Who Uses Bitcoin?

An exploration of the Bitcoin community

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***Abstract*—Many cryptocurrencies have come into existence in recent years, with Bitcoin the most prominent among them. Although its short history has been volatile, the virtual currency maintains a core group of committed users. This paper presents an exploratory analysis of Bitcoin users. As a virtual currency and peer-to-peer payment system, Bitcoin may signal future challenges to state oversight and financial powers through its decentralized structure and offer of instantaneous transactions with relative anonymity. Very little is known about the users of Bitcoin, however. Utilizing publicly available survey data of Bitcoin users, this analysis explores the structure of the Bitcoin community in terms of wealth accumulation, optimism about the future of Bitcoin, and themes that attract users to the cryptocurrency. Results indicate that age, time of initial use, geographic location, mining status, engaging online discourse, and political orientation are all relevant factors that help explain various aspects of Bitcoin wealth, optimism, and attraction.**

Keywords—Bitcoin, Cryptocurrency, Anonymity, Virtual Currency, Digital Money

I. INTRODUCTION

Virtual currencies have made great developmental leaps in recent years. Earlier forms of electronic currencies such as DigiCash or CyberCash were innovative in their ability to digitally transfer large amounts of money between parties at fast speeds while offering some level of anonymity. However, they were more properly characterized as payment systems rather than currencies on their own terms, as these systems primarily served to transfer fiat currencies between parties while offering some form of anonymity. More recent innovations in virtual currency has taken the next step into creating what may be characterized as digital *money*, serving as both a peer-to-peer payment system as well as a store of value. This innovation was first made by Bitcoin, which simultaneously serves as a medium of exchange (by way of a peer-to-peer payment system) as well as a store of value (in the form of a denationalized, decentralized digital currency), released in 2009 by the pseudonymous programmer(s) Satoshi Nakamoto. In the original manifesto, Nakamoto described Bitcoin as providing "a system for electronic transactions without relying on trust" through the use of cryptographic proof [1].

As a decentralized form of currency, Bitcoin offers users the opportunity to have nearly anonymous transactions. When users make a transaction using Bitcoin, a change of ownership over the Bitcoin is sent to a public transaction log (which does not reflect private data such as user name). Transactions are bundled into blocks which are linked into chains. Through a process called mining, these transactions are verified through cryptographic proof in the peer-to-peer network. The computer that successfully solves the cryptographic puzzle is rewarded with new bitcoins for the service of preventing fraudulent activity and verifying that Bitcoin's "books" are balanced. Miners occupy a critical role in building the infrastructure of Bitcoin and are essential to its growth and maintenance. During the early days of Bitcoin, personal computers were able to participate in the mining process. Today, however, the difficulty has developed such that mining Bitcoin requires dedicated hardware—graphics processing units (GPUs) rather than central processing units (CPUs)—and consumes intense amounts of energy that necessitate economies of scale in order to make Bitcoin mining profitable.

The total amount of bitcoins is finite, with the final bitcoin expected to be in circulation by 2140. There are currently about 12.5 million bitcoins in circulation of a total possible 21 million. This was designed to protect against inflationary forces; though critics note that the finite design makes Bitcoin susceptible to deflation, proponents argue that because Bitcoin is divisible to eight decimal places (about 2 quadrillion units), Bitcoin is not consigned to the fate of deflation. This finite characteristic of Bitcoin has drawn comparisons to money based on gold standards, a quality

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that attracts a number of libertarian and anti-statist users [2, 3]. However, while libertarians are well represented within the community, many individuals using Bitcoin around the world identify with left-of-center political orientations [4].

Perhaps because of speculators getting involved with Bitcoin as an investment rather than practical currency, the value of Bitcoin has been extremely volatile over its short history. This, combined with security exploits, has tarnished the image of Bitcoin within the general public. The world's largest Bitcoin exchange—Mt. Gox, based in Tokyo—filed for bankruptcy protection in the United States in early March 2014 after halting transactions for a month in response to an alleged bug in the Bitcoin software.

The anonymity afforded by Bitcoin has made it popular as a medium for exchanges involving illicit goods [5]. Websites such as the Silk Road—an online market primarily organized around narcotics—facilitate the exchange of illegal goods around the world. Although taken down by U.S. authorities in 2013, the Silk Road 2.0 launched soon after. One analysis estimated that approximately 4.5% - 9% of the Bitcoin economy moved through the original Silk Road website [6].

Aside from the potential criminal elements entering the Bitcoin community, virtual currencies present a broader set of problems for the status quo of state oversight over currency transactions. Entities such as Bitcoin force regulators to discuss whether existing anti-money laundering laws are sufficient to cover virtual currencies, or whether Bitcoin could become a haven for tax evasion [7, 8, 9]. Recently, New York state initiated the conversation over the financial regulation of Bitcoin, though a clear direction regarding its future regulatory culture has not taken shape at the time of this writing [10].

Throughout the early examination of Bitcoin, little attention has been paid to what characterizes the Bitcoin user community itself. As an exploratory analysis, this paper will ask three research questions. First, what predicts the accumulation of wealth among Bitcoin users? Second, what predicts optimism about the near- and long-term value of Bitcoin? And third, what attracts people to Bitcoin? This paper uses results from a survey of Bitcoin users to analyze the community in terms of demographics, behavior, and political orientation.

II. DATA AND METHODS

Surveying a random sample of the Bitcoin community is nearly impossible as Bitcoin offers a lot of privacy to its user, the currency is not regulated by any centralized agency, and adoption of Bitcoin is still not widespread. Data collection is thus in an exploratory stage, and analysis should be interpreted as suggesting future lines of inquiry. The most comprehensive dataset on Bitcoin users to date was collected by Lui Smyth[1]. It is important to note that this publicly available data was collected prior to the problems at Mt. Gox, and thus provides an interesting contrast to future data collection that may reveal sharp changes in attitudes or behaviors within the Bitcoin community. Still, this data provides the best information available on the characteristics of Bitcoin users.

Among other things, this dataset includes several points of information useful for exploring broad trends among Bitcoin users. Two types of analyses are carried out in this paper. Three variables are included as outcomes for the first section of analysis. These include

Table 1. Descriptive Statistics of Variables Used in Analysis.

Variable	*M*	*SD*	*Range*
Log2 Bitcoins	5.14	3.47	0 – 14.87
Log2 Near-term Bitcoin value	5.985	1.10	0 – 10.55
Log2 Long-term Bitcoin value	9.26	2.82	0 – 17.19
Age	32.61	10.08	18 – 72
Lives in U.S.	0.44	0.50	0 – 1
Installation (centered on mean)	0	3.75	-10.74 – 5.26
Miner	0.51	0.50	0 – 1
Bitcoin sins	0.10	0.29	0 – 1
Illicit goods	0.34	0.47	0 – 1
Bitcoin talk	0.60	0.49	0 – 1
Investor	0.69	0.46	0 – 1
Profit	3.72	1.21	1 – 5
Community	2.73	1.25	1 – 5

[1] This dataset was downloaded from Lui Smyth's website on January 15, 2014. A total of 1,193 responses were collected from February 12, 2013 through April 4, 2013. A link to the survey was posted on Bitcointalk.org, Reddit, Twitter, and Google+, from which point the survey was reposted on related Bitcoin sites.

the self-reported amount of bitcoins owned as well as the respondent's estimation of what the near-term (four months from time of survey) and long-term (six years from time of survey) value of one bitcoin will be in USD. As the distribution of each of these variables was skewed, they were transformed to their log base 2 values. The second section of analysis examines what characteristics predict whether or not a Bitcoin user will reference a particular theme when answering an open-ended question about Bitcoin. Respondents were asked, "In 140 characters (or so), what is your favorite aspect of Bitcoin?" A list of keywords and phrases was generated from this data, and select themes were considered for analysis. These include whether or not respondents used words to relate Bitcoin to anonymity, freedom or the banking system.

Several independent variables are included in both types of analyses (Table 1). The average respondent age was about 33 years old, and a little less than half indicated that they live in the United States. The age distribution of Bitcoin users in the sample is plotted in Figure 1. An Age^2 variable was included to account for nonlinear effects in some models. Although data on traditional money spent on purchasing bitcoins was available, it was too highly collinear with outcomes to include in analysis. It is also worth noting that we did not include gender as a variable in analysis because there is almost no gender variation within this dataset—about 95% of the sample reported a male gender status.

Most measurements refer to behaviors or identities specific to the Bitcoin community. "Installation" refers to when respondents first downloaded the Bitcoin client (software that connects to the Bitcoin network), and ranges from 1 = the first quarter of 2009 to 17 = the first quarter of 2013, then centered on the mean.[2] A "Miner" dummy variable was created to account for whether or not individuals had ever gone through the process mining bitcoins (about half of the sample). In order to test whether early Bitcoin miners obtained a large advantage in Bitcoin accumulation versus late adopters of Bitcoin, an interaction term was created for Installation x Miner.

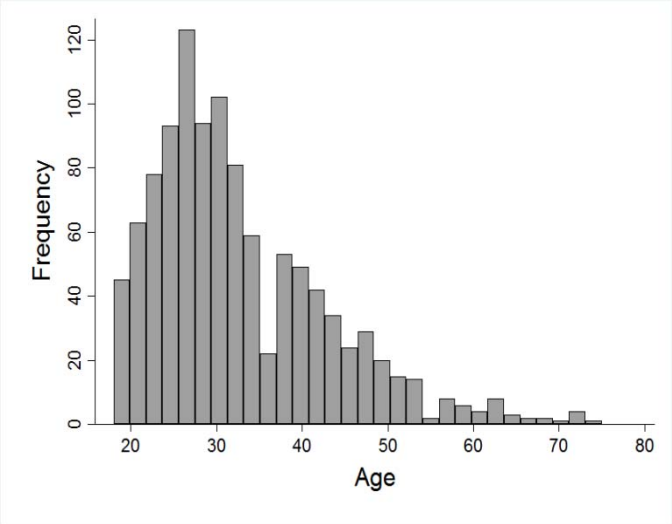

Fig. 1. Age Distribution of Bitcoin User Sample.

Within the Bitcoin community, it is considered a "sin" to mine bitcoins through someone else's hardware without their permission (via malware). Mining bitcoins is a very energy-intensive process and can run up costly electricity bills, thus mining bitcoins by surreptitious means can result in dishonest profits. The "Bitcoin sins" variable was coded 1 for anyone admitting to either this practice or stealing someone else's bitcoins (about 10% of the sample). Since there is ample public concern regarding what users of Bitcoin purchase, "Illicit goods" was coded = 1 for whether respondents admitted to purchasing narcotics, gambling services, or other illicit goods with their bitcoins.

"Bitcoin talk" captures a social aspect of the Bitcoin community. This was coded 1 for respondents indicating that they use Bitcoin-specific platforms to talk with others about Bitcoin. "Investor" refers to whether or not the respondent self-described their role within the context of Bitcoin as an investor. Respondents were also asked how important "profit" and "community" were as motivating factors for their initial involvement with Bitcoin (ranging from 1 = not motivating to 5 = very motivating).

Data was also collected on the political orientation of Bitcoin users, shown in Figure 2. Almost half of the sample identified as Libertarian, but many other perspectives are represented. Progressives, Socialists, Centrists, and Greens all have a notable presence in the Bitcoin user community.

A total of six models were estimated from this data. The first three models use log-linear regression to analyze predictors of log-transformed values of bitcoin accumulation, near-term, and long-term perceptions of the value of Bitcoin. Since the outcome variables for the final three models are binary (whether respondents

[2] Centering variables on the mean is helpful when they constitute interaction terms, as centering reduces multicollinearity and aids interpretation such that the influence of Z on Y in the interaction term is shown at the value of X equal to its mean value.

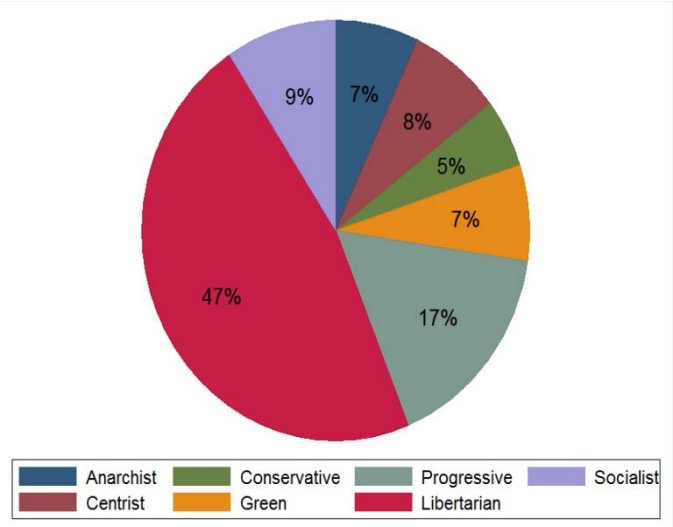

Fig. 2. Percentage of Bitcoin Sample by Selected Political Ideology.[3]

referenced anonymity, freedom, or the banking system in relation to their favorite aspect of Bitcoin), logistic regression was used for analysis.

III. RESULTS

Results from log-linear regression analyzing logged bitcoin accumulation are presented in Table 2. The logged value of traditional money invested in Bitcoin was excluded from the model because it was so highly correlated with the outcome and presented problems of multicollinearity in the model, but explained about 43% of the variance by itself. The presented model explains about 25% of the variance in logged bitcoin accumulation. The basic demographics of age and being based out of the U.S. are both statistically significant predictors. To ease interpretation, the marginal effects of age are plotted in Figure 3. In terms of age, the accumulation of bitcoin wealth conforms to patterns we expect to find in terms of traditional currency wealth, where wealth increases with age and plateaus in the mid- to upper-50s. As the dependent variable is the log base 2 of bitcoins, 25 year olds have about half as many bitcoins as 35 year olds, who themselves have about half as many bitcoins as 45 year olds (after which point the marginal effects of age on bitcoin accumulation slow down and then decline around age 60).

Since the process of mining bitcoins was much easier during the early days of its operation, we could hypothesize that early adopter miners gained an advantage in Bitcoin accumulation versus their non-

[3] The following categories had fewer than 15 observations and are not represented in Fig. 1: Communist/Marxist, Monarchist/Imperialist, Nationalist/Nativist, and Theocratic.

Table 2. Unstandardized Coefficients (and Standard Errors) from Log-Linear Regressions Predicting Log2 Bitcoin.

Variable	**b (SE)**
Age	0.227 (.055)**
Age^2	-0.002 (.001)**
Lives in U.S.	-0.814 (.205)**
Installation	-0.093 (.038)*
Miner	0.265 (.220)
Installation x Miner	-0.118 (.052)*
Bitcoin sins	-0.319 (.351)
Illicit goods	0.474 (.219)*
Bitcoin talk	1.085 (.222)**
Investor	1.939 (.216)**
Profit	0.074 (.085)
Community	0.109 (.082)
R^2	0.251
N	933

*p <.05 **p <.01

miner peers. The statistical significance of the Installation x Miner interaction confirms this hypothesis. These marginal effects are plotted in Figure 4. The difference in Bitcoin accumulation between miners and non-miners was statistically significant through the second quarter of 2011. Miners accumulated about twice as many bitcoins as non-miners during 2009, with the gap between these groups declining as time passed. From the middle of 2011 through the first quarter of 2013, participating in mining did not give users a significant advantage in accumulating bitcoins.

Several other variables were statistically significant in predicting the accumulation of bitcoins. Controlling for other factors, the marginal effect of spending bitcoins on illicit goods (narcotics, gambling services, or other illegal goods) predicted that those users had about 25% - 45% more bitcoins (within the 95% Confidence Interval) than those who had not spent bitcoins on illicit goods. Engagement with Bitcoin-specific platforms to discuss Bitcoin was another positive predictor of Bitcoin accumulation, as talking about Bitcoin online was correlated with owning about twice as many bitcoins as those who do not engage discussions on Bitcoin-specific platforms. Unsurprisingly, users who self-identified as investors had accumulated about four times as many bitcoins as those who did not self-identify as investors.

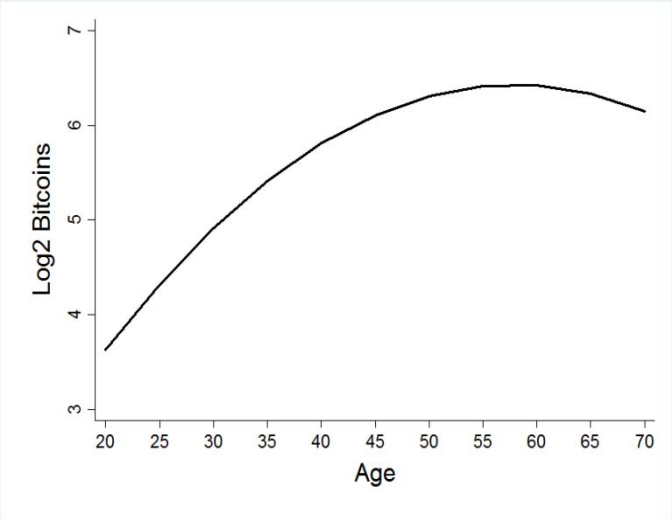

Fig. 3. Conditional Effects of Age on Bitcoin Accumulation.

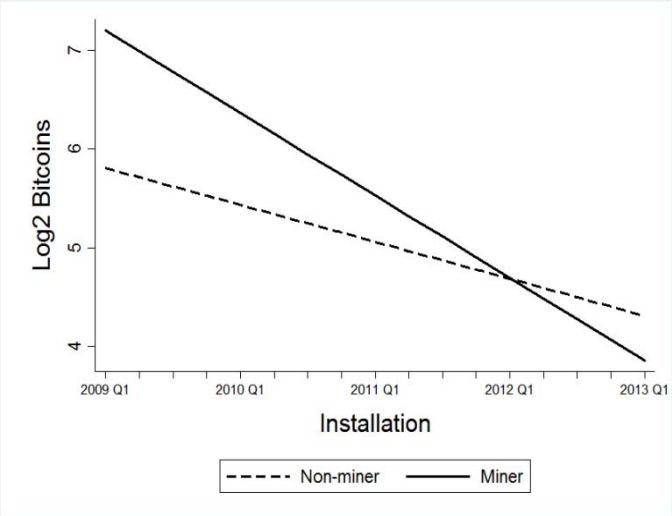

Fig. 4. Conditional Effects of Installation by Miner Status on Bitcoin Accumulation.

It was more difficult to predict near- and long-term optimism regarding the value of Bitcoin given available data. Results predicting near-term optimism are presented in Table 3. Overall, this model only explained about 7% of the variance. Age demonstrated a statistically significant but weak relationship to predicted near-term Bitcoin value, with older users less optimistic than younger users. The time of installation was related to near-term optimism, with later installers more optimistic about the near-term value. Interestingly, whether or not community was a motivating factor for initial involvement with Bitcoin positively predicted user perception of its near-term value. Those who were very motivated predicted the near-term value 25% higher versus those who were not at all motivated by community for involvement with Bitcoin.

Table 3. Unstandardized Coefficients (and Standard Errors) from Log-Linear Regressions Predicting Logged Near-term Predicted Value of Bitcoin.

Variable	**b (SE)**
Age	-0.013 (.004)**
Lives in U.S.	0.118 (.075)
Installation	0.038 (.010)**
Miner	-0.075 (.082)
Bitcoin sins	0.072 (.129)
Illicit goods	-0.020 (.082)
Bitcoin talk	-0.078 (.080)
Investor	0.323 (.080)**
Profit	0.017 (.032)
Community	0.076 (.030)*
R^2	0.071
N	871

*p <.05 **p <.01

Results from log-linear regression predicting long-term optimism for the value of Bitcoin are presented in Table 4. Once again, this model does not explain much of the variance (about 8%). There is a statistically significant nonlinear relationship between age and long-term optimism regarding the value of Bitcoin. The marginal effects of age are plotted in Figure 5. Long-term optimism peaks around the ages of 35 – 40, declining thereafter. Users around the age of 60 predict that the long-term value of Bitcoin will be about half the level predicted by 35-40 year olds. Interestingly, miners—who contribute to building the infrastructure of Bitcoin—are more pessimistic than non-miners regarding the long-term value of Bitcoin.

Two other variables positively predict user optimism regarding the long-term value of Bitcoin. These are whether users engaged discussion on Bitcoin-specific forums and whether a user self-identified as an investor in relation to Bitcoin. The latter characteristic is intuitive, as we should not expect a rational investor to get involved with a commodity that they do not believe has long-term potential. That seeking out discussion on Bitcoin-specific forums correlates with increased optimism regarding the long-term value of Bitcoin implies that a distinctly social aspect of the Bitcoin community engenders a user culture committed to the future of Bitcoin.

Table 4. Unstandardized Coefficients (and Standard Errors) from Log-Linear Regressions Predicting Logged Long-term Predicted Value of Bitcoin.

Variable	**b (SE)**
Age	0.104 (.053)*
Age^2	-0.001 (.001)*
Lives in U.S.	-0.167 (.193)
Installation	0.038 (.256)
Miner	-0.521 (.208)*
Bitcoin sins	0.157 (.329)
Illicit goods	-0.389 (.211)
Bitcoin talk	0.820 (.204)**
Investor	1.022 (.204)**
Profit	0.057 (.082)
Community	0.121 (.078)
R^2	0.078
N	832

*p <.05 **p <.01

The second set of analyses focused on an open-ended question that asked users about their favorite aspect of Bitcoin. Users who described Bitcoin in relation to anonymity (about 8% of the sample), freedom (about 16% of the sample), or the banking system (about 10% of the sample) were analyzed using logistic regression. Different combinations of political identities were tested, controlling for either libertarian, conservative, and centrist political identities with left-of-center ideologies as the reference category, or progressive, green, and socialist identities with centrist and right-of-center ideology as the reference category. Results analyzing the likelihood of invoking these themes are presented in Table 5.

Somewhat surprisingly, none of the dichotomous measures of political identity were statistically significant predictors of whether or not users referenced anonymity as their favorite aspect of Bitcoin (and were consequently dropped from the model). This fact could reflect the relatively small sample of users who volunteered answers to this question, or that Bitcoin users attracted to anonymity are not ideologically distinct from one another. Instead, the only statistically significant predictor considered was whether or not a user mined bitcoins. Controlling for other factors, miners were less than half as likely as non-miners to reference anonymity as their favorite aspect of Bitcoin.

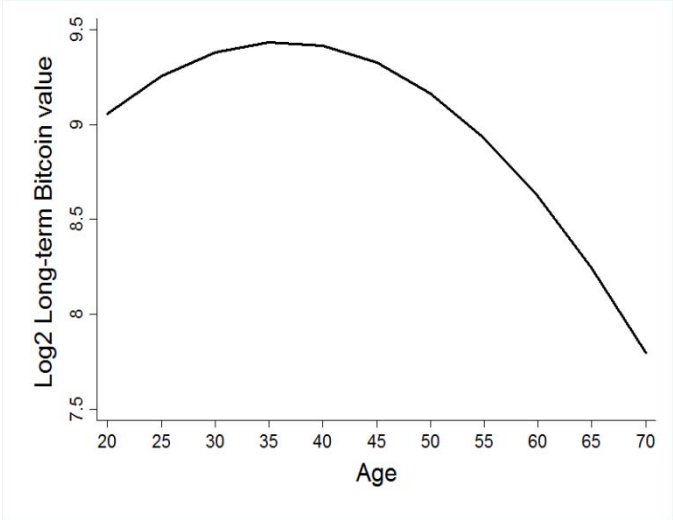

Fig. 5. Conditional Effects of Age on Long-term Predicted Bitcoin Value.

Three variables were found to be statistically significant predicting the theme of freedom. Bitcoin users based out of the U.S. were less than half as likely to reference freedom as users based outside of the U.S., as were Bitcoin users between the ages of 30 – 39. Unsurprisingly, respondents who identified as libertarian were about twice as likely as those with left-of-center political beliefs to reference freedom. A qualitative inspection of these results shows that these users are attracted to Bitcoin precisely as a means to subvert state oversight. The following quotes are representative of the statements submitted by libertarians about Bitcoin:

- "Bitcoin could one day allow freedom from the State. It is not subject to manipulation or coercion. It is simply a medium for voluntary exchange." (United States, 20 years old)
- "Freedom!, nobody can forbid me to buy/sell bitcoins, there's no government regulations on that. Here in Argentina we CAN'T buy foreign currencies as a saving/investment and Bitcoin is a workaround." [sic] (Argentina, 28 years old)
- "Taking away the power of the money supply from centralist states which will start the long path to their disbandment and the rise of the first true free market in history." (Netherlands, 27 years old)

If this sample is representative of libertarian Bitcoin users in general, then the references to freedom indicate an attraction to Bitcoin as an alternative currency, and not simply a peer-to-peer payment system. As individual rights in opposition to state oversight is a popular theme of libertarian political philosophy, the

Table 5. Unstandardized Coefficients (and Standard Errors) from Logistic Regressions Predicting Themes Associated with Bitcoin by Users.

	Anonymity	**Freedom**	**Banking**
Variable	**b (SE)**	**b (SE)**	**b (SE)**
Ages 18 – 29	0.718 (.431)	-0.449 (.289)	-0.853 (.369)*
Ages 30 – 39	0.309 (.491)	-0.729 (.326)*	-0.583 (.369)
Lives in U.S.	0.311 (.325)	-0.981 (.256)**	-0.768 (.316)**
Miner	-0.838 (.333)**	0.106 (.244)	-0.949 (.317)**
Illicit Goods	0.110 (.333)	0.126 (.261)	0.270 (.324)
Libertarian	--	0.674 (.272)*	--
Conservative	--	0.487 (.611)	--
Centrist	--	0.254 (.536)	--
Progressive	--	--	0.084 (.455)
Green	--	--	1.127 (.422)**
Socialist	--	--	0.536 (.466)
Pseudo R^2	0.04	0.05	0.08
N	534	534	534

* $p < .05$ **$p < .01$

libertarian attraction to Bitcoin should be understood in the context of potentially empowering individual freedom to undertake economic transactions independent from state regulatory structures.

There were also three statistically significant predictors of the banking theme. Users under the age of 30 as well as those based out of the U.S. were less than half as likely as users over the age of 40 and based outside of the U.S. to reference Bitcoin in relation to banking, respectively. While none of the centrist or right-of-center political identities were statistically significant predictors, testing the left-of-center ideologies revealed that greens were three times as likely as centrists, conservatives, and libertarians to reference the banking theme in answer to their favorite aspect of Bitcoin. The following quotes are typical of the answers given by greens:

- "The current monetary system is a fraud based on an old scam bitcoins are open, free and not a scam. No bailout of banks etc. However IÂ´m not sure Bitcoin is the ultimate form of money, since it can be 51% attacked, could be used by criminals and is not divided evenly among people. But it atleast gives the banks competition for now." [sic] (Norway, 34 years old)
- "It can by-pass the unfair fees and profiteering of banks." (Australia, 34 years old)
- "Bitcoin means that individuals around the world are free to trade with each other outside of the untrustworthy banking system. It has opened my eyes to money, and there is no going back." (United States, 45 years old)
- "Ability to be your own bank. Its complicated simplicity." [sic] (New Zealand, 29 years old)

Given comments like these, we could consider the possibility that greens (and maybe left-of-center ideologies more generally) are attracted to Bitcoin as a payment system that challenges the power of centralized financial institutions, rather than Bitcoin as an alternative currency that challenges state power and opens up individualistic freedoms.

IV. CONCLUSION

This paper provided a more in depth exploration of publicly available data on Bitcoin users than previously analyzed. Results indicate that age, early installation and mining, spending bitcoins on illicit goods, and participating in Bitcoin-specific forums positively predicted Bitcoin accumulation, while being based in the U.S. negatively predicted Bitcoin accumulation. Age has a nonlinear relationship predicting optimism toward Bitcoin over the long run, with younger and older users

less optimistic than users in their late 30s. Long-term optimism is also structured around investor identity and discourse on Bitcoin-specific platforms. This study has also presented ideological divergence as a possible explanation of differentiated user attraction to Bitcoin. While libertarians view Bitcoin as an alternative currency that can free the individual from state power structures, left-of-center users may be more attracted to Bitcoin as a decentralized payment system that challenges power structures within the realm of finance.

The results presented here should be interpreted with some caution. Due to the decentralized and relatively anonymous nature of Bitcoin, it is impossible to draw a random sample and confidently generalize to the global or English-speaking Bitcoin community. The data analyzed here represents the best data available on the (English-speaking) Bitcoin community and can serve to confirm or dispel certain myths surrounding Bitcoin users. Still, this exploratory analysis provides targets for future empirical investigation.

If the adoption of Bitcoin (or cryptocurrencies more generally) continues, it may become feasible to capture a sufficient number of users from a random sample of a general population. Such studies could explore user behavior in greater detail, conduct more detailed cross-sectional analysis, and examine what makes Bitcoin users distinct from non-users along an array of social structural, psychological, cultural, and political factors. For example, can we identify significant differences in educational levels, technical capabilities, political identities, subcultural orientations, or personality types between users and skeptics of Bitcoin? A study designed with a general population sample in mind could also explore non-user attitudes toward Bitcoin and identify attraction and fear associated with using the cryptocurrency and payment system.

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