Supporting Information

Cryptoasset networks: Flows and regular players in Bitcoin and XRP

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Appendix A  Granger Causality Analysis of Price and Number of Players

Our VAR (vector auto regressive) model describes the time evolution of the log change rate of the price of cryptoassets, the number of IN players, and the number of BAL players. In the following, we denote the log change rate of the price of cryptoasset by \( y_t \) and the log change rate of the number of IN players and BAL players by \( x_t \). As the evaluation criterion for the VAR model, we use the mean square error

\[
M[y_t | \mathcal{U}] = E[(y_t - \hat{y}_t)^2], \quad (S1)
\]

where \( \mathcal{U} \) is the information used in the model and \( \hat{y}_t \) is the prediction by the model defined by

\[
\hat{y}_t = E[y_t | \mathcal{U}]. \quad (S2)
\]

In Granger causality analysis, \( x_t \) is interpreted to be the cause of \( y_t \) when the following relation

\[
M[y_t | \mathcal{X}(t-1) \cup \mathcal{Y}(t-1)] < M[y_t | \mathcal{Y}(t-1)] \quad (S3)
\]

is satisfied. It also interprets \( x_t \) as being the instantaneous cause of \( y_t \) when the relation

\[
M[y_t | x_t \cup \mathcal{X}(t-1) \cup \mathcal{Y}(t-1)] < M[y_t | \mathcal{X}(t-1) \cup \mathcal{Y}(t-1)] \quad (S4)
\]

is satisfied. Here \( \mathcal{X}(t-1) \) is the information set about past \( x_t \), and \( \mathcal{Y}(t-1) \) is the information set about past \( y_t \).

Granger causality analysis requires a stationary time series process. We conducted a unit root test to determine if it is a stationary process. The obtained augmented Dickey–Fuller statistic and the p-values are shown in Tables S1 and S2. The p-values were less than 5% for all variables and periods except where underlined. These results confirm that the overall process is stationary.

We performed a Granger causality analysis to examine the significance of the effect of changes in the number of players \( x_t \) on price changes \( y_t \). Tables S3, S4, S5, and S6 show the F statistic and the p-value, which is the probability of hitting a value greater than the F statistic in an F distribution with two degrees of freedom \( d_f_1 \) and \( d_f_2 \) for active IN player, active BAL player, regular IN player, and regular BAL player, respectively, obtained in the Granger causality analysis. For all variables and periods, the p-values are very large. These results indicated in the tables mean that \( x_t \) is not interpreted to be the cause of \( y_t \) for all cases.

In addition, We performed an instantaneous causality analysis to examine the significance of the changes in the number of players \( x_t \) as being the instantaneous cause of price changes \( y_t \). Tables S7, S8, S9, and S10 show the \( \chi^2 \) value and the p-value, which is the probability of hitting a value greater than the \( \chi^2 \) value in an \( \chi^2 \) distribution with degree of freedom \( df \) for active IN player, active BAL player, regular IN player, and regular BAL player, respectively, obtained in the instantaneous causality analysis. The p-values show sufficiently small values for all variables and periods except where underlined. These results indicated in the tables mean that the \( x_t \) is interpreted to be the instantaneous cause of \( y_t \) for all cases.

In summary, \( x_t \) is not the cause of \( y_t \) in the Granger sense. Including \( x_t \) in the model does not improve the prediction accuracy of \( y_t \). On the other hand, \( x_t \)
is an instantaneous cause of $y_t$. However, instantaneous causality does not lead to more accurate forecasts. These results indicate that it is difficult to forecast the prices of cryptoasset using the number of players. These results support the results discussed in Table 5, Table 6, and Table 7.

### Table S1: Unit root test of the return and the active player

| Period               | Return ADF | Return p-value | active IN ADF | active IN p-value | active BAL ADF | active BAL p-value |
|----------------------|------------|----------------|---------------|-------------------|----------------|-------------------|
| 2016-07-03 to 2017-07-01 | -5.22      | 0.00064        | -3.43         | 0.062             | -7.52          | 4.3e-07           |
| 2017-07-02 to 2018-06-30  | -4.53      | 0.0043         | -2.52         | 0.32              | -5.16          | 0.00077           |
| 2018-07-01 to 2019-06-29   | -4.09      | 0.013          | -5.01         | 0.0012            | -2.75          | 0.22              |
| 2019-06-30 to 2020-06-27    | -4.92      | 0.0015         | -6.26         | 3.1e-05           | -4.4           | 0.0061            |
| 2020-06-28 to 2021-06-26    | -4.45      | 0.0052         | -6.92         | 3.7e-06           | -6.59          | 1.1e-05           |

### Table S2: Unit root test of the regular player

| Period               | regular IN ADF | regular IN p-value | regular BAL ADF | regular BAL p-value |
|----------------------|----------------|--------------------|-----------------|---------------------|
| 2016-07-03 to 2017-07-01 | -6.25          | 3.2e-05            | -6.14           | 4.5e-05             |
| 2017-07-02 to 2018-06-30  | -3.3           | 0.081              | -6.57           | 1.2e-05             |
| 2018-07-01 to 2019-06-29   | -6.13          | 4.6e-05            | -5.86           | 1e-04               |
| 2019-06-30 to 2020-06-27    | -4.46          | 0.0052             | -4.73           | 0.0025              |
| 2020-06-28 to 2021-06-26    | -5             | 0.0012             | -6.01           | 6.6e-05             |

### Table S3: Granger causality of the active IN player

| Period               | F-statistic | $df_1$ | $df_2$ | p-value |
|----------------------|-------------|--------|--------|---------|
| 2016-07-03 to 2017-07-01 | 0.515  | 4      | 76     | 0.72    |
| 2017-07-02 to 2018-06-30  | 0.956  | 4      | 76     | 0.44    |
| 2018-07-01 to 2019-06-29   | 0.568  | 4      | 76     | 0.69    |
| 2019-06-30 to 2020-06-27    | 0.251  | 4      | 76     | 0.91    |
| 2020-06-28 to 2021-06-26    | 0.811  | 4      | 76     | 0.52    |
Table S4: Granger causality of the active BAL player

| Period                  | F-statistic | $d_f$ | $d_f$ | p-value |
|-------------------------|-------------|-------|-------|---------|
| 2016-07-03 to 2017-07-01| 0.515       | 4     | 76    | 0.72    |
| 2017-07-02 to 2018-06-30| 0.956       | 4     | 76    | 0.44    |
| 2018-07-01 to 2019-06-29| 0.568       | 4     | 76    | 0.69    |
| 2019-06-30 to 2020-06-27| 0.251       | 4     | 76    | 0.91    |
| 2020-06-28 to 2021-06-26| 0.811       | 4     | 76    | 0.52    |

Table S5: Granger causality of the regular IN player

| Period                  | F-statistic | $d_f$ | $d_f$ | p-value |
|-------------------------|-------------|-------|-------|---------|
| 2016-07-03 to 2017-07-01| 0.614       | 4     | 76    | 0.65    |
| 2017-07-02 to 2018-06-30| 0.378       | 4     | 76    | 0.82    |
| 2018-07-01 to 2019-06-29| 0.968       | 4     | 76    | 0.43    |
| 2019-06-30 to 2020-06-27| 2.54        | 4     | 76    | 0.046   |
| 2020-06-28 to 2021-06-26| 1.35        | 4     | 76    | 0.26    |

Table S6: Granger causality of the regular BAL player

| Period                  | F-statistic | $d_f$ | $d_f$ | p-value |
|-------------------------|-------------|-------|-------|---------|
| 2016-07-03 to 2017-07-01| 0.614       | 4     | 76    | 0.65    |
| 2017-07-02 to 2018-06-30| 0.378       | 4     | 76    | 0.82    |
| 2018-07-01 to 2019-06-29| 0.968       | 4     | 76    | 0.43    |
| 2019-06-30 to 2020-06-27| 2.54        | 4     | 76    | 0.046   |
| 2020-06-28 to 2021-06-26| 1.35        | 4     | 76    | 0.26    |

Table S7: Instantaneous causality of the active IN player

| Period                  | $\chi^2$ | df | p-value |
|-------------------------|----------|----|---------|
| 2016-07-03 to 2017-07-01| 3.03     | 1  | 0.082   |
| 2017-07-02 to 2018-06-30| 12.3     | 1  | 0.00046 |
| 2018-07-01 to 2019-06-29| 7.04     | 1  | 0.008   |
| 2019-06-30 to 2020-06-27| 0.174    | 1  | 0.68    |
| 2020-06-28 to 2021-06-26| 15.4     | 1  | 8.6e-05 |

Table S8: Instantaneous causality of the active BAL player

| Period                  | $\chi^2$ | df | p-value |
|-------------------------|----------|----|---------|
| 2016-07-03 to 2017-07-01| 3.03     | 1  | 0.082   |
| 2017-07-02 to 2018-06-30| 12.3     | 1  | 0.00046 |
| 2018-07-01 to 2019-06-29| 7.04     | 1  | 0.008   |
| 2019-06-30 to 2020-06-27| 0.174    | 1  | 0.68    |
| 2020-06-28 to 2021-06-26| 15.4     | 1  | 8.6e-05 |
### Table S9: Instantaneous causality of the regular IN player

| Period               | \( \chi^2 \) | df | p-value |
|----------------------|--------------|----|---------|
| 2016-07-03 to 2017-07-01 | 9.91         | 1  | 0.0016  |
| 2017-07-02 to 2018-06-30      | 3.46         | 1  | 0.063   |
| 2018-07-01 to 2019-06-29      | 11.7         | 1  | 0.00062 |
| 2019-06-30 to 2020-06-27      | 6.73         | 1  | 0.0095  |
| 2020-06-28 to 2021-06-26      | 4.26         | 1  | 0.039   |

### Table S10: Instantaneous causality of the regular BAL player

| Period               | \( \chi^2 \) | df | p-value |
|----------------------|--------------|----|---------|
| 2016-07-03 to 2017-07-01 | 9.91         | 1  | 0.0016  |
| 2017-07-02 to 2018-06-30      | 3.46         | 1  | 0.063   |
| 2018-07-01 to 2019-06-29      | 11.7         | 1  | 0.00062 |
| 2019-06-30 to 2020-06-27      | 6.73         | 1  | 0.0095  |
| 2020-06-28 to 2021-06-26      | 4.26         | 1  | 0.039   |
Appendix B  Identity of Bitcoin Users

This supplement explains how we obtain the identity and classification of business activities of regular players for Bitcoin.

In the case of Bitcoin, we employed a simple but useful method, proposed by [1] and widely used in the literature, to identify users from wallets or addresses by identifying a set of multiple inputs of addresses in each transaction as a user in the way that the identification must be consistent in the entire history of all the transactions up to a certain point in time (see [2] for technical details). Our study is based on this method and on the entire history from the genesis block (first block issued on January 9, 2009) until the block of height 693,999 (issued on August 3, 2021).

As a result, among more than 700 million different addresses, 500 million of them were identified as 73 million users. A user corresponds to two or more addresses by the above mentioned method of identification. A user can possess a large number of addresses; the largest one corresponds to the case of 13 million addresses for a single user. We denote such users with two or more addresses by type A. The rest of unidentified addresses are regarded as users individually, denoted by type B. We label a user of type A by a user ID, sequential and increasing with the number of identified addresses, e.g. 0000012345, while a user of type B is labeled by its address, e.g. 3CjqmbuRA1LEWmLHiWoSWHcWuTEVPfU24P.

Because of the very nature of anonymity inherent in the technology of blockchain, it is difficult to obtain the information of actual names of those users. However, in the case of agents who are doing business activities such as exchanges, services, gambling, and mining, it is known that one can obtain the identity of users. Such information could be useful for our study, even if not complete and exhaustive, as we found in our paper. In fact, WalletExplorer.com [3] is a well known web site providing information about identity of addresses in Bitcoin blockchain. The site merges addresses together, if they are part of the same wallet, and also identifies wallets with actual names. According to the site, the method to merge addresses is precisely the same as [1], which is the one we employed in our paper. Additionally, the identification of actual names is done by WalletExplorer.com as follows (quoted from the web site):

In most of the cases, I registered to service, made transaction(s) and saw which wallet bitcoins were merged with, or from which wallet it was withdrawn.

There is probably no easier way how to discover names other than this.

Please note that the name database is not updated, so it does not contain newer exchanges (or newer wallets of existing exchanges).

We matched our data with this useful information to obtain the identity and classification of business activities for the users of type A. We were successful in unravel the identity of 369 users in this way, which are used in the main body of our paper. Table S11 is the classification into exchanges, services, gambling, historic, and mining pools. Table S12 is the complete list of the matching.
### Table S11: Classification of identified users (compiled from [3])

| Classification | #Users | Examples |
|----------------|--------|----------|
| Exchanges      | 116    | Bittrex.com, Huobi.com, Bit-x.com, HitBtc.com |
| Old/Historic   | 94     | AgoraMarket, EvolutionMarket, SilkRoadMarketplace |
| Services/Others| 89     | Xapo.com, ePay.info, Cubits.com |
| Gambling       | 52     | 999Dice.com, CoinGaming.io, SatoshiMines.com |
| Pools          | 18     | BTCCPool, SlushPool.com, BitMinter.com |
| **Total**      | 369    | —        |

### Table S12: Identity of Users (compiled from [3])

**Definitions**
- **No:** sequential number
- **User ID:** an arbitrarily but uniquely assigned ID to each user in our data
- **#Addr.:** number of addresses identified to each User ID in our data (rows are sorted by this column)
- **Name:** Web site (N.B. old, hotwallet, etc. are additional information)
- **Category:** Exchanges, Old/Historic, Services/Others, Gambling, Pools

| No. | User ID     | #Addr.      | Name                  | Category       |
|-----|-------------|-------------|-----------------------|----------------|
| 1   | 00000000001 | 13,206,603  | Bitcoin-24.com-old-hotwallet | Old/Historic   |
| 2   | 00000000001 | 13,206,603  | ePay.info             | Services/Others|
| 3   | 00000000002 | 9,263,042   | CoinPayments.net      | Services/Others|
| 4   | 00000000005 | 2,183,405   | Xapo.com              | Services/Others|
| 5   | 00000000013 | 1,636,640   | Bittrex.com           | Exchanges      |
| 6   | 00000000014 | 1,630,483   | Cubits.com            | Services/Others|
| 7   | 00000000016 | 1,284,661   | Xkaraen.com           | Exchanges      |
| 8   | 00000000018 | 1,195,256   | Huobi.com-2           | Exchanges      |
| 9   | 00000000022 | 1,019,378   | Poloniex.com          | Exchanges      |
| 10  | 00000000029 | 962,592     | Cryptonator.com       | Services/Others|
| 11  | 00000000033 | 912,950     | AnXPro.com            | Exchanges      |
| 12  | 00000000033 | 912,950     | 999Dice.com           | Gambling       |
| 13  | 00000000033 | 912,950     | LocalBitcoins.com-old | Exchanges      |
| 14  | 00000000036 | 879,110     | Luno.com              | Exchanges      |
| 15  | 00000000042 | 810,136     | 999Dice.com           | Gambling       |
| 16  | 00000000053 | 659,719     | CoinGaming.io         | Gambling       |
| 17  | 00000000063 | 523,330     | LocalBitcoins.com     | Exchanges      |
| 18  | 00000000065 | 498,001     | AgoraMarket           | Old/Historic   |
| 19  | 00000000069 | 478,854     | Bitstamp.net          | Exchanges      |
| 20  | 00000000079 | 420,632     | EvolutionMarket       | Old/Historic   |
| 21  | 00000000086 | 372,753     | SilkRoadMarketplace   | Old/Historic   |
| 22  | 00000000087 | 369,593     | MercadoBitcoin.com.br | Exchanges      |
| 23  | 00000000091 | 350,036     | SilkRoad2Market       | Old/Historic   |
| 24  | 00000000093 | 348,491     | BTC-e-old             | Exchanges      |
| 25  | 0000000108  | 307,508     | BTC-e.com             | Exchanges      |
| 26  | 0000000111  | 287,684     | VIPTZ.com             | Services/Others|
| 27  | 0000000114  | 280,963     | Bitcoin.de            | Exchanges      |
| 28  | 0000000120  | 268,458     | SatoshiMines.com      | Gambling       |
| 29  | 0000000123  | 263,074     | YoBit.net             | Exchanges      |
| 30  | 0000000124  | 259,401     | Cryptsy.com-old       | Exchanges      |
| 31  | 0000000125  | 249,048     | Bitmance.com          | Exchanges      |
| 32  | 0000000126  | 244,678     | BitcoinFog            | Services/Others|
| 33  | 0000000133  | 238,480     | Oex.io                | Exchanges      |
| 34  | 0000000144  | 207,477     | Coinlarr.com          | Services/Others|
| 35  | 0000000145  | 205,601     | BitZlato.com          | Exchanges      |
| 36  | 0000000152  | 197,164     | NitrogenSports.eu     | Gambling       |
| 37  | 0000000159  | 189,776     | AlphaBayMarket        | Services/Others|
| 38  | 0000000162  | 187,189     | BitStc.com            | Exchanges      |
| 39  | 0000000165  | 186,000     | BitPay.com            | Services/Others|
| 40  | 0000000187  | 172,413     | BitPay.com-old2       | Services/Others|
| 41  | 0000000198  | 166,077     | BitPay.com-old        | Services/Others|
| 42  | 0000000203  | 161,974     | BitPay.com-old3       | Services/Others|
| 43  | 0000000221  | 146,381     | NucleusMarket         | Services/Others|
| 44  | 0000000234  | 138,182     | Bitstamp.net-old      | Exchanges      |
| No. | User ID     | #Addr.   | Name                          | Category       |
|-----|-------------|----------|-------------------------------|----------------|
| 45  | 0000000239  | 134,562  | Cryptsy.com                   | Exchanges      |
| 46  | 0000002457  | 134,257  | CloudBet.com                  | Gambling       |
| 47  | 0000002582  | 125,004  | PocketDice.io                 | Gambling       |
| 48  | 0000002650  | 120,562  | FortuneJack.com               | Gambling       |
| 49  | 0000002666  | 119,119  | AbraxasMarket                 | Old/Historic   |
| 50  | 0000002765  | 115,775  | CoinKite.com                  | Services/Others|
| 51  | 0000002772  | 114,099  | Bleutrade.com                 | Exchanges      |
| 52  | 0000002799  | 114,464  | Kraken.com-old                | Exchanges      |
| 53  | 0000002846  | 109,151  | Instawallet.org               | Old/Historic   |
| 54  | 0000002938  | 97,347   | Bitcoin.de-old                | Exchanges      |
| 55  | 0000003054  | 96,890   | SecondsTrade.com              | Gambling       |
| 56  | 0000003223  | 87,705   | BitcoinWallet.com             | Services/Others|
| 57  | 0000003232  | 87,424   | BtcX.com                      | Services/Others|
| 58  | 0000003265  | 85,606   | MintPal.com                   | Old/Historic   |
| 59  | 0000003383  | 85,590   | Hashnest.com                  | Exchanges      |
| 60  | 0000003384  | 83,724   | BtcTrade.com                  | Exchanges      |
| 61  | 0000003445  | 80,987   | BCCoin.com-2                  | Exchanges      |
| 62  | 0000003474  | 79,712   | Bter.com                      | Exchanges      |
| 63  | 0000003582  | 78,849   | BitZino.com                   | Gambling       |
| 64  | 0000003644  | 78,119   | BCOin.com                     | Exchanges      |
| 65  | 0000003650  | 77,666   | Bitfinex.com-old2             | Exchanges      |
| 66  | 0000003637  | 74,602   | Rollin.io                     | Gambling       |
| 67  | 0000003679  | 68,927   | VirWoX.com                    | Exchanges      |
| 68  | 0000004111  | 64,803   | BTCC.com                      | Exchanges      |
| 69  | 0000004511  | 57,770   | MaxCoin.com                   | Exchanges      |
| 70  | 0000004565  | 56,953   | BTCPool                       | Pools          |
| 71  | 0000004627  | 55,757   | PandoraOpenMarket             | Old/Historic   |
| 72  | 0000004710  | 55,271   | Fuxul.com                     | Exchanges      |
| 73  | 0000004741  | 54,640   | PrimeDice.com                 | Gambling       |
| 74  | 0000004826  | 53,775   | PrimeDice.com-old4            | Exchanges      |
| 75  | 0000004838  | 53,639   | SheepMarketplace              | Old/Historic   |
| 76  | 0000004868  | 53,102   | Cavirterx.com                 | Exchanges      |
| 77  | 0000005017  | 51,039   | MoonBit.co.in                 | Services/Others|
| 78  | 0000005033  | 50,878   | BlackRockMarket               | Exchanges      |
| 79  | 0000005077  | 50,295   | HaoBTC.com                    | Services/Others|
| 80  | 0000005157  | 48,602   | EX.in.th                      | Exchanges      |
| 81  | 0000005230  | 47,295   | Mateba.com                    | Exchanges      |
| 82  | 0000005482  | 46,051   | PrimeDice.com-old3            | Gambling       |
| 83  | 0000005655  | 44,277   | CoinMotion.com                | Exchanges      |
| 84  | 0000005885  | 42,781   | SatoshiDice.com               | Exchanges      |
| 85  | 0000005921  | 42,301   | PrimeDice.com-old2            | Gambling       |
| 86  | 0000006011  | 41,156   | BTCJam.com                    | Services/Others|
| 87  | 0000006165  | 36,999   | Justcoin.com                  | Old/Historic   |
| 88  | 0000006179  | 35,545   | SafeDice.com                  | Exchanges      |
| 89  | 0000006282  | 35,495   | BTC.com-old                   | Exchanges      |
| 90  | 0000006383  | 35,453   | MxMW.com                      | Old/Historic   |
| 91  | 0000006408  | 35,433   | Co8x.com                      | Exchanges      |
| 92  | 0000007087  | 34,149   | MiddleEarthMarketplace        | Old/Historic   |
| 93  | 0000007134  | 33,436   | Vircurex.com                  | Exchanges      |
| 94  | 0000007324  | 32,823   | Purse.io                      | Services/Others|
| 95  | 0000007362  | 32,701   | Satoshi.f.com                 | Gambling       |
| 96  | 0000007373  | 32,017   | SwCPoker.eu                   | Gambling       |
| 97  | 0000007399  | 31,940   | BitBargain.co.uk              | Exchanges      |
| 98  | 0000007583  | 30,965   | SeaiXKittyclubs.eu            | Old/Historic   |
| 99  | 0000007575  | 30,704   | CoinKako.com                  | Exchanges      |
| 100 | 0000007661  | 30,187   | DLink.com                     | Services/Others|
| 101 | 0000007722  | 29,256   | Huobi.com                     | Exchanges      |
| 102 | 0000007796  | 27,892   | Bit-x.com                     | Exchanges      |
| 103 | 0000008233  | 26,643   | BtcDice.com                   | Old/Historic   |
| 104 | 0000008238  | 26,014   | BitBay.net                    | Exchanges      |
| 105 | 0000008383  | 25,060   | Betcoin.ag                    | Gambling       |
| 106 | 0000008688  | 24,445   | Bter.com-old                  | Exchanges      |
| 107 | 0000008800  | 23,886   | Payium.com                    | Services/Others|
| 108 | 0000008982  | 23,831   | BTC.com-old2                  | Exchanges      |
| 109 | 0000009122  | 22,597   | Loambase.com                  | Services/Others|
| 110 | 0000009162  | 22,304   | Coinlor.com                   | Gambling       |
| 111 | 0000009300  | 21,093   | FaucetREX.com                 | Services/Others|
| 112 | 0000009400  | 21,339   | BitcoinVideoCasino.com-old    | Gambling       |
| 113 | 0000009600  | 20,730   | CampX.com-old                 | Exchanges      |
| 114 | 0000009692  | 20,502   | FYSEG.com                     | Exchanges      |
| No. | User ID | #Addr. | Name | Category |
|-----|---------|--------|------|----------|
| 115 | 0000000998 | 19,810 | TheRockTrading.com | Exchanges |
| 116 | 0000001025 | 18,997 | BlueSkyMarketplace | Old/Historic |
| 117 | 0000001035 | 18,489 | Crypto-Games.net | Gambling |
| 118 | 0000001066 | 17,705 | CoinSwap.net | Old/Historic |
| 119 | 0000001084 | 17,365 | BitcoinVideoCasino.com-old2 | Gambling |
| 120 | 0000001097 | 17,137 | TheRockTrading.com-old | Exchanges |
| 121 | 0000001150 | 15,965 | Anonist.com | Gambling |
| 122 | 0000001155 | 15,905 | ChangeTip.com | Services/Others |
| 123 | 0000001162 | 15,757 | Bitait.net | Old/Historic |
| 124 | 0000001168 | 15,495 | Coinsault.com | Services/Others |
| 125 | 0000001182 | 15,260 | BtcMarkets.net | Exchanges |
| 126 | 0000001213 | 14,966 | Inputs.io | Old/Historic |
| 127 | 0000001228 | 14,233 | CrimeNetwork.co | Services/Others |
| 128 | 0000001243 | 13,072 | Bter.com-old2 | Exchanges |
| 129 | 0000001258 | 13,713 | Vaultoro.com | Exchanges |
| 130 | 0000001326 | 12,486 | CryptoStocks.com | Services/Others |
| 131 | 0000001328 | 12,456 | BitCas. | Old/Historic |
| 132 | 0000001343 | 12,118 | HelixMixer-old18 | Services/Others |
| 133 | 0000001418 | 11,221 | Coins-e.com | Exchanges |
| 134 | 0000001419 | 11,220 | Igot.com | Exchanges |
| 135 | 0000001444 | 10,901 | SatoshiRoulette.com | Gambling |
| 136 | 0000001447 | 10,837 | HelixMixer-old34 | Services/Others |
| 137 | 0000001469 | 10,601 | HelixMixer-old33 | Services/Others |
| 138 | 0000001484 | 10,357 | HelixMixer-old16 | Services/Others |
| 139 | 0000001499 | 10,264 | HelixMixer-old27 | Services/Others |
| 140 | 0000001508 | 10,195 | Bter.com-old3 | Exchanges |
| 141 | 0000001564 | 9,666 | HelixMixer-old4 | Services/Others |
| 142 | 0000001591 | 9,512 | Crypto-Trade.com | Old/Historic |
| 143 | 0000001604 | 9,430 | HelixMixer-old28 | Services/Others |
| 144 | 0000001605 | 9,428 | CoinVault | Old/Historic |
| 145 | 0000001622 | 9,274 | HelixMixer-old19 | Services/Others |
| 146 | 0000001628 | 9,210 | SlushPool.com | Pools |
| 147 | 0000001634 | 9,165 | Crypto Rush | Old/Historic |
| 148 | 0000001641 | 9,122 | BTOOracle | Old/Historic |
| 149 | 0000001662 | 8,967 | Genesis-Mining.com | Services/Others |
| 150 | 0000001675 | 8,882 | HelixMixer-old2 | Services/Others |
| 151 | 0000001692 | 8,767 | HelixMixer-old14 | Services/Others |
| 152 | 0000001693 | 8,751 | HelixMixer-old20 | Services/Others |
| 153 | 0000001734 | 8,444 | HelixMixer-old17 | Services/Others |
| 154 | 0000001736 | 8,430 | Exmo.com | Exchanges |
| 155 | 0000001755 | 8,370 | HelixMixer-old9 | Services/Others |
| 156 | 0000001787 | 8,120 | VaultofSatoshi.com | Old/Historic |
| 157 | 0000001807 | 8,032 | BitcoinVideoCasino.com | Gambling |
| 158 | 0000001809 | 8,030 | PrimeDice.com-old | Gambling |
| 159 | 0000001814 | 8,006 | HelixMixer-old12 | Services/Others |
| 160 | 0000001821 | 7,977 | HelixMixer-old15 | Services/Others |
| 161 | 0000001834 | 7,865 | BTOGuild.com | Old/Historic |
| 162 | 0000001836 | 7,857 | Peerbet.org | Gambling |
| 163 | 0000001839 | 7,848 | 796.com | Exchanges |
| 164 | 0000001866 | 7,605 | HelixMixer-old10 | Services/Others |
| 165 | 0000001867 | 7,603 | Hitbtc.com-old | Exchanges |
| 166 | 0000001869 | 7,585 | Btc38.com | Exchanges |
| 167 | 0000001889 | 7,479 | Betcoins.net | Old/Historic |
| 168 | 0000001920 | 7,302 | HelixMixer-old21 | Services/Others |
| 169 | 0000001946 | 7,172 | HelixMixer-old23 | Services/Others |
| 170 | 0000001952 | 7,151 | AlphaBayMarket-old | Services/Others |
| 171 | 0000001967 | 7,109 | LitBit.eu | Exchanges |
| 172 | 0000001972 | 7,088 | HelixMixer-old25 | Services/Others |
| 173 | 0000002027 | 6,853 | HelixMixer-old30 | Services/Others |
| 174 | 0000002043 | 6,790 | Bitbond.com | Services/Others |
| 175 | 0000002063 | 6,747 | HappyCoins.com | Exchanges |
| 176 | 0000002069 | 6,736 | HelixMixer-old3 | Services/Others |
| 177 | 0000002122 | 6,477 | Bitcoin-Roulette.com | Old/Historic |
| 178 | 0000002151 | 6,356 | HelixMixer-old7 | Services/Others |
| 179 | 0000002163 | 6,309 | AllCoin.com | Old/Historic |
| 180 | 0000002185 | 6,255 | HelixMixer-old24 | Services/Others |
| 181 | 0000002187 | 6,242 | Coin.mx | Old/Historic |
| 182 | 0000002205 | 6,179 | HelixMixer-old3 | Services/Others |
| 183 | 0000002235 | 6,046 | LakeBTC.com | Exchanges |
| 184 | 0000002238 | 6,019 | HelixMixer-old6 | Services/Others |
| No. | User ID | #Addr. | Name | Category       |
|-----|---------|--------|------|----------------|
| 185 | 0000000259 | 5,066  | 777Coin.com | Gambling       |
| 186 | 0000002273 | 5,034  | GHash.io     | Pools          |
| 187 | 0000002279 | 5,007  | Bitcoin-24.com-old | Old/Historic |
| 188 | 0000002297 | 5,840  | CriptoNetwork.co-old | Services/Others |
| 189 | 0000002319 | 5,762  | DoctorDMarket | Services/Others |
| 190 | 0000002379 | 5,576  | C-Gox.com-old | Exchanges      |
| 191 | 0000002403 | 5,481  | Helmixer-old22 | Services/Others |
| 192 | 0000002404 | 5,481  | Coinomat.com  | Exchanges      |
| 193 | 0000002474 | 5,297   | Coinmate.io  | Exchanges      |
| 194 | 0000002546 | 5,253  | Helmixer-old31 | Services/Others |
| 195 | 0000002518 | 5,188  | Helmixer-old26 | Services/Others |
| 196 | 0000002586 | 5,035  | Helmixer-old29 | Services/Others |
| 197 | 0000002591 | 5,024  | BitVC.com     | Exchanges      |
| 198 | 0000002607 | 4,096  | SatoshiCircle.com | Gambling     |
| 199 | 0000002647 | 4,086  | MyBitcoin.com | Old/Historic   |
| 200 | 0000002698 | 4,775  | AllCrypt.com  | Old/Historic   |
| 201 | 0000002761 | 4,629  | GermanPlazaMarket | Services/Others |
| 202 | 0000002776 | 4,605  | MasterExchange.com | Old/Historic |
| 203 | 0000002792 | 4,560  | CoinSafe.com  | Exchanges      |
| 204 | 0000002848 | 4,530  | BitXonan.com  | Exchanges      |
| 205 | 0000002814 | 4,517  | QuadrigaCX.com | Exchanges     |
| 206 | 0000002836 | 4,451  | BitElfin.com  | Old/Historic   |
| 207 | 0000002844 | 4,435  | SpectroCoin.com | Exchanges     |
| 208 | 0000002871 | 4,377  | OrderBook.net | Exchanges      |
| 209 | 0000002884 | 4,358  | Betcoin.ag-old | Gambling      |
| 210 | 0000002887 | 4,354  | Bitcurrency.com | Exchanges   |
| 211 | 0000002888 | 4,352  | BitKees-za-old | Old/Historic   |
| 212 | 0000002893 | 4,338  | Coinichiva.com | Gambling      |
| 213 | 0000002915 | 4,292  | Betcoin.ta    | Gambling      |
| 214 | 0000002960 | 4,232  | XBTC.com      | Exchanges      |
| 215 | 0000003070 | 3,999  | Bitfinex.com  | Exchanges      |
| 216 | 0000003109 | 3,937  | Helmixer-old32 | Services/Others |
| 217 | 0000003157 | 3,861  | Beta2Bitco.in | Old/Historic   |
| 218 | 0000003167 | 3,840  | JetWin.com    | Old/Historic   |
| 219 | 0000003305 | 3,609  | BitZillions.com | Gambling     |
| 220 | 0000003349 | 3,545  | Korbit.co.kr  | Exchanges      |
| 221 | 0000003403 | 3,485  | BTCPop.co     | Services/Others |
| 222 | 0000003515 | 3,356  | Helmixer-old5 | Services/Others |
| 223 | 0000003850 | 3,308  | BTC-e.com-output | Exchanges |
| 224 | 0000003617 | 3,238  | TAFITCL.com   | Exchanges      |
| 225 | 0000003716 | 3,121  | BItTooa.com   | Old/Historic   |
| 226 | 0000003752 | 3,086  | BitYes.com    | Old/Historic   |
| 227 | 0000003770 | 3,065  | FoxBit.com.br-cold | Exchanges   |
| 228 | 0000003934 | 2,998  | CoinURL.com   | Services/Others |
| 229 | 0000003972 | 2,848  | Helmixer-old8 | Services/Others |
| 230 | 0000003985 | 2,829  | CannabisRoadMarket | Old/Historic |
| 231 | 0000004072 | 2,760  | Ice-Dice.com | Old/Historic   |
| 232 | 0000004094 | 2,744  | Ch8tc.com     | Exchanges      |
| 233 | 0000004122 | 2,724  | Bitfinex.com-old | Exchanges    |
| 234 | 0000004135 | 2,713  | CoinArch.com  | Exchanges      |
| 235 | 0000004198 | 2,652  | Banx.io-old  | Exchanges      |
| 236 | 0000004205 | 2,645  | Coinork.com   | Old/Historic   |
| 237 | 0000004214 | 2,636  | Bitcoinica.com-old | Old/Historic |
| 238 | 0000004247 | 2,618  | BitZ.com     | Services/Others |
| 239 | 0000004255 | 2,614  | CleverCoin.com | Exchanges     |
| 240 | 0000004309 | 2,575  | CoinMkt.com   | Old/Historic   |
| 241 | 0000004457 | 2,459  | Helmixer-old | Services/Others |
| 242 | 0000004609 | 2,355  | DicBitco.in  | Old/Historic   |
| 243 | 0000004747 | 2,276  | BitcoinVietnam.com.vn | Exchanges |
| 244 | 0000004851 | 2,221  | Indacoin.com  | Exchanges      |
| 245 | 0000005248 | 2,023  | BitClix.com  | Services/Others |
| 246 | 0000005320 | 1,992  | Coin-Sweeper.com | Old/Historic |
| 247 | 0000005426 | 1,948  | GoCerely.com  | Services/Others |
| 248 | 0000005638 | 1,941  | Satoshi-Karoshi.com-old | Gambling |
| 249 | 0000005799 | 1,812  | Playt.in     | Old/Historic   |
| 250 | 0000005811 | 1,805  | Helmixer-old11 | Services/Others |
| 251 | 0000005814 | 1,804  | Bitcash.cz   | Old/Historic   |
| 252 | 0000005823 | 1,802  | CampBX.com   | Exchanges      |
| 253 | 0000006116 | 1,713  | BTC2led.org  | Services/Others |
| 254 | 0000006145 | 1,704  | CoinChimp.com | Exchanges      |
| No. | User ID    | #Addr.          | Name                      | Category       |
|-----|------------|-----------------|---------------------------|----------------|
| 255 | 0000006170 | 1.699           | BtcExchange.ro            | Old/Historic   |
| 256 | 0000006199 | 1.690           | AdmiralCoin.com           | Old/Historic   |
| 257 | 0000006222 | 1.681           | CryptoPay.ne-old          | Services/Others|
| 258 | 0000006351 | 1.643           | Bitcoinit.co              | Old/Historic   |
| 259 | 0000006425 | 1.623           | Coingi.com                | Exchanges      |
| 260 | 0000006514 | 1.594           | Gatecoin.com              | Exchanges      |
| 261 | 0000006610 | 1.572           | Bter.com-old              | Exchanges      |
| 262 | 0000006854 | 1.508           | BetChain.com-old          | Gambling       |
| 263 | 0000007050 | 1.471           | BabyLotMarket             | Old/Historic   |
| 264 | 0000007174 | 1.443           | HelixMixer                | Services/Others|
| 265 | 0000007356 | 1.401           | Cryptonator.com-old       | Services/Others|
| 266 | 0000007428 | 1.389           | FlushPool.com-old2        | Pools          |
| 267 | 0000007580 | 1.314           | Bylls.com                 | Old/Historic   |
| 268 | 0000008204 | 1.246           | Btcst.com-pirateat40      | Old/Historic   |
| 269 | 0000008226 | 1.244           | BitcoinWeBank.com         | Old/Historic   |
| 270 | 0000008600 | 1.189           | PocketRocketsCasino.eu    | Old/Historic   |
| 271 | 0000008905 | 1.188           | Bitso.com                 | Exchanges      |
| 272 | 0000008652 | 1.181           | CoinRoyale.com-old2       | Gambling       |
| 273 | 0000008671 | 1.178           | BTC.t.com                 | Old/Historic   |
| 274 | 0000008682 | 1.176           | DuDice.com                | Old/Historic   |
| 275 | 0000008940 | 1.140           | SatoshiDice.com-old       | Old/Historic   |
| 276 | 0000009253 | 1.098           | Cryptonite.net            | Exchanges      |
| 277 | 0000009395 | 1.082           | Dges.com-old              | Old/Historic   |
| 278 | 0000009446 | 1.076           | BitStarz.com              | Gambling       |
| 279 | 0000009819 | 1.040           | Ccedx.com                 | Exchanges      |
| 280 | 0000010013 | 1.020           | Satoshi-Karoshi.com       | Gambling       |
| 281 | 0000010664 | 0.978           | Just-Dice.com             | Old/Historic   |
| 282 | 0000010770 | 0.968           | CryptoLocker              | Old/Historic   |
| 283 | 0000010798 | 0.965           | GreenRoadMarket           | Services/Others|
| 284 | 0000011220 | 0.963           | FlushPool.com-old2        | Pools          |
| 285 | 0000010941 | 0.953           | CoinRoyale.com            | Gambling       |
| 286 | 0000010985 | 0.950           | CryptoBounty.com-old      | Old/Historic   |
| 287 | 0000011403 | 0.915           | Chainroll.com-old         | Old/Historic   |
| 288 | 0000012399 | 0.846           | CoinRoyale.com-old        | Gambling       |
| 289 | 0000014332 | 0.741           | EmpeEX.com                | Exchanges      |
| 290 | 0000014593 | 0.729           | FairProof.com             | Gambling       |
| 291 | 0000015294 | 0.700           | UseCrypto.com             | Services/Others|
| 292 | 0000016863 | 0.670           | AntPool.com               | Pools          |
| 293 | 0000016928 | 0.668           | Coinbroker.io             | Exchanges      |
| 294 | 0000017070 | 0.665           | UpDown.BT                 | Old/Historic   |
| 295 | 0000017688 | 0.648           | DiceNow.com               | Gambling       |
| 296 | 0000017899 | 0.643           | CrimeNetwork.cc-old       | Old/Historic   |
| 297 | 0000017921 | 0.643           | Dagenzia.eu               | Old/Historic   |
| 298 | 0000019081 | 0.614           | WatchMyBit.com            | Services/Others|
| 299 | 0000019524 | 0.604           | MPEx.co                   | Old/Historic   |
| 300 | 0000020410 | 0.593           | Banx.io                   | Exchanges      |
| 301 | 0000020698 | 0.588           | EclipscMC.com-old         | Pools          |
| 302 | 0000021439 | 0.572           | CloudHashing.com          | Old/Historic   |
| 303 | 0000021756 | 0.565           | Eligius.st                | Pools          |
| 304 | 0000023664 | 0.527           | EuropeX.eu                | Old/Historic   |
| 305 | 0000024299 | 0.515           | EveryDice.com             | Old/Historic   |
| 306 | 0000024598 | 0.511           | CrimeNetwork.cc-old       | Old/Historic   |
| 307 | 0000025484 | 0.499           | Braoker.com               | Old/Historic   |
| 308 | 0000027631 | 0.473           | 10xBitco.io               | Old/Historic   |
| 309 | 0000029250 | 0.450           | Cryptonite.net-old        | Exchanges      |
| 310 | 0000029949 | 0.440           | BitMinter.com             | Pools          |
| 311 | 0000033271 | 0.402           | BW.com                    | Pools          |
| 312 | 0000033478 | 0.400           | Chainroll.com             | Old/Historic   |
| 313 | 0000035156 | 0.390           | DicoCoin.io               | Gambling       |
| 314 | 0000035978 | 0.382           | FooxBit.com.br-2          | Exchanges      |
| 315 | 0000036098 | 0.380           | PonziCoin.co              | Old/Historic   |
| 316 | 0000036395 | 0.377           | Banx.io-old2              | Exchanges      |
| 317 | 0000036405 | 0.377           | Biroo.com-old             | Old/Historic   |
| 318 | 0000038093 | 0.351           | Zyado.com                 | Exchanges      |
| 319 | 0000040205 | 0.341           | SuzukiDice.com            | Old/Historic   |
| 320 | 0000043429 | 0.316           | 50BTC.com-old2            | Old/Historic   |
| 321 | 0000047851 | 0.297           | KnMiner.com               | Pools          |
| 322 | 0000048078 | 0.295           | CrimeNetwork.biz          | Old/Historic   |
| 323 | 0000048367 | 0.293           | BitcoinPokerTables.com    | Gambling       |
| 324 | 0000050535 | 0.280           | Folinine.pl               | Old/Historic   |
| No. | User ID     | #Addr.     | Name                        | Category           |
|-----|-------------|------------|-----------------------------|--------------------|
| 325 | 0000050829  | 279        | MineField.BitcoinLab.org    | Gambling           |
| 326 | 0000064447  | 239        | Zyado.com-old               | Exchanges          |
| 327 | 0000065935  | 234        | EmenarnaBitcoin.cz          | Old/Historic       |
| 328 | 0000072171  | 219        | FoxBit.com.br-cold-old      | Exchanges          |
| 329 | 0000077659  | 204        | 50BTC.com-old3              | Old/Historic       |
| 330 | 0000083970  | 195        | Eger.com                    | Old/Historic       |
| 331 | 0000091628  | 190        | Bitlaunder.com              | Services/Others    |
| 332 | 0000098744  | 176        | AntPool.com-old2            | Pools              |
| 333 | 0000102180  | 170        | BitMillions.com             | Old/Historic       |
| 334 | 0000133798  | 131        | CrimeNetwork.cc-old         | Old/Historic       |
| 335 | 0000134052  | 131        | CrimeNetwork.cc-old2        | Old/Historic       |
| 336 | 0000140685  | 125        | Vic-Socks.to                | Services/Others    |
| 337 | 0000157956  | 112        | Bitcoin-24.com              | Old/Historic       |
| 338 | 00001627145 | 111        | CoinApult.com-old           | Services/Others    |
| 339 | 0000278134  | 75         | Bitfury.org                 | Old/Historic       |
| 340 | 0000317097  | 66         | BTTradeAustralia.com-incoming| Exchanges          |
| 341 | 0000369533  | 51         | 50BTC.com                   | Old/Historic       |
| 342 | 0000478261  | 46         | HolyTransaction.com         | Services/Others    |
| 343 | 0000538557  | 35         | SecureVPS.to                | Services/Others    |
| 344 | 0000642621  | 28         | DiceOnCrack.com             | Old/Historic       |
| 345 | 0000726645  | 22         | SecureVPS.to-old            | Services/Others    |
| 346 | 0000938175  | 20         | ActionCrypto.com            | Old/Historic       |
| 347 | 0001143065  | 19         | Kano.is-old                 | Pools              |
| 348 | 0001505994  | 15         | ASICMiner                   | Old/Historic       |
| 349 | 0002158176  | 14         | Telco214                    | Pools              |
| 350 | 0002496530  | 12         | PinballCoin.com             | Old/Historic       |
| 351 | 0002567310  | 12         | BTTradeAustralia.com        | Exchanges          |
| 352 | 0002659360  | 12         | SimpleCoin.cz-old4          | Exchanges          |
| 353 | 000385120   | 8          | EclipseMC.com-old2          | Pools              |
| 354 | 0004264612  | 8          | SimpleCoin.cz-old2          | Exchanges          |
| 355 | 0005131973  | 7          | SimpleCoin.cz               | Exchanges          |
| 356 | 0005469510  | 7          | SimpleCoin.cz-old5          | Exchanges          |
| 357 | 0007026580  | 6          | Lucky8.it                   | Gambling           |
| 358 | 000772443   | 5          | Exchanging.ir               | Exchanges          |
| 359 | 0007878575  | 4          | FoxBit.com.br               | Exchanges          |
| 360 | 0012987571  | 4          | SimpleCoin.cz-old3          | Exchanges          |
| 361 | 0013830337  | 4          | EclipseMC.com-old3          | Pools              |
| 362 | 0017639315  | 3          | EclipseMC.com               | Pools              |
| 363 | 0021692739  | 3          | StrongCoin.com-fee          | Services/Others    |
| 364 | 002749055   | 2          | DeepBit.net                 | Old/Historic       |
| 365 | 0029599951  | 2          | BetMoose.com                | Gambling           |
| 366 | 0043069626  | 2          | Dispenser.tf                | Old/Historic       |
| 367 | 0063718479  | 2          | CoinWorker.com              | Services/Others    |

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3. Bitcoin block explorer with address grouping and wallet labeling (accessed on 2022-03-29);. https://www.walletexplorer.com.