

# Competition in the Crypto-Currency Market

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May 6, 2014

# MOTIVATION

- Bitcoin and crypto-currencies are new
- we would like to understand better
- to predict their impact, if any

## THIS PAPER

- exchange rate data
- analyze past developments
- use existing results from economics literature
- to inform predictions about the future of this market

### focus on competition

- crypto-currencies
- exchanges

## EXISTING LITERATURE – NETWORK EFFECTS

- network effects in both crypto-currencies and exchanges
- but different in nature

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### crypto-currencies

- one-sided platforms
- only same-side effects, and only positive
- we expect “winner-take-all”

### exchanges

- two-sided platforms
- positive cross-side effects
- negative same-side effects
- “winner-take-all” dynamics mitigated by negative same-side effects

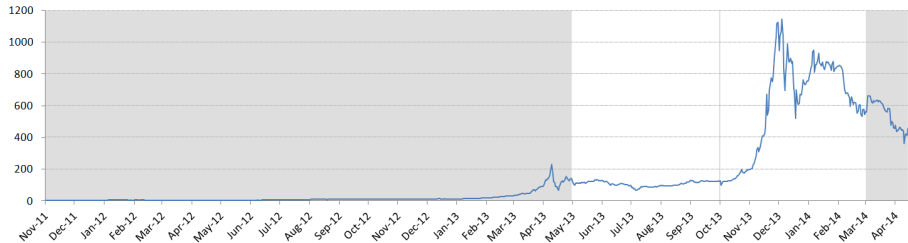
## DATA

- exchange rate data from BTC-e and other exchanges (Cryptsy, Bitstamp, Bitfinex)
- for Bitcoin and other currencies (Litecoin, Peercoin, Namecoin, Novacoin, Feathercoin, Terracoin)
- from May 2, 2013 until February 28, 2014
  - ▶ *first period*: May 2–September 30, 2013
  - ▶ *second period*: October 1, 2013–February 28, 2014

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  - ▶ on October 2 FBI shut down Silk Road — big news

# BITCOIN PRICE OVERTIME

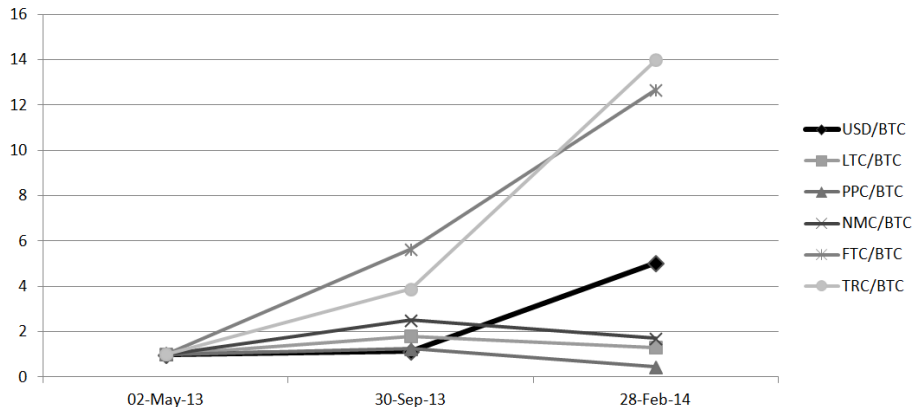




## COINS (BTC-e)

Currency	May 2, 2013 beginning of data	September 30, 2013	February 28, 2014 end of data
USD/BTC	106.8	123.0	537.5
LTC/BTC	31.3	56.6	40.9
PPC/BTC	378.8	471.7	166.1
NMC/BTC	97.8	246.3	166.7
NVC/BTC	31.9	33.5	74.5
FTC/BTC	197.2	1111.1	2500.0
TRC/BTC	198.4	769.2	2777.8

# COINS (BTC-e)



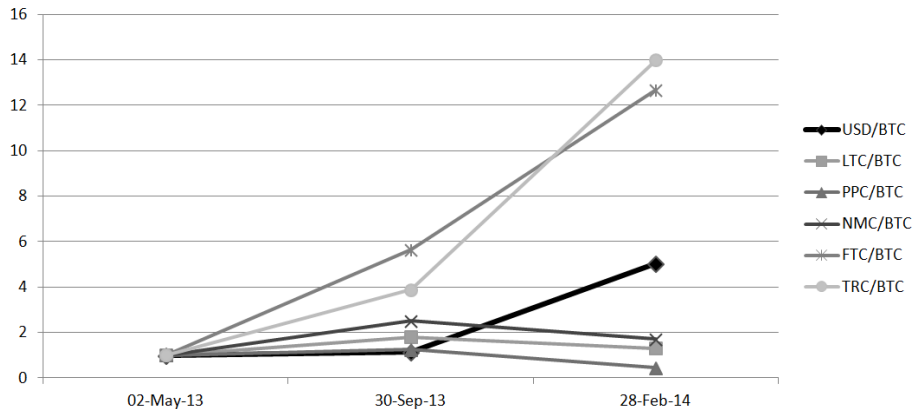
● winners and losers

## COINS (BTC-e)

### winners and losers

- consistent with “winner-take-all” ’
- one (or very few) would stay around
- maybe not the ones here
- but entry very difficult

# COINS (BTC-e)



- pattern for winners

## CORRELATIONS IN DAILY CLOSING PRICES

	USD/BTC	LTC/BTC	PPC/BTC	NMC/BTC
USD/BTC	1.00			
LTC/BTC	0.78	1.00		
PPC/BTC	0.09	0.31	1.00	
NMC/BTC	0.28	0.72	0.45	1.00

(a) at BTC-e in first period

	USD/BTC	LTC/BTC	PPC/BTC	NMC/BTC
USD/BTC	1.00			
LTC/BTC	-0.78	1.00		
PPC/BTC	-0.77	0.93	1.00	
NMC/BTC	-0.61	0.91	0.92	1.00

(c) at BTC-e in second period

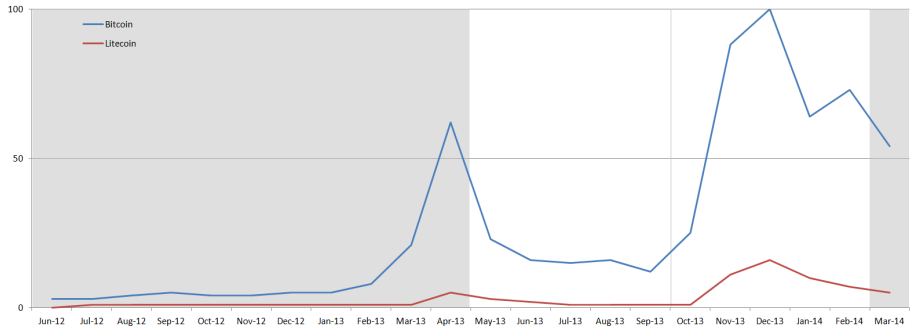
	LTC/BTC	PPC/BTC	NMC/BTC
LTC/BTC	1.00		
PPC/BTC	0.15	1.00	
NMC/BTC	0.19	0.32	1.00

(b) at Cryptsy in first period

	LTC/BTC	PPC/BTC	NMC/BTC
LTC/BTC	1.00		
PPC/BTC	0.93	1.00	
NMC/BTC	0.91	0.91	1.00

(d) at Cryptsy in second period

# GOOGLE TRENDS



## EXCHANGES

Exchange	Trading pairs	Volume (in BTC) Mid February	Percent
OKCoin	2 (BTC/CNY, LTC/CNY)	156,380	74.0
BTC-e	19	14,284	6.8
Bitstamp	1 (BTC/USD)	13,263	6.3
Bitfinex	3 (USD/BTC, LTC/BTC & USD/LTC)	12,325	5.8
BTCChina	1 (BTC/CNY)	7,565	3.6
Bter	84	2,222	1.1
Cryptsy	148	1,256	0.6
Other Exchanges		4,007	1.9
<b>Total</b>		<b>211,301</b>	<b>100</b>

- significant changes over time

## ARBITRAGE?

- triangular arbitrage within BTC-e exchange  
(USD→BTC→LTC→USD)
  
- arbitrage across exchanges (BTC-e, Bitstamp, Bitfinex)



## TRIANGULAR ARBITRAGE WITHIN BTC-e EXCHANGE

$$r(\text{LTC}/\text{BTC}) = \beta_0 + \beta_1 \cdot \frac{r(\text{USD}/\text{BTC})}{r(\text{USD}/\text{LTC})}, \quad \text{for first and second periods}$$

$$r(\text{PPC}/\text{BTC}) = \beta_0 + \beta_1 \cdot \frac{r(\text{USD}/\text{BTC})}{r(\text{USD}/\text{PPC})}, \quad \text{for second period only}$$

$$r(\text{NMC}/\text{BTC}) = \beta_0 + \beta_1 \cdot \frac{r(\text{USD}/\text{BTC})}{r(\text{USD}/\text{NMC})}, \quad \text{for second period only}$$

- no triangular arbitrage means  $\beta_0 = 0$  and  $\beta_1 = 1$

## TRIANGULAR ARBITRAGE WITHIN BTC-e EXCHANGE

Using BTC-e exchange	Dependent Variable			
	LTC/BTC		PPC/BTC	NMC/BTC
	First Period	Second period	Second Period	Second period
Independent Variables				
Constant	0.010 (0.10)	0.030 (0.50)	0.73 (0.86)	1.24 (2.69)
(USD/BTC   USD/LTC)	0.999 (390.61)	0.999 (950.97)		
(USD/BTC   USD/PPC)			0.996 (191.94)	
(USD/BTC   USD/NMC)				0.994 (619.22)
# of Observations	152	150	91	144
Adjusted R-squared	0.9990	0.9998	0.9976	0.9996

- LTC, PPC: a 95% confidence interval for the slope includes 1.00
- NMC: a 95% confidence interval for the slope **does not** include 1.00

## ARBITRAGE ACROSS EXCHANGES

$$r(\text{USD/BTC, at BTC-e}) = \beta_0 + \beta_1 \cdot r(\text{USD/BTC, at Bitstamp}),$$

for first and second periods;

$$r(\text{LTC/BTC, at BTC-e}) = \beta_0 + \beta_1 \cdot r(\text{LTC/BTC, at Bitfinex}),$$

for second period only.

- no arbitrage means  $\beta_0 = 0$  and  $\beta_1 = 1$

## ARBITRAGE ACROSS EXCHANGES

USD/BTC	Dependent Variable		
	USD/BTC (BTC-e)		LTC/BTC (BTC-e)
	First Period	Second period	Second Period
Independent Variables			
Constant	2.33 (2.22)	3.25 (0.83)	0.07 (0.29)
USD/BTC (Bitstamp)	0.958 (97.44)	0.973 (199.37)	
LTC/BTC (Bitfinex)			0.984 (88.83)
# of Observations	104	148	97
Adjusted R-squared	0.989	0.995	0.988

- USD/BTC: a 95% confidence interval for the slope **does not** include 1.00
  - ▶ slope estimate increases from the first period to the second
- LTC/BTC: a 95% confidence interval for the slope includes 1.00

## ARBITRAGE ACROSS EXCHANGES

- small (or no) arbitrage opportunities
- transaction, withdrawal, and deposit fees → unlikely net arbitrage opportunities
  
- also true for CNY/BTC at OKCoin and BTCChina
- future: test arbitrage between USD and CNY exchanges

## CONCLUSIONS

### competition between crypto-currencies

- winners and losers → consistent with winner-take-all dynamics
- the “winners” become more popular against BTC in the second period → familiarity with BTC expanding the market?

### competition between exchanges

- no triangular arbitrage
- unlikely arbitrage across exchanges (after fees)
- with no arbitrage and sufficient liquidity, no reason why multiple exchanges couldn't coexist
- in current environment there are benefits to many exchanges (hacker risk, regulatory risk)