An examination of the cryptocurrency pump and dump ecosystem

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Abstract

The surge of interest in cryptocurrencies has been accompanied by a proliferation of fraud. This paper examines pump and dump schemes. The recent explosion of nearly 2,000 cryptocurrencies in an unregulated environment has expanded the scope for abuse. We quantify the scope of cryptocurrency pump and dump schemes on Discord and Telegram, two popular group-messaging platforms. We joined all relevant Telegram and Discord groups/channels and identified thousands of different pumps. Our findings provide the first measure of the scope of such pumps and empirically document important properties of this ecosystem.

1 Introduction

As mainstream finance invests in cryptocurrency assets and as some countries take steps toward legalizing bitcoin as a payment system, it is important to understand how susceptible cryptocurrency markets are to manipulation. This is especially true since cryptocurrency assets are no longer a niche market. The market capitalization of all cryptocurrencies exceeded $800 Billion at the end of 2017. Even after a huge fall in valuations, the market capitalization of these assets remains around $260 billion as of September 2019, which is greater than the $100 billion valuation of the fifth largest U.S. commercial bank/commercial bank holding company, Morgan Stanley and not far from the $400 billion valuation of the largest, JPMorgan Chase.

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In this paper, we examine a particular type of price manipulation: the "pump and dump" scheme. These schemes inflate the price of an asset temporarily so a select few can sell at the artificially higher price. In the case of cryptocurrencies, at the beginning of a pump, a signal indicating the currency to buy is transmitted to insiders via a group messaging platform. Ideally, from the standpoint of the pumpers, the coordinated buying increases the trading activity and begins to drive up the price. When outside buyers are attracted and begin making purchases, the price rises further; then the pumpers sell the positions they acquired previously at lower prices.

Pump-and-dump schemes are not a new phenomenon. In the case of stocks, pump and dump schemes primarily focus on penny stocks with low trading volume. Pump and dump schemes involving stocks are typically isolated episodes conducted quietly away from the spotlight. So what is different about cryptocurrencies? Several attributes have yielded a robust pump and dump ecosystem at unprecedented scale:

- New social media/technology: Pump-and-dump schemes have proliferated on a common public medium: Telegram. Telegram is a cloud-based instant messaging service using Voice over Internet Protocol (VoIP). Users can send messages and exchange files of any type. Messages can be sent to other users individually or to groups of up to 100,000 members. As of March 2018, Telegram had 200 million active users. Pumps also occurred on Discord, a platform with similar characteristics to Telegram.

- Low cost: The majority of pumps occur on Telegram channels, which are easy to form and free to join. Channel members are potential participants in pump and dump schemes.

- Many cryptocurrencies: The explosion of cryptocurrencies have created myriad opportunities for exploitation. Most are thinly traded, creating favorable conditions for pumpers.

- Many trading platforms: There has been a proliferation of cryptocurrency exchanges that enable unregulated trade between coins. Exchanges profit from the transaction fees resulting from pumps.

- Regulators (so far) have mostly taken a hands-off approach.

- These conditions led to an explosion of cryptocurrency pump and dump schemes.

We have managed to find and identify virtually every pump and dump scheme that took place during a six month period (from January – June 2018.) We thus are in a unique position to shed light on how this illegal ecosystem functions on the Internet.

Before discussing our findings, we first briefly describe the process of putting together this unique data set. The data collection required for the analysis was substantial. Pump data was gathered by collecting messages posted to hundreds of dedicated Discord and Telegram channels using their APIs and manually labeling messages that signaled pumps. In order to obtain the data, we had to join scores of channels on Discord and Telegram and manually process their communication. We describe this process in detail in the body of the paper.

We then collected price data on nearly 2,000 coins across 220 cryptocurrency trading exchanges from `coinmarketcap.com`, the leading website of aggregated data on cryptocurrency trading during the six month period from January to June 2018. The price data is captured at the finest granularity presented by `coinmarketcap.com` at the time of collection, namely 5-minute intervals. Finally, we merged these two data sets in order to conduct the analysis.

Overall, we identified thousands of pump and dump schemes that primarily took place on Telegram, and to a lesser extent on Discord, that took place during six month period from January to June 2018. This provides the first measure of the scope of pump and dump schemes involving cryptocurrencies and indicates that the phenomenon is widespread.

1.1 Our Analysis

In the paper, we examine some of the properties of this ecosystem and its dynamics over time. This analysis sheds light on questions of interest in mainstream finance.

We first describe in detail how the pumps work in the cryptocurrency realm and quantify the extent of the phenomenon. We next measured the "success" (or profitability)[1] of the schemes, which we define to be the percentage increase in the price following a pump.

[1]Obviously, this measure does not capture total profits made by those involved. We do not have data on individual trades. The measure does, however, capture the maximum potential profit to insiders.

We then examine what happened to the profitability or "success" over time. For reasons we discuss in the paper, economic theory suggests that the cryptocurrency "pump and dump" ecosystem would not succeed over time. Our dynamic data over time allow us to examine this thesis empirically, that is, to examine whether profitability declined over time.

The dynamic data also enable us to examine other key questions about the ecosystem: (I) Was the ecosystem dominated by a few channels (running a lot of pumps) or were there many active channels? (II) Did pumps occur on many exchanges or just a few? (III) Were coins pumped repeatedly? (IV) Did regulators take any actions over time? If so, were these actions effective?

We find that even after controlling for other factors that affect pump and dump success, success falls over time, with a steep drop-off near the end of the period for which we have data. This provides support for the thesis that these schemes would become less profitable over time.

We then examined the ecosystem in detail and (perhaps surprisingly) found high levels of concentration in both exchanges employed for pumps and channels involved in running the pumps:

- Cryptocurrency Exchanges: From our data, Binance and Bittrex were by far the most popular exchanges for pump and dump schemes. Binance and Bitfinex together accounted for 86% of the pumps for pumps that listed or recommended an exchange.

- Pump Channels: The perceived wisdom was that there were many channels running pumps. It turns out that, like exchanges, this aspect of the ecosystem was highly concentrated as well.

- These findings suggest that regulators could perhaps diminish the pump and dump scheme ecosystem by focusing on the small number of exchanges and "pump" channels where activity is most prevalent. It is not necessary to examine hundreds of channels and exchanges.

Importantly, we found that there are significant differences (both in terms of organization/methodology and results) between two very different types of pump and dump schemes we identified. One type was quite open and transparent about their operations while the other type took steps to obscure their coordinated activities. We uncovered these critical differences:

- The transparent pump and dumps typically did not pump the same coin over and over, while those belonging to groups that obscured their actions often pumped the same coins over and over.

- Transparent pumps were more likely to pick a particular trading platform (exchange) for the schemes, while the obscured type often did not specify and exchange. Transparent pumps were also more likely to stay away from the dominant exchanges.

- The transparent pump and dump schemes achieved a 7.7% median rate of return, while the obscured pump and dump schemes achieved a 4.1% median return.

- Strikingly, the returns earned by the transparent pumps did not decline at all over time, while the returns earned by the obscured pump and dump organizers declined significantly over time. We discuss possible explanations for these differences in the paper.

This paper also sheds light on some key issues in finance. First, the cryptocurrency pump and dump ecosystem gives us a sense what financial markets might be like without regulation. Secondly, we show that different levels of "investor" sophistication can make a huge difference in results, even when trading on common signals. (In this case, the signal is the pump.)

Additionally, our findings suggest that regulators could perhaps diminish the pump and dump scheme ecosystem by focusing on the small number of exchanges and "pump" channels where activity is most prevalent and readily observed. It is not necessary to examine hundreds of channels and exchanges. Indeed, the regulatory focus on the main channels whose activities are most brazen could undermine the most egregiously successful schemes.

The road map for the paper is as follows. In the remainder of this section, we provide background information and review the literature. Section 2 provides a detailed description of the methodology and how we collected the data. In section 3 we describe the ecosystem and examine it descriptively. Section 4 presents our analysis, while section 5 provides and discusses our results. Section 6 briefly concludes with thoughts about regulatory policy.

1.2 Background

History of the Cryptocurrency Market 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 bitcoin fell to $400 in a very short period of time. Despite the dramatic fall, cryptocurrencies were on the map and massive entry (as well as non-trivial exit) has occurred in the industry during the last five 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 et al. analyzed how network effects affected competition in the cryptocurrency market during the price spike and subsequent fall in the price of Bitcoin [4]. 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. Eventually, in December 2017, Bitcoin reached a peak of more than $19,000 before plummeting over the next few months to $6,000.

The market capitalization of cryptocurrency grew stunningly in the past few years. In February 2014, the market capitalization of all cryptocurrencies was approximately $14 Billion. In January 2018, near Bitcoin's peak, the total market capitalization reached $825 Billion. As of February 2019, total market capitalization is approximately $132 billion.

In February 2018, there were 715 cryptocurrencies with market capitalization

between $1 million and $100 million.[2] January 2014, there were less than 30 coins with market capitalization between $1 million and $100 million. This sharp four year rise in high-valued coins raises concerns of an increased potential for price manipulation.

The Larger Picture Cryptocurrency manipulations tie in to a concern over trading in unregulated financial exchanges. The potential for manipulation in the Over-the-Counter (OTC) markets is a significant concern for financial regulators. OTC trading is conducted directly between two parties, without going through a stock exchange. In a recent white paper, the SEC noted that "OTC stocks are also frequent targets of market manipulation by fraudsters."[3] The U.S. Securities and Exchange Commission (SEC) report also documents that OTC trading has increased significantly over time.[4]

Pump and dump schemes were outlawed in the 1930s. Nevertheless, the practice has continued. In the early 1990s the brokerage Stratton Oakmont artificially increased the price of "penny" stocks it owned by creating a "hype" around the stock. Once the price rose, the firm sold its shares in the relevant holding. The founder of Stratton Oakmont, Jordan Belfort, was convicted for securities fraud.

The U.S. SEC actively prosecutes pump and dump cases using publicly traded stocks. Such schemes involving cryptocurrencies are not any different. However, regulators have yet to prosecute pump and dumps involving cryptocurrencies. With the exception of insuring that taxes are paid on cryptocurrency profits and individual state-based regulation, US regulatory policy towards cryptocurrencies and initial coin offerings (ICOs) has been generally been "hands-off." One problem in moving forward in the regulatory sphere is that – unlike stocks, commodities, or fiat currency – cryptocurrencies do not have a regulatory agency in charge of all cryptocurrency policy.

Technologies like Telegram and Discord allow people to easily coordinate such schemes. Telegram is a cloud-based instant messaging service and uses Voice over Internet Protocol (VoIP). Users can send messages and exchange photos, videos,

[2] As of February 2019, there are 751 such coins.

[3] Outcomes of Investing in OTC Stocks, by Joshua White, December 16, 2016, U.S. Securities and Exchange Commission Division of Economic and Risk Analysis (DERA).

[4] In 2008 around 16 percent of U.S. stock trades were of the OTC type. By 2014, OTC trades accounted for 40 percent of all stock trades in the US. Like cryptocurrency trading, OTC trades are not transparent and not regulated, and there is concern that such trading is more harmful than high-frequency trading via regulated exchanges – See [13].

stickers, audio and files of any type. Messages can be sent to other users individually or to groups of up to 100,000 members. As of March 2018, Telegram had 200 million active users. Discord has similar capabilities and had 150 million users as of August 2018.

Discord and Telegram are primary sources for cryptocurrency pumps and have been used for pump and dump schemes on a large scale. Perhaps because of the regulatory vacuum, some of the pump groups do not hide their goals.

1.3 Literature Review

Mainstream Finance The academic literature on price manipulation and pump and dump schemes involving stocks includes Aggarwal and Wu [1]. They examined SEC litigation against market manipulators in OTC markets. They find stocks with low volume are subject to manipulation. They find that stock prices, volume, and volatility increase during the pump and dump scheme, but end quickly once it is over. They write that while manipulative activities have declined on main exchanges, it is still a serious issue in the over-the-counter (OTC) market in the United States.

Massoud et al. [12] studied OTC companies that hire promoters to engage in secret stock promotions to increase their stock price and trading volume. They find that the "promotions," or informal pump and dump schemes, coincide with trading by insiders. Brüggemann et al. [2] show that OTC stocks have lower levels of liquidity than a matched sample of similar NASDAQ listed stocks.

Our paper is also related to papers in finance that examine how investors of different sophistication trade. For example, Brunnermeir and Nagel [3] examined the behavior of hedge funds during the "Tech Bubble" in 2000. In their paper, there was discussion about different types of traders. Their paper cannot, however, identify specific traders. However given our data, we can identify trader (i.e., pumper) types and examine how the organizations and results differed among the types of pumpers.

Many scholars argue that the "Tech Bubble," was driven by irrational individual investors. An interesting question in Finance is whether rational traders are able to neutralize the price impact of irrational traders. If so, then markets are still efficient despite the presence of irrational traders. Our analysis does not address the presence of irrational traders, but it does examine how differences in coordination measured by the transparency of signals can affect returns, and that these differences can persist over time.

Cryptocurrency Price Manipulation Krafft et al. [9] created bots that executed penny trades in 217 different cryptocurrency markets. While their intent was not to incite bubble-type behavior, their bots created large price swings in the individual currencies after very small purchases.

Gandal et al. [5] identify and analyze the impact of suspicious trading activity on the Mt. Gox Bitcoin currency exchange, in which approximately 600,000 bitcoins (BTC) valued at $188 million were fraudulently acquired. They find that the USD-BTC exchange rate rose by an average of four percent on days when suspicious trades took place, compared to a slight decline on days without suspicious activity. They conclude that the suspicious trading activity by the Mt. Gox exchange itself likely caused the unprecedented spike in the USD-BTC exchange rate in late 2013, when the rate jumped from around $150 to more than $1,000 in two months.

A June 2018 working paper examined whether Tether, a digital cryptocurrency that is pegged to USD, affected the price of Bitcoin and other cryptocurrency prices during the huge increase in cryptocurrency valuations in 2017 [7]. Since they do not have data on which accounts initiated trades, they use algorithms to analyze blockchain data. They find that purchases with Tether occur following falls in Bitcoin prices and that the Tether purchases led to subsequent price rises in Bitcoin (and other cryptocurrency) prices. In particular, they find that short periods with especially heavy Tether trading volume are associated with "50 percent of the meteoric rise in Bitcoin and 64 percent of other top cryptocurrencies." They conclude that these purchases cannot be explained by investor demand, but that they are consistent with the hypothesis that Tether was used to provide price support and manipulate cryptocurrency prices.

Other researchers have studied financial fraud using cryptocurrencies. In two separate studies, Vasek and Moore [17, 18] researched online Ponzi schemes using cryptocurrencies. They measured millions of dollars reaped in by Ponzi scheme runners. Furthermore, they found that the most successful scams depend on large contributions from a very small number of victims. They then investigated Ponzi schemes advertised on the Bitcoin forum and the ecosystem that perpetuates them. Similar to our work, they mine information from the large social ecosystem around the cryptocurrency fraud they investigated.

Our work is quite different from the existing research on price manipulations; to the best of our knowledge, this is the first study to assess the scope of pump and dump schemes involving cryptocurrencies. We are also the first to examine

which factors affect the "success" of pumps, where success means a large percentage increase in price.

Four other (essentially) concurrent papers also examine pump and dump schemes on cryptocurrencies, but with a different emphasis. Kamps and Kleinberg [8] use market data to identify suspected pump and dumps based on sudden price and volume spikes (and the following sharp decreases). They evaluate the accuracy of their predictions using a small sample of manually identified pump signals. Employing a similar approach with a different dataset, Mirtaheri et al. [14] use data collected from Twitter on cryptocurrencies cross-referenced with pump signal data from Telegram and market data. They note that a lot of the tweets are automated and attempt to predict pumps using only the Twitter traffic. Xu and Livshits [19] use data on just over 200 pump signals to build a model to predict which coins will be pumped. Their model distinguishes between highly successful pumps and all other trading activity on the exchange. Li et al. [10] use a difference-in-difference model to show that pump and dumps lower the trading price of affected coins.[5]

Our work is different from these papers in several important ways. First, we have collected many more pump signals from channels on Discord and Telegram and evaluate them all, without restricting ourselves to the successful pumps. Our goal was to the extent possible to reach all pump and dump schemes on Discord and Telegram. Second, we investigate reported pumps for all coins with public trading data, not only those taking place at selected exchanges. This enables us to incorporate ecosystem-wide explanatory variables such as the number of exchanges on which a coin is traded on, the rank of the coin, etc., in order to assess what makes a pump and dump scheme successful.

2 Methodology

In this section, we discuss the methodology we used to collect the data on pump signals from social media and public messaging sources, as well as how we gathered pricing data and measured pump success.

[5]There have been media articles about the pump and dump phenomenon as well. Mac reported on pump and dump schemes in a Buzzfeed article published in January 2018 [11]. This was followed by work by Shifflet and Vigna [16] in a Wall Street Journal article published in August 2018.

2.1 Pump Signals Data from Discord and Telegram

Collecting Pump Signals Our objective was to collect as many pump signals as possible from all channels in these platforms. These platforms are the main outlets for pump and dump schemes.

A pump signal is an announcement to encourage people to buy a cryptocurrency and then take advantage of the price manipulation created by the surge in purchasing. The first step in collecting this data was to become familiar with the Discord and Telegram applications.

We programmatically scraped Discord and Telegram channels about pump and dumps using their respective APIs. We started our collection with URLs from a bitcointalk page on Discord pump groups: `https://bitcointalk.org/index.php?topic=2887116.0`. We then inspected all groups with over 4,000 users from an Android app that tracks the popularity of pump and dump groups (`https://padl.mine.nu/`). Afterward, we filtered the data based on keywords chosen specifically for each channel based on their posting patterns. This required a huge effort because communications/language on the channels were not uniform. We then manually inspected the filtered data and verified whether the post actually described an attempted pump or not, recording those that appeared to be pump signals. We parsed any additional channels that we learned about from a particular channel, adding them to our database. We are confident that we managed to get to most of the relevant channels during the period we examine: January to June 2018 period.

With Discord, people join the servers. Individual channels/groups are associated with servers. The main purpose of the channels is to organize data, and any member of a server has access to all channels in that server. Thus, in the case of Discord, we were able to collect data on the number of members that belong to a specific server. It is not specific to a particular pump, since servers contain many channels; it essentially measures the potential market for participating on pump schemes promoted on channels on that server.

Telegram is a cloud-based service where individual channels are set up by individual operators and hosted on Telegram's infrastructure. Hence, there is no analogous variable to number of members that belong to a specific server in the Telegram data.

We joined as many cryptocurrency-related channels as possible on both Discord and Telegram. The main challenge is that the only way to join many channels is by

invitation. Another challenge is to make sure that an announcement is actually a pump signal.

We systematically ignored a few types of posts. We did not consider posts about users predicting the future prices of the coins. We also ignored signals coins to "hodl" coins, which is a cryptocurrency meme for holding on to coins for a long period of time. Since "hodl"-ing is antithetical to the short term pump and dumps, we ignored these. We ignored channels with very few members. From the conversations between members of these unpopular channels, it became clear that even the few members do not actually participate in the pumps.

We sorted the channels/groups into three broad categories:

- Transparent Pumps: These channels used the words "pump" and "dump" everywhere, including in the name of their channels.
- Obscure Pumps: These channels usually avoided the words "pump" and "dump". The main concern that was reflected in their "chatrooms" was that members were not sure if pump and dump was legal, so they avoided using the terminology.
- This category contains signals copied from other sources.

After painstaking going through the pumps, we discovered that there were significant differences between the way the "transparent" and "obscured" pumps operated. We now describe the key characteristics of the two types of pumps.

Transparent Pumps This type of pump-and-dump scheme was typically very clear about how the pumps would work. They essentially used a "countdown" strategy. They usually posted the first announcement between 24 to 48 hours before the pump. Then, they posted many other announcements about timing and the cryptocurrency exchange where the pump would occur. When the time of pump came, they posted the name of the coin. They usually posted the pump results a few hours afterward, along with the date of the next pump.

These channels usually had premium membership. The premium membership was based on how many people a person had recruited to the channel. Users could also buy premium membership plans. Based on the type of plans, premium members would receive the pump signals a certain amount of time before others.

Finally, these channels did not typically pump the same coins over and over.

Obscured Pumps These channels usually avoided the words "pump" and "dump". The main concern that was reflected in their chatrooms was that members were not sure if pump and dump was legal, so they avoided using the terminology. Further, since broadcasting a countdown clearly demonstrates coordinated pumping, the obscured pumps designed their signals differently. Instead of a countdown, they typically gave target prices along with the coins, exhorting channel members not to sell below the target price. We termed this a "price target" strategy.

Whether caused by a lack of sophistication or a desire to avoid detection, the obscured pumps lacked many of the hallmarks of coordination. These channels typically did not a have premium membership option. Unlike the first group, they did not make multiple announcements about a particular pump. They typically simply posted the name of the coin and its current price, without any previous announcement.

Importantly, unlike the transparent pumps, they often pumped the same coins many times.

Differentiation between "countdown" vs. "price signal" To be sure that the two types of pumps typically had differentiated strategies ("countdown" vs. "price signal") we randomly inspected 75 Telegram signals in detail. Three coders inspected the signals in detail. 70 of the 75 pump signals included either a countdown or a price target. Of the 35 transparent pumps, 19 included a countdown but no target, 9 had both a countdown and target, and 7 had a target but no countdown. 33 of the 35 inspected obscured pumps only had a target, with the remaining 2 including a target and countdown. Thus we concluded that transparent pumps mostly use countdowns while obscured pumps almost exclusively set price targets.

Copied Pumps The remaining category was signals copied from other sources. Although they usually posted the signals hours after the pump, they included the actual time that a pump was published. They also included the source of that pump. We preferred not to use these signals, because we wanted to collect our data from primary sources. We used these channels to ensure complete coverage, i.e., to find the pump sources and follow them. We included them in the analysis when we could not get access to the source channels. Copied pumps accounted for 4 Discord groups with 514 associated pump signals not found elsewhere. There are no Telegram pumps in this category because of the complete overlap between these

Telegram groups and other signals already collected.

We include the copied pumps for completeness, but our results are qualitatively unchanged if we remove the "copied pumps" from the analysis.

Summary of Pump Signals In the case of Telegram, 88 percent of the signals were obscured pumps and 12 percent were transparent.

In the case of Discord, 42 percent of the signals were obscured, 40 percent of the signals were copied, and 11 percent transparent.

2.2 Pricing Data on Cryptocurrencies

We collected price data on nearly 2,000 coins and tokens (henceforth referred to as coins) across 220 exchanges as reported to `coinmarketcap.com`, the leading website of aggregated data on cryptocurrency trading. We collected all price data for each of the coins listed on `coinmarketcap.com` from January through June 2018. This gave us a total of 316,244,976 collective volume and price data points across all of the coins listed. The data points collected are at the finest granularity presented by `coinmarketcap.com` at the time of collection, a 5-minute interval.

We realize there are limitations to this method of data collection. For instance, `coinmarketcap.com` does not list every coin or token available for purchase or trade. Further, this data is slightly different than what one would be able to collect from an exchange API. Since the website is collecting data from so many sources, it reports a volume weighted average of all of the prices reported at each exchange to calculate the price it reports. On the plus side, this approach is more comprehensive in the number of exchanges and coins covered.

Every internet service experiences outages planned or otherwise; the services we are interested in are no exception to the rule. During the initial data exploration phase, gaps in the data were discovered. To make sure these gaps were recorded in the data and not a result of our collection efforts, we programmatically check the data for proper intervals. If a gap exists in the data that spans a time period equal to or greater than 7.5 minutes, we report that data point as missing. We chose 7.5 minutes because of the 5 minute average interval in the data collected. After iterating through the timeline of each of the coins, we create an hour long window surrounding the missing data points and query `coinmarketcap.com` for that data. If the gap persists after the additional data collection, we surmise it is because of an outage either due to the exchange or `coinmarketcap.com`. In total we are

missing approximately 3,806,474 volume and price records across all of the coins, or approximately 1% of the data.

Matching Discord/Telegram Information with Trading Data For the purpose of our study, it was essential to ensure a consistent mapping between what is announced in the pump signal to what is associated with the trading data. In particular, pump signals are by no means consistent when it comes to the coin names used in the messages. Some users refer only to the coin ticker such as DOGE, which is the ticker for Dogecoin. This can be a bad idea as several cryptocurrencies employ identical tickers (being decentralized, there is no equivalent to NYSE or NASDAQ to enforce the uniqueness of ticker symbols). Others use the full coin or token name, but that can be problematic because many coins have similar names. For instance, the cryptocurrency IOTA has the ticker MIOTA; the coin name is similar to the ticker for IoTex, which is IOTX. Still others use some combination of the ticker and full or partial name. For example, "Bitcoin (BCD)" refers to Bitcoin Diamond and not Bitcoin as the ticker for Bitcoin is BTC and not BCD.

We normalized reports to the name used by `coinmarketcap.com`. To do this, we created a name map that contains several variations of the actual cryptocurrency name based on our observations. We then removed special characters from the names reported in Discord and performed a case insensitive comparison to the map we created. If a match was found, we replaced the pump name with a clean version that matches the name elsewhere in our data. Some of the names required manual replacement since cryptocurrencies have the ability to rebrand. In this way, we were able to map 952 of the Discord pump signals and 2,649 of the Telegram pump signals to more than 300 cryptocurrencies.[6]

Identifying Pump Timing and Success Throughout the processes of aggregating, combining, and cleaning the data, it became increasingly apparent that we could not reliably use the time of a pump signal to mark the beginning of a period of anomalous trading activity.[7]

[6] We have more total pumps than that, but approximately 5% do not have complete data and cannot be used in the analysis.

[7] This may be because "insiders," i.e., those running the pump, strategically purchase before the agreed upon time. This is consistent with the other work in this area. [8] noticed that pumps sometimes occurred exactly when a signal was put out and other times occurred afterwards. [10] collected more pump signal information than [8] and observed the same effect. [19] collected *hourly* market data, and found that the markets move as much as 72 hours before an announced pump.

Hence, instead of taking the pump signal time as given, we treat it as the starting point to identify associated spikes in trading activity. We inspect 48 hours before and after the time of the reported signal to find the maximum percentage jump between two consecutive price data points (typically spaced 5 minutes apart).

In the data analysis described in the next section, we use this maximum 5-minute percentage increase in this 96 hour period in the coin's price relative to BTC as our measure of pump success.

2.3 Data Summary

The Discord and Telegram data span the six month period from January to June 2018. A small number of observations were duplicates in the sense that they involved the same coin on the same day and roughly at the same time (within an hour) on the same exchanges. We eliminated the duplicates, but the results are qualitatively unchanged if we include them. Once we eliminate the duplicate observations and a few observations for which we did not have complete data, we are left with 952 observations with complete data on Discord and 2,469 observations with complete data on Telegram. This gives a sense of the scope of the pump and dump phenomenon on these platforms.[8]

We find that ten percent of the pumps on Telegram (Discord) increased the price by 16.3 percent (15.6 percent) in just five minutes. Recall that the January-June 2018 period was a period in which cryptocurrency prices were falling significantly; hence "moderate" percentage increases were an achievement for the pump.

3 Informal Analysis of the Ecosystem

3.1 A Bit of Theory...

Economic theory suggests that the cryptocurrency "pump and dump" ecosystem would not succeed over time for the following reasons:

- Pump and dump schemes need outside investors to succeed. The idea is that the initial surge in volume attracts additional traders. Such (honest) traders

[8]It is possible that there are a small number of pumps that occur both on Telegram and Discord, primarily in May 2018. This is not a problem since we analyze the Discord and Telegram data separately. (We do this because some of the variables are not available for both of the platforms.) Our results are robust to eliminating these potential duplicates.

in cryptocurrencies would learn how to recognize pump and dumps and adjust their strategies accordingly, so as not to fall prey to the schemes. It has been documented in the literature that it is fairly straightforward to adjust investment strategies to account for cryptocurrency pump and dumps.

- Many insider members of the pump and dump schemes actually lose money. This is because, as has been documented, administrators/insiders of the schemes typically make purchases before the "beginning" time of the pump. This would make it less attractive to participate over time.

- Regulators might begin to react if the phenomenon becomes prolific. A few pump and dump schemes will not have an effect on regulatory policy, but hundreds or thousands of pumps might eventually lead regulators to act.

3.2 Dynamics over time in the ecosystem

Our dynamic dataset allows us to examine whether profitability has in fact declined over time. From our data, the median profitability of the pumps go down over time for the six months we have data (January to June 2018.) This is true both for Telegram and for Discord.[9] See Table 11. The decline is steep on both platforms: On Telegram profitability was essentially 50% lower on average in June than in January. In the case of Discord, profitability was essentially 60% lower on average in June than in January.

While we cannot definitively answer the interesting question whether this decline in profitability reduced pumps over time,[10] it is interesting to note the following: "Google Trends" data suggest that interest in pump and dump schemes took off during the increase in bitcoin's massive increase in price in late 2017 and declined sharply after June 2018. See Figure 1 in the Appendix.[11] While we do not want to push this point, it does provide some support for a decline in the cryptocurrency pump and dump phenomenon, which is consistent with declining profits over time.

[9] In the formal analysis, we run regressions. The regression results show that even after controlling for other factors that affect pump and dump success, success falls over time, with a steep drop-off near the end of the period for which we have data.

[10] It was not possible to collect detailed information after the period for which we have data, since pump channels removed us from the groups.

[11] It is well known that interest in bitcoin in Google trends data is very highly correlated with the price of bitcoin.

3.3 Concentration in the Ecosystem

The data also enable us to examine other key questions about the ecosystem: (I) Was the ecosystem dominated by a few channels (running a lot of pumps) or were there many active channels? (II) Did pumps occur on many exchanges or just a few? (III) Were coins pumped repeatedly? We (perhaps surprisingly) find high levels of concentration in both exchanges employed for pumps and channels involved in running the pumps.

- Cryptocurrency Exchanges: From our data, Binance and Bittrex were by far the most popular exchanges for pump and dump schemes. Binance and Bitfinex together accounted for 86% (87%) of the pumps for pumps that listed/recommended an exchange on Telegram (Discord). During this period and afterwards, Binance was the largest cryptocurrency exchange, by trading volume, and Bittrex had large trading volume as well. Both exchanges offer trading in hundreds of cryptocurrencies, which likely made them attractive to organizers of the pump and dumps.

- The perceived wisdom was that there were many channels running pumps. It turns out that, like exchanges, this aspect of the ecosystem was highly concentrated as well. In the case of Telegram for example, six channels accounted for more than 70 percent of the pumps.

- Additionally, twenty-three coins were pumped 18 or more times (thus on average, these coins were pumped at least three times a month during the six month period.). These twenty-three coins accounted for more than 20% of all pumps during that period on Telegram. Similarly on Discord, the top 20 coins accounted for 28 percent of the pumps. Again, this suggests a concentrated industry. This information should be helpful to regulators.

4 Analysis

Here we examine whether declining profitability over time holds when controlling for various other factors such as the rank of the coin. An additional and important part of the analysis here is to examine what factors explain the success of the pump and dump scheme, where success means that the pump increased the price significantly.

We first examine this including all pump and dump types together in the analysis. We then revisit the analysis by examining the same issue separately for the two types of pump groups

4.1 Both Types of Pump Groups Examined Together

We employ the maximum % price increase (as described above) in the 48 hours preceding and following the pump as the dependent variable. We denote this variable as % Price Increase. Most of the cryptocurrencies cannot be directly traded with USD, but they can be traded with bitcoin. Hence, we use coin prices in bitcoin.[12]

4.1.1 Independent Variables

We have the following independent variables.

- Exchanges: the number of exchanges on which the coin can be traded. We measured this variable twice: once at the end of 2017 and once in September 2018. The correlations are above 0.99 and the results are unchanged regardless which date we choose. The 2018 variable has more observations, so we use that one.
- Rank: the rank of the coin in terms of market capitalization. Bitcoin is #1. Coins with higher rank have lower market capitalization.
- Pair Count: the number of other coins that the coin can be traded with.[13]
- Server-Member-Count (Discord Only): the number of members that belong to a server (which is not specific to a particular pump). This variable essentially measures the potential market for participating on pump schemes promoted on that server.
- Views: (Telegram only) Number of views per pump.[14]
- Dummy variables for February, March, April, May and June 2018.

[12]Because of this, we cannot include the very small number of pumps using bitcoin itself.

[13]Similar to exchanges, we measured this variable twice, once at the end of 2017 and once in September 2018. The correlations are above 0.99 and the results are unchanged regardless which date we choose. The 2018 variable has more observations, so we use that one.

[14]With the possible exception of views, all of these variables are clearly exogenous to the pump. We think that views is essentially exogenous as well. Results are unchanged if we do not include views in the analysis

- Dummy variables for Binance-only, Bittrex-only, and Binance-Bittrex. A non-trivial potion of the pumps were on both exchanges. In that case, Binance-Bittrex takes on the value one.

- other-exchange takes on the variable one when the pump lists an exchange other than Binance or Bittrex.

- no-exchange is a dummy variable that on the value one if no exchange was listed in the pump.

Descriptive statistics for all variables used in the analysis appear in Table 1 and Table 2.

These table shows that in the case of Telegram (Discord), 45 percent (50 percent) of the pumps occurred on either Binance, Bittrex, or both and 48 percent (46 percent) occurred without an exchange listed.

Table 3 groups coins by rank (in terms of market capitalization.) In Table 3 shows that while many of the pumps involve coins with light trading and low market capitalization (similar to penny stocks), pumps are not limited to obscure coins. Coins with greater market caps experience smaller spikes in prices: the median price increase for the top 75 coins (in rank) is 2.4% for Discord and 2.6% for Telegram. The median return for coins ranked between 500 and 1000 was 5.8% for Discord and 7.1% for Telegram. See Table 3 for the full breakdown.

The pumping of more "mainstream" coins may be because it is not always easy to pump obscure coins that are traded on a small number of exchanges. Additionally, there is less volatility in mainstream coins, and some "investors" (pumpers) may have preferred a relatively lower risk level.

Overall, in the case of Discord data, the median (mean) percentage price increase was 3.5% (7.4%), while the 75th percentile of the distribution was 6.3%. In the case of Telegram data, the median (mean) percentage price increase was 5.1% (9.8%), while the 75th percentile of the distribution was 9.2%. Recall that the January–June 2018 period was a period in which cryptocurrency prices and trading volume were falling significantly; hence "moderate" percentage increases were an achievement for the pump.

From the above discussion, it is not surprising that the coin rank is the independent variable that is most highly correlated with the percent price increase of

the pump, both on Discord (0.48) and Telegram (0.35.) The correlations among the variables are shown in Table 4 and Table 5. As Table 4 and Table 5 show, the correlations are similar across the Discord and Telegram platforms.

4.2 Analyzing the Two Types of Pump Groups Separately: Telegram Data Only

The analysis by pump-and-dump category is only conducted for Telegram. This is because Discord only has 71 transparent pumps, while Telegram has 271.

Descriptive statistics for the same variables used in the "unified" analysis are shown separately for the transparent and obscured pump types separately in Table 7 and Table 8. We found the following key differences:

- The transparent type of pump and dumps did not pump the same coin over and over. In particular, 167 different coins were used in the 271 transparent pumps. In the case of obscured pumps, just 276 different coins were used in 2,198 pumps! Thus although the second category had roughly eight times as many pumps as the first category, they employed less than twice the number of coins.

- Transparent pumps were more likely to pick a particular trading platform (exchange) for the schemes, while the obscured type often did not specify and exchange. transparent pumps were also more likely to stay away from the dominant exchanges.

- The transparent pump and dump schemes achieved a 7.7% median rate of return, while the obscured pump and dump schemes achieved a 4.1% median return.

Additionally, there is high concentration for both channels in terms of pump origin. In the case of the transparent traders, three channels accounted for more than 65 percent of the pumps. In the case of the obscured traders, six channels accounted for more than 75 percent of the pumps.

5 Formal Regression Results

5.1 All Pump and Dump Schemes Included Together

In the regressions in Table 6, we use the percentage price increase as the dependent variable. Because the variables in the analysis are skewed, we run a log/log OLS regression using the natural logarithm of the variables, both the dependent variable and the independent variables.[15] We employ clustered standard errors at the level of the coin, since many of the coins appear more than once in the data set.

Our regression results when all pump and dump schemes are included together (see Table 6 are as follows:

- In the case of Telegram, the log/log regression has an adjusted R-squared of 0.32 versus 0.30 for Discord.
- The ranking of the coin is positively associated with success for both Discord and Telegram. This effect is highly significant in both cases.[16] Coins with lower market capitalization typically have lower average volume. Lower average volume gives the pump scheme a greater likelihood of success.
- The number of exchanges on which the coin can be traded is negatively associated with success and the effect is statistically significant for both Discord and Telegram. This makes intuitive sense, because with fewer exchanges, pump schemes have better control over the total volume of the coin.
- The number of other coins that the coin can be traded with is positive and statistically associated with success in the case of Discord. In the case of Telegram, the estimated coefficient is positive but is insignificant. One possibility is that more trading pairs allow greater flexibility for those involved in the pumps.
- In the case of Discord, the estimated coefficient on the variable "Server Member Count" is negative, but not significant. In the case of Telegram, the variable "Views" is negatively associated with success and the effect is statistically significant. Although we do not push this, one possible interpretation is

[15] Not surprisingly, the log/log regression has much higher explanatory power (in the sense that it has a much higher adjusted R-squared) than either a log/linear or linear/linear specification. This is true both for Discord and Telegram.

[16] Recall that higher rank means more obscure.

that it is hard to coordinate if there are too many people potentially involved in the pump.[17]

- Pumps on Binance and Bittrex do worse than pumps not on those exchanges. It might be that, since these are dominant exchanges, more people are involved in the pumps - and coordination is more difficult.

- Perhaps most importantly, the declining "success" rate over time, as shown by the negative coefficients on the monthly dummy variables holds, even after controlling for the other factors. In both Telegram and Discord, the estimated coefficients associated with April, May and June are statistically significant, suggesting a deep decline in profitability over time.

5.2 Transparent and Obscured Analyzed Separately: Telegram Only

Our regression results when the pump and dump schemes are analyzed separately by category are shown in Table 9. The key results are as follows:

- In the case of transparent traders, the log/log regression has an adjusted R-squared of 0.60 versus 0.26 for obscured traders.

- The ranking of the coin is positively associated with success for both types. This effect is highly significant for transparent traders and significant for obscured traders.

- The number of exchanges on which the coin can be traded is negatively associated with success and the effect is statistically significant for both groups.

- Again, pumps on Binance and Bittrex do worse than pumps not on those exchanges.

- Interestingly, the variable "Views" is positively associated with success and the effect is statistically significant for transparent traders. However, this variable is negatively associated with success and the effect is statistically significant for obscured traders . This may be because, in general, there are fewer "viewers" for the transparent pumps. Recall that the transparent pumpers typically restricted membership.

[17] It might also be because "Views" could be endogenous. All of the other results are robust to excluding "Views" from the analysis.

- For the obscured traders, the declining "success" rate over time, as shown by the negative coefficients on the monthly dummy variables holds, even after controlling for the other factors.

- Strikingly for the transparent traders, the "success" rate is virtually constant over time as shown by the very similar coefficients for the dummy variables on the months February through June 2018.[18]

5.3 What happens after the pump is over

An interesting question is what happens after the pump is over. To address this issue, we calculate two additional variables.

- **Starting price**: this is the starting price associated with the maximum five minute percentage increase in price. It can be interpreted as the "pre-pump" price.

- **End price**: This is the minimum price in the 48 hours after pump.

- We then calculate the following variable: $\frac{\text{End price}-\text{Starting price}}{\text{Starting price}}$. This is the percentage change in price from the pre-pump period to the post-pump period.

We find the following: The median percentage change in price from the pre-pump period to the post pump period is -41% for Discord data and -38% for Telegram data. Overall, more than 60% of the coins have a lower "post-pump" price than the "pre-pump" price. Even though prices were generally falling during this period, a 40% fall in prices in 48 hours is large.[19]

5.4 Trading Volume Data

We do not have corresponding volume data, since volume data on `coinmarketcap.com` is reported continuously over the preceding 24 hour period and it is not clear how often volume information is updated.[20]

[18] It appears that the success rate jumped from January to February, and stayed at that level over time.

[19] We ran regressions using the percentage change in price from the pre-pump period to the post-pump period as the dependent variable, and the right-hand-side variables as the independent variables. In these regressions, the adjusted R-squared was virtually zero.

[20] Since we do not have delineated trading volume, we cannot quantify profitability from the pumps. Even if did have trading volume by time, it still would be impossible to measure profitability.

But we did calculate the following volume variable: "Per-change volume after," which equals the maximum (24 hour) volume in the 24 hours following a pump signal less the minimum (24 hour) volume in the 24 hours following a pump signal divided by the minimum (24 hour) volume in the 24 hours following a pump signal. We find the following.

- On both Discord and Telegram, there is approximately a 30 percent correlation between (i) the maximum five-minute percentage change in price and (ii) the "Per-change volume after."

- Since the price signal occurs before the changes in volume, we could run a regression with volume change as the dependent variable and put the maximum five-minute percentage change in price as a right-hand-variable along with the other independent variables used in the price regressions. In such a case, only that variable is significant and the adjusted R-squared is relatively large. Since we are not exactly sure of the timing, we do not want to push this too much, but it does suggest the following: The pump organizers buy first, increasing the price. Then the "herd" jumps in, where the herd is comprised of other people who received the pump signal and outsiders (some of whom may be using trading algorithms.) During this period, the original "pumpers" are likely selling there shares as well.

- The two points above suggest that the maximum five-minute percentage change in price is a good proxy for success.

5.5 The number of exchanges mentioned by the pump

Finally, we briefly summarize data regarding the number of exchanges mentioned by the pump. We observed this for 546 pumps on Discord, around half of the total. We scraped this data from the pump signal, counting any exchanges directly mentioned in the signal message.

While most pumps mention a single exchange, more than 18 percent of the pumps mention more than one exchange. Correlations among the number of pump exchanges and the independent variables are shown in Table 10. Not surprisingly,

This is the "pumpers" act as individuals and others can trade as well. The only way to measure profitability would be to have access to trading activity over time at the individual level; labeled trading data is not available.

the number of exchanges used in the pump is negatively correlated with the rank of the coin (-0.25) and positively correlated with the number of exchanges the coins are traded on (0.29.) These numbers give us additional confidence that we are indeed picking up actual pumps.

6 Brief Conclusions and Thoughts on Regulation

In this paper we examined the phenomenon of pump and dump schemes for cryptocurrencies. The proliferation of cryptocurrencies and changes in technology have made it relatively easy (and virtually costless) for individuals to coordinate their activities. In terms of scope, we found that this pump and dump phenomenon is widespread on both Discord and Telegram.

We identified two distinct approaches to pumping cryptocurrencies: transparent pumps that openly promote coordinated purchases to raise prices and obscured pumps that set price targets instead. By making pump signals so obvious (e.g., pre-announcements, countdown messages, revealing the coin name at precisely the intended purchase time), the organizers of transparent pumps likely increased the chances of coordinated purchasing behavior to drive up prices. This is reflected in the superior returns to transparent pumps compared to obscure ones.

Our analysis has implications for regulatory policy. Regulators could perhaps significantly disrupt future pump and dump schemes by focusing their efforts on the most prolific exchanges and brazen pump channels. Far from insurmountable, a concentrated ecosystem makes enforcement tractable.

Pump and dump schemes historically involved stocks or securities. Hence, in the U.S., the Securities and Exchange Commission (SEC) had regulatory authority. However, the U.S. Commodity Futures Trading Commission (CFTC) defined cryptocurrencies as commodities. This interpretation gives them legitimacy to be involved in the regulation of cryptocurrencies.

During the period of our data, the CFTC (February 2018) issued a press release warning consumers to avoid pump and dump schemes. As they noted, this was the "First Pump-and-Dump Virtual Currency Customer Protection Advisory." The CFTC took an additional step by issuing a bounty shortly thereafter on cryptocurrency pump and dumps.

In February 2018, the same month as the first CFTC warning, interest in the CFTC shot up to a "Google trends" high that was never reached again. A compar-

ison (using Google trend data) between interest in pump-and-dump schemes and interest in the CFTC showed that interest in pump-and-dumps peaked shortly before interest in the CFTC. Perhaps, more regulatory action at this stage might have dampened the phenomenon.

In general, U.S. regulatory policy towards cryptocurrencies can be characterized as hands-off. U.S. regulatory policy is inhibited in part because overlapping agencies have authority for regulating different aspects of the cryptocurrency ecosystem. The Internal Revenue Service (IRS), Financial Crimes Enforcement Network (FinCEN), the Commodity Futures Trading Commission (CFTC), and the Securities and Exchange Commission (SEC) are all involved in regulation related to the issuance, sale, and exchange of cryptocurrencies. A recent paper notes that depending on the regulatory agency, according to U.S. Law, cryptocurrencies can be money, property, a commodity, and a security [6]. This causes confusion and creates a regulatory vacuum.[21]

While federal regulators have not been pursuing pump-and-dump schemes, state attorneys general have been active in investigating forms of price manipulation. The New York State Office of the Attorney General investigated cryptocurrency fraud at the cryptocurrency exchange level [15]. They found that while most trading platforms acknowledged that market manipulation and fraud were issues, they lacked controls to evade abusive behavior, such as pump and dump trading activity. One currency exchange, Kraken, did not submit to their formal inquiry, but rather submitted a statement admitting that they did not believe market manipulation to be an issue.

In general, federal regulators should be very concerned by the presence of the pump and dump ecosystem. Even though we have demonstrated a decline in pump profitability (primarily among obscured pumps), the scope of the phenomenon should raise red flags and trigger countermeasures.

[21]Nevertheless, market manipulation such as cryptocurrency-related pump and dump schemes could be viewed as illegal in the United States under the Securities Exchange Act of 1934 Rule 10-b5 which makes interstate commerce using manipulation or deceptive devices illegal. This is not a legal opinion, of course; it is simply an example of an existing law that could apply. Such clarification would be helpful since there is widespread belief spread by pump organizers that these schemes might be legal under US law.

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A Appendix

Table 1: Descriptive Statistics: Discord, N=952

Variable	Obs	Mean	Std. Dev.	Min	Max
Max % Price inc.	952	6.78	17.34	0.64	221.90
Exchanges	952	21.11	26.50	1	182
Pair Count	952	24.74	89.05	1	759
Rank	952	257.64	309.30	2	1,863
Server Member Count	952	5,373	9,467	141	49,415
January 2018	952	0.15	0.36	0	1
February 2018	952	0.12	0.33	0	1
March 2018	952	0.13	0.34	0	1
April 2018	952	0.12	0.33	0	1
May 2018	952	0.37	0.48	0	1
June 2018	952	0.11	0.31	0	1
Binance-only	952	0.22	0.41	0	1
Bittrex-only	952	0.20	0.40	0	1
Binance-Bittrex	952	0.08	0.27	0	1
other exchange	952	0.04	0.20	0	1
No exchange	952	0.46	0.50	0	1

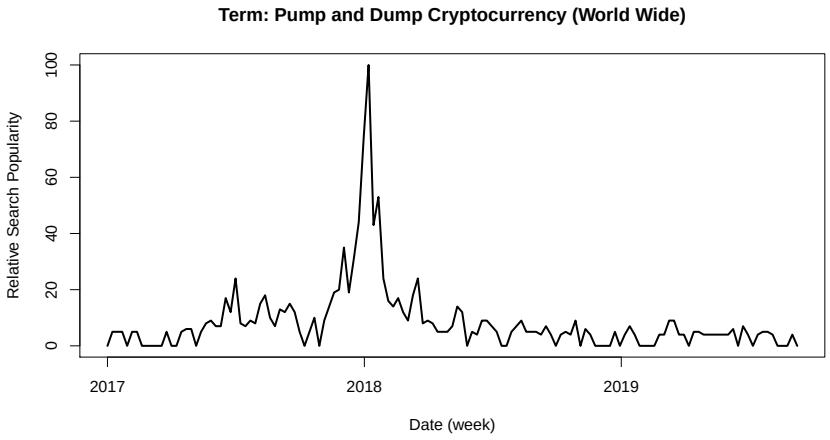

Figure 1: Google Trends results from searching for pump and dump cryptocurrency.

Table 2: Descriptive Statistics: Telegram, N=2,469

Variable	Obs	Mean	Std. Dev.	Min	Max
Max % Price inc.	2,469	9.57	22.93	0.42	341.99
Exchanges	2,469	17.72	22.5	1	182
Pair Count	2,469	16.89	64.17	1	759
Rank	2,469	375	417	2	2,036
Views	2,469	9,649	9,815	0	77,266
January 2018	2,469	0.16	0.37	0	1
February 2018	2,469	0.12	0.32	0	1
March 2018	2,469	0.13	0.34	0	1
April 2018	2,469	0.27	0.45	0	1
May 2018	2,469	0.19	0.39	0	1
June 2018	2,469	0.13	0.40	0	1
Binance-only	2,469	0.22	0.41	0	1
Bittrex-only	2,469	0.18	0.39	0	1
Binance-Bittrex	2,469	0.05	0.23	0	1
other exchange	2,469	0.07	0.25	0	1
No exchange	2,469	0.48	0.50	0	1

Table 3: Median Price Increases by Coin Rankings.

	Discord		Telegram	
	Pumps	Price	Pumps	Price
Rank	#	Inc %	#	Inc %
≤ 75	308	2.4	635	2.6
76-200	239	3.2	520	3.3
201-500	269	3.5	682	4.1
501-1000	99	5.8	393	7.1
> 1000	37	15.7	239	13.7

Table 4: Correlations Among Variables: Discord, N=952

Variable	% Price inc.	Exchanges	Pair Count	Rank	Server Members
% Price inc.	1				
Exchanges	−0.15	1			
Pair Count	−0.053	0.72	1		
Rank	0.46	−0.42	−0.18	1	
Server Member	−0.035	−0.0031	0.021	0.000	1

Table 5: Correlations Among Variables: Telegram, N=2,469

Variable	% Price inc.	Exchanges	Pair Count	Rank	Views
% Price inc.	1				
Exchanges	−0.14	1			
Pair Count	−0.06	0.64	1		
Rank	0.40	−0.44	−0.19	1	
Views	−0.10	0.09	0.04	−0.06	1

Table 6: Examining What Affects Success of Pump and Dump Schemes:

	Telegram	Discord
Independent Variables	Dept. Var. % Price Increase log/log	Dept. Var. % Price Increase log/log
Exchanges	-0.29***	-0.23***
	(0.057)	(0.067)
Pair Count	0.034	0.15**
	(0.05)	(0.066)
Rank	0.16***	0.24***
	(0.043)	(0.050)
Server Members		-0.007
		(0.020)
Views	-0.061***	
	(0.013)	
February 2018	-0.036	-0.24**
	(0.067)	(0.087)
March 2018	-0.046	-0.13
	(0.069)	(0.091)
April 2018	-0.20***	-0.40***
	(0.052)	(0.11)
May 2018	-0.43***	-0.49***
	(0.070)	(0.079)
June 2018	-0.26***	-0.66***
	(0.075)	(0.11)
Binance Only	-0.31***	-0.24***
	(0.055)	(0.062)
Bittrex Only	-0.17***	-0.23***
	(0.050)	(0.075)
Binance-Bittrex	-0.41***	-0.38***
	(0.086)	(0.080)
Observations	2,649	952
Adjusted R^2	0.32	0.30

Standard errors in parentheses: They are clustered at the level of the coin.

* significant at the 90% level

** significant at the 95% level

*** significant at the 99% level

Table 7: Descriptive Statistics: (Telegram) Transparent Pumps, N=271

Variable	Obs	Mean	Std. Dev.	Min	Max
Max % Price inc.	271	29.44	53.4	0.49	341.99
Exchanges	271	13.5	20.3	1	163
Pair Count	271	14.56	71.25	1	759
Rank	271	699.53	613.43	3	2,036
Views	271	3,241.33	3,021.19	0	14,498
January 2018	271	0.14	0.35	0	1
February 2018	271	0.13	0.34	0	1
March 2018	271	0.24	0.43	0	1
April 2018	271	0.23	0.42	0	1
May 2018	271	0.16	0.37	0	1
June 2018	271	0.1	0.3	0	1
Binance-only	271	0.18	0.38	0	1
Bittrex-only	271	0.11	0.32	0	1
Binance-Bittrex	271	0.06	0.24	0	1
other exchange	271	0.42	0.5	0	1
No exchange	271	0.23	0.42	0	1

Table 8: Descriptive Statistics: (Telegram) Obscured Pumps, N=2,198

Variable	Obs	Mean	Std. Dev.	Min	Max
Max % Price inc.	2,198	7.12	13.64	0.42	309.09
Exchanges	2,198	18.24	22.72	1	182
Pair Count	2,198	17.18	63.25	1	759
Rank	2,198	334.73	366.64	2	1,935
Views	2,198	10,438.91	10,070.62	0	77,266
January 2018	2,198	0.16	0.37	0	1
February 2018	2,198	0.11	0.32	0	1
March 2018	2,198	0.12	0.32	0	1
April 2018	2,198	0.28	0.45	0	1
May 2018	2,198	0.2	0.4	0	1
June 2018	2,198	0.13	0.34	0	1
Binance-only	2,198	0.22	0.42	0	1
Bittrex-only	2,198	0.19	0.4	0	1
Binance-Bittrex	2,198	0.05	0.22	0	1
other exchange	2,198	0.02	0.15	0	1
No exchange	2,198	0.51	0.5	0	1

Table 9: Examining What Affects Success of Pump and Dump Schemes:

Independent Variables	Transparent Max % Price inc.	Obscured Max % Price inc.
Exchanges	-0.38**	-0.21***
	(0.14)	(0.055)
Pair Count	0.11	-0.04
	(0.12)	(0.05)
Rank	0.39***	0.09*
	(0.11)	(0.039)
Views	0.11*	-0.04**
	(0.049)	(0.012)
February 2018	0.92***	-0.21**
	(0.23)	(0.061)
March 2018	0.75***	-0.17*
	(0.21)	(0.069)
April 2018	0.57*	-0.27***
	(0.25)	(0.054)
May 2018	0.77*	-0.55***
	(0.34)	(0.065)
June 2018	0.87*	-0.42***
	(0.33)	(0.072)
Binance Only	-0.88***	-0.2***
	(0.21)	(0.054)
Bittrex Only	-0.72***	-0.03
	(0.19)	(0.052)
Binance-Bittrex	-1.09**	-0.31***
	(0.32)	(0.084)
Constant	-0.67	2.33***
	(0.89)	(0.32)
Observations	271	2,198
Adjusted R^2	0.60	0.26

Standard errors in parentheses: They are clustered at the level of the coin.
* significant at the 90% level
** significant at the 95% level
*** significant at the 99% level

Table 10: Correlation Table: Pump Exchange and Independent Variables, N=546

Variable	Pump Exchanges	Exchanges	Pair Count	Rank75
Pump Exchanges	1			
Exchanges	0.29	1		
Pair Count	0.13	0.73	1	
Rank	−0.25	−0.40	−0.18	1

Table 11: Pump (Median) Success/Profitability by Month in Percentage Terms

Month	Discord	Telegram
Jan 2018	5.4	6.4
Feb 2018	4.1	4.9
Mar 2018	3.9	5.2
Apr 2018	3.2	4.2
May 2018	2.9	2.8
Jun 2018	2.2	3.2