The Price of a Digital Currency

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   - Governments, investors, and users: Price Dynamics and Regulations (security, taxes, money laundering, and etc.)

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   ▶ Governments, investors, and users: Price Dynamics and Regulations (security, taxes, money laundering, and etc.)

2. Regulating is very complicated and connected to volatility.

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Study price of digital currencies in competitive exchange markets:

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1. Bitcoin price discrepancies in various denominated fiat currencies.

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3. Bitcoin is not priced globally!

4. A pricing relation in competitive markets.

5. An economy with *zero fundamental value* digital currencies.

Bitcoin Mispricing

- A simple rule (**the law of one price**):
  A currency should be traded at the same rate in various exchanges
  in the absence of frictions.

  Yermack (2014): a disparity of around **7%** between the high and
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$/€ = $/£ × £/€

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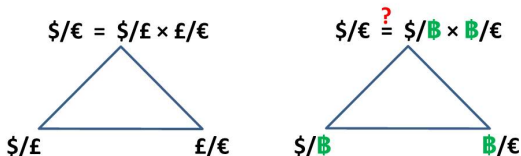$$\$/\math鈥{\text{€}} = \$/\pounds \times \pounds/\text{€}$$

$$\$/\text{€} \overset{?}{=} \$/\mathbb{B} \times \mathbb{B}/\text{€}$$

$$\$/\pounds \qquad \pounds/\text{€}$$

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Bitcoin Price Discrepancy on Kraken

If we divide € price of Bitcoin to its $ price on Kraken, its deviations from the MSCI quote for the €/$ is, as follows:
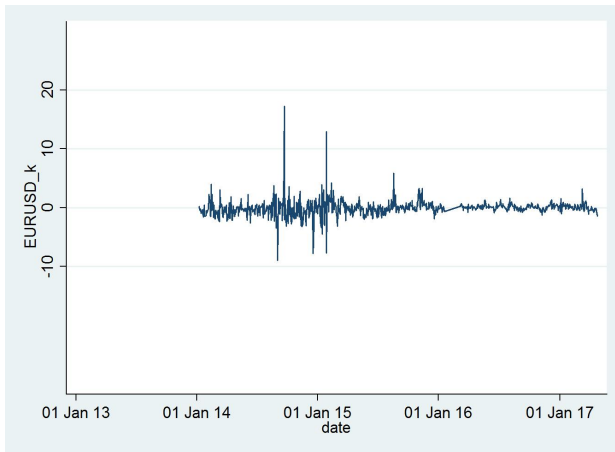
Bitcoin Price Discrepancy on Coinbase

Left graph: €/$ Bitcoin price discrepancy relative to the MSCI €/$.

Right graph: £/$ price discrepancy.
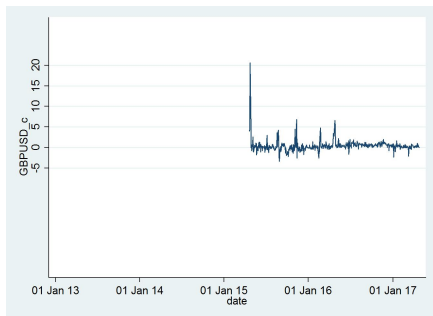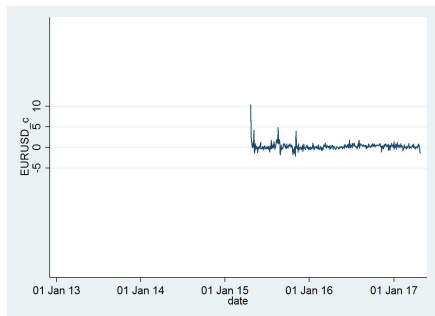
The Bitcoin price discrepancies are much higher on the less popular exchanges like Localbtc (LocalBitcoins).

Bitcoin Price Correlations across Coinbase and Kraken

60-day Rolling Correlations

Left graph: USD price-change correlation of Bitcoin.

Right graph: EUR price-change correlation of Bitcoin.
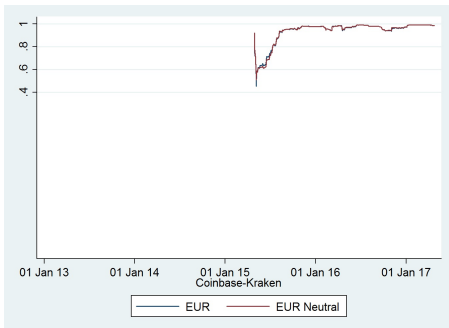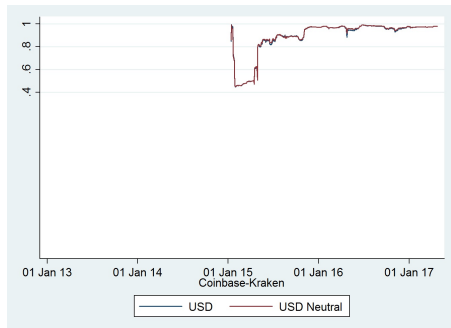
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USD as a Denominated Currency

	USD>0.005			USD<-0.005		
Mean	0.008			-0.008		
S.D.	0.003			0.003		
	Oil	Sugar	Gold	Oil	Sugar	Gold
Mean	-0.006	-0.003	-0.007	0.005	0.001	0.009
S.D.	0.023	0.018	0.012	0.025	0.018	0.011
	CAD	EUR	GBP	CAD	EUR	GBP
Mean	-0.006	-0.008	-0.007	0.006	0.008	0.007
S.D.	0.005	0.005	0.009	0.005	0.005	0.006
	Localbtc	Coinbase	Kraken	Localbtc	Coinbase	Kraken
Mean	0.020	0.003	0.000	-0.006	0.005	0.001
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Correlations with the USD

USD>0.005			USD<-0.005		
Oil	Sugar	Gold	Oil	Sugar	Gold
-0.09	-0.04	-0.30	-0.12	-0.27	-0.21
CAD	EUR	GBP	CAD	EUR	GBP
-0.49	-0.56	-0.54	-0.63	-0.53	-0.51
Localbtc	Coinbase	Kraken	Localbtc	Coinbase	Kraken
-0.11	0.00	-0.03	0.03	-0.01	-0.01

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Bitcoin is not a globally priced asset!

The USD price movements affect the values and correlations of globally-priced assets.

How can we neutralize price fluctuations of a denominated-currency?

Triangular Arbitrage: An Extended Version

Assume an agent that uses a domestic fiat currency H and a digital currency D, and that she can exchange D and H, as follows:

$$\Delta s_{D,t+1}^{H} = s_{D,t+1}^{H} - s_{D,t}^{H} \tag{1}$$

where, $s_{D,t}^{H}$ is the log exchange rate of a digital currency D per unit domestic fiat currency H at time t.

In the absence of triangular arbitrage, we have;

$$s_{D,t+1}^{H} = s_{i,t+1}^{H} - s_{i,t+1}^{D}, \quad \forall i \tag{2}$$

thus,

$$\Delta s_{D,t+1}^{H} = \Delta s_{i,t+1}^{H} - \Delta s_{i,t+1}^{D}, \quad \forall i \tag{3}$$

Triangular Arbitrage: An Extended Version

$$\Delta s_{D,t+1}^{H} = \frac{1}{N-1} \sum_{i \neq H}^{N-1} (\Delta s_{t+1}^{H} - \Delta s_{t+1}^{D}) \tag{4}$$

By rearranging Equation 4, we get;

$$\Delta s_{D,t+1}^{H} = \frac{N-1}{N} \left[\frac{1}{N-1} \sum_{i \neq H}^{N-1} (\Delta s_{t+1}^{H}) \right] - \left[\frac{1}{N} \sum_{i}^{N} (\Delta s_{t+1}^{D}) \right] \tag{5}$$

$$\Delta s_{D,t+1}^{H} = \frac{N-1}{N} CB_{t+1}^{H} - CB_{t+1}^{D} \tag{6}$$

$$CB_{t+1}^{D} = ? \tag{7}$$

Bitcoin Price Correlations at the Coinbase and Kraken
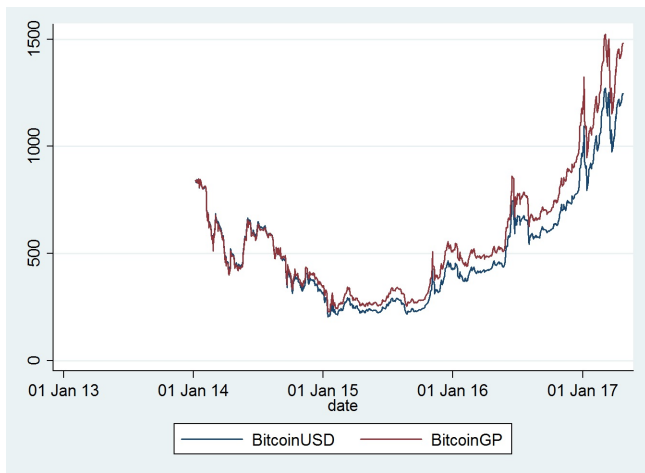
	USD	BitcoinUSD	BitcoinGP
Mean	0.08	0.36	0.44
S.D.	0.09	0.63	0.64

Denominated-Neutral (Global Perspective) Correlations

From 12/04/2013 to 24/04/2017

	USD Perspective			Global Perspective		
	Oil	Sugar	Gold	Oil	Sugar	Gold
Oil	1.00			1.00		
Sugar	0.10	1.00		0.09	1.00	
Gold	0.05	0.08	1.00	-0.02	0.03	1.00

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Gold	0.05	0.08	1.00	-0.02	0.03	1.00
	CAD	EUR	GBP	CAD	EUR	GBP
CAD	1.00			1.00		
EUR	0.41	1.00		-0.37	1.00	
GBP	0.44	0.53	1.00	-0.01	0.00	1.00

Denominated-Neutral Correlations

From 10/03/2016 to 24/04/2017

Coinbase	USD	EUR	CAD	GBP	C_{USD}	C_{EUR}	C_{GBP}	
C_{USD}	**0.08**	0.06	-0.01	-0.20	1.00			
C_{EUR}	0.19	**0.02**	0.01	-0.25	0.98	1.00		
C_{GBP}	0.21	0.06	0.01	**-0.36**	0.95	0.96	1.00	

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Kraken	USD	EUR	CAD	GBP	K_{USD}	K_{EUR}	K_{CAD}	Denominated-Neutral		
K_{USD}	**0.08**	0.06	-0.01	-0.20	1.00			1.00		
K_{EUR}	0.20	**0.02**	0.01	-0.24	0.97	1.00		0.98	1.00	
K_{CAD}	0.14	0.10	**-0.07**	-0.22	0.81	0.81	1.00	0.81	0.81	1.00

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Very volatile and not correlated with the denominated-currency as we expect.

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Final Q.: What price dynamics do we expect for digital currencies?

Fundamental Value of a Digital Currency

Zero fundamental value of a digital currency suggests that:

$$CB_{t+1}^{D} = 0. \tag{8}$$

Outcomes:

- Digital Currency price changes are closely related to fiat currencies, as follows:

$$\Delta s_{D,t+1}^{H} = \frac{N-1}{N} CB_{t+1}^{H} \tag{9}$$

- The exchange rate risks of digital currencies should be even slightly lower than those of fiat currencies (as $\frac{N-1}{N} < 1$).
- The relative price of two digital currencies is totally constant.
- Regulating, holding and using them are much easier.

Conclusions

- Using an extended version of triangular arbitrage, which helps to study price of globally-traded assets, I find that Bitcoin is not priced globally.

- This paper documents Bitcoin discrepancies in various denominated currencies, which are 3 time higher than the Bitcoin price disparities.

- A digital currency with zero-fundamental value has a much lower volatility and thus it is easier to regulate, hold, and use them.