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**Global Fintech:
Defi or Defy
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INFORMATION PROCESSING COSTS: EVIDENCE FROM DEFI MARKETS

MOTIVATION

- Most financial markets are opaque and exhibit asymmetric information
 - Regulators aim at transparency
 - Transparency => Efficiency
 - Holds only if traders take advantage of the available information
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- Motivating question: when available, do traders take advantage of all free and publicly available information?

SETUP

- Take advantage of blockchain based markets where all trades are available in real time for all to see
- MakerDao decentralized lending platform on the Ethereum blockchain
- Loans taken for leveraging and margin trading

Ask:

- Do traders take advantage of publicly available data?
 - Measured by tendency of traders to follow other traders' investment strategy
- If not, why?
 - What costs may be associated with the use of free and publicly available information

PREVIEW OF RESULTS

- Previous loan performance can be a useful indicator to help traders identify those with superior/inferior past performance.

Do traders follow “winners”? No!

- No evidence that traders with higher past loan returns attract more followers

Why? Awareness, integration and acquisition costs.

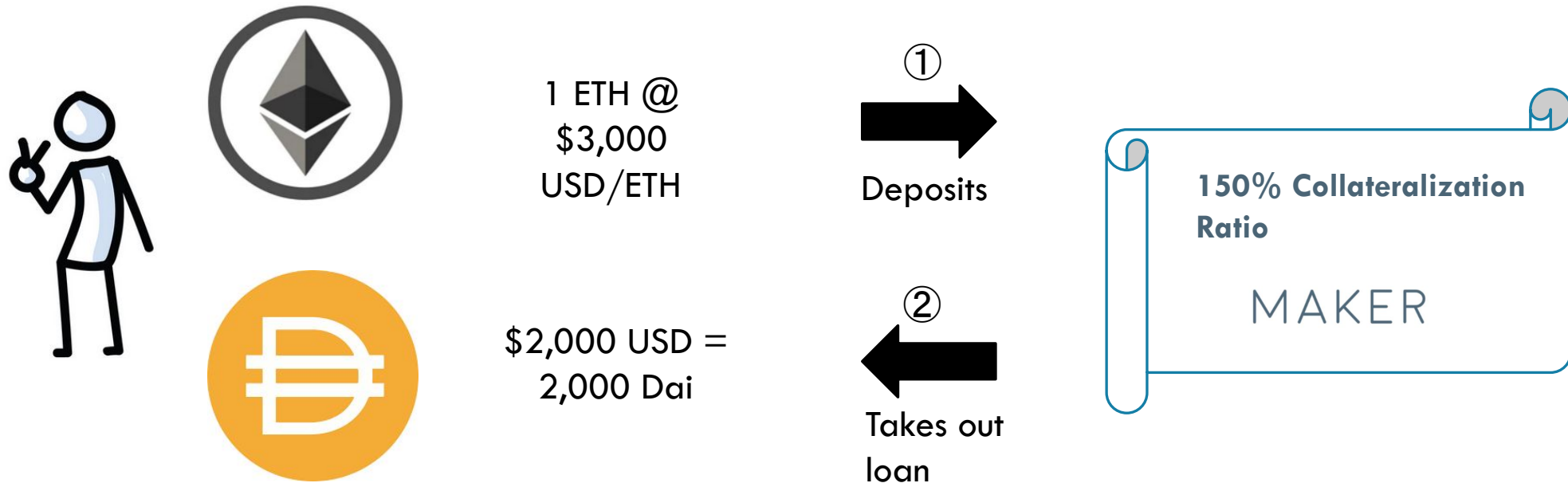
- High integration costs—calculating returns on investment is complex
- High awareness and acquisition costs—monitoring transactions in real-time as well as acquiring the information has (at least) high initial fixed costs
 - Likely requires a bot and an Ethereum node for data acquisition and evaluation
 - Costly for the non-sophisticated traders

THE MAKERDAO PROTOCOL

- A set of smart contracts deployed on Ethereum that allows users to borrow Dai when depositing ETH.
 - Public and permissionless
 - Loans are overcollateralized
 - Decentralized
- Dai is Maker's native token and is pegged to the US dollar.

THE MAKERDAO LOAN CONTRACT

- The amount that the user can borrow depends on the collateralization ratio (= collateral in USD / value of Dai in USD)



LIQUIDATION

If the collateralization ratio is below 150% (for example, when the value of ETH suddenly drops), the user can face a liquidation event: ETH in the account is sold to cover the loan, interest, and liquidation expense (13% fee).



1 Deposited ETH @
\$2,000 USD/ETH



2,000 Borrowed
Dai

Liquidation



ETH sold to payback
the loan and fees;
what's left is returned
to User

DATA

MakerDao's official Dai 1.0 API:

- All loan contracts from December 2017 to May 2020 (350,000 loans).
- Sample restrictions
 - Users have at least two loans
 - Borrowers took out at least \$1 US dollar in each loan
- Final sample size of 8,062 loans, and 2,545 unique users

Every transaction executed under the loan contract

User-specific information on the Ethereum blockchain

LEVERAGED TRADING (LOOPING)

One of the most popular trading strategies in our dataset is to

- Deposit ETH to borrow Dai
- Convert back to ETH
- Deposit back to the loan contract to take out more Dai

This process increases investor's exposure to ETH and can be profitable if the value of ETH appreciates while the traders hold the loan.

Transaction Time	Collateral (ETH)	Collateral (Dai)	Principal (Dai)	Repayment (Dai)	Transaction Type	Cash Balance (MakerDao Funds)	External Cash Used
9/1/19 21:19:56	0	0			Opening contract		
9/1/19 21:19:56	0.06	10.23			Place collateral		10.23
9/1/19 21:19:56	0	0	5.5		Borrow loan	5.5	
9/2/19 0:50:09	0.1	17.08			Place collateral	0	$17.08 - 5.5 = 11.58$
9/2/19 21:48:18	0	0	5		Borrow loan	5	
9/2/19 23:44:51	0.06	10.5			Place collateral	0	$10.5 - 5 = 5.5$
10/4/19 23:05:34	0	0	6		Borrow loan	6	
10/4/19 23:05:34	0.033	6			Place collateral	0	
10/8/19 21:39:14	0	0	8		Borrow loan	8	
10/8/19 21:39:14	0.041	8			Place collateral	0	
11/20/19 19:51:15	0	0		24.5	Repay loan		24.5
11/20/19 19:51:15	0	0		0.31	Interest Expense		0.31
11/20/19 19:51:15	0.298	52.08			Collateral Returned		

DEFINITION OF LOAN RETURN

Return

$$\frac{\textit{Ending collateral value} + \textit{ending cash balance} - \textit{cash used}}{\textit{cash used}}$$

EXAMPLE: CALCULATING LOAN

DFTI IDNI

Transaction Time	Collateral (ETH)	Collateral (Dai)	Principal (Dai)	Repayment (Dai)	Transaction Type	Cash Balance (MakerDao Funds)	External Cash Used
9/1/19 21:19:56	0	0			Opening contract		
9/1/19 21:19:56	0.06	10.23			Place collateral		10.23
9/1/19 21:19:56	0	0	5.5		Borrow loan	5.5	
9/2/19 0:50:09	0.1	17.08			Place collateral	0	17.08-5.5=11.58
9/2/19 21:48:18	0	0	5		Borrow loan	5	
9/2/19 23:44:51	0.06	10.5			Place collateral	0	10.5-5=5.5
10/4/19 23:05:34	0	0	6		Borrow loan	6	
10/4/19 23:05:34	0.033	6			Place collateral	0	
10/8/19 21:39:14	0	0	8		Borrow loan	8	
10/8/19 21:39:14	0.041	8			Place collateral	0	
11/20/19 19:51:15	0	0		24.5	Repay loan		24.5
11/20/19 19:51:15	0	0		0.31	Interest Expense		0.31
11/20/19 19:51:15	0.298	52.08			Collateral Returned		

Ending collateral value = 52.08 Ending cash balance = 0

Cash used = 10.23 + 11.58 + 5.5 + 24.5 = 51.81

Return is $(52.08-51.81)/51.81 = 0.5\%$

WHAT INDICATORS MAY INFORM OF PERFORMANCE: RETURNS

Panel A. Persistence in return

Regressions	I		II	
	return	tstat	return	tstat
return(-1)	0.107	5.41	0.107	5.43
order	-0.001	-0.69	-0.001	-1.06
collateralization(-1)	-0.011	-3.07	-0.011	-3.05
leverage(-1)	-0.063	-7.77	-0.064	-7.69
principal(-1)	0.009	5.11	0.008	4.47
duration(-1)	-0.000	-1.31	-0.000	-1.16
volatility(-1)	-0.615	-2.65	-0.610	-2.63
same_day(-1)	0.007	0.50	0.004	0.25
age			0.000	0.07
NA_trading_hours			0.002	0.12
NA_regular_hours			0.027	1.42
num_txhash			0.001	1.30
Observations	5518		5518	
R-squared	0.252		0.252	
Month-year FE	Yes		Yes	
Clustering	Wallet		Wallet	

- Persistence in return: last loan return positively predicts current loan return.
- One standard deviation increase in last loan return increases next loan return by 3.6%

WHAT INDICATORS MAY INFORM OF PERFORMANCE: LIQUIDATION EVENTS

Panel B. Persistence in liquidation

Regressions	I		II	
	liquidated	tstat	liquidated	tstat
liquidated(-1)	2.308	22.32	2.270	21.78
order	-0.045	-3.33	-0.030	-2.17
collateralization(-1)	-0.085	-1.88	-0.094	-2.02
leverage(-1)	0.285	3.34	0.312	3.56
principal(-1)	-0.102	-6.71	-0.084	-5.17
duration(-1)	0.001	2.54	0.001	2.58
volatility(-1)	-0.095	-0.04	0.154	0.06
same_day(-1)	-0.164	-1.04	-0.041	-0.25
age			-0.001	-2.62
NA_trading_hours			0.007	0.07
NA_regular_hours			0.087	0.43
num_txhash			-0.032	-3.67
Observations	5518		5518	
R-squared	0.275		0.280	
Month-year FE	Yes		Yes	
Clustering	Wallet		Wallet	

- Persistence in liquidation events: previous liquidation event positively predicts current liquidation.
- Previous liquidation increases the probability of current liquidation by almost 30%.

DO TRADERS FOLLOW
“WINNERS”?

THE FOLLOWING MEASURE

Transaction Time	Collateral (USD)	Collateral (ETH)	Principal (Dai)	Repayment (Dai)	Transaction Type
2019-09-01 21:19:56	0	0			Opening contract
2019-09-01 21:19:56	10.23	0.06			Place collateral
2019-09-01 21:19:56	0	0	5.5		Borrow loan
2019-09-02 00:50:09	17.08	0.1			Place collateral
2019-09-02 21:48:18	0	0	5		Borrow loan
2019-09-02 23:44:51	10.5	0.06			Place collateral
2019-10-04 23:05:34	0	0	6		Borrow loan
2019-10-04 23:05:34	6	0.033			Place collateral
2019-10-08 21:39:14	0	0	8		Borrow loan
2019-10-08 21:39:14	8	0.041			Place collateral
2019-11-20 19:51:15	0	0		24.5	Repay loan
2019-11-20 19:51:15	52.08	0.294			Collateral Returned

The follower of this transaction borrows from the MakerDao protocol within 15 minutes after the original transaction.

The follower of this loan is someone who follows at least half of all borrowing and repayment transactions.

The following score is the number of followers of a loan.

DO TRADERS FOLLOW “WINNERS”? NO!

Regressions	I	tstat
return(-1)	0.008	0.83
liquidated(-1)		
collateralization(-1)	0.002	0.35
leverage(-1)	-0.013	-1.81
principal(-1)	-0.004	-1.86
duration(-1)	0.000	1.38
volatility(-1)	0.512	2.50
same_day(-1)	0.080	3.92
age	-0.000	-1.23
NA_trading_hours	0.008	0.65
NA_regular_hours	-0.063	-1.68
num_txhash	0.003	2.60
Observations	5516	
R-squared	0.033	
Month-year FE	Yes	
Clustering	Wallet	

COSTS ASSOCIATED WITH FOLLOWING

Why don't traders use the publicly available information to follow "winners"?

Following requires:

1. Historical data to identify "winners" and "losers"
 - Acquire historical information and calculate returns
2. Real time data to actively follow other traders
 - Monitor, acquire, evaluate in real time

COSTS ASSOCIATED WITH USING HISTORICAL DATA

- Awareness and acquisition costs for historical blockchain data are low
- Integration costs may still be high—requires the calculation of returns
- Test whether a reduction in *integration* costs of historical data result in more following
 - Focus on liquidations, as avoiding “losers” does not require use of real time data
 - Study how the availability of tools that provide data that makes identifying liquidation easy yet does not affect the costs associated with calculating affect traders’ following behavior.
 - Split the sample before/after December 2018 when the Maker foundation launched a website that provided aggregated loan information data—highlighting liquidated loans.

Traders still don't follow "winners" BUT avoid "losers" once tracking them becomes easy

Panel C. Subsample test on loans opened before or after the introduction of the MakerDao website

Regressions	Before Introduction of Website				After Introduction of Website			
	I		II		III		IV	
	follow	tstat	follow	tstat	follow	tstat	follow	tstat
return (-1)	0.000	0.07			0.020	1.47		
liquidated(-1)			-0.000	-0.06			-0.039	-3.28
collateralization(-1)	-0.002	-1.46	-0.002	-1.33	0.004	0.57	0.003	0.50
leverage(-1)	-0.002	-0.20	-0.002	-0.21	-0.011	-1.29	0.001	0.17
principal(-1)	-0.001	-0.90	-0.001	-0.81	-0.005	-2.08	-0.006	-2.27
duration(-1)	0.000	0.65	0.000	0.62	0.000	0.96	0.000	1.65
volatility(-1)	0.244	1.44	0.244	1.43	0.533	2.18	0.577	2.34
same day(-1)	0.009	1.51	0.009	1.46	0.091	3.83	0.091	3.86
age	-0.000	-0.70	-0.000	-0.74	-0.000	-1.03	-0.000	-1.06
NA trading hours	0.005	1.79	0.005	1.82	0.014	0.93	0.015	0.99
NA_regular_hours	0.002	0.67	0.002	0.64	-0.073	-1.67	-0.074	-1.71
num txhash	-0.000	-1.19	-0.000	-1.23	0.003	2.55	0.003	2.44
Observations	835		835		4371		4371	
R-squared	0.006		0.006		0.033		0.034	
Month-year FE	Yes		Yes		Yes		Yes	
Clustering	Wallet		Wallet		Wallet		Wallet	

COSTS ASSOCIATED WITH USING REAL TIME DATA

- Monitoring and acquiring real time data is costly, specifically if done manually.
- Following likely requires investment in automating the process.
- Even when automated, costs of following in real-time increases with the number of smart contracts the followed trader interacts with

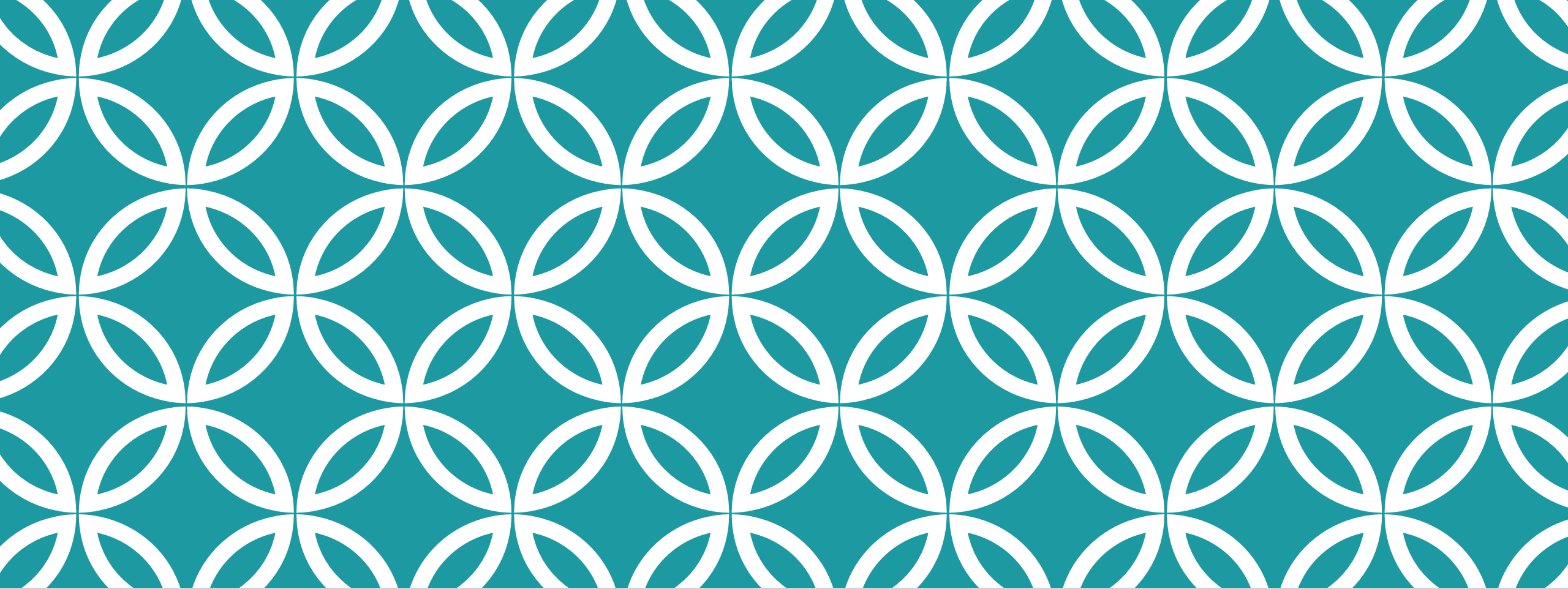
Traders that interact with more smart contracts are less likely to be followed

Regressions	I	tstat
return(-1)	0.042	1.69
loan_smart_contracts	-0.022	-3.29
loan_smart_contracts* return(-1)	-0.021	-1.87
loan_transactions	-0.000	-3.89
loan_transactions* return(-1)	-0.000	-1.33
collateralization(-1)	0.002	0.31
leverage(-1)	-0.006	-0.82
principal(-1)	-0.004	-1.99
duration(-1)	0.000	1.84
volatility(-1)	0.514	2.50
same_day(-1)	0.080	3.92
age	-0.000	-1.32
NA_trading_hours	0.009	0.72
NA_regular_hours	-0.061	-1.65
num_txhash	0.002	2.47
Observations	5516	
R-squared	0.034	
Month-year FE	Yes	
Clustering	Wallet	

CONCLUSION

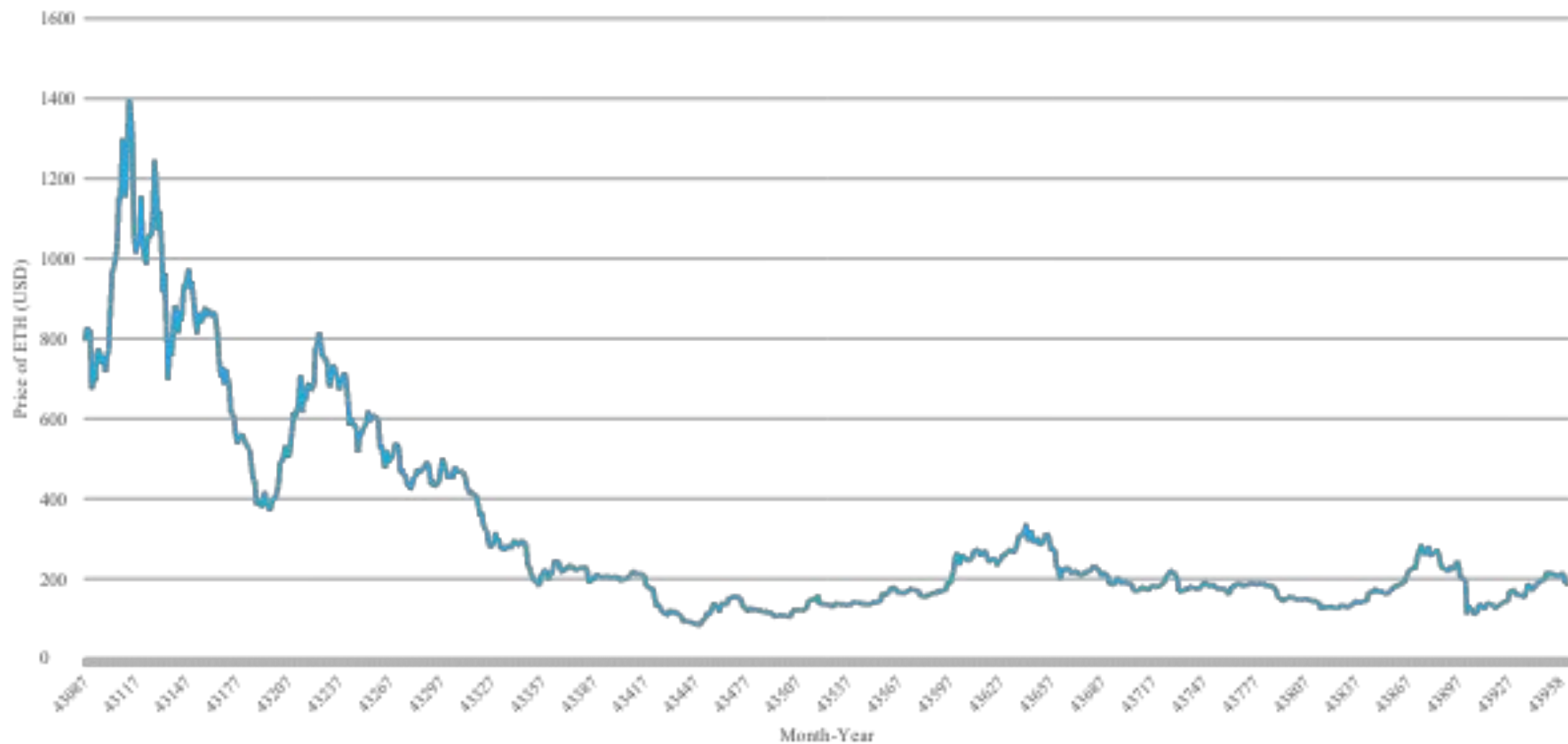
Policy implications:

- Transparency by itself is not enough
- Information should be easy to collect and process
- Policy makers should aim at the provision of easy to access and digestible information, rather than transparency per-se.



ADDITIONAL INFORMATION |

Daily Closing Price ETH Over Sample Period



STABILITY FEE

Appendix A: Interest fee change schedule for the Maker Protocol

Begin Time	End Time	Interest Rate	TxHash used to facilitate the change
Dec-18-2017 20:15:01	Aug-30-2018 20:15:01	0.50%	
Aug-30-2018 20:15:01	Dec-21-2018 19:11:50	2.50%	0x9012d9a877dfce00501208ecb536045fc6d4540408868a377f9fc78f41d9170d
Dec-21-2018 19:11:50	Feb-09-2019 20:19:26	0.50%	0x644f94010bf0a5a077f0a05568e4319565f480fb307587e7b096462278b1c8a9
Feb-09-2019 20:19:26	Feb-23-2019 19:24:23	1%	0x7fb069a649d73166dbd6428fec7a28493f5502beda20038a7b78784c6ed00e75
Feb-23-2019 19:24:23	Mar-09-2019 02:27:42	1.50%	0x9cfeb1dde25706f868c34c34ce6cc8c8c7686bed13e736f26b1169dc1723bcc9
Mar-09-2019 02:27:42	Mar-22-2019 22:58:39	3.50%	0x0332973a529c1d68556ea1399ea807f19805b1b6461972bbbfd66d26f94c2a
Mar-22-2019 22:58:39	Apr-14-2019 23:39:09	7.50%	0xee9f25fbb05d8f91580c0f81bc7eb38dcb92f35117055e6976076b5b0320441c
Apr-14-2019 23:39:09	Apr-19-2019 19:56:33	11.50%	0x121af46b6eb05157327b43324ae54ac7612e8b3ca375fe631d280d3bdc37f8d
Apr-19-2019 19:56:33	Apr-28-2019 04:04:21	14.50%	0x04c73f2e1664b50c2d0d3458f237adecae71a26f1d9bb43bc6fb8c9fce9982f4
Apr-28-2019 04:04:21	May-03-2019 20:23:23	16.50%	0xe063598c19bb7c5ec52f9c82cfd8c986b8141351f7dfe3d05677ba3d262e204f
May-03-2019 20:23:23	May-28-2019 21:06:19	19.50%	0xfecb046baeeb49d39d2fe00333c94903132e87a0372cd5ee62953b9c06d396fa
May-28-2019 21:06:19	Jun-05-2019 13:12:18	17.50%	0x694006c530c902d441e38a17f29b41a1a66f2a136e931778c71109d884e35db7
Jun-05-2019 13:12:18	Jun-05-2021 13:12:18	16.50%	0xf0b6a4187fde63b239a85764cdf5e1246c8e6f3ec2e2f09965003ea16544f02

CORRELATION MATRIX

Panel B. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) following	1.00												
(2) return	0.01	1.00											
(3) collateralization	0.00	0.05	1.00										
(4) leverage	-0.03	0.03	-0.37	1.00									
(5) principal	-0.09	-0.02	-0.11	0.20	1.00								
(6) duration	-0.06	-0.08	-0.02	0.06	0.22	1.00							
(7) age	-0.04	0.07	0.10	-0.10	0.20	0.03	1.00						
(8) NA_trading_hours	-0.04	0.02	0.00	0.02	0.20	0.06	0.13	1.00					
(9) NA_regular_hours	-0.04	0.02	0.04	-0.00	0.11	0.06	0.11	0.37	1.00				
(10) num_txhash	0.07	0.02	-0.07	0.07	0.12	-0.17	-0.12	0.00	-0.02	1.00			
(11) volatility	-0.01	-0.00	0.05	-0.01	0.18	0.10	0.04	0.03	0.02	0.03	1.00		
(12) same_day	-0.13	-0.11	-0.06	0.10	0.25	0.20	0.06	0.07	0.07	-0.18	0.03	1.00	
(13) liquidated	0.19	0.06	0.08	-0.11	-0.27	-0.27	-0.04	-0.11	-0.10	0.27	-0.03	-0.70	1.00