abandonment and resurrection are visible in Figure 9. Using the heuristics we develop on coin abandonment and resurrection, we examine market dynamics in this ecosystem.

Intuitively, during a period of rapid price hikes, more competing currencies are being minted. Benefiting from traders' exuberance, they enter circulation in noticeable volumes. However, when markets calm and prices fall, some currencies are abandoned.

Taking this to the data, we would expect the share of altcoins being abandoned would lag the trend in prices. Well-established currencies such as Bitcoin might endure the volatility of cryptocurrency markets (and indeed we have found that no currencies with more than $1 billion in trading volume has been abandoned). However, a new currency which doesn't yet have a substantial number of users holding it will likely suffer from the network effects that push activity towards bigger, more widely accepted, cryptocurrencies. This might lead to an increase in the number of coins entering the market as well as the number of coins being abandoned.

What does the data actually show? The top graph in Figure 9 illustrates the churn, with the number of newly introduced and abandoned coins per month. In early 2014, many coins were introduced, followed by a spike in abandonments later that year. The rate of both introduction and abandonment stayed relatively constant in 2015 and early 2016, before rising markedly in 2017. The next graph looks at resurrection and the daily transaction volume over time. Here, there is a fairly strong correlation: rates of resurrection are flat through 2015, slowly picking up in 2016 before accelerating rapidly in early and late 2017. As more people trade cryptocurrencies, it makes sense that more people would seek an opportunity to invest in previously abandoned coins.

The next two graphs in Figure 9 show how the rate of introduction and abandonment impact the overall number of coin offerings over time. The solid black line in the third graph plots the number of coins currently active in a given month, while the dashed line plots the number of presently abandoned coins in a given month. The trend shows a steadily increasing number of active coins, and a lesser number of abandoned coins with a spike in late 2017. To see the impact of the spike, look at the next graph plotting the fraction of coins each month that are currently abandoned. In early 2015, nearly 40% of coins were marked as abandoned. That proportion has steadily declined in the time since, with considerable fluctuation. By January 2018, following 2017's build-up of interest in cryptocurrencies, only around 20% of coins were still abandoned.

The last graph plots the BTC-USD price on a logarithmic scale. Notably, spikes in activity in the graphs above frequently coincide with peaks in the BTC-USD price.

To dig a bit deeper, in Table 3 we provide correlations between the key variables in the ecosystem using monthly data. These correlations reveal two key trends in the market.

- As expected, resurrection is highly correlated with the number of price and volume peaks (0.85 and 0.90 respectively). This suggests that many of the resurrected coins are riding "the wave" created by the huge increase in the cryptocurrency market. Additionally, trade volume (0.75) and the log-transformed BTC-USD price (0.71) are both positively correlated with resurrection (0.75)[11].
- There is a high positive correlation (0.61) between the number of coins abandoned and the number of new coins created, suggesting that new coins are created to fill gaps left by coin abandonment. Thus, despite the general upward trend in prices, volume, there appears to be some competition between coins. This also

[11] See Figure 9 for a graphic representation of the latter correlation.

Table 3 Monthly correlations between key variables in the coin ecosystem.

	# Coins Abandoned	# Coins Resurrected	# Coins Created	Trade Volume	log_{10}(Average BTC Price)	# Price Peaks	# Volume Peaks
# Abandoned	1						
# Resurrected	0.2080	1					
# Created	0.6107	0.3858	1				
Trade Volume	0.0695	0.7512	0.0959	1			
log_{10}(Average BTC Price)	0.5321	0.7078	0.5053	0.7996	1		
# Price Peaks	0.2756	0.8504	0.4515	0.6524	0.6798	1	
# Volume Peaks	0.3795	0.9007	0.5013	0.7072	0.7756	0.9721	1

suggests that there is substitutability among some of the coins. Thus, it is not the case that a "rising tide" is lifting all cryptocurrencies.

Figure 9 illustrates these effects visually. The top plot shows that coin abandonment and creation have similar trends over time. The second from the top plot shows the coin resurrection trend. We can see that coins start to be resurrected after there are sufficient dead coins. After that point, resurrection tracks the rest of the other trend lines. What seems to explain all of the currency trends is shown on the bottom plot – the bitcoin/USD trading price over time. Bitcoin is the market leader and still sets the trend for all of the other coins. This is supported by the relatively high correlation values among all variables and the log transformed BTC-USD price.

5.4 Token Dynamics

As shown in Figure 10, unprecedented growth was seen in all tokens at the end of 2017. This was in part due to an impressive increase in the price of all cryptocurrencies at the time, which was driven by the popularity of Bitcoin. With this growth came new and diverse offerings trying to "ride the wave" of success.

Similar to the growth of coins during the same time period, the trend of token creation follows the fluctuations in the price of Bitcoin. When the price is high more tokens are released and when the price falls new token issuance slows. This movement is explained in greater detail later in this section with Figure 12.

The two plots in Figure 11 show a significant correlation between the number of price and volume peaks each month. Unlike the coin peak activity which saw an almost constant number of peaks between 2014 and 2016, the bottom graph shows tokens experience price and volume peaks much more infrequently. However, the longterm number and percentage growth mirrors that of coins for the same time period. The number of peaks for both price and volume are initially low but increase rapidly beginning in mid-2017 ending the dataset with around 50% of tokens experiencing both price and volume peaks.

The relationship between Bitcoin price, coin creation, abandonment, and resurrection are visible in the plots found in Figure 12.

Similar to coins, tokens benefit from cryptocurrency's popularity and typically enter the market with substantial trading volume. However, unlike coins, token trading volume can initially be pushed even higher through the use of an initial coin offering (ICO). Following this spike when the popularity inevitably declines the markets correct and already low token prices fall further. This activity occasionally results in the token becoming abandoned. Token abandonment is expected to lag behind the price trend. Certain tokens seem to endure periods of low trading activity as very few tokens in the largest ($>$ 1 billion USD) aggregate trading volume group have been abandoned.

The top plot in Figure 12 shows the differences over time within the number of newly created and abandoned tokens per month. Abandonment is relatively flat throughout the entire time window only slightly increasing when the number of coins created increases rapidly in 2017. Token creation was also fairly flat until early 2017 when the price of Bitcoin began to rise.

The second plot from the top examines the rate of coin resurrection per month and the daily transaction volume over time. There is a substantial correlation between the two: token resurrection remained flat through 2016 and rose at the end of 2017. This implies that as more money enters the cryptocurrency ecosystem investors seek out opportunities with significant upward potential.

Table 4 Monthly correlations between key variables in the token ecosystem.

	# Tokens Abandoned	# Tokens Resurrected	# Tokens Created	Trade Volume	log_{10}(Average BTC Price)	# Price Peaks	# Volume Peaks
# Abandoned	1						
# Resurrected	0.47	1					
# Created	0.75	0.78	1				
Trade Volume	0.35	0.72	0.71	1			
log_{10}(Average BTC Price)	0.65	0.75	0.81	0.90	1		
# Price Peaks	0.37	0.75	0.85	0.78	0.67	1	
# Volume Peaks	0.48	0.80	0.91	0.83	0.77	0.99	1

The next two plots in Figure 12 show how the rate of abandonment affect the overall number of token offerings over time. The middle plot shows the number of available tokens increasing at a steady pace, and although it appears to be flat the number of abandoned tokens is also rising just at a much slower pace. Because the total number of tokens abandoned at one time never exceeds 10 its difficult to see any real decrease in the number of active tokens.

The final plot shows the USD price of Bitcoin over time on a logarithmic scale. Increases on this plot regularly coincide with points of interest on other plots in this figure.

To further explore the relationships between these variables the correlations between were calculated and are displayed in Table 4. Through close examination of the coefficients in this table a few key trends emerge.[12]

5.5 Comparing Coin and Token Dynamics

Comparing the two correlation tables, there are several similarities between coins and tokens:

- Like coins, there exists a high positive correlation between token abandonment and tokens created (0.75 for tokens vs. 0.61 for coins), suggesting that new tokens are created to fill the void left by abandoned tokens.
- Again, similar to coins, resurrection is highly correlated with price (0.75 for tokens vs. 0.85 for coins) and volume peaks (0.80 for tokens and 0.90 for coins). This suggests that, like coins, many of the tokens are "riding the wave" created by the huge increases within the cryptocurrency market.

There are also some striking differences between coins and tokens.

- Overall, we find that 44% of publicly-traded coins are abandoned, at least temporarily. 71% of abandoned coins are later resurrected, leaving 18% of coins to fail permanently.
- Tokens experience abandonment much less frequently, with only 7% abandonment and 5% permanent token abandonment at the end of the data.
- In the case of tokens, the correlation between creation and trade volume is very high (0.71) while the same correlation is very low (0.10) for coins.
- In the case of tokens, the correlation between abandonment and trade volume is relatively high (0.35) while the same correlation is much smaller (0.07) for coins.

The results involving the similarity between coins and tokens suggest that this "young" industry is characterized by a great deal of entry and exit, but winners and losers emerge even in early stages. Regarding the second set of results, one possible interpretation of these results is that that "product" or "service" innovation (via tokens) has less churn (fewer abandonments and resurrections) than innovation in coins. Further this "product" or "service" innovation occurs when there is a lot of economic (trade) activity. In the case of coins, this effect is absent.

5.6 Regression Analysis

It is insightful to go beyond correlations among the variables. In this section, we run regressions to examine whether market variables are significant drivers of either creation or resurrection for both coins and tokens.

[12] Many of these trends can be seen in Figure 12. The Bitcoin price was again included as the bottom plot of this figure because it continues to be the market leader and set the trend for other cryptocurrencies. These Bitcoin backed trends are apparent through the examination of high correlations found involving the log transformed Bitcoin price in Table 4.

Table 5 Regressions examining how market dynamics affect coin and token creation and abandonment

	Dependent Variable					
Independent Variables	Coins Created	Coins Resurrected	Coins Resurrected	Tokens Created	Tokens Resurrected	Tokens Resurrected
BTC Price	-0.000885	.003813***	–	0.00271**	.000225***	–
	(-1.44)	(8.42)		(3.30)	(7.71)	
Total Volume	–	–	1.68×10^{-6}***	–	–	9.79×10^{-8}***
			(8.81)			(7.57)
Volume Peaks	0.0663***	–	–	0.261***	–	–
	(3.85)			(7,67)		
Constant	16.9	2.45	4.30	2.56	0.0816	0.200
	(10.8)	(1.55)	(2.97)	(1.32)	(0.77)	(1.97)
N	51	51	51	48	48	48
R^2	0.282	0.591	0.613	0.853	0.564	0.555

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We examine the monthly data that was presented graphically in Figures 9 and 12. In the case of coins we have monthly data from December 2013 through February 2018. Hence, there are 51 observations. In the case of tokens, our data begins three month later. Hence, we have 48 observations. Our dependent variables in the regressions are respectively:

- The total number of coins resurrected during that month
- The total number of tokens resurrected during that month
- The total number of coins created during that month
- The total number of tokens created during that month

In the case of creation, all market variables are exogenous, since we did not use volume or price variables to measure creation. The following market variables are possible explanatory variables both in the case of creation and in the case of resurrection:

- Average Bitcoin price for the relevant month (BTC price)
- Average Trading volume for coins for the relevant month (Total Volume)

Although resurrection was defined at the coin level by volume of the coin, it is reasonable to view total coin volume, which is at the level of the market, as exogenous. This is because virtually all of the volume involves BTC and other high profile coins, not the marginal coins. Token volume is small, so it cannot be considered exogenous. Hence, in the case of resurrection, only the BTC price and Total Volume (for coins) are exogenous.[13]

However, there is a very high correlation between these variables (0.97 for tokens and 0.96 for coins), so we can only include one of them in a regression.

Given that background, we now examine regressions. The results are summarized in Table 5.

Resurrections In the case of coins, the regression with Total Volume as an explanatory variable has a slightly higher R squared than the one with BTC price as an explanatory variable (61 percent vs. 59 percent). In the case of tokens, the regressions have essentially the same R squared (56 percent).

Thus market conditions are moderate drivers of resurrection. Given these very small differences, it is not possible to conclude whether Total Volume or BTC price are driving resurrections. We now examine regressions with Creation as the dependent variable.

Creations When examining creation, we have two possible additional explanatory variables:

- Number of coins/tokens in the market that exhibited a volume peak during that month
- Number of coins/tokens in the market that exhibited a price peak during that month

[13] Tokens typically give access to a product or service. On the other hand, recent research has shown that during the period we analyze, Bitcoin is primarily used for speculative and criminal activity. Hence, it is very unlikely that tokens' life cycle (i.e., resurrection) affects Bitcoin's value - and thus it is reasonable to treat the BTC price as exogenous.

However, the number of peak prices and the number of peak volume peaks are highly correlated (0.99 for tokens and 0.97 for coins). Hence only one of these independent variables can be included in the regressions with Creation as the dependent variable.

The regression with coin creation as the dependent variable shows coin creation is less driven by market variables than resurrections. In the case of coins, only the number of volume peaks is significantly associated with creation. The estimated coefficient on the Bitcoin price is not statistically significant. The regression does not explain very much of the variation (28 percent) of the variation in coin creation.

In the case of tokens, both the number of peak volumes and BTC price are positively associated with issuance of new tokens, and their effects are quite statistically significant. These two variables together explain a great deal (85 percent) of the variation in creation rates for tokens.

Thus, in the case of coin creation, market variables do not drive the issuance of new coins. On the other hand, market variables are significant drivers in the case of token creation. This makes sense since tokens are associated with utility in a platform, while coins are more of a speculative instrument.

Finally, the goal of this paper was a broad, comprehensive study of both coins and tokens. The regression analysis in this section is in that spirit and does not examine what determines the success or failure of individual tokens, but rather examine what variables affect (1) the total number of tokens resurrected month by month and (2) the total number of tokens created during that month.

6 Bursting of the Bubble and Increased Competition

During the steep decline is Bitcoin prices in 2014, Gandal and Halaburda (2016) found that the trading prices of other cryptocurrencies fell when the price of Bitcoin fell Gandal and Halaburda (2016). Particularly, when Bitcoin fell from $1 151 on December 4, 2013 to $448 on April 30, 2014, Litecoin, the second most popular cryptocurrency at the time, fell from to $44.73 to $10.90. While the drop in Bitcoin was steep (-61%), Litecoin fell by 76%. From April 2014 through February 2016, the price of Bitcoin stayed virtually constant (it fell by 2%), while the prices of all the other top cryptocurrencies declined significantly in USD, with the declines ranging between 69% and 94%.

In the recent rise and fall of Bitcoin, the currency reached a peak value of $19 498 on December 17, 2017. In the fifty-two days following the peak (to February 6, 2018), Bitcoin declined to $6 955, which is a decline of 64%. In the 52 days preceding the peak, Bitcoin rose from $5 905 to $19 498.

Unlike the previous "rise and fall" at the end of 2013/beginning of 2014, other currencies behaved differently. Ethereum, for example, did not fall at all during the period in which Bitcoin fell by 64 percent. Similarly, Ripple fell by just 6%.

Some currencies declined steeply, similar to the same magnitude as Bitcoin. As Table 6 shows, of the top 14 coins, eight (including Bitcoin) declined steeply after Bitcoin's peak. Three coins declined slightly. In addition to Ripple, and Ethereum, Cardana declined by less than 20%. Two coins in the top-10, NEO and XLM, continued to rise even after the Bitcoin peak.

This is very different behavior compared to early 2014. In large part, this appears to be due to innovations by late entrant cryptocurrencies, which has led to a changing playing field. The changes show that Bitcoin's network effect and first-mover advantage may not be able to compensate for the fact that Ripple and Ethereum's platform have built complementary products onto the platform. Ethereum, for example, has applications outside of simply financial transactions, something that Bitcoin does not really have.

Furthermore, Ethereum used its own token, Ether, to create a decentralized marketplace for computing power and other services. Ripple focuses on sending global payments quickly (a few seconds per transaction) and cheaply.

These two platforms have cut into Bitcoin's market share. At the beginning of 2017, Bitcoin's market share was still above 80%. As of early February 2018, Bitcoin's share of the total cryptocurrency market had fallen to just 34 percent. Ethereum's market share was 20 percent, while Ripple's market cap was 10 percent. Even long after the bursting of the bubble (April 2020,) Bitcoin's market share was 64 percent, Ethereum's share was 9 percent, while Ripple had 4 percent of the market. This is quite different that the 94% Bitcoin had after the bursting of the first bubble.

And it is not just Ethereum and Ripple who are challenging Bitcoin: many other late entrant cryptocurrencies are creating platforms for the exchange of digital goods. We may be indeed increased competition in the cryptocurrency industry.

Table 6 Currency movement during different influential time periods.

Coin	Percent change during each time period			Percent change in 12/17 bubble		
	10/16 - 10/17	10/16-12/17	10/16-2/18	52 days prior	52 days following	all 104 days
Bitcoin (BTC)	774	2 861	972	239	-64	23
Ethereum (ETH)	2 519	6 018	6 119	134	2	137
Ripple (XRP)	2 201	8 389	7 837	269	-6	245
Bitcoin Cash (BCH)				446	-51	168
Cardano (ADA)				1 311	-14	1 108
Litecoin (LTC)	1 344	7 618	3 161	434	-58	126
NEO (NEO)	20 887	36 554	61 853	75	69	195
Stellar (XLM)	1 395	9 852	14 181	566	43	855
NEM (XEM)	5 162	16 692	11 564	219	-31	122
IOTA (MIOTA)				723	-59	234
Dash (DASH)	2 978	10 704	4 737	251	-55	57
Monero (XMR)	1 348	5 287	2 870	272	-45	105
Lisk (LSK)	2 686	5 553	8 075	103	45	193
Ethereum Classic (ETC)	941	3 310	1 542	227	-52	58
Qtum (QTUM)				174	-28	96
Bitcoin Gold (BTG)				117	-71	-38
Nano (XRB)				2 079	269	7 947
Zcash (ZEC)				117	-35	41
Steem (STEEM)	470	1 106	1 803	111	58	234
Bytecoin (BCN)	2 402	6 566	6 139	166	-6	149
Verge (XVG)	20 215	160 350	166 215	690	4	719
Siacoin (SC)	761	2 792	3 948	236	40	370
Stratis (STRAT)	12 465	26 702	15 328	113	-42	23
BitShares (BTS)	1 072	9 959	4 398	758	-55	284
Waves (WAVES)	948	3 673	1 179	260	-66	22
Dogecoin (DOGE)	382	2 602	1 518	461	-40	236
Decred (DCR)	3 941	9 609	6 779	140	-29	70
Hshare (HSR)				130	-64	-17
Ardor (ARDR)	1 518	7 350	2 908	360	-60	86
Komodo (KMD)				138	-27	74
Ark (ARK)				94	-36	24
DigiByte (DGB)	2 673	9 210	7 869	236	-14	187
PIVX (PIVX)	96 865	196 640	133 964	103	-32	38
ZClassic (ZCL)				137	1 683	4 134
Bitcore (BTX)				136	1	137
Syscoin (SYS)	2 451	5 217	4 165	108	-20	67
GXShares (GXS)				156	-16	116
MonaCoin (MONA)	12 268	44 501	10 345	261	-77	-16
Factom (FCT)	491	1 110	724	105	-32	39
ZCoin (XZC)	259	1 677	1 092	395	-33	232
ReddCoin (RDD)	2 152	5 824	10 889	163	86	388
Nxt (NXT)	747	9 446	2 075	1 027	-77	157
Neblio (NEBL)				-18	110	72
Vertcoin (VTC)	8 140	22 740	6 100	177	-73	-25
DigitalNote (XDN)	569	2 078	5 549	226	159	745
ZenCash (ZEN)				34	-10	20
Achain (ACT)				376	-14	307
Asch (XAS)				58	-35	4
Einsteinium (EMC2)	4 919	135 317	19 688	2 598	-85	294
Metaverse ETP (ETP)				-16	-64	-70
LBRY Credits (LBC)	223	783	527	174	-29	94
BitConnect (BCC)				122	-99	-98
Voxels (VOX)	73	1 484	486	814	-63	238
Steem Dollars (SBD)	9	1 069	198	972	-75	173
Elastic (XEL)				50	-45	-18
Rise (RISE)	4854	13 004	2 816	165	-78	-41
ATBCoin (ATB)				-44	-58	-76
Internet of People (IOP)				120	-65	-24
Regalcoin (REC)				-74	-97	-99
ATMCoin (ATMC)				0	27	27
Tezos (Pre-Launch) (XTZ)				237		
SegWit2x (B2X)				-80	-96	-99
InfChain (INF)				172	-59	12

We then examined in more detail the returns from the top 80 coins (in terms of trading volume) produced during the following three (52 day) periods, where returns are measured price changes in percentage terms.[14]

- Period I: From October 26, 2017 – Dec 17, 2017 (December 17 was Bitcoin's peak)
- Period II: From Dec 17, 2017 – Feb 6, 2018
- Period III: From Feb 6, 2018 – March 31, 2018

In period one (the euphoric period), we find that the median return was 174%. Nevertheless, during this period, 25% of the top 80 coins lost 18% or more. On the flip side, 25% of the coins earned a median return greater than 376%. The variance of the returns was extremely large. Bitcoin itself rose from $5,748 to $19,475.

In period two, when Bitcoin declined significantly (from its peak to $7 051), the median return was -32% and more than 75% of the coins had declines in value. Further, 25% of the coins lost more than 60% of their value. Nevertheless, 10% of the coins increased in value by 58% or more. The variance of the returns was an order of magnitude smaller than period one. The highest return during this period was 1 683%.

In period three, when Bitcoin remained virtually unchanged, the median return was -36%. More than 75% of the coins declined in value. 25% of the coins lost more than 60% of their value. More than 95% of the valuations fell. The variance was two orders of magnitude smaller than the variance in the second period. The highest return during this period was "only" 17%.

There is virtually no correlation between period I and period II returns, while the correlation between periods II and III is -0.41. This suggests that those coins that did not decline in the second period did so in the third period, and vice versa.

Total volume and market capitalization of the coins (as of May 15, 2018) are uncorrelated with first and second period returns. Total volume and market capitalization are, however, positively correlated with third period returns.

When we split these 80 coins into two groups (large trade volume vs. small trade volume and large market capitalization vs. small market capitalization), we find the following: the correlation between period III returns and volume/market cap is much higher for the more important coins, i.e., those with higher trading volume and market capitalization. The analysis suggests that investors/speculators became somewhat more selective in the third period.

7 Conclusion

In this paper, we provided a preliminary analysis of the dynamics in the cryptocurrency market and devised methods to identify peaks in trading volume and prices for over 1 000 coins and 700 tokens.

The high correlation between resurrection and exit for both coins and tokens suggests that there is competition between both coins and tokens. There is also evidence consistent with increasing competition: unlike the bursting of Bitcoin's first bubble in early 2014 (when nearly all coins fell further than Bitcoin), the aftermath after the bursting of the bubble in early 2018 there was a difference. Bitcoin's absolute dominance (more than a 90 percent market share through 2016) was reduced. It is possible that Bitcoin will likely face increased competition moving forward.

The difference between coins and tokens is especially interesting. The trends regarding abandonment that we identified during the 2014-2018 period continue to this day: 26% of the tokens we studied during the 2014-2018 period are currently (2020) listed as inactive by `coinmarketcap.com`. By contrast, 48% of the coins we studied are listed as inactive in 2020. It will be important for future research to continue to explore the difference in the dynamics between coins and tokens, as well as investigate why so many fall spectacularly after rising so high.

[14] We chose 52 day periods in order to have three periods to analyze: the rise, the fall, and the aftermath.

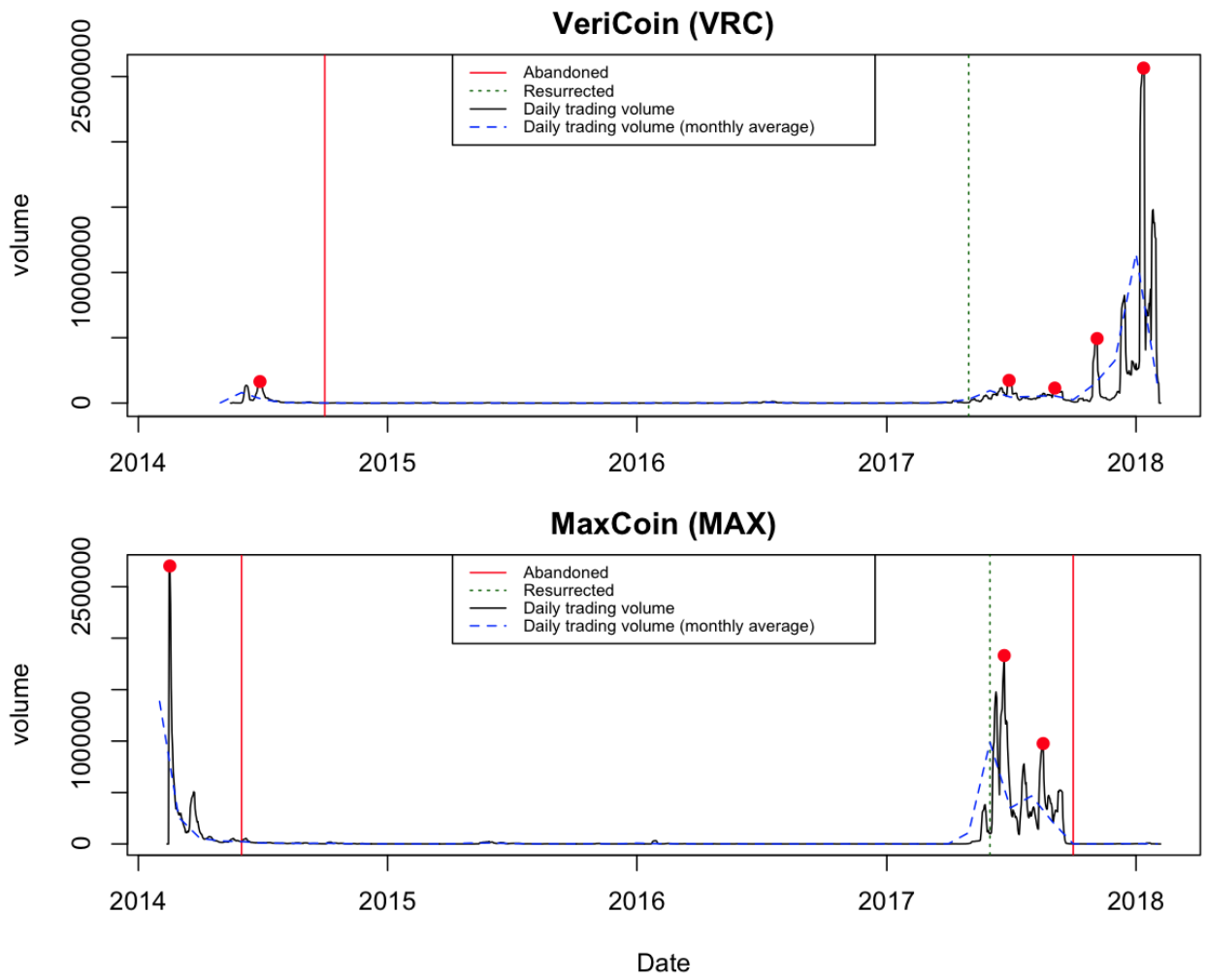

Fig. 1 Volume plot showing currency abandonment. Red dots indicate peaks.

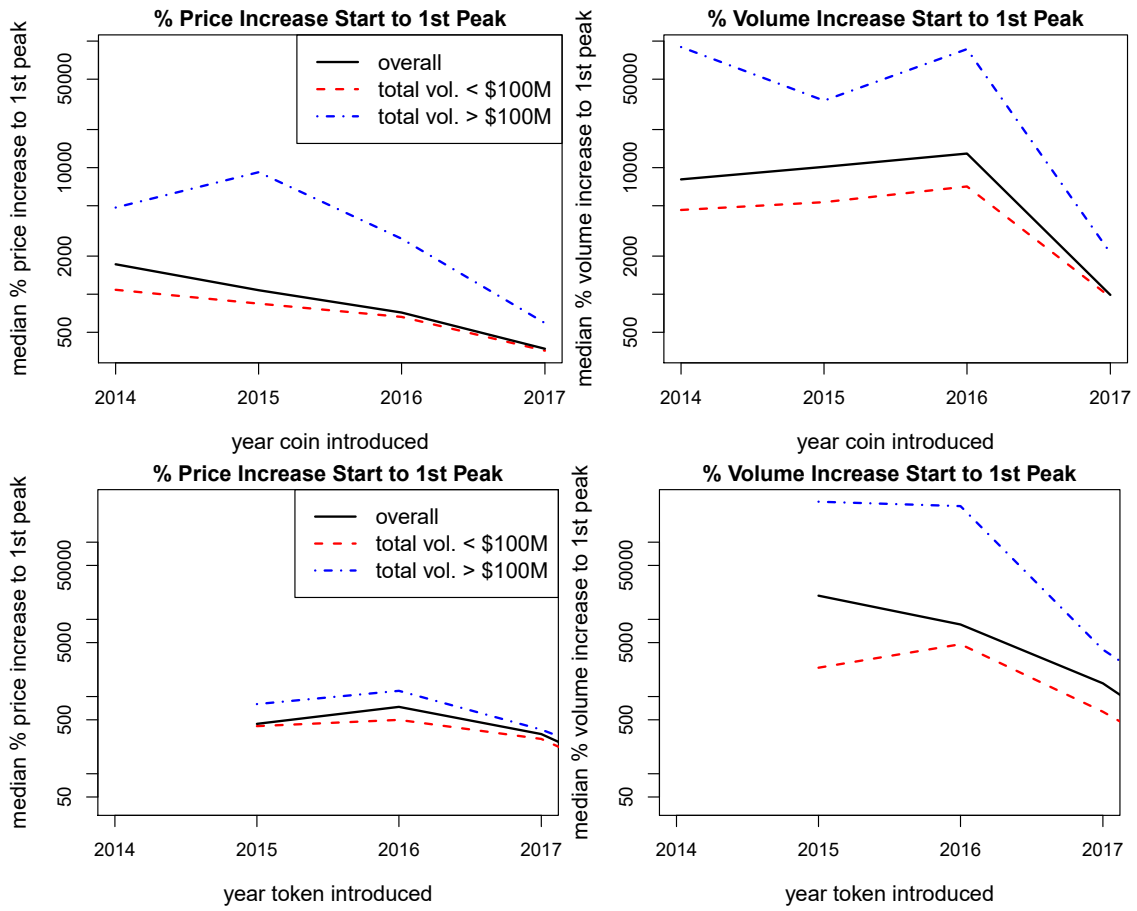

Fig. 2 Percentage price and volume increase from a coin/token's launch to first peak, based on the year in which the coin is launched and its size. (Note: the vertical axes are logarithmic.)

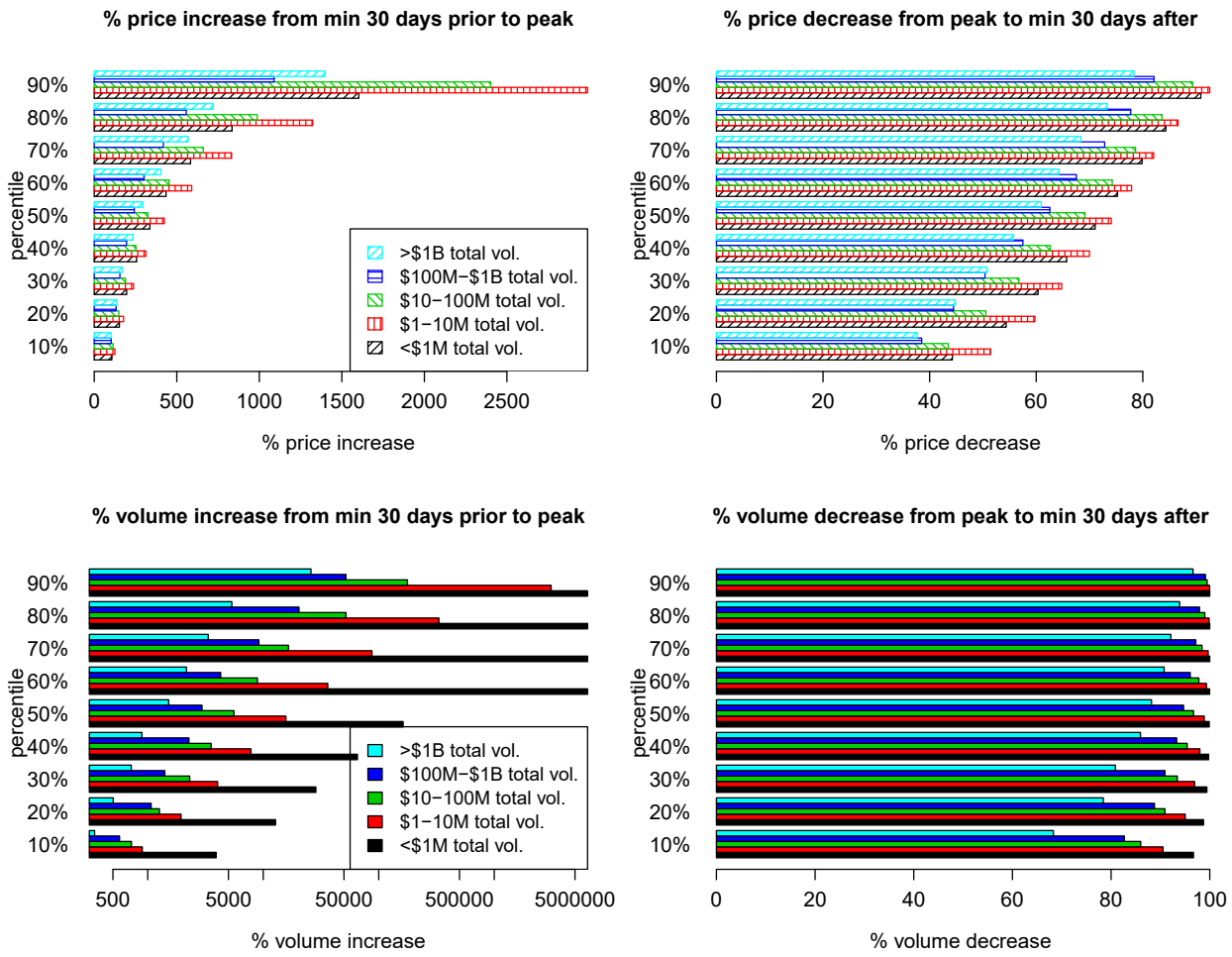

Fig. 3 COIN: Deciles of percent price and volume rises from the smallest value in the month prior to a peak to the peak itself (left graphs); deciles of percent price and volume falls from the peak to the smallest value in the month following the peak (right graphs).

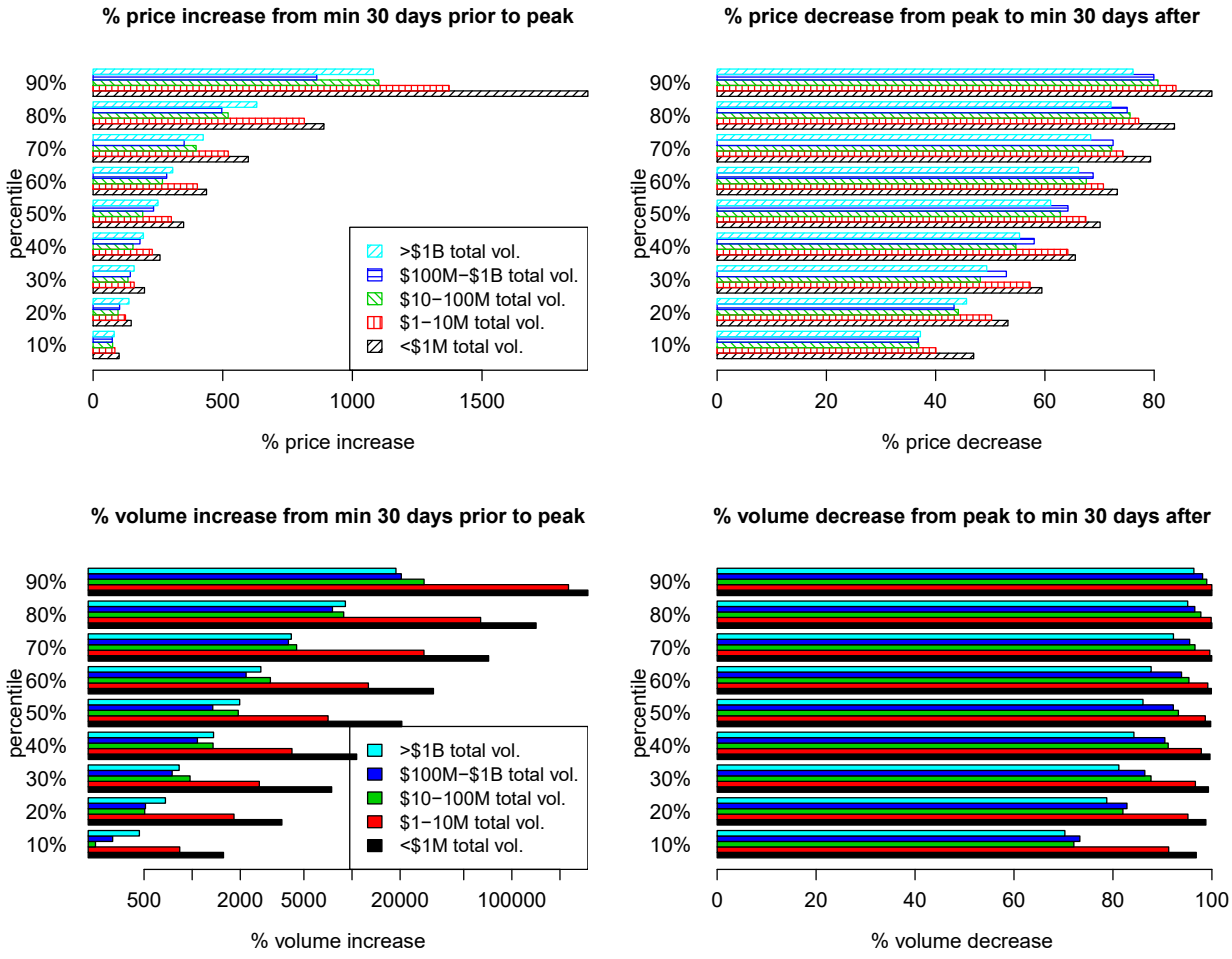

Fig. 4 TOKEN: Deciles of percent price and volume rises from the smallest value in the month prior to a peak (left graphs) and deciles of percent price and volume falls from the peak to the smallest value in the month following the peak (right graphs).

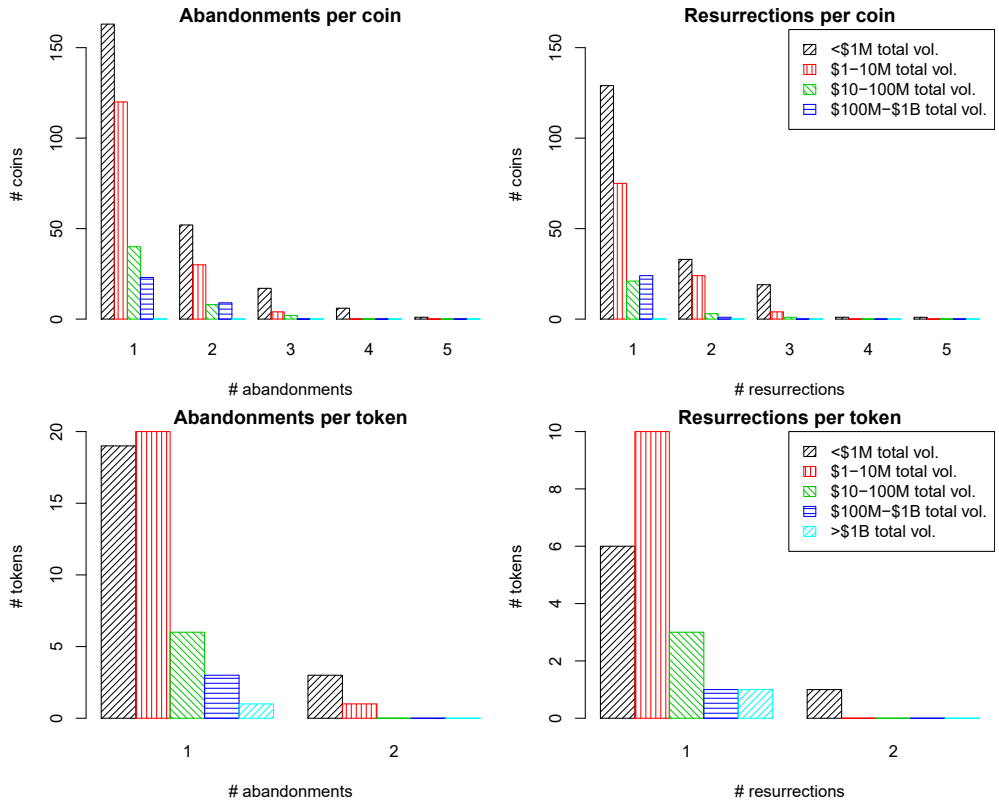

Fig. 5 Abandonments (left) and resurrections (right) per coin (top) and token (bottom), split by total trading volume.

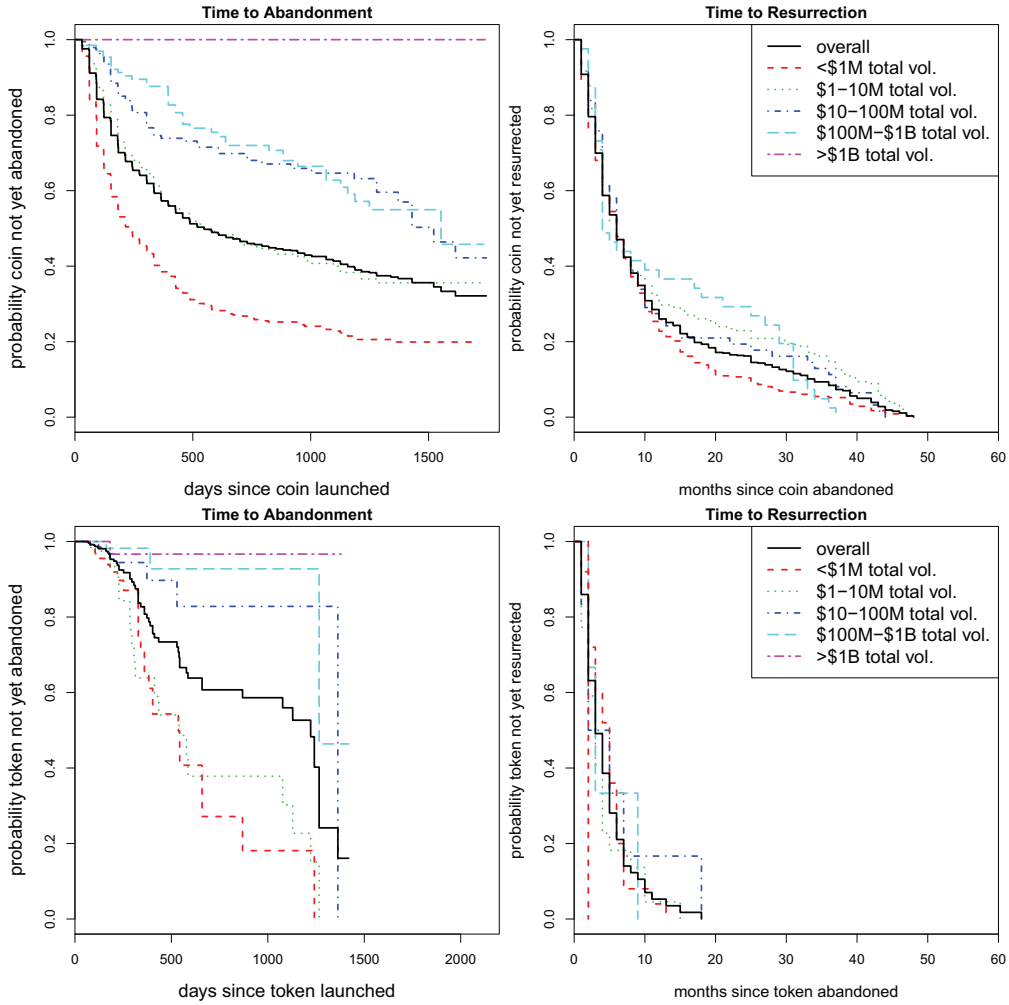

Fig. 6 Survival probabilities for the time to abandonment (left) and time to resurrection (right) for coins (top) and tokens (bottom).

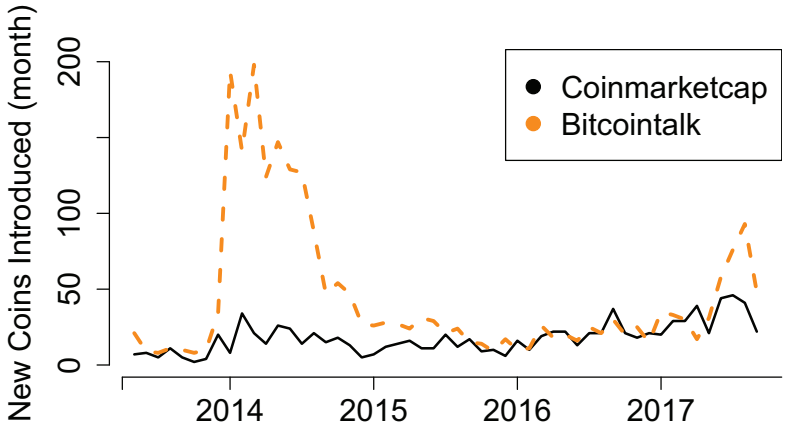

Fig. 7 COIN: New currencies announced on the Bitcoin Forums each month (orange) compared to new currencies traded each month (black).

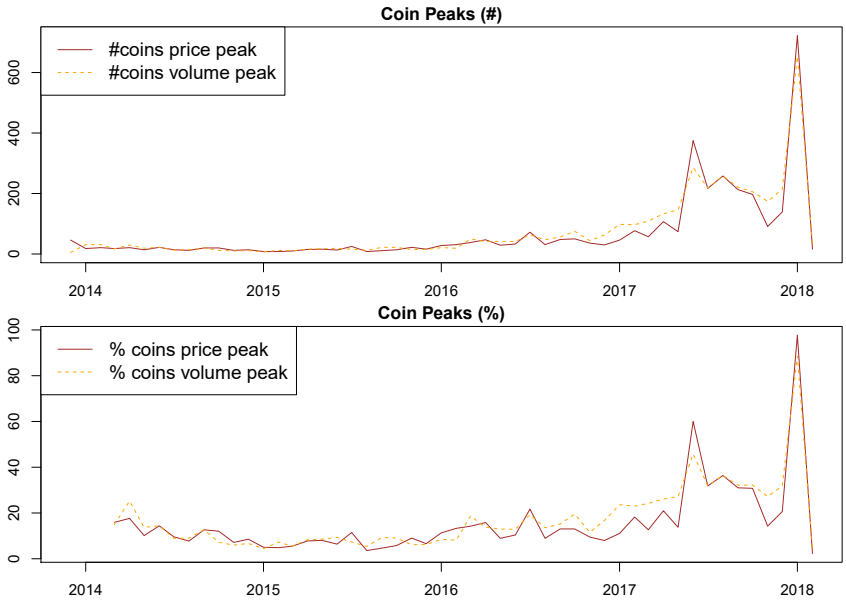

Fig. 8 COIN: Number (top) and percentage of active (bottom) coins experiencing price and volume peaks over time.

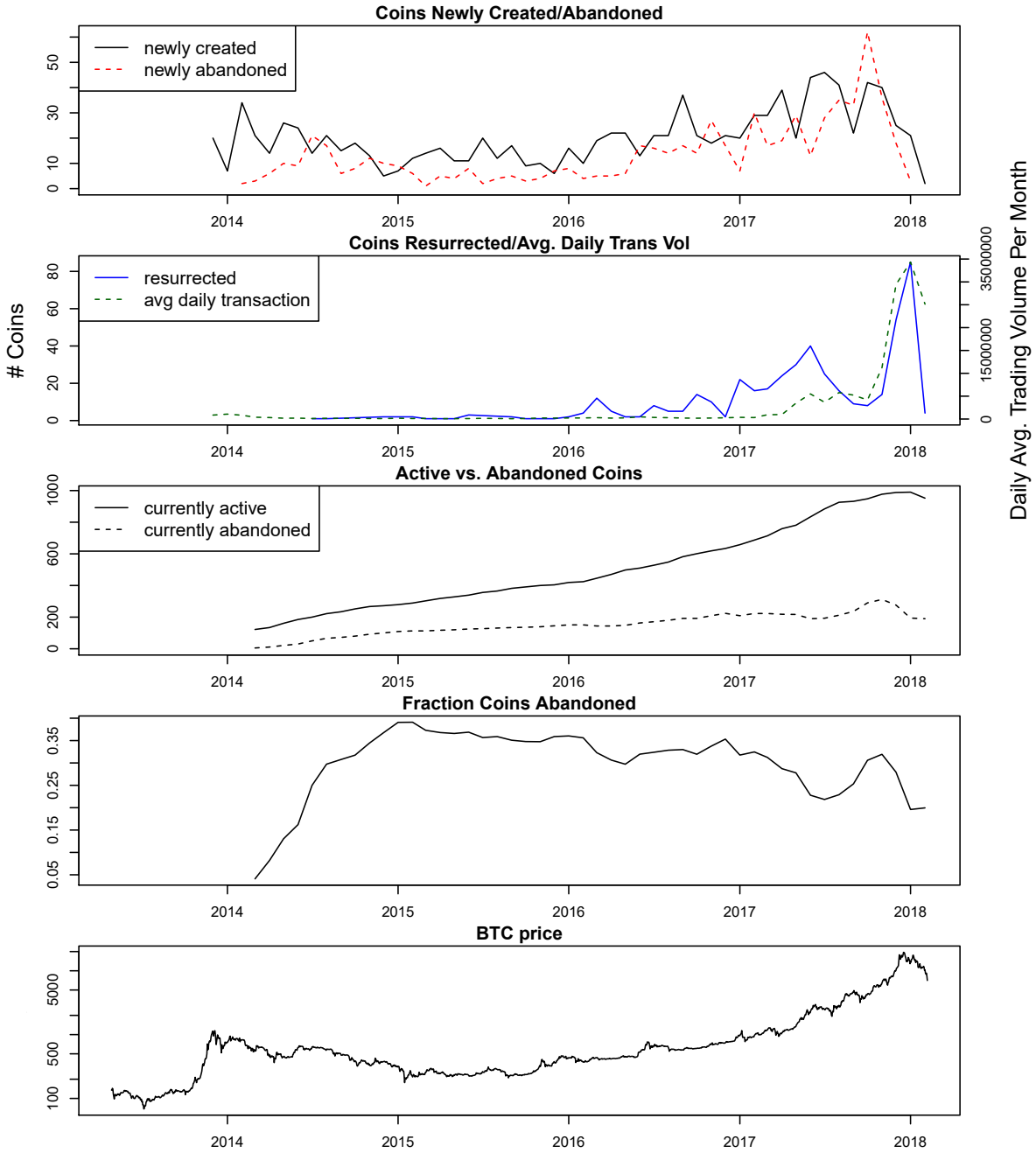

Fig. 9 COIN: Cryptocurrency summary statistics including abandonment, resurrection, creation, and daily average trading volume.

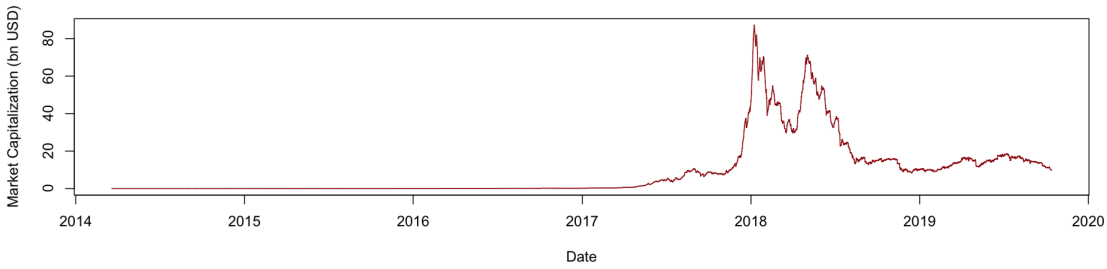

Fig. 10 TOKEN: Market capitalization of all tokens traded (in billions of dollars).

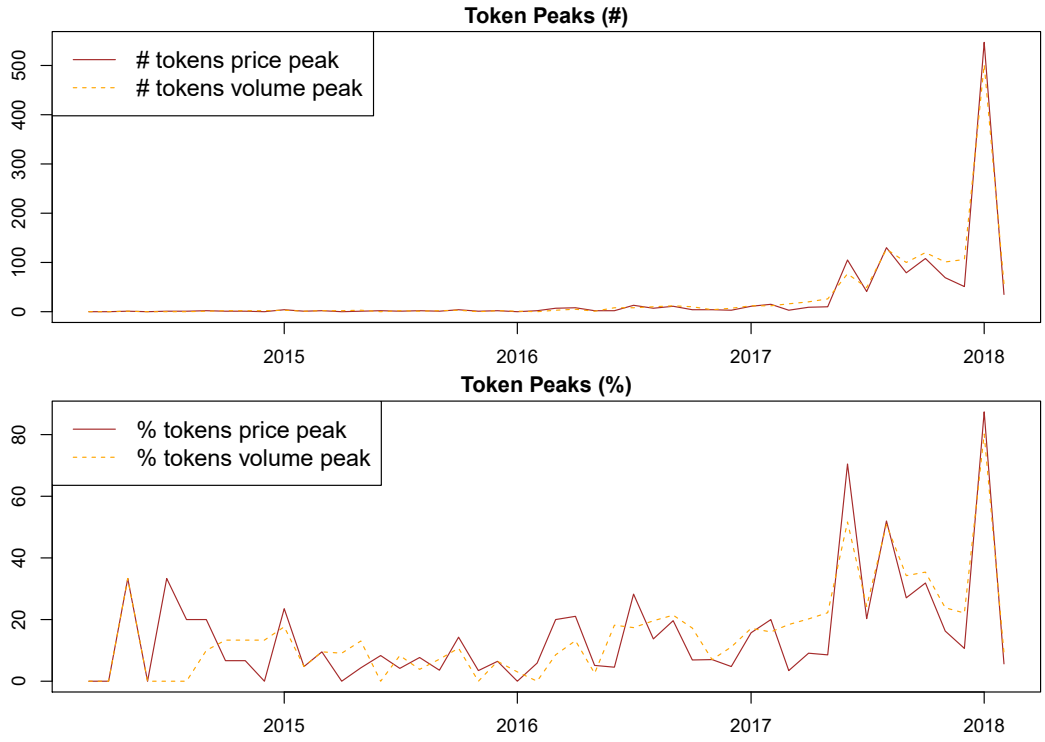

Fig. 11 TOKEN: Number (top plot) and percentage of active tokens (bottom plot) experiencing price and volume peaks over time.

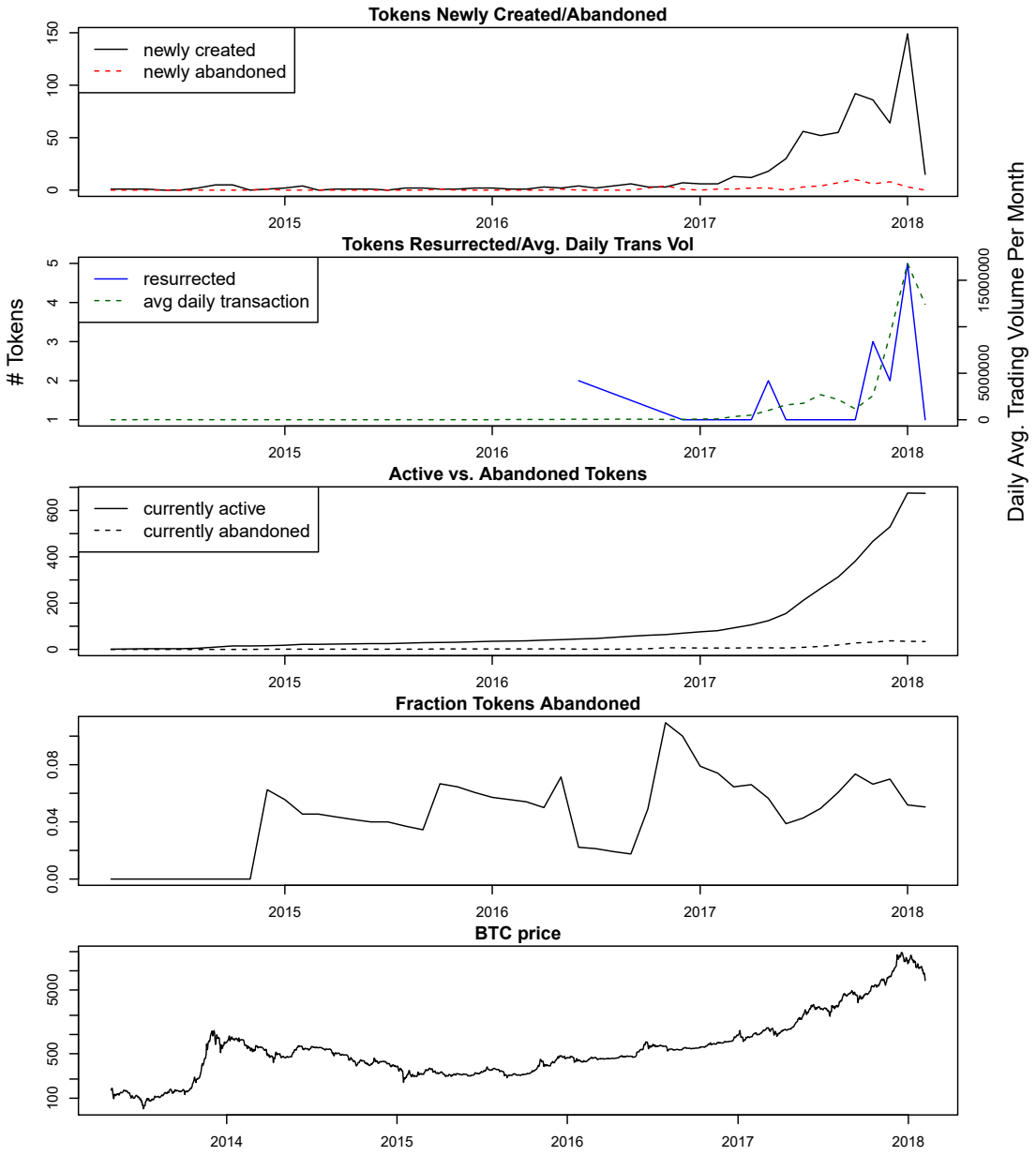

Fig. 12 TOKEN: Token summary statistics including creation, resurrection, abandonment, and daily average trading volume.

References

Adhami S, Giudici G, Martinazzi S (2018) Why do businesses go crypto? an empirical analysis of initial coin offerings. Journal of Economics and Business 100:64 – 75

Aggarwal RK, Wu G (2006) Stock market manipulations. The Journal of Business 79(4):1915–1953

Amsden R, Schweizer D (2018) Are blockchain crowdsales the new 'gold rush'? success determinants of initial coin offerings, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3163849

Audretsch DB, Mata J (1995) The post-entry performance of firms: Introduction. International Journal of Industrial Organization 13(4):413–419

Benedetti HE, Kostovetsky L (2018) Digital Tulips? Returns to Investors in Initial Coin Offerings. SSRN Electronic Journal

Böhme R, Holz T (2006) The effect of stock spam on financial markets. In: Workshop on the Economics of Information Security

Böhme R, Christin N, Edelman B, Moore T (2015) Bitcoin: Economics, technology, and governance. Journal of Economic Perspectives 29(2):213–38

Bolt W, van Oordt M (2020) On the value of virtual currencies. Journal of Money, Credit and Banking

Corbet S, Meegan A, Larkin C, Lucey B, Yarovaya L (2018) Exploring the dynamic relationships between cryptocurrencies and other financial assets. Economics Letters 165:28 – 34

Foley S, Karlsen JR, Putniņš TJ (2019) Sex, Drugs, and Bitcoin: How Much Illegal Activity Is Financed through Cryptocurrencies? The Review of Financial Studies 32(5):1798–1853

Frieder L, Zittrain J (2007) Spam works: Evidence from stock touts and corresponding market activity. Hastings Comm & Ent LJ 30:479

Gandal N (2002) Compatibility, standardization, and network effects: Some policy implications. Oxford Review of Economic Policy 18(1):80–91

Gandal N, Halaburda H (2016) Can we predict the winner in a market with network effects? competition in cryptocurrency market. Games 7(3):16

Gandal N, Hamrick J, Moore T, Oberman T (2018) Price manipulation in the bitcoin ecosystem. Journal of Monetary Economics 95:86 – 96

Geroski PA (1995) What do we know about entry? International Journal of Industrial Organization 13(4):421–440

Griffin JM, Shams A (2020) Is bitcoin really un-tethered? Journal of Finance (forthcoming)

Hamrick J, Rouhi F, Mukherjee A, Feder A, Gandal N, Moore T, Vasek M (2018) An examination of the cryptocurrency pump and dump ecosystem. Available at SSRN 3303365

Hanke M, Hauser F (2008) On the effects of stock spam e-mails. Journal of Financial markets 11(1):57–83

Huang W, Meoli M, Vismara S (2019) The geography of initial coin offerings. Small Business Economics pp 1–26

Krafft PM, Della Penna N, Pentland AS (2018) An experimental study of cryptocurrency market dynamics. In: Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, Association for Computing Machinery

Li X, Wang CA (2017) The technology and economic determinants of cryptocurrency exchange rates: The case of bitcoin. Decision Support Systems 95:49–60

Lyandres E, Palazzo B, Rabetti D (2019) Do Tokens Behave like Securities? An Anatomy of Initial Coin Offerings. SSRN Electronic Journal

Makarov I, Schoar A (2020) Trading and arbitrage in cryptocurrency markets. Journal of Financial Economics 135(2):293–319

Momtaz PP (2018) Initial Coin Offerings. SSRN Scholarly Paper ID 3166709, Social Science Research Network, Rochester, NY, URL https://papers.ssrn.com/abstract=3166709

Moore T, Christin N (2013) Beware the middleman: Empirical analysis of Bitcoin-exchange risk. In: Financial Cryptography and Data Security, Springer, pp 25–33

Popper N (2018a) Rise of Bitcoin competitor Ripple creates wealth to rival Zuckerberg. The New York Times Available at: https://www.nytimes.com/2018/01/04/technology/bitcoin-ripple.html

Popper N (2018b) Worries grow that the price of bitcoin is being propped up. The New York Times Available at: https://www.nytimes.com/2018/01/31/technology/bitfinex-bitcoin-price.html

Rob R (1991) Learning and capacity expansion under demand uncertainty. The Review of Economic Studies 58(4):655–675

Vasek M, Moore T (2015) There's no free lunch, even using Bitcoin: Tracking the popularity and profits of virtual currency scams. In: Financial Cryptography and Data Security, Springer, pp 44–61

Vettas N (1998) Demand and supply in new markets: diffusion with bilateral learning. The RAND Journal of Economics pp 215–233

Xie P, Chen H, Hu YJ (2017) Signal or noise in social media discussions: Investigating the role of network cohesion, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2894089

Xu J, Livshits B (2019) The anatomy of a cryptocurrency pump-and-dump scheme. In: 28th USENIX Security Symposium, pp 1609–1625