"It was honestly just gambling": Investigating the Experiences of Teenage Cryptocurrency Users on Reddit

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Abstract

Despite fears that minors may use unregulated cryptocurrency exchanges to gain access to risky investments, little is known about the experience of underage cryptocurrency users. To learn how teenagers access digital assets and the risks they encounter while using them, we conducted a multi-stage, inductive content analysis of 1,676 posts made to teenage communities on Reddit containing keywords related to cryptocurrency. We identified 1,409 (84.0%) posts that meaningfully discussed cryptocurrency, finding that teenagers most often use accounts in their parents' names to purchase cryptocurrencies, presumably to avoid age restrictions. Teenagers appear motivated to invest by the potential for relatively large, short-term profits, but some discussed a sense of entertainment, ideological motivation, or an interest in technology. We identified many of the same harms adult users of digital assets encountered, including investment loss, victimization by fraud, and loss of keys. We discuss the implications of our results in the context of the ongoing debates over cryptocurrency regulation.

1 Introduction

Over the last decade, cryptocurrencies, non-fungible tokens, and other crypto assets [28] have become very popular investments, especially among younger people. An online survey of 2,872 users conducted at the end of 2022 found that cryptocurrencies were the most popular type of investment among investors aged 18 to 25 [15]. Moreover, many survey respondents began investing at an extremely young age, with 25% reporting that they began investing as a minor. This

raises important security and privacy concerns: Private keys are difficult for even adult users to manage safely and any mistakes can result in immediate financial loss [47]. Most cryptocurrencies are pseudonymous, meaning that once a person's wallet address is known, many, if not all, of their past transactions can be identified [56]. Besides these usability and privacy issues, the cryptocurrency world has historically been rife with scams and other financial crimes that defraud users [7, 37, 59, 66].

Crypto asset investment also presents considerable financial risks. Many speculative crypto assets feature the characteristics of "gamblified" investments as defined by Newall et al. [63]: it is difficult for most to profit reliably [22, 26, 32, 80], it is attractive to users who are susceptible to gambling [43], and it presents the allure of out-sized profits. Even more established cryptocurrencies, like Bitcoin, are highly volatile, with the price of Bitcoin peaking around $65,000 in November 2021 before dropping to a three-year low of around $15,000 just a year later.[1]

There is good reason to hypothesize that minor teenagers (aged 13 to 17 years old) may be more vulnerable to these risks of cryptocurrency. Teenagers have developing brains, generally showing higher risk-taking and sensation-seeking behavior that declines with age [48, pp. 528–530]. They may also be affected more by certain motivational factors such as peer pressure [23] or influence from social media personalities [21], some of which have been implicated in illegally promoting crypto assets [7, 37]. Moreover, like other marginalized and vulnerable groups (e.g., immigrants [20], older adults [67], etc.), teens could be targeted by unique types of fraud tailored to their experiences.

The under-regulated nature of cryptocurrencies has also raised concerns [76] that teenagers may gain access to risky assets without parental oversight. While most exchanges require users to be 18 years of age or older to create an account,[2] it is

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[1]Historical prices obtained from https://coinmarketcap.com/

[2]For example, the user agreement of the publicly traded cryptocurrency exchange, Coinbase, states that "To be eligible to use the Coinbase Services, you must be at least 18 years old." [19]

possible that teenagers could invest via unregulated exchanges with absent or lax Know Your Customer (KYC) policies.[3] Indeed, this method is advocated by online blogs [6, 49].

Despite these risks, little empirical evidence exists about how minor teenagers use crypto assets and the harms they encounter while investing. To address this gap, we analyzed posts about cryptocurrency from teenagers on Reddit, a US-based social media platform and link aggregation website. First, we used a set of 48 keywords to identify 4,979 posts likely to be about cryptocurrency in six Reddit communities ("subreddits") used by teenagers (e.g., /r/Teenagers, /r/ApplyingToCollege, etc.). We then performed inductive thematic analysis on a random subset of 1,676 posts, seeking to answer the following research questions:

1. **How do teenage users gain access to the crypto asset ecosystem?**
2. **What motivates teenagers to engage with crypto assets?**
3. **What types of harm do teenagers experience when using crypto assets?**

We ultimately identified 1,409 (84.0%) posts meaningfully discussing cryptocurrency. We found little evidence for the widespread use of unregulated exchanges, with minor teenagers most often claiming to use accounts in their parents' names to purchase cryptocurrencies. Some also received donations from other users or mined for cryptocurrency. Teenagers appear motivated to invest by profit, but some discussed a sense of entertainment, ideological motivation, or an interest in technology. Finally, we identified many of the same harms adult users of digital assets encountered, including investment loss, victimization by fraud, and loss of keys. Our main contribution is to provide the first insight into teenagers' interactions with cryptocurrency and the harms they encounter. We discuss our results in the context of ongoing debates about crypto asset regulation.

2 Background and Related Work

In this section, we review important background information and previous research related to our own, including 1) usable security and privacy research focused on crypto assets, 2) research about crypto assets and social media, and 3) children's online safety.

2.1 Cryptocurrency and Usable Privacy and Security

One of the main security and usability challenges of cryptocurrencies is the need to manage cryptographic keys. Rather than relying on a central intermediary to process transactions,

cryptocurrencies use public-key cryptography to verify transactions [60]. To prevent financial loss, users must ensure that they maintain access to their private keys or the underlying seed phrase while also ensuring that their (private) keys are protected from attackers. Cryptocurrency wallets are, therefore, highly vulnerable to accidental loss [72], social engineering attacks [89], or hacking [87]. Alternatively, users may rely on custodial services like wallet providers or exchanges that manage cryptocurrency on behalf of users. While custodial services lift much of the key management burden from users, they introduce new institutional risks (e.g., the service may be hacked as Bitfinex was in 2016 [68]).

Previous research has shown that cryptocurrency users can struggle to manage their cryptographic keys securely [1, 31, 47, 52, 88]. For example, Krombholz et al. [47] surveyed 990 Bitcoin users on their security and privacy practices, finding that nearly a quarter of users experienced some sort of financial loss due to user error (e.g., they formatted the hard drive containing their private key), system failure (e.g., dead hard drive, corrupted key file), or a malicious attacker (e.g., malware). Users' lack of conceptual understanding of how cryptocurrencies work may also contribute to these security lapses. Mai et al. [52] conducted an interview study with 29 participants (both current cryptocurrency users and non-cryptocurrency users) to learn about their mental models of cryptocurrencies in relation to security and privacy threats. They identified a number of misconceptions that could lead to financial loss, especially with respect to the function of private keys in cryptocurrency systems. For example, some participants did not realize that private keys were unique to each user and should not be shared with others. These misconceptions could be mitigated by improving the design of cryptocurrency wallets [25, 88] and abstracting away key management tasks [52].

Cryptocurrencies also present unique privacy risks. By necessity, all transactions are recorded on a public ledger, which can be viewed by anyone. While some cryptocurrencies (e.g., Monero, Zcash, etc.) attempt to offer greater privacy guarantees, the most popular cryptocurrencies, including Bitcoin and Ethereum, are merely pseudonymous. That is, there is no inherent link between a person's identity and the address that corresponds to their wallet, but anyone who knows that an address belongs to a particular person can find their transaction history on the blockchain. Moreover, users may be identifiable even if they take steps to hide their identity [5, 11, 56]. Users may overestimate the privacy guarantees of cryptocurrencies. Many participants in the study by Mai et al. [52] believed that transactions on the blockchain were encrypted and, therefore, could not be tracked. Similarly, almost a third of the participants in the study conducted by Krombholz et al. [47] incorrectly believed that Bitcoin was anonymous.

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[3]KYC regulations vary by jurisdiction but generally require financial institutions to verify a user's identity to help prevent money laundering and other criminal transactions [30].

2.2 Cryptocurrency and Online Communities

Social media plays an important role in modern investing, including cryptocurrency. Social media platforms can help users to learn about new cryptocurrencies [41] and promote the adoption of their favorite projects [46, 57]. Bad actors also use social media to manipulate the cryptocurrency market and promote scams [59, 65, 86]. For example, Nizzoli et al. [65] compiled a dataset of 50 million messages discussing cryptocurrency on Twitter, Discord, and Telegram, finding that Twitter bots were used to promote hundreds of different Telegram channels that facilitated Ponzi schemes and pump-and-dumps. Social media users with large followings, commonly known as "influencers" [40], have been implicated in illegally using their platforms to promote cryptocurrencies they own or were paid to promote without proper disclosure [7, 37], sometimes while actively investing against the very products they were promoting [45].

Reddit, in particular, has many communities focused on finance and investing (e.g., /r/WallStreetBets, /r/PersonalFinance, etc.), including many dedicated to discussing cryptocurrencies (e.g., /r/CryptoCurrency, /r/Bitcoin, etc.). Discussions of finance are not restricted to these communities, with cryptocurrency being the most popular topic across all of Reddit in 2021 [75]. A number of researchers have applied quantitative methods to study cryptocurrency discussion on Reddit, with a specific focus on the relationships with price movements [70, 71, 91, 95]. For example, Papadamou et al. [70] conducted an analysis of the relationship between Reddit activity and the price of cryptocurrencies, finding a strong cross-correlation between the number of posts mentioning a cryptocurrency and its price for 30 of the top-50 currencies by market cap. They also observed a correlation between average sentiment and price movement, with greater joy expressed during market upswings and anger expressed during market downturns.

Only a few researchers have applied qualitative methods to characterize the discussion of cryptocurrency on Reddit [17, 34, 44, 46]. Most relevantly, Childs [17] conducted a thematic analysis of the top 200 posts on /r/CryptoCurrency that mentioned the word "scam" in order to evaluate how users cope with fraud. He found that users attempt to prepare the community to deal with scams by providing resources (e.g., providing newcomer guides that discuss scams, sharing experiences of victimization, etc.) and establishing community norms to counter scammers (e.g., calling out suspected scam projects, identifying blockchain addresses associated with scams, etc.). He also found that users seem to promote the view that scams are an inevitable "cost of decentralisation." Johnson et al. [44] performed a thematic analysis of posts discussing psychological well-being, mental health, or gambling made to /r/CryptoCurrency during a decline in the cryptocurrency markets in 2022. They identified coping strategies users employ emotionally to handle the downturn, as well as content that explicitly and implicitly connected cryptocurrency trading with gambling. To the best of our knowledge, no prior research has focused on online cryptocurrency discussions among teenagers.

2.3 Teens' online safety and fraud

Teenagers represent an important demographic to study due to their distinctive patterns of online behavior and susceptibility to digital risks. Modern American teenagers are "digital natives" [54] who have grown up in a world where digital devices and the internet are commonplace. The vast majority of American teenagers own or have access to a smartphone (95%) or a desktop/laptop computer (90%). Most also use some form of social media, with YouTube (93%), TikTok (63%), Snapchat (60%), and Instagram (59%) being the most popular. Only 14% of American teenagers use Reddit [4].

The teenage years are a critical psychological developmental stage. At that age, emotional and social networks in the brain mature faster than the prefrontal cognitive-control network, which continues to develop into the early to mid-20s. This renders teenagers particularly susceptible to heightened impulsivity, sensation seeking, and emotional reactivity. While there is a great deal of individual variance, adolescents often encounter challenges in performing executive function tasks requiring inhibition, planning, and future orientation. These developmental dynamics contribute to a general trend of increased risk-taking behaviors among teenagers that declines with age [48, pgs. 528 – 530].

Teenagers face many of the same security and privacy challenges as adults, such as poor password management [85], susceptibility to phishing [64], and difficulties managing both interpersonal and data privacy [50, 55] online. Teenagers may experience these risks in ways distinct from adults. For example, Jia et al. [42] argue that some degree of privacy risk-taking (e.g., over-sharing information) on social media may help teenagers develop their privacy risk-coping strategies.

Teenagers also encounter some online risks more frequently than adults. For example, online sexual exploitation [3, 90] and cyberbullying [94] have been extensively studied in the scientific literature. No prior research has explored the types of safety risks that teens may encounter while using cryptocurrency.

3 Methods

We next describe the methods used to answer our research questions. We conducted an inductive thematic analysis of 1,676 posts containing keywords related to cryptocurrency from a set of Reddit communities used by English-speaking teenagers.

3.1 Dataset

Our study is based on posts and comments on Reddit. The platform is divided into thousands of user-created communities called "subreddits," which focus on particular topics (e.g., /r/politics for American politics) or identity groups (e.g., /r/gaybros for gay men). Users can submit posts that link to external websites or present original text and multimedia content. Users can vote to affect the visibility of posts, with an "upvote" boosting a post and a "downvote" lowering the post's visibility. Users can also comment on posts, with the order of comments determined by a similar voting scheme. Reddit is a common data source for academic research, particularly in computer science [73].

Rather than collect data directly from Reddit, we used an archived copy of the Pushshift dataset [8] with posts and comments from June 2005 to December 2022 (inclusive).[4] The dataset also includes the content of some posts that were deleted by users or removed by moderators, making it more complete than the data available directly from Reddit. Pushshift is widely used for academic research on Reddit [8, 73].

Anyone 13 or older can register for Reddit, and an estimated 14% of American teenagers have used the platform [4]. For our content analysis, we focus on six communities that we assume are predominantly used by teenagers: /r/Teenagers, /r/ApplyingToCollege, /r/SAT, /r/ACT, /r/HighSchool, and /r/PSAT (henceforth referred to collectively as the "teenage subreddits"). /r/Teenagers describes itself as "the biggest community forum run by teenagers for teenagers," /r/ApplyingToCollege has over 1 million users and focuses on topics related to college admissions, with an emphasis on students enrolling directly out of high school. Similarly, /r/SAT, /r/ACT, and /r/PSAT are subreddits focused on discussion of college admissions exams that are most frequently taken by teenagers. Finally, /r/HighSchool is a subreddit that includes a wide range of content related to the secondary school experience. Previous studies [10, 16, 82, 93] have considered users' participation in Reddit communities like /r/Teenagers as an indication of a user being underage.

To identify posts that discussed cryptocurrency, we used a keyword-based sampling technique. Previous studies of Reddit have also used keyword-based sampling to study cryptocurrency [44, 70] as well as other topics [29, 92]. We first selected a heterogeneous set of keywords based on popular cryptocurrencies (e.g., Bitcoin, Ethereum, Dogecoin, etc.), cryptocurrency exchanges (e.g., Binance, FTX, etc.), interest-yielding services (e.g., Nexo, Blockfi, etc.), cryptocurrency gambling services (stake.com, Cloudbet, etc.), and concepts related to cryptocurrency (e.g., blockchain, decentralized, etc.). Our goal in selecting keywords was to identify a diverse set of

posts about cryptocurrency with a low false positive rate. The complete list of keywords and their frequencies can be found in Appendix B.

We then collected all posts that contained one or more of these keywords in either the title or the body of the post. We initially collected 6,408 posts; however, as discussed in the next subsection, several keywords were removed during codebook development. The final dataset contained 4,979 posts (0.06% of the total posts on the teen subreddits). For the thematic analysis, we selected a random sample of 1,676 (33.7%) to review.[5] We also collected all the comments ($n = 3,738$) associated with the posts in the sample. Most posts (80.0% of the sample) included only a single unique keyword. The most common keyword was some variation of "NFT," with 680 posts (40.6% of the sample) including at least one instance of this word.

3.2 Thematic Analysis

Thematic analysis was performed by two authors in multiple stages. To generate an initial codebook, the lead coder reviewed a subset of 100 posts from the 6,408 post dataset and performed inductive thematic analysis. The coder viewed the post title, post body, and all the comments associated with the post. If a post contained a link, the coder also considered this content if it was available.

Codes were selected to identify content relevant to our research questions and provide valuable categories for subsequent analysis. For example, we identified discussions of different types of behavior (trading, mining, using crypto for payment, etc.). We also identified different types of harm (e.g., monetary losses, crimes, and gambling). We also selected codes that characterized the kind of post (e.g., discussion of crypto-related news, joke/meme, question about crypto assets, etc.). Most posts had more than a single code assigned.

Some posts were recorded in the Pushift dataset with the body text replaced by "[removed]" or "[deleted]." This indicates that, before Pushift could collect the post, it was removed by moderators or deleted by the user who posted it. Often, it was still possible to assign a theme to these posts, although this analysis is necessarily less reliable. For example, a removed post titled "Artist Seed - The NFT project that births a metahuman through cryptoart" evidently promotes the Artist Seed project. Removed or deleted posts that could not be assigned a theme were coded as "Removed/Deleted (Ambiguous Content)." For example, a removed post with the title "Dogecoin" was given this code.

To help contextualize each post, we also viewed user and post flairs. Flairs are tags that can be added to a post or a user profile to indicate something about them. On /r/Teenagers, post flairs are required to indicate the type of content (e.g., "Meme," "Art," "Discussion," etc.).

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[4]In response to changes in Reddit's policies in 2023, the Pushshift API is no longer publicly available to all users. We maintained an archive of the data available before this change and used it for this study.

[5]This sample size was selected based on the sample necessary to achieve a 99% confidence level with a 2.5% margin of error.

User flairs on `/r/Teenagers` are used to indicate a user's age. Flairs are unique to each subreddit. For example, on `/r/ApplyingToCollege`, user flairs are used to indicate a user's year in school (e.g., HS Freshman, College Senior, Graduate Student, etc.). When quoting users, we list their flair if available in Pushshift. All deleted posts and many removed posts had the author field replaced with the text "[deleted]" and the user flair removed. We are, therefore, unable to report age information for users with deleted posts.

During codebook development, some keywords were eliminated. For example, we realized that the keyword "ether" mostly resulted in false positives, as all posts returned by this keyword in the subsample were people misspelling the word "either." The keywords eliminated during this stage are listed in Appendix B with the note that they were removed.

After developing the initial codebook, the lead coder and another author collaboratively coded the remainder of the posts. The process was broken into blocks of 10% to 20% of the sample. For each block, the coders independently reviewed the sample and assigned codes based on the definitions in the codebook. The coders then met to compare their analyses, discuss differences, and select a consensus code for each post. Additional codes were added as needed throughout this process. During coding, the coders also recorded memorable or archetypal posts to serve as examples for the paper.

After all the posts were assigned an initial set of codes, the coders reviewed every post a second time to gain additional insights into the nuance of particular codes and refine the initial categorization. For example, for posts that were categorized as "Working on a crypto project," the coders enumerated the specific types of projects that users described. During this secondary analysis, the coders changed the codes assigned originally to some posts as needed. The final codebook with examples for each code can be found in Appendix A.

3.3 Ethical Considerations

Our research is not human subjects research, as we relied on publicly available data.[6] We recognize that social media users may not expect their posts to be reviewed and analyzed as part of research [27]. Moreover, teenagers, as members of a vulnerable population, deserve special consideration to ensure their protection. We do not report the names of users in the dataset. We will not publicly post our curated dataset, although interested researchers may contact the corresponding author to request an archived copy.

3.4 Limitations

The generalizability of our results is necessarily limited by the structure and demographics of Reddit. Due to the Reddit voting scheme, posts and comments that are more broadly

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[6]Our study was submitted to our Institutional Review Board(s), which confirmed that human subjects research review was not necessary.
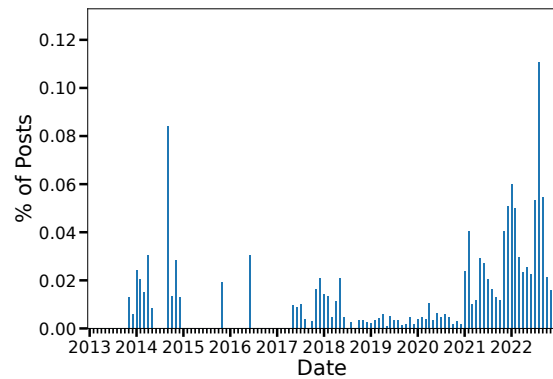

Figure 1: Frequency of posts in the random sample that contained relevant content each month, normalized by the number of posts in the teen subreddits per month. There were 8,803,440 posts on the teenage subreddits from January 1, 2013 to December 31, 2022. No posts in our sample were posted before 2013.

appreciated are more likely to be seen and interacted with. Reddit users are more likely male, with 20% of teen boys in the United States using Reddit as compared to only 10% of teen girls [4]. Moreover, we cannot verify the claims made by users, and some posts and comments may contain fabrications or exaggerations. The subreddits we investigated are not age-restricted, and some users are likely to be adults. Finally, we focused exclusively on English posts and users who do not speak English are, therefore, not represented.

4 Results

In this section, we describe the results from our qualitative analysis. We begin by giving an overview of the sample before discussing results relevant to each of our research questions.

4.1 Overview

Figure 1 shows the frequency of posts about cryptocurrency in our sample. To account for the varying number of posts per month, we normalized the number of posts each month by dividing by the total number of posts in the teen subreddits that month. The highest posting volume is associated with an increased discussion surrounding the Reddit NFTs, which were given away to many users in the second half of 2022 [53]. Only 267 (16.0%) of the posts in the random sample did not contain relevant content about cryptocurrency. Most of these posts (181) were false positives, which did not contain any mention of cryptocurrency. The rest of these posts (86) contained some mention of cryptocurrency, but in such a manner that they provided no useful information. For example, one user made a post in `/r/SAT` where they stated that they "want

Table 1: An overview of the results of coding the sample. The percentage for "# in Sample" refers to the proportion of the entire sample. The percentage for all other columns refers to the proportion of posts from each subreddit.

Subreddit	# in Sample (%)		# Irrelevant (%)		# Promotional (%)		# Removed/Deleted (%)	
/r/teenagers	1486	(88.7%)	204	(13.7%)	241	(16.2%)	497	(33.4%)
/r/ApplyingToCollege	109	(6.5%)	52	(47.8%)	10	(9.2%)	15	(13.8%)
/r/Sat	47	(2.8%)	2	(4.3%)	43	(91.5%)	42	(89.4%)
/r/ACT	15	(0.9%)	6	(40.0%)	7	(46.7%)	7	(46.7%)
/r/APStudents	11	(0.7%)	0	(0.0%)	3	(27.3%)	2	(18.2%)
/r/highschool	8	(0.5%)	3	(37.5%)	1	(12.5%)	2	(25.0%)
/r/psat	0	(0.0%)						
Total	1676	(100.0%)	267	(16.0%)	305	(18.2%)	565	(33.7%)

to apply to Computer engineering (preferring specialization in blockchain tech., cloud computing, data tech.)" While this indicates that they have some interest in crypto-related technology, it does not indicate anything about whether or not they currently use cryptocurrencies.

1,027 of the 1,409 relevant posts in our sample (72.9%) were made by users without user flair or with a flair that did not indicate their age (e.g., "2 MILLION ATTENDEE"). The most common age flairs identified the author as under 18 (385 or 81.7% of posts with age flair). Only 78 of the relevant posts (17.4% of posts with age flair) indicated that a user was 18 or 19.[7] The remaining 4 relevant posts (0.8% of posts with age flair) were made by users with the flair "OLD," indicating that the user was 20 years old or older. These age distributions should be viewed skeptically, as they are sparse and user-provided. Users may forget to change their flair after a birthday or purposefully lie about their age. Still, this result supports our assumption that most of the discussion in our sample comes from users under the age of 18.

Table 1 provides an overview of the posts in our sample, broken down by subreddit. The overwhelming majority of posts in the sample were posted on /r/teenagers (88.7%). This result is in line with the distribution of posts in the PushShift dataset, as /r/teenagers is by far the largest subreddit we examined. /r/PSAT contained no posts containing any of the cryptocurrency-related keywords. Across the entire sample, 33.7% of the posts were removed by moderators or were deleted by users prior to collection by PushShift. 67 of these posts (11.9%) had no code assigned (i.e., the probable content was ambiguous). The remaining 498 posts (88.1%) were assigned one or more codes, albeit at a lower confidence level than others. When reporting the frequency of codes in Appendix A, we specify the number that had removed or deleted content.

Table 2 shows the frequency of codes in our dataset. The most common post type in the sample were posts that pro-

moted a specific project or service (305 instances or 18.2%). These posts seemed fairly ineffective: 228 (74.8%) were removed or deleted, and most (200 or 66.6%) received no comments. Many of these posts advertised the same projects repeatedly, often using identical or near-identical text. The most commonly promoted projects were Pi Network (8.9% of promotional posts), Ethereum Name Service (7.8% of promotional posts), and Dogecoin (7.2% of promotional posts). Another common feature of these posts was some sort of giveaway or sign-up bonus. For example, many posts promoting the Ethereum Name Service stated "Ethereum Name Service ($ENS) is Airdropping Tokens worth up to 5000$ for the first 1000 People To Claim it." Airdrops are free distributions of digital assets given away to promote a project [2]. When promotional posts were not removed right away, users often reacted negatively. For example, a post promoting Pi Network in /r/teenagers in August 2019 received negative replies from 5 different users, many calling it a scam (e.g., "That's 100% scam. Watch out").

As one might expect from a social media website, jokes and meme posts were also common. 254 posts (15.2%) were coded as being a joke or meme, mostly because they were explicitly labeled as such (i.e., using post flair). An additional 52 posts (3.1%) were tagged as probable sarcasm. We used this code when a post was not labeled as a joke but seemed so absurd as to be unbelievable or was otherwise clearly intended to be a joke. For example, one deleted post from 2019 to /r/teenagers stated, "$20 for a pic of my belly PM me accepting Bitcoin only (pic unrelated)." This post is unlikely to represent a genuine attempt at selling photos for Bitcoin. There was a great heterogeneity among the different types of jokes. However, a common theme seemed to be criticizing the intangibility of cryptocurrencies in general and NFTs in particular. For example, many users made jokes about the ability to "screenshot' or "right-click and save" NFTs. When we coded a post with "joke or meme" or "sarcasm," we refrained from applying any other codes to that post since we assumed the post does not reflect actual behavior.

Many of the relevant, non-joke posts were uninformative

[7]For this analysis, we assume that users with flair "HS Senior" are 18. We assume that users with flair indicating another class year (E.g., "HS Junior" are under 18.

for our research questions. For example, 69 posts (4.1%) discussed news related to crypto assets, such as the failure of the exchange FTX. While these posts demonstrate that users were interested in discussing crypto, they lacked information about users' experience with crypto assets.

Posts discussed a range of interactions with crypto assets, including obtaining/holding crypto assets (226 posts or 13.5%), mining cryptocurrencies (59 posts or 3.5%), selling or otherwise transferring crypto assets to others (30 posts or 1.8%), short term trading (25 posts or 1.5%), using cryptocurrencies for payment (25 posts or 1.5%), and gambling with crypto assets (13 posts or 0.8%). It is important to note that not all of these posts described actual, current behavior. For example, 10.2% (23) of the posts tagged as "discussion of obtaining/holding crypto" discussed a user's desire to obtain a crypto asset and 5.8% (13) conveyed a question about obtaining crypto assets.

Table 2: Most common codes assigned to posts in the dataset. Complete definitions and examples can be found in appendix A

Code	Frequency (%)	
Explicit promotion of project	305	(18.2%)
Joke or meme	254	(15.2%)
Discussion of obtaining/holding crypto	226	(13.5%)
Irrelevant	181	(10.8%)
Reddit NFT	156	(9.3%)
Giveaway	145	(8.7%)
Criticism of crypto	110	(6.6%)
Subjective question about crypto	105	(6.3%)
Irrelevant, Crypto mentioned in passing	86	(5.1%)
Discussion of news in crypto	69	(4.1%)

4.2 RQ1: How do teenage users access crypto assets?

The most common way for teenagers in our sample to gain access to cryptocurrency services was apparently by creating accounts in the name of their parents or another trusted adult. While most posts about obtaining crypto assets did not explicitly address how the user accessed the crypto ecosystem, we observed users discussing this when they asked others how they could access crypto assets. For example, in November 2021, one user posted a thread to /r/teenagers titled "Are you able to get into the stock market and cryptocurrency as a teenager." The body of the post stated "I wanna buy one of those funny looking monkey pictures but I'm clueless on how it works." One 17-year old user replied "you can have your parents set up your account." A different 17-year old user stated "I trade crypto under my moms name but to my knowledge you have to be 18 at least where I live." In response to a deleted post titled "Had to sell a lot of my crypto,"

made to /r/teenagers in November 2021, one user wrote "Dude I am sorry... can you tell me why you had to sell it, how you got in, and where do you sell your crypto (I've been tring get in for a while but i dont know how)." A 15-year-old user replied, writing, "I'm not OP but for crypto I would use Binance. It's an online exchange with pretty low fees. You'd need your parents' permission though, since it requires you to be over 18 and provide a drivers license..." Similarly, in reply to a post promoting Bitcoin in February 2021, one user commented "I wanna use Blockfi and earn interest but I'm not 18 :(((((((." A 15-year user replied with advice, stating "If you have a parent, you could do it with their account." Purchasing cryptocurrency through a parent's account is likely the safest way for teenagers to access the crypto markets, assuming they supervise their child's investments.

Users also discussed mining cryptocurrency to use it for speculation. For example, one 17-year-old user made a post to /r/teenagers in March 2021 titled "Decided to start mining for eth and made some btc out of it. Time to hold and watch it raise!" The image attached to the post showed $100 worth of Bitcoin in a wallet. Mining refers to the process of generating cryptocurrency by running a computer that validates transactions on a blockchain. Once mined, cryptocurrency could be transferred to an exchange and traded for other cryptocurrencies. This is presumably what the user meant when they said they were "mining for eth and made some btc." If an underage user were to use a decentralized exchange or other service that does not deal in US dollars or other fiat currencies, they could avoid age restrictions and KYC regulations. Another user more explicitly described this process in a post to /r/ApplyToCollege in July 2017: "Recently I started to get engaged with the cryptocurrency market. Ive been building multiple mining rigs and buying/sellimg the currencies in an attempt to make money. Would this count as an extracurricular?" Throughout our analysis, we encountered many posts similar to this, where users described some kind of involvement in crypto to see if it was worth discussing in their college applications.

Mining was also recommended to some users who inquired about obtaining cryptocurrency as a minor. For example, a 17-year-old user posted a thread to /r/teenagers titled "Is there anyway to buy crypto without being 18." The body of the thread stated "Since i cant participate in stonks without being 18 crypto i legally can, is there any service that doesnt ask for age verification?" Along with several replies recommending that the user get help from his parents or another adult, one 16-year-old user replied that they could "GPU mine for a while... and trade with that."

Some users also gained cryptocurrency via gifts from other users on Reddit. For example, in May 2021, a 15-year-old user posted to /r/teenagers "thank you to whoever tipped me dogecoin like a few months back." The body of the post added "i managed to reinvest in crypto and now have £290 from like £40" We also found a few examples of threads where users

gave away small amounts of cryptocurrency to users who commented in /r/teenagers. In January, 2014 a 16-year-old made a post titled "[Other]I'm back with another bitcoin giveaway!" The poster used the /u/changetip[8] bot to gift users fractional amounts of bitcoin. The post received over 900 comments. Similarly, in September 2014, a user made a post to /r/teenagers with the title "Free Bitcoin - Just Comment." The thread also received hundreds of comments.

This kind of post was rare. Most of the threads tagged with the "giveaway" code were promotional posts advertising some sort of airdrop or sign-up bonus given out by a service. All of the peer-to-peer giveaways occurred in 2014. Users directly donating to others could be motivated by a sense of philanthropy; however, donating small amounts of cryptocurrency directly to other users is also a good way to introduce new users to the ecosystem. Indeed, the poster in the January 2014 giveaway explicitly stated this, writing, "...I am doing this giveaway to get my peers involved in bitcoin. I believe in bitcoin as a currency, and not just an investment, and I think it could benefit other teens..." As Bitcoin became more mainstream, it became less necessary to introduce users through free giveaways.

Some teenagers created their own crypto projects. For example, one user made a post to /r/ApplyingToCollege in August 2018 where they asked if they should update colleges about a cryptocurrency project they launched: "So I just recently finished making my own crypit currency with a relatively high market cap of 100k ish. I didn't mention this on my app at all (besides interest in crypto) because I didn't think I would get it done in time, but I did. Would it be worth emailing my colleges about this new stage in my life..." The open-source nature of major cryptocurrencies makes it relatively trivial to fork an existing project, tweak some properties, and give the currency a new name. Dogecoin, for example, began as a fork of an existing project (LuckyCoin) [18].

We found little evidence for teenagers using unregulated exchanges to purchase cryptocurrency. We only found one comment or post where a user stated that they used an unregulated exchange to avoid "know-your-customer" (KYC) practices. In reply to a comment expressing frustration about being unable to purchase cryptocurrency, one user in mid 2021 stated "Lol I'm a minor and I bought Bitcoin using a non kyc site, and a vpn..." Using a VPN could allow users to avoid KYC requirements and other regulations that are only enforced for users who appear to be in a particular jurisdiction. Some exchanges, such as Binance International, were complicit in helping US-based users avoid geo-blocking by recommending the use of a VPN [51]. We did find another comment where a user recommended Binance International in a discussion where a different user shared that they were interested in getting started in cryptocurrency: "yeah go for it man, hmu if U need help, im using binance international."

This user did not indicate that they were under 18 nor did they state that they were using Binance International to avoid regulations.

There may be more users who used unregulated exchanges but did not discuss it for various reasons (e.g., they may not want to admit to trying to circumvent exchange rules). Our keyword-based sampling approach may have also prevented us from finding more examples. Still, finding only a single example of the use of an unregulated crypto exchange suggests that the practice is less common than the other ways minors may obtain crypto assets.

4.3 RQ2: What motivates teenagers to engage with crypto assets?

A desire to realize relatively large, short-term profits seemed to be the most common motive for teens acquiring crypto assets. The most valuable insight into users' motives came from 23 of the posts coded with "discussion of obtaining/holding crypto" where users discussed their intention or desire to purchase crypto assets. The potential for large, relatively short-term gains was commonly brought up. For example, one 14-year-old user made a post to /r/teenagers in March 2021, stating, "Hey guys so my parents are giving me 100 dollars to invest in whatever I want... I think a good crypto to buy is Bitcoin... I've been tracking it... it is fairly stable and usually doesn't go down a lot and since by 2030 my investment of 100 will grow ten fold if I buy it now." A different 14-year-old user made a post to /r/teenagers in June 2021, writing "I'm becoming obsessed. I wanna transfer some of my personal money into Bitcoin so I can have enough for a car when I'm 17 in 3 years. Anyone else involved at all in crypto?" In reply, several users recommended against trading crypto. However, a 15-year-old user shared an anecdote that might reinforce the sense of easy profits: "I put $500 on doge when it was 0.04 and when it hit 0.72 it became $5,000."

Users actively engaged in crypto asset investment discussed how profitable it seemed to be compared to other ways to make money. For example, in August 2021, a user made a deleted post to /r/teenagers titled "Lmao. Trading stocks seems like a scam when I see shit like this. With Crypto trading I've seen 50-100% profits in literally minutes. Still learning but starting with small amounts. Like 18/20 of the trades I made so far were at least 50% profit." The post linked to a picture of text explaining that day trading stocks are typically unprofitable. Similarly, in November 2021, a user made a post to /r/teenagers titled "If Shiba Inu lists on Robinhood I'll have enough money to move out of my parents house." The body of the post stated "And yes that's my only hope... because dog crypto coins have made me more profit in a week than minimum wage pays in 8 months."

Short-term profit potential was also frequently emphasized in posts promoting crypto asset investing. For example, one user wrote a post to /r/teenagers in January 2021, stating

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[8]This bot is now defunct. While operating, it allowed users to gift cryptocurrency using commands in Reddit comments [39]

"My advice to everyone here is to invest, whether it be in cryptocurrency or the stock market... Cryptocurrency (like bitcoin) is more wild and fluctuating than the stock market, so it's riskier... If you do it right, a measly $1K can pay your entire college fund in a few years." Similarly, an 18-year-old user wrote in a post to /r/teenagers in May 2021, "...I have reason to believe that Safemoon is going places... this crypto could rocket up, and if you invest now you could make a good profit if it does get anywhere..." This example is particularly disturbing, as the company and founders of SafeMoon were subsequently charged with defrauding investors [78].

Interestingly, several users described being pushed by their parents to develop NFTs based on a desire for outsized profits. For example, a 14-year-old user made a post to /r/teenagers in July 2022 titled "Any Crypto Teens here to answer this?" The body of the post shared "I do art as a hobby, and my dad's been telling me to turn them into NFTS. I've refused twice, but on the third time, he told me that I'm missing out on the chance to make him and I millionaires. Do I go for it or not?" Similarly, a 14-year-old user made a post to /r/teenagers titled "So uh." in January 2022. The body of the post stated "My parents are asking me to make NFTs and sell them because 'you have some knowledge about it, why not go and make some money like him...'" The post linked to an article about a computer science student who made millions of dollars from selling an NFT collection [24].

Users and their parents' desire to profit off crypto assets is generally misguided. While some popular NFT projects are very profitable, most make little to no money [69]. The story is similar in cryptocurrency markets. Most retail investors sold at a loss following the collapse in cryptocurrency prices in 2022 [22,26], and many fall prey to institutional investors [80]. Short-term profits may trick users into feeling that they are skillful or have discovered a successful strategy, however, the ambiguity of the crypto asset market makes it difficult for traders to consistently profit over time [32]. Crypto asset trading may appeal particularly to teens due to their limited wealth and low incomes. A modest gain from buying and holding traditional equities may seem trivial to a person who only has a few hundred dollars to invest.

Some users discussed crypto investing as a form of obsessive entertainment akin to gambling. For example, one user made a post to /r/teenagers in November 2021 titled "I invested like $100 into crypto and [can't] stop looking at the charts and stuff." In response to a commenter who stated that "The market is too volatile imo," the original poster wrote "That makes it fun." A 17-year-old user replied to the thread, sharing the same experience: "I got interested in it a year ago and I couldn't stop looking at charts even during online classes for months." Another user shared that they went on a "...wild rally of not sleeping and keeping my eye on the charts." Increased checking of markets has previously been associated with investment in crypto assets [35].

User justifications for purchasing high-risk assets also men-

tioned the "fun" of the activity alongside the potential for a high reward. For example, in July 2021, a user made a post to /r/teenagers titled "i invested $1000 into a dog meme crypto haha." In the body, they explain "...I saw a lot of videos about it on tiktok and want to make some money so decided to stick $1,000 into a cryptocurrency meme coin called hoge lol... whether I become a millionare or make nothing it would be a fun experiment." In the comments, they stated they were under 18. Similarly, in response to a post promoting a project called PhunWallet in January 2021, one 17-year-old user wrote, "im interested, just for fun yk... I'm more into well established cryptos like btc,eth,sol,doge,aval,xrp,xlm,etc etc" The original poster replied stating, "Yeah this is a start up, costs nothing to get into this... maybe in 5 years it could be worth something."

The comparison with gambling is not just inferred. As Johnson et al. [44] observed, users in our sample directly compared the experience of crypto trading to gambling. For example, an 18-year-old user wrote in a post to /r/ApplyingToCollege in "...I got into investing around that time as well, and I flipped $10 to around $2.7k after multiple trades. It was honestly just gambling..." Similarly, a 17-year-old user responding to a critique of the riskiness of crypto assets wrote "u see risk = profits... cryptos are like gambling rn also its the best way to pay and receive money without paying extra because of tax... anyways if it gets me money i'mma do it."

The design of real-time trading services may contribute to the entertainment appeal of crypto asset investing. The continuous feedback and speed of transactions facilitated by these services can make them more engaging. Additionally, so-called "gamification" techniques (e.g., investing leaderboards, rewards points, etc.) are commonly used in trading services [74]. These have been shown to increase the frequency of trading, potentially leading to harm [12].

We also observed motives for engaging with crypto assets besides profit. A few users shared ideological justifications for using cryptocurrency, especially in posts promoting cryptocurrency use in general. 35 (2.1%) posts were coded as "General promotion of crypto." For example, one user made a post to /r/teenagers in February 2022 titled "Dudes fr never gave a single fuck about the environment until they want to use that as an excuse to hate crypto." The body of the post read "It's so ignorant too, banks use more energy and cause a lot more pollution than crypto. We're trying to phase out evil and corrupt banks, we can't do that without using any fucking power..." This kind of justification for the use of cryptocurrency has its roots in the first posts from the anonymous creator of Bitcoin who expressed a deep distrust of the conventional financial system [62].

A few posts, particularly in /r/ApplyingToCollege, discussed crypto assets in relation to a more general interest in technology. For example, one user wrote in a post in July 2018, "I kind of have a passion for home automation/raspberry pi and arduino projects. Using these mini computers (running

python and c++) I've made my own automatic door lock, a weather sensor and display, ... and a bot that manages and displays crypto prices." Another user made a post in October 2022, describing how they were the co-founder of their school's "Intel-Tech Club" in 11th grade. They explained that, as a leader in the club, they "...hosted Fintech, Business sessions; conducted bimonthly contests; hosted seminars on AI, Blockchain, ML, AR/VR, etc." Ultimately, this kind of purely technical interest in crypto assets was rarely discussed.

The Reddit collectible avatar NFTs introduced many users to crypto assets. The Reddit NFT was by far the most discussed crypto asset in our sample. 156 posts (9.3%) were coded as being about the Reddit NFT. Moreover, 99 (43.8%) of the posts coded as "discussion of obtaining/holding crypto" were about the Reddit NFT. Bitcoin (26 posts or 11.5%) and Dogecoin (17 posts or 7.5%) were the next most popular crypto assets that users discussed holding.

Reddit NFTs are hosted on the Polygon blockchain, and allow holders to uniquely customize their Reddit avatar. The NFT was given out for free to some on Reddit [53] in late 2022. In the wake of this giveaway, many users discussed receiving the avatar on /r/teenagers, with dozens of posts featuring images of the avatars titled things like "I got one of those free NFT avatars." and "I got random free NFT avatar while surfing the home page :/ and it is weird af." Some users reacted negatively, particularly to the idea of the avatars being NFTs. For example, one user made a post in August 2022, stating "I just got a fucking reddit nft avatar and I feel like a shitty crypto bro."

Unlike other crypto assets, users interested in purchasing a Reddit NFT discussed their aesthetic value. For example, a 15-year-old user wrote a post titled "am i the only one who's tempted to buy a reddit nft." By way of explanation, they commented "GUYS THEY LOOK COOL I DONT HAVE REDDIT PREMIUM I CANT MAKE MY [AVATAR] COOL LIKE URS." Similarly, a 13-year-old user made a deleted post to /r/teenagers in September 2022, writing "I want Reddit nft." In response to another user they explained "I want the reddit avatar items that come with the nft." These posts suggest that the Reddit NFT may be understood more like a cosmetic item in a video game rather than a financial asset.

4.4 RQ3: What types of harm do teenagers experience when using crypto assets?

Users discussed a variety of harms, including fraud victimization, wallet loss, and financial losses from poor investments. 27 posts (1.6%) were coded as including "crime," including crimes perpetrated by users and crimes victimizing users. Some crimes were only tangentially related to cryptocurrency. For example, several users discussed accounts being compromised to post spam related to crypto assets. This type of anecdote appears in our dataset because of the inclusion of crypto-keywords, however, this example of abuse is not related to the use of crypto assets.

The most common type of crime that victimized users was extortion facilitated by cryptocurrency. For example, one teen made a post titled "What do I do?" to /r/teenagers in 2020 asking for advice on a "sextortion" message he received: "I just got an email about something very weird. Someone emailed me some with the name of my password... it said that if I did [not] pay this certain address $2000 dollars in bitcoin it would send 3 random people in my contact a video of me wanking. Idk if this is real or just a scam to get money out of me. I am only 14 and don't know what to do. Please help me..." Thankfully, this user's post received several comments reassuring them that the extortion attempt could be safely ignored. For example, one 14-year-old user wrote "Lol it's a scam. Everyone and their mother has gotten that e-mail. You should change your password tho because it was leaked..." Bitcoin and other cryptocurrencies are often used to facilitate extortion and other scams [66], as they are pseudonymous and lack payment reversal mechanisms like credit card chargebacks [61].

Technical aspects of cryptocurrency were rarely discussed; however, we observed issues with key management. The giveaway posts (see subsection 4.2) featured the most discussion of wallets and key management, as users needed to be on-boarded into the ecosystem to receive their gift. Most of this discussion was vague and non-specific, providing little insight into users' key management practices.

Key loss was mentioned in a small number of posts and comments in the dataset. For example, a 15-year-old wrote in a post to /r/teenagers in January 2021 "I had $0.60 or whatever in ETH a long time ago, now it's worth $18 and I can't find the private key :(But i did find the key to an account with $11 of bitcoin so that's cool." This comment is typical of what teenage users described when discussing key loss: small amounts of forgotten money that became valuable in retrospect. More often than dedicated posts about key loss, users mentioned losing wallets in unrelated contexts. For example, a 16-year-old wrote in a giveaway thread, "About a year or so ago, I decided to try bitcoin mining, but my computer was pretty lame... I mined like one whole dollar! I wish I still had that hard drive :'(" This type of user error leading to financial harm is similar to that discussed by Krombholz et al. [47].

Users also shared experiences with investment and trading losses. More posts were coded as discussing profit (51 or 3.0%) than loss (17 or 1.0%). This likely does not reflect the overall frequency of investment losses relative to profits, as users may be too ashamed to discuss their losses. A few users shared extreme examples of loss. For example, a post titled "Screenshot of my crypto portfolio in October vs what it is now" in /r/teenagers in July of 2022 showed images of $18,000 in value dropping to about $100. Only the value of the assets was shown in the screenshots, so it is difficult to tell what type of investments this user made or if they engaged in active trading. A 17-year-old user shared an experience of

making a huge gain on paper, before losing most of it. The post was made to /r/teenagers in April 2022 with the title "I made $160K on crypto and my social anxiety dissapeared. Then I lost it and It's back but worse lmao." They explained in the body of the post that "...i made a high risk bet that paid off... I was worth 160k for like a couple weeks and i felt like the fucking man, my social anxiety literally crumbled i was so confident..." In the comments, they explained that they started with a few hundred dollars and provided a screenshot of their portfolio, which consisted of a handful of obscure cryptocurrencies.

Most losses from investment were much smaller than shown in these examples. For example, on /r/teenagers in December 2021, one 16-year-old user wrote a post titled "I bought yesterday shib for 50$ and it dipped in the night." The body of the post added "Pain. And btc also dipped from 170 I had mined to 140. Ehh just remember HODL."[9] In response, a 14-year-old user shared "my portfolio literally went from $9.5k to $7.5k this week lol." These losses are the inevitable flip side of engaging in high-risk investing for easy, short-term profits, particularly in hard-to-predict markets like those for crypto assets. While some users will be lucky enough to pick the right coin and sell it at the right time, others will experience losses. While many of the losses we observed are small in absolute terms, they may represent a large proportion of a teenager's total wealth.

We found several examples of teenagers losing money to pump-and-dump schemes. A pump-and-dump is where an investor or group of investors drives up the price of an asset through false or misleading statements, hype, or other manipulative tactics (the "pump"). Once the price has been inflated to a certain level, the perpetrators sell their holdings (the "dump"), causing the price to plummet and leaving many investors with losses. Pump and dump schemes are illegal in most jurisdictions. In a thread on /r/teenagers in April 2014, a 16-year-old user commented. "Want to know the struggle? I lost 47k on paper with cryptocurrencies. Yes, USD." In response to a reply, they elaborated "So, when I was dumb and gullible in the world of crypto earlier this year, I would try to ride these pump and dumps that people on twitter/IRC would do..." They explained the concept of a pump and dump before concluding with the statement "I was a bag holder in a twitter pump and dump of BlackCoin since early February. I had 180k of them. BlackCoin reached between 0.0008 and 0.009 at one point and currently hovers around 0.0005. If I had sold at 0.0008, I would have had 144 btc, a 7200% ROI. Actually looking at it now, that'd be about 72k USD. Instead I sold at 0.00008, taking a near 60% loss." Their comment suggests that they participated in multiple pump-and-dump schemes before the loss they discussed.

Another thread posted to /r/teenagers in February 2021

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also describes a pump-and-dump, although the user seems to understand less about what occurred. In the body of the post, they explain that they participated in a pump and dump: "Today a thing called pump(a lot of people buy a coin at the same time so the price go up and the you sell it have like 200% of profit) was made and i said ok this Is my moment... When the name of the coin was released I run to my investing app and spend 20€ in that coin... I wait to the price to raised and then I sell it. I don't no how but I finished losing money." This user seems to have participated in a pump and dump group similar to those described in Nizzoli et al. [65] but without the awareness that they risked losing their investment. These examples highlight the risk of uneducated and inexperienced teenagers participating in under-regulated markets.

One user claimed to have taken a leadership role in market manipulation. Using a one-time-use or "throwaway" account, they posted a thread to /r/ApplyingToCollege titled "How should I describe a crypto extracurricular?" requesting advice on how to discuss running a pump-and-dump group on college applications. The body of the post stated "I run a discord server... that has a lot of members and can move prices on obscure crypto (think <15 million market cap). I started with a small sum of ∼$40,000 from previous investments and small gifts, and have made nearly 100 times profit. I spend nearly all of my spare time doing this, so my grade in my foreign language dropped (from A to B) and I don't have any other ECs to put on my application other than really trivial things." Teenagers have previously been identified as perpetrators in various types of cybercrimes, including high-profile security breaches (e.g., "MafiaBoy" [38]). Leading a crypto pump-and-dump requires no significant resources or special skill, so while this description is concerning, it is unsurprising that a teen might engage in this kind of unethical and likely illegal behavior. The poster however insists their actions were legal, stating, "I cleared it with my parents and other family friends who are securities lawyers..."

Teenage users also described participating in cryptocurrency gambling. 13 posts (0.8%) were coded as containing content about gambling, with 4 of these posts promoting a service. These are distinct from posts where users described their trading behavior as analogous to gambling (see section 4.3), as they involve users discussing unregulated, online crypto casinos. These include centralized services and decentralized gambling applications hosted on a blockchain [14, 58]. In the US and Europe, the legal minimum gambling ages range from 18 to 25 [9], so minor teenagers are not legally permitted to gamble.

The most concerning example was a user who discussed what they describe as an addiction to both trading and gambling in a post to /r/ApplyingToCollege in November 2022. The post asked about how they should discuss cryptocurrency in their college applications. In the relevant part, they stated "...I did crypto/nfts/skins reselling during Quarantine. Most of my revenue came from altcoins mooning, such

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[9]The word "HODL" (a joking misspelling of the word hold) alongside the phrase "diamond hands" are commonly used in crypto communities to encourage users to hold onto assets, regardless of price activity [33].

as Ada and Solana... Probably made over $250k+ in revenue (did this probably like 5-8 hours a day on average, I was fucking addicted)... Only came out with like $3k in profit... I was a fucking gambling addict. I was addicted to Roobet, Bustabit, and Stake.com... I deeply regret doing crypto, it was such a mentally draining and useless thing..." Some users replied with similar experiences. For example, one high school senior wrote "i also had an addiction, crypto makes it way too easy to lose it all lol. glad to hear you're better..." Another user wrote "for reference, i made (roughly) 2 million on the crypto spike during 2020-2021 i am also a stake addict $̃450k gambled i did also start a sports betting server and get involved with certain things i would rather not discuss, but overall i actually ended up profiting from gambling..."

Most examples of users discussing gambling were less extreme. For example, an 18-year-old user made a post in `/r/teenagers`, stating "Hey guys, I got into Dogecoin a while back and I've been able to gamble my way up for about $5 from mining, to $30... I've since lost all of that and now I'm sitting at about $0.30 in doge, and I'm sad about it. I... will try to make the money back from the same gambling process with tips made on reddit..." It is startling that this user lost almost all their cryptocurrency gambling, but still felt that it was a reasonable way to make money. Incidents like this suggest that increased regulation in this space may be needed to protect teenagers and adults.

5   Discussion

This section discusses the implications of our results, particularly in contrast to adult populations. We also discuss ways to better protect users from the risks of crypto assets and the potential for future work investigating teen crypto users.

Underage teenagers on Reddit seem to most often gain access to crypto assets with the help of parents or other trusted adults rather than international services or decentralized exchanges, as was feared by Ryan [76] (RQ1). Teens' motivations for using crypto assets focus on profit, similar to adults (RQ2), as long-term investment, trading, or other forms of financial speculation are the most commonly reported uses of crypto assets in adult populations [81]. Parental pressure was a unique motivational factor we noted in several posts; however, this seems rooted in parents' sense that crypto could be highly profitable. Engaging in speculative investing and trading with crypto assets during a formative period may teach bad habits that could harm teens future financial success. We also identified many of the same harms experienced by adults [47], including financial loss due to poor key management, speculative investing, and even fraud (RQ3).

Underage teens' method of access to crypto assets seems to be the greatest factor that distinguishes them from adult users. While using an exchange account in the name of a parent may allow for some level of parental supervision, exchanges such as Coinbase and Binance do not support traditional "custodial

accounts" [84] that are explicitly designed to enable parental oversight of finances. Implementing account types specifically designed for teens, perhaps with limited access to riskier assets, could promote safer crypto investment behavior.

Increased regulation of crypto assets may help protect both underage teenagers and adults in crypto markets. Some types of crypto assets may be regulated under existing laws governing securities and commodities. For example, in 2023, the US Securities and Exchange Commission (SEC) charged multiple crypto companies for operating unregistered securities exchanges, including Kraken [79] and Coinbase [77]. Forcing crypto assets to register as securities could increase transparency and allow greater market surveillance to prevent fraud. It would also promote legal clarity by unambiguously defining market manipulation, including pump-and-dump schemes, as illegal. However, treating crypto assets like traditional financial assets is far from a one-size-fits-all approach. As illustrated by the example of the Reddit NFT, not all crypto assets are purchased for profit-seeking motives, and some may be more akin to collectibles, which are generally not treated as securities or commodities. Moreover, some crypto assets that are purchased for their profit potential do not fit with the classic definition of securities [36].

Future work should explore teenage experiences with crypto assets more directly using human-subjects research. While we have confirmed that teens participate in the crypto markets, quantitative studies could determine the frequency of underage market participation and the various harms we identified. Qualitative studies could be employed to probe teens' motivations for investing in crypto and more deeply explore individual experiences. Such work is essential to further protect vulnerable populations like teenagers.

6   Conclusion

Our study sheds light on the largely unexplored area of underage cryptocurrency usage. Through an inductive content analysis of 1,676 Reddit posts from teenage communities, we found that teenagers predominantly utilize their parents' accounts to circumvent age restrictions and engage in crypto-asset transactions. Their primary motivation seems to be profit-seeking, although other motivations were discussed (e.g., ideological conviction). Our findings also highlight the risks inherent to this activity, including investment losses, fraud victimization, and cryptographic key loss. While somewhat limited by the unreliability of Reddit discussion, our research underscores the need for protective measures to safeguard young investors from potential harm.

Acknowledgments

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A   Code Book

The following lists the codes derived from the inductive analysis of Reddit posts. Each definition includes an example of one of the posts assigned this code, the number of posts assigned this code, and the number of deleted or removed posts that were assigned this code.

Irrelevant: Not actually discussing cryptocurrency, but containing a keyword. e.g., ***Title: We ZOINKED the kraken!***

Haha! **Body:***The kraken is now dead, ZOINKED by our fine crew.But the JINKIES nation lies in the distance. Prepare for D-Day, and prepare to ***ZOINK****
Count: 181 (10.8% of sample), 16 removed/deleted

Other (relevant): Post that mentions cryptocurrency but does not fit into other categories and/or does not really have content of interest. e.g., **Title: *Fun fact: Body: In germany it's legal to scam nfts, because they don't count as reallife possessions, same with cs:go skins etc.***
Count: 19 (1.1% of sample), 3 removed/deleted

Irrelevant, cryptocurrency mentioned in passing: Cryptocurrency is mentioned in passing but is not actually the subject of the post or discussion in the comments. e.g., **Title: *After you guys complete school what will you do? Body: everyone: become a gamer and and nft bro [newline] no like fr what will you do?***
Count: 86 (5.1% of sample), 3 removed/deleted

Deleted/Removed (ambiguous content): Post content is removed or deleted. The title mentions cryptocurrency, but it's impossible to determine exactly what the content was about. There are either no comments or the existing comments do not permit us to infer the content. e.g., **Title: *Cryptocurrency Body: [removed]***
Count: 67 (4.0% of sample), all removed/deleted

Joke or meme: Post is either explicitly labeled as or is clearly interpreted by users as a joke; it also applies to meme images or videos. e.g., **Title: *You think its FUNNY to take screenshots of people NFT huh Body: Property theft is a joke to you***
Count: 254 (15.2% of sample), 29 removed/deleted

Sarcasm: The post is not clearly a joke, but the content is so outrageous that it seems likely that it is sarcastic. e.g., **Title: *GIVEAWAY ALERT Will send 1 Bitcoin to everyone who sends me 2 bitcoins HURRY! Body: Edit:this is no scam trust me bro***
Count: 52 (3.1% of sample), 16 removed/deleted

Reddit NFT: Post mentions the Reddit NFTs. e.g., **Title: *Nft update, accepted it and it looks terrible, thank you Reddit* Body**: *[Post linked to image of Reddit NFT]*
Count: 156 (9.3%), 28 removed/deleted

Criticism of crypto: Post is either a critique of crypto in general or specific projects. e.g., **Title: *NFTS are scams and not worth any sort of money Body: You are buying the rights to some gettyimages monkey for $200k lol***
Count: 110 (6.6% of sample), 24 removed/deleted

Discussion of obtaining/holding crypto: Post includes a discussion of purchasing or otherwise obtaining crypto, in-

cluding via giveaways; also includes situations where users just describe that they own crypto. e.g., **Title: *I put my entire allowence into crypto Body: [deleted]***
Count: 226 (13.5% of sample), 57 removed/deleted

Discussion of mining crypto: Posts discusses mining crypto currency. e.g., **Title: *[other] Late night Dogecoin miner thread, go! Body: [Post linked to an image of a terminal running Dogecoin mining software]***
Count: 59 (3.5% of sample), 21 removed/deleted

Discussion of trading crypto: Post discusses trading crypto currency or NFTs. Includes instances where users describe the act of trading without calling it trading. e.g., **Title: *i'm trading 10$ worth of crypto Body: so quirky amirite [newline] no***
Count: 25 (1.5% of sample), 6 removed/deleted

Discussion of transferring crypto: Comments or post include discussion of users selling or otherwise transferring crypto. e.g., **Title: *found some emails from 2017 showing Bitcoin i sent/received. This is now worth $333 Body: [Post linked to an image showing a Coinbase confirmation email for sending 0.008931 Bitcoin]***
Count: 30 (1.8% of sample) , 15 removed/deleted

Cryptocurrency expected to increase in value: Post suggests an expected boost in a cryptocurrency or other digital asset. e.g., **Title: *DOGECOIN TO THE MOON Body: [removed]***
Count: 29 (1.7% of sample), 18 removed/deleted

Profit: Post includes discussion of user making money in some way off of crypto assets. e.g., **Title: *Bought more of a crypto coin then it went up 10% within a few hours lul. Body:[removed]***
Count: 51 (3.0%), 13 removed/deleted

Loss: Post includes discussion of a user losing money in some way off of NFTs or another crypto. e.g., **Title: *Lost almost 5K in my crypto since Elon Musk was a Douche on twitter and value plummeted by over 30%. I feel so dispondant. I need hugs. Body: [Post linked to an image of a portfolio of crypto assets worth around $7,700.]***
Count: 17 (1.0% of sample), 6 removed/deleted

Explicit promotion of specific project: Posts encourage users to use a particular project or service. e.g., **Title: *Pi Network Cryptocurrency the most promising Cryptocurrency. Body: [removed]***
Count: 305 (18.2% of sample) , 228 removed/deleted

General promotion of crypto: The post generally promotes crpyto assets without specifying a specific project; includes

posts that push back against criticism. e.g., **Title:** *Cryptocurrency is the only valuable thing in the world that can be set up in a way where nobody can take it from you.* **Body:** *[no text]*
Count: 35 (2.1% of sample) , 8 removed/deleted

Informational question about crypto: Post or comments that asks for information about crypto (e.g., what it is, how it works, etc.) e.g., **Title:** *Can someone explain to me what is dogecoin is it a new form of crypto currency or sumthin.* **Body:** *[deleted]*
Count: 68 (4.1% of sample), 11 removed/deleted

Subjective question about crypto: Post that asks a subjective question about users' perspective on cryptocurrency or personal experience with cryptocurrency. e.g., **Title:** *What is your opinion on NFTs?* **Body:** *I'm curious to hear what everyone thinks about these things. edit: Interesting. It sounds like most people don't like them, but also dont know very much about them.*
Count: 105 (6.3% of sample), 34 removed/deleted

Using crypto for payment: Post mentions or is about using crypto for payment. e.g., **Title:** *SKIDS ACCOUNTS SHOP QUALITY SUPPORT + LIFETIME Warranties - ONLY $4+ Netflix, Hulu, Spotify, etc. [W] PayPal, BTC, Cash App.* **Body:***[removed]*
Count: 25 (1.5% of sample), 10 removed/deleted

Crime: Post or comments suggest that the user has fallen victim to a scam, virus, or other crime; also applies to posts that describe a crime, even if the user is not the victim. e.g., **Title:** *Crypto scammers are the scum of the earth.* **Body:** *So, i went onto my YouTube subscriptions inbox today, only to notice a Livestream promoting Ethereum. Turns out one of the YT channels I'm subbed to was hacked by crypto scammers. Seriously, fuck these people. I know it's fun to laugh at NFT collectors, spending millions on Bored Apes, but screw these people.*
Count: 27 (1.6% of sample) , 4 removed/deleted

Working on a crypto project: Post or comments discuss a teenager creating or working for crypto asset project. e.g.,

Title: *I made some new nfts* **Body:** *So far I have giga chad, peter Griffin, moist critical, and American syco. Who else should I make?*
Count: 36 (2.1% of sample), 3 removed/deleted

Discussion of news in crypto: Post or comments about news related to a crypto project. e.g., **Title:** *Binance Acquired regulated Crypto exchange.* **Body:** *[Post linked to article about acquisition]*
Count: 69 (4.1% of sample), 13 removed/deleted

Giveaway: Post or comment purports to be giving away/airdropping some sort of cryptocurrency; includes "faucets." e.g., **Title:** *Free Bitcoin for Teens Only.* **Body:** *Make any comment below for your complimentary 100 bits of Bitcoin and it will be delivered to you via the ChangeTip bot! What is Bitcoin? What is ChangeTip? Edit: I am going to bed, but leave your comments below if you haven't been tipped and I will get to you in the morning. Night.*
Count: 145 (8.7% of sample) , 118 removed/deleted

Gambling: Post discusses gambling with crypto. e.g., **Title:** *I just made $250 gambling bitcoin.* **Body:** *[Post links to a referral code for Bitsler.com]*
Count: 13 (0.8% of sample), 3 removed/deleted

Begging: Post requests that users send cryptocurrency to the poster in exchange for no consideration. e.g., **Title:** *Anyone have some bitcoin to spare.* **Body:** *[removed]*
Count: 8 (0.5% of sample), 5 removed/deleted

B Filtering Keywords

The following tables show the regular expression strings used to identify posts that were potentially about crypto in the teenage subreddits. Matches were identified using Python 3.9.7 re package. The \b at the beginning and end of each string ensures that matches are only returned if the match is a free-standing word. For example, \bterra\b matches "terra" or "(terra)" but not "terrarium." Complete documentation can be found at https://docs.python.org/3.9/library/re.html.

Table 3: Keywords derived from the top ten coins by market cap, according to `coinmarketcap.com` as of June 1st, 2023. For most currencies, regex strings are included for both the currency's name and abbreviation(s). Some names and abbreviations are excluded, as we anticipated that their inclusion cause too many false positives (i.e., polygon, ripple, and doge). A regex string for "binance coin" was also excluded, since there is a string for "binance" in another category of keywords

Keyword	# in Sample	% Irrelevant (#)
`\bbit( |-)?coin(s)?\b`	280	7.5% (21)
`\bbtc\b`	33	3.0% (1)
`\bdoge( |-)?coin(s)?\b`	83	6.0% (5)
`\bethereum(s)?\b`	56	3.6% (2)
`\beth\b`	35	60.0% (21)
`\bether(s)?\b`	removed	removed
`\btether(s)?\b`	14	85.7% (12)
`\busdt\b`	3	33.3% (1)
`\bmatic\b`	5	100.0% (5)
`\bsolana\b`	3	0.0% (0)
`\bsol\b`	removed	removed
`\bcardano\b`	1	0.0% (0)
`\bada\b`	removed	removed
`\bxrp\b`	1	0.0% (0)
`\busd( |-)?coin(s)?\b`	2	50.0% (1)
`\busdc\b`	1	100.0% (1)
`\bbnb\b`	6	83.3% (5)

Table 4: Keywords derived from three high-profile failed crypto projects: the Terra USD stable coin [13], SafeMoon [78], and Squid Game Token [83]. For TerraUSD, we include both the name of the project (Terra) and the abbreviations for the pair of coins that were core to the algorithmic stablecoin system (TerraUSD and Luna). For Squid Game Token, we include two possible variations (Coin or Token)

Keyword	# in Sample	% Irrelevant (#)
`\blun(c)?\b`	4	100.0% (4)
`\bust(c)?\b`	33	93.9% (31)
`\bterra\b`	34	97.1% (33)
`\bsafe( |-)?moon\b`	8	0.0% (0)
`\bsquid( |-)?game( |-)?coin\b`	0	—
`\bsquid( |-)?game( |-)?token\b`	0	—

Table 5: Keywords derived from the names of centralized crypto exchanges, decentralized crypto exchanges, and interest bearing services.

Keyword	# in Sample	% Irrelevant (#)
`\bbinance\b`	7	0.0% (0)
`\bftx\b`	3	0.0% (0)
`\bcoin( |-)?base\b`	10	10.0% (1)
`\bkraken\b`	35	100.0% (35)
`\bsushi( |-)?swap\b`	0	—
`\buni( |-)?swap\b`	2	0.0% (0)
`\bpancake( |-)?swap\b`	2	0.0% (0)
`\bcelsius\b`	removed	removed
`\bblock( |-)?fi\b`	0	—
`\bnexo\b`	3	100.0% (3)

Table 6: Keywords derived from the names of cryptocurrency gambling services

Keyword	# in Sample	% Irrelevant (#)
`\bstake(\.com|\.us)\b`	1	0.0% (0)
`\bcloud( |-)?bet\b`	0	—
`\bmeta( |-)?spin(s)?( |-)?casino\b`	0	—
`\b7( |-)?bit( |-)?casino\b`	0	—
`\bbets\.io\b`	0	—
`\bbit(-| )?starz\b`	0	—
`\bm(-| )?bit( |-)?casino\b`	0	—
`\broll( |-)?bit\b`	0	—

Table 7: Keywords derived from words and concepts related to crypto assets.

Keyword	# in Sample	% Irrelevant (#)
`\bcrypto(s)?\b`	281	11.0% (31)
`\bblock( |-)?chain(s)?\b`	35	25.7% (9)
`\bnft(s)?\b`	680	3.5% (24)
`\bdefi\b`	5	20.0% (1)
`\bcrypto( |-)?currenc(y|ies)\b`	173	12.1% (21)
`\bdao(s)?\b`	1	100.0% (1)
`\bdecentralize(d|s)?\b`	12	66.7% (8)
`\bstable( |-)?coin(s)?\b`	1	0.0% (0)
`\bmoon( |-)?shot(s)?\b`	8	100.0% (8)
`\bdegen(s)?\b`	removed	removed
`\baping\b`	removed	removed
`\bde( |-)?peg(s|ging)?\b`	0	—
`\bshill(s|ing|ed)?\b`	removed	removed
`\bmarket( |-)?cap(s)?\b`	8	12.5% (1)