From Tulips to Bitcoin: Crazy Markets and Financial Derivatives

AEM4210

Spring 2023

Introduction

- Bitcoin is a digital, decentralized, partially anonymous currency, not backed by any government or other legal entity, and not redeemable for gold or other commodity.
- It relies on peer-to-peer networking and cryptography to maintain its integrity
- The rise of Bitcoin and derivative coins and tokens as part of a fiat-free globalist electronic currency has many economists scratching their heads
- This presentation explores the market for Bitcoin and other cryptocurrencies to illustrate some fundamental market principles including fundamental value

My View

- It is, so far as one can tell, the first existential asset to be traded in the sense that Bitcoin exists for no other reason than its existence.
- The many platforms to trade and exchange have led to a carnivalistic, wild-west, a euphoric orgy of speculative delight, like the gold rushes of the 19^{th} century, or tulip bulbs in the 17^{th} century, or emu in the 20^{th} century.
- But at least when the madness of crowds subsided in these prior events the Dutch had a tulip bulb to plant, the miner had a claim on land, and the emu farmer had a few tasty ratites and a store of soothing oil.
- For the cryptomaniacs, however, they will be left with an empty electronic shell of intangible encrypted code which at best might be used to purchase a few pennies worth of trinkets from China, if indeed China decides to permit unfettered access to crypto exchanges.

Bitcoin Futures Feb '23 (BTG23) - Barchart.com
75,000
70,000
65,000
60,000
55,000
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
23,320
40000
17584
8448
0
Jan '18
Apr '18
Jul '18
Oct '18
Jan '19
Apr '19
Jul '19
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Jan '20
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Apr '21
Jul '21
Oct '21
Jan '22
Apr '22
Jul '22
Oct '22
Jan '23

The Great (Texas) Emu Bubble

The Economist | Topics | Current edition | More

It will never take off

The great Texas emu bubble

What if tulips had been six feet tall and ran at 50km an hour?

Alamy

Print edition | Christmas Specials

Dec 18th 2018 | DALLAS AND KENDALIA, TEXAS

THE SUN is a giant, gleaming emu egg in the sky, and if you gaze long enough at the Milky Way, you can see the long body of an emu formed from the stars. The world's second largest bird after the ostrich, the emu is native to Australia and has long been a source of mythical

Number 3/2002/p.49-61 www.CAFRI.org

Current Agriculture, Food & Resource Issues

A Journal of the Canadian Agricultural Economics Society

The Great Emu Bubble: A Retrospective Look at a New Industry Failure

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The Issue

Innovative new products offer agri-food producers and processors an opportunity to differentiate their output from the commodities prevalent in the sector. Unfortunately, many new products do not live up to initial expectations and are eventually abandoned. However, even with products that are doomed to fail, there is occasionally a period of time after their introduction when strong, but fallacious, indicators of success appear.

https://www.economist.com/christmas-specials/2018/12/18/the-great-texas-emu-bubble

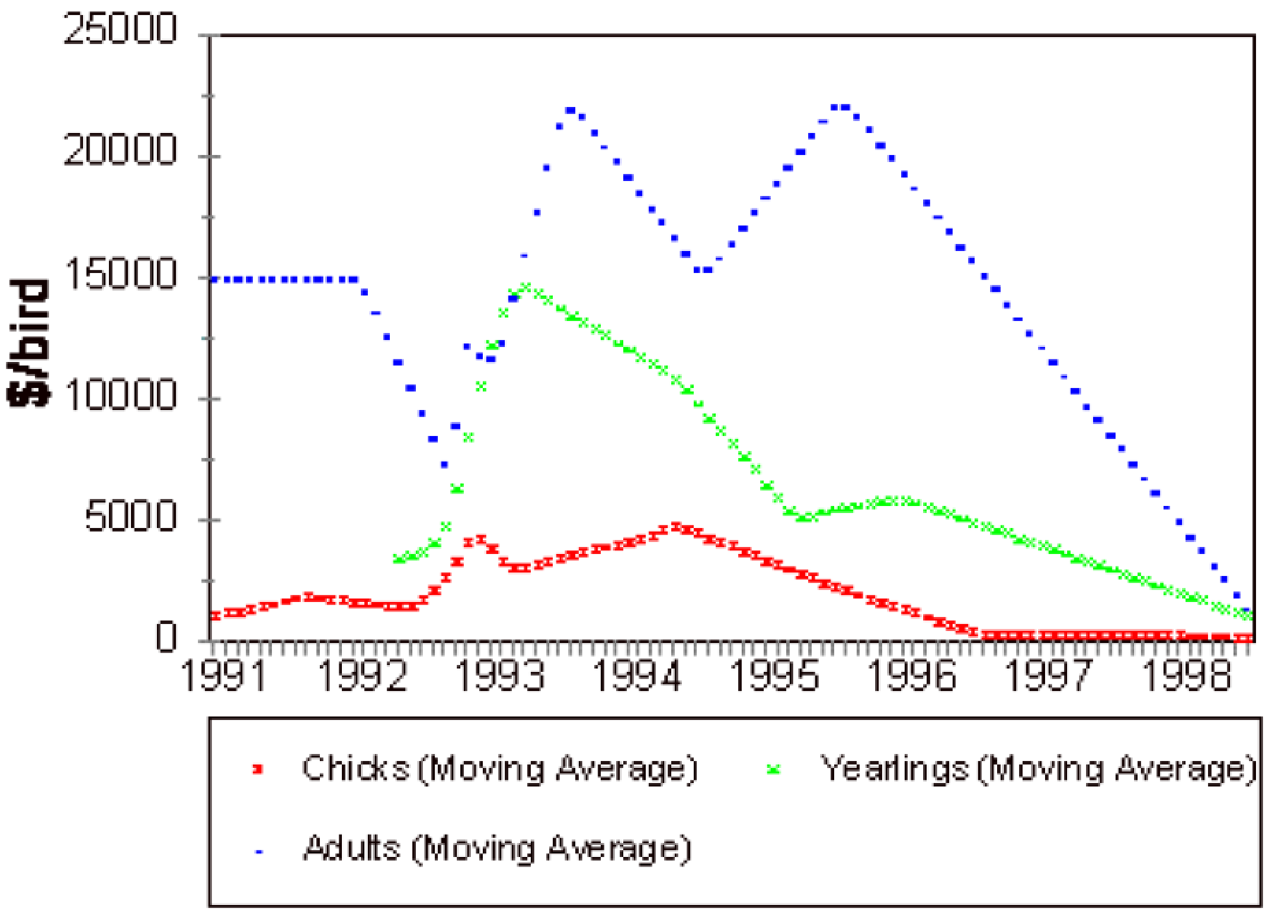
What does a bubble look like?

In the mid 1990s there was a craze for Emu meat and oil

A red poultry meat, and oil that sooths

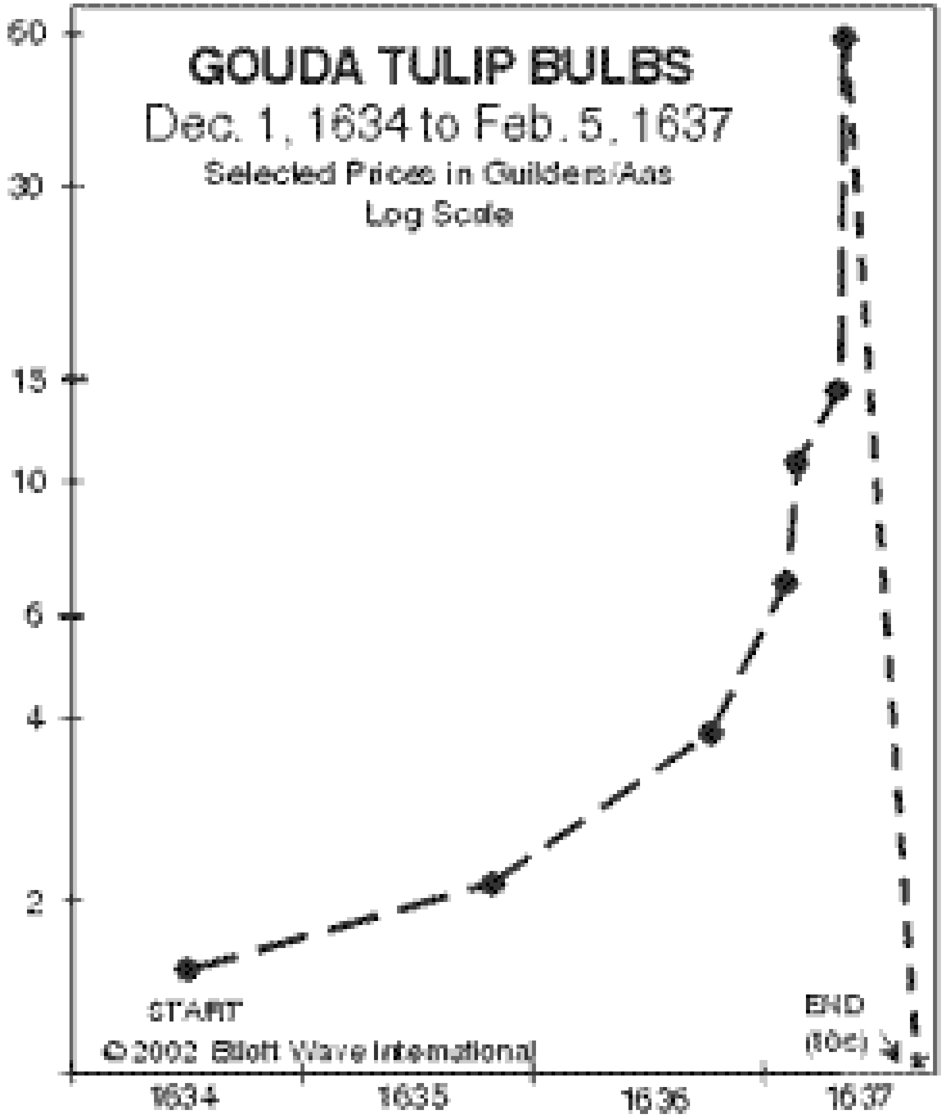
All across USA and Canada some farmers went nuts bidding up the price of birds and eggs.

Everything was driven by unrealistic market expectations and a euphoria



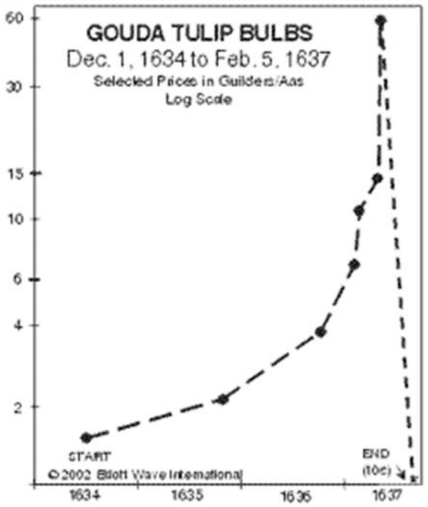
When the Emu Bubble Burst this is what happened

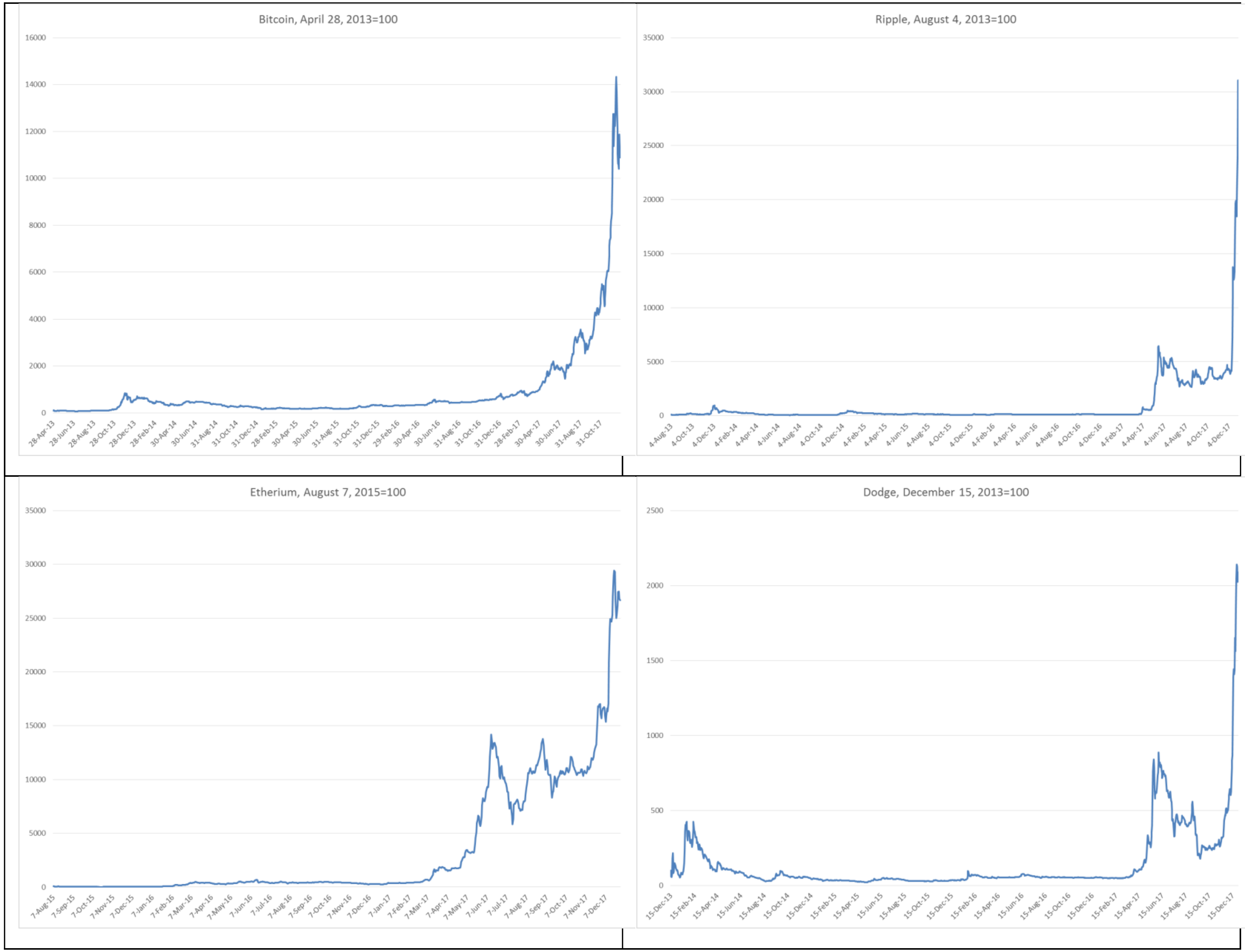
The Great Tulip Bubble and Mania: 1636-1637



And Now…….

Cryptocurrency … 2013-2018





Random Walk? Bubbles are ‘Fractional’ Processes

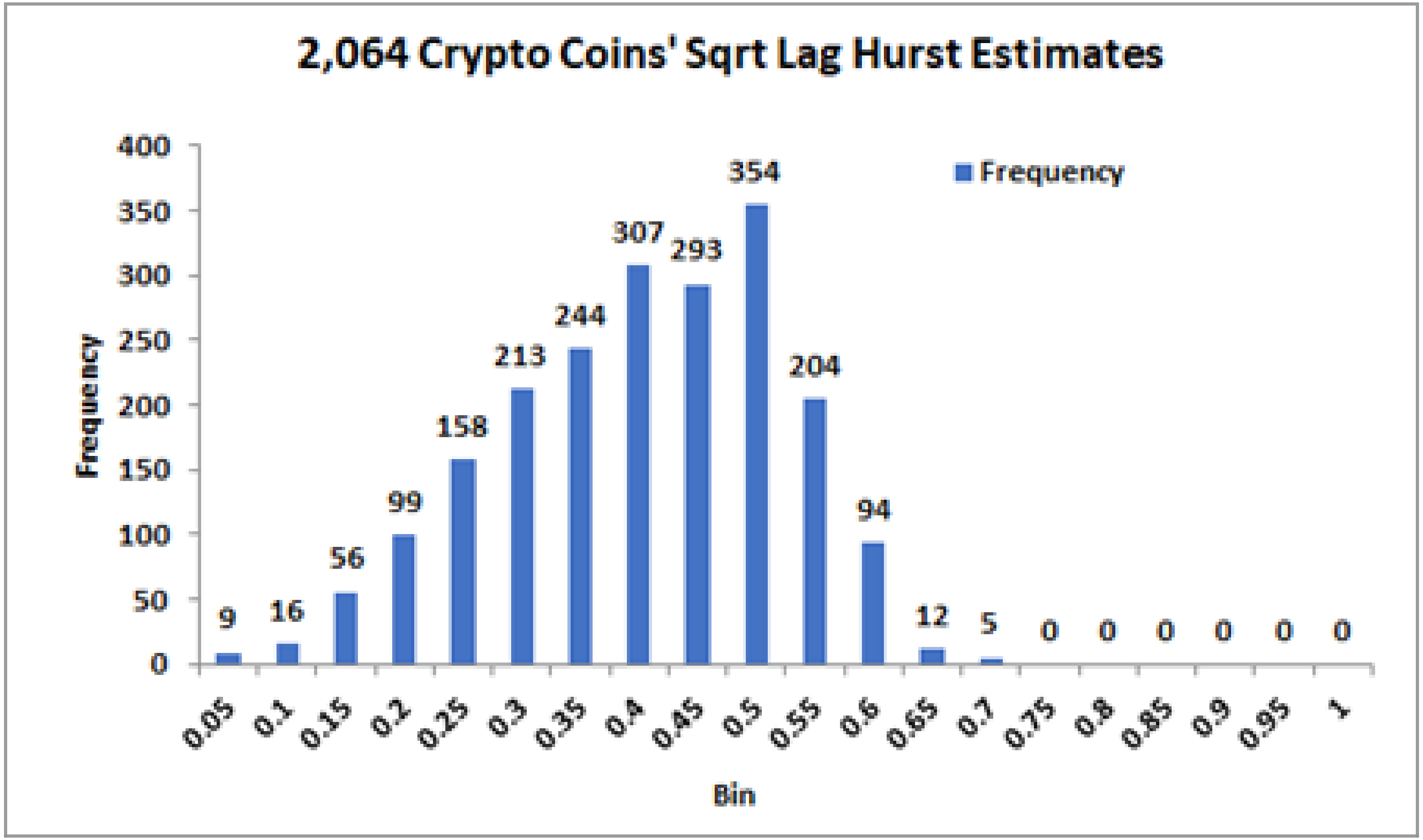
- A random walk assumes that prices of assets in an efficient market are lognormally distributed, with log differences being normally distributed.
  - Called a geometric Brownian motion
  - Markov property means no-memory in the system
  - Daily shocks are independently distributed ---- uncorrelated
- A fractional Brownian motion reveals correlation in shocks over time
  - Negative correlation is mean reverting
  - Positive correlation is called persistent
- Measured by Hurst coefficient

$$H = \frac{1}{2}\frac{Log\left(\frac{Var\left[x_{500} - x_1\right]}{Var\left[x_t - x_{t-1}\right]}\right)}{Log\left(T\right)}$$

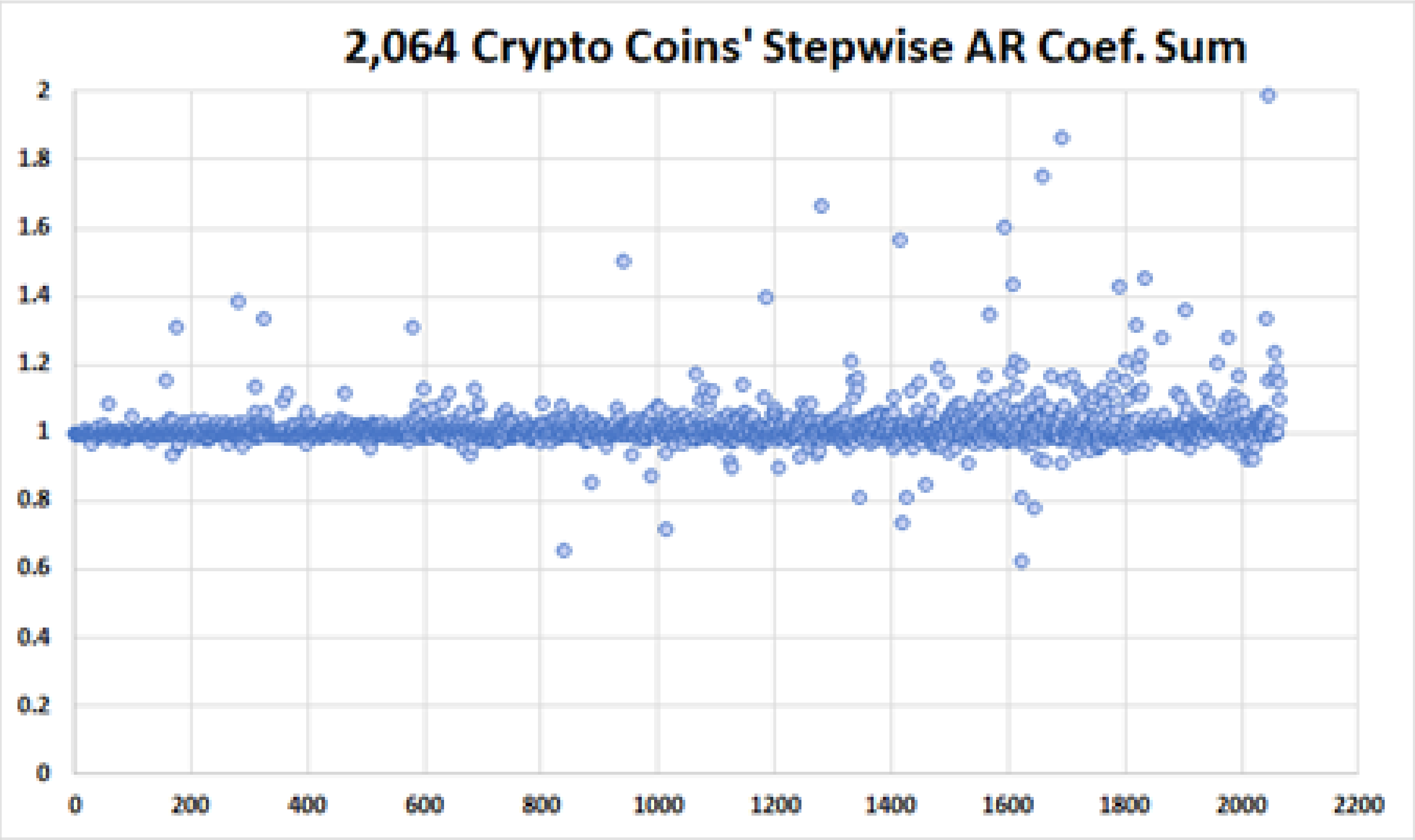
Bitcoin H=0.635,
Ripple H=0.635,
Etherium H= 0.644,
Dodge H=0.622.

H should = 0.5

Distribution of Hurst Coefficients



Using Autoregressive Process the sum of the coefficients should equal 1.0 if there are (fractional or geometric) Brownian Motion. (The rest are nuts)



Why should we care?

- The world of derivatives is a world of risk
- The purpose of derivatives is to transfer risk… buying and selling
- With no risk, class is cancelled
- To understand risk, we need to understand markets
- To understand markets we need to understand the drivers of supply and demand
- To understand supply and demand we must understand fundamental value
- So what does fundamental value mean?

Fundamental value of cryptocurrency

- *"…we don't really understand how that worked, as economists."* **- Lawrence White, economics professor at George Mason University / IEEE Spectrum interview**
  - **Source: the mysterious Satoshi Nakamoto**
- **Proponents point to Blockchain – blockchain is a ledger system that tracks ownership of cryptocoins to ensure that they are only used once… Blockchain has value as a technology but it serves a homogenous purpose across coins….**
- **Cryptocoins should be linked in value to a basket of goods (or a bushel of corn if you like) and should exchange according to the law of one price**

Law of One Price and the Theory of Exchange

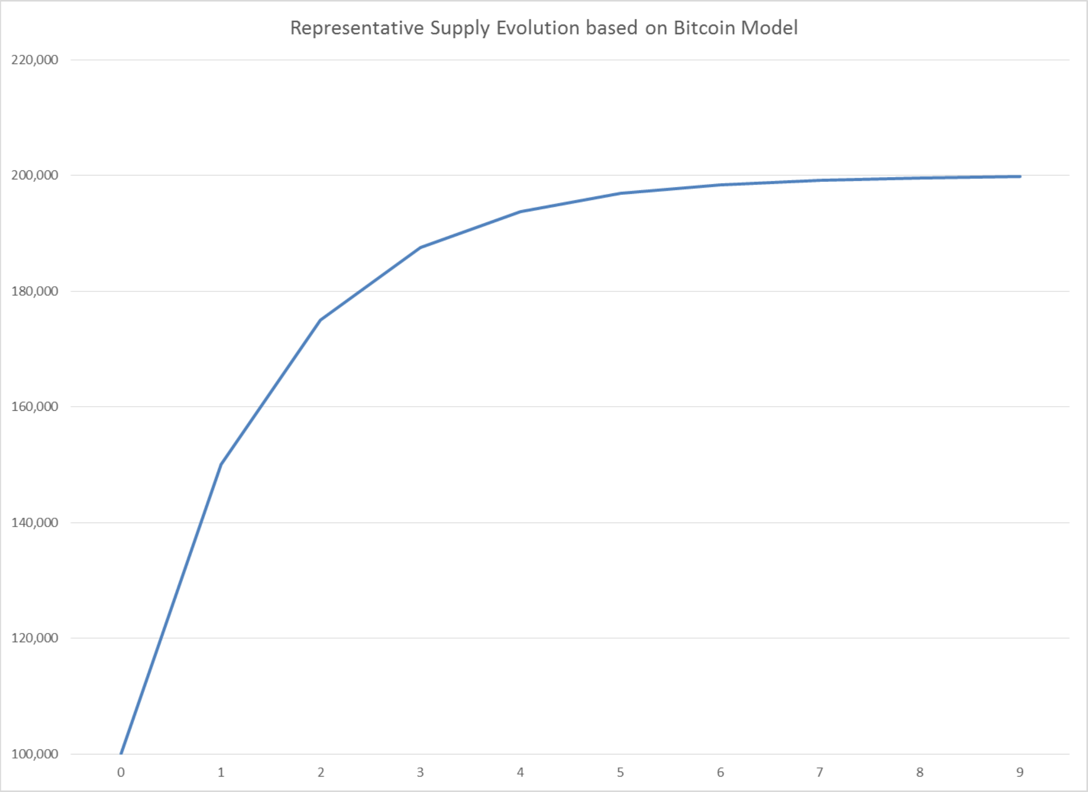
- a bitcoin in April 2013 could have purchased
  - 19.34 bushels of corn
  - 13.5% of a high def TV,
  - 10gm of marijuana
- A bitcoin (December 2017) could purchase
  - 5,143 bushels of corn
  - 27 high def televisions,
  - 221 kg of marijuana.

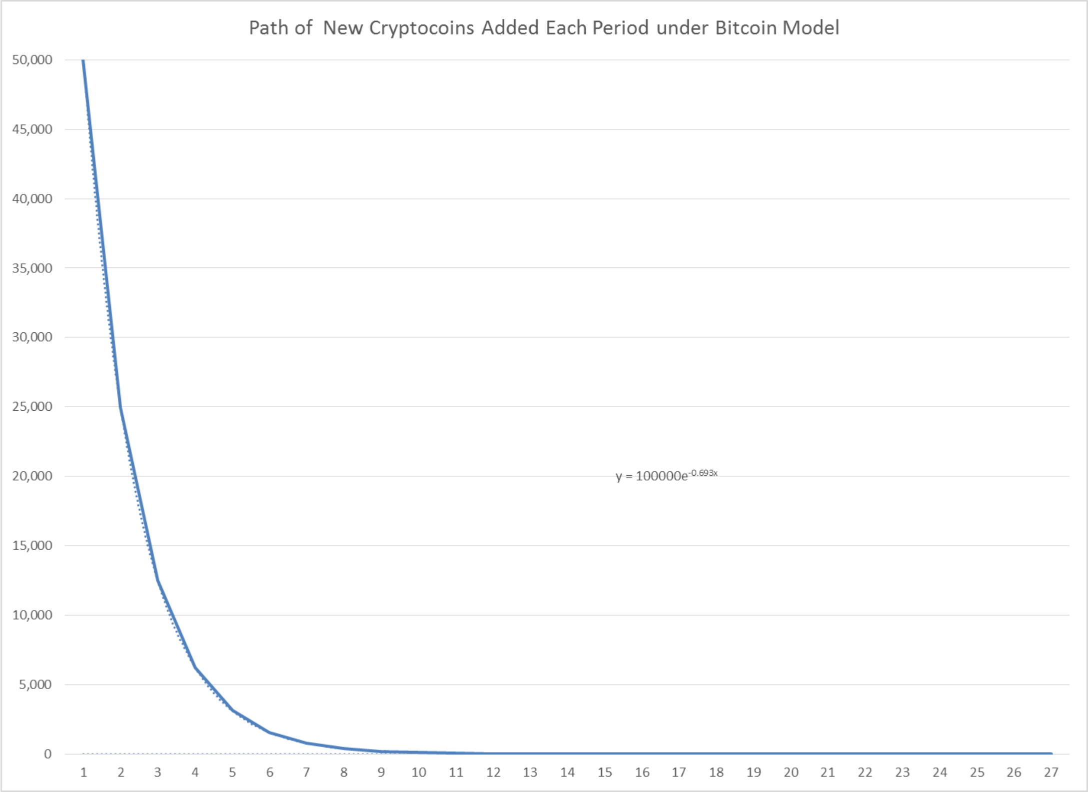
Structural Bubble

- Bitcoin has designated that no more than 21 million coins will ever be available
- The rate of release is ½ the release of the previous period
- Mathematically (my derivation of) the theoretical supply of bitcoin at any moment of time is given by

$$Y_T = Y_0 \left(1 + \sum_{t=1}^{T} e^{-0.693t} \right)$$

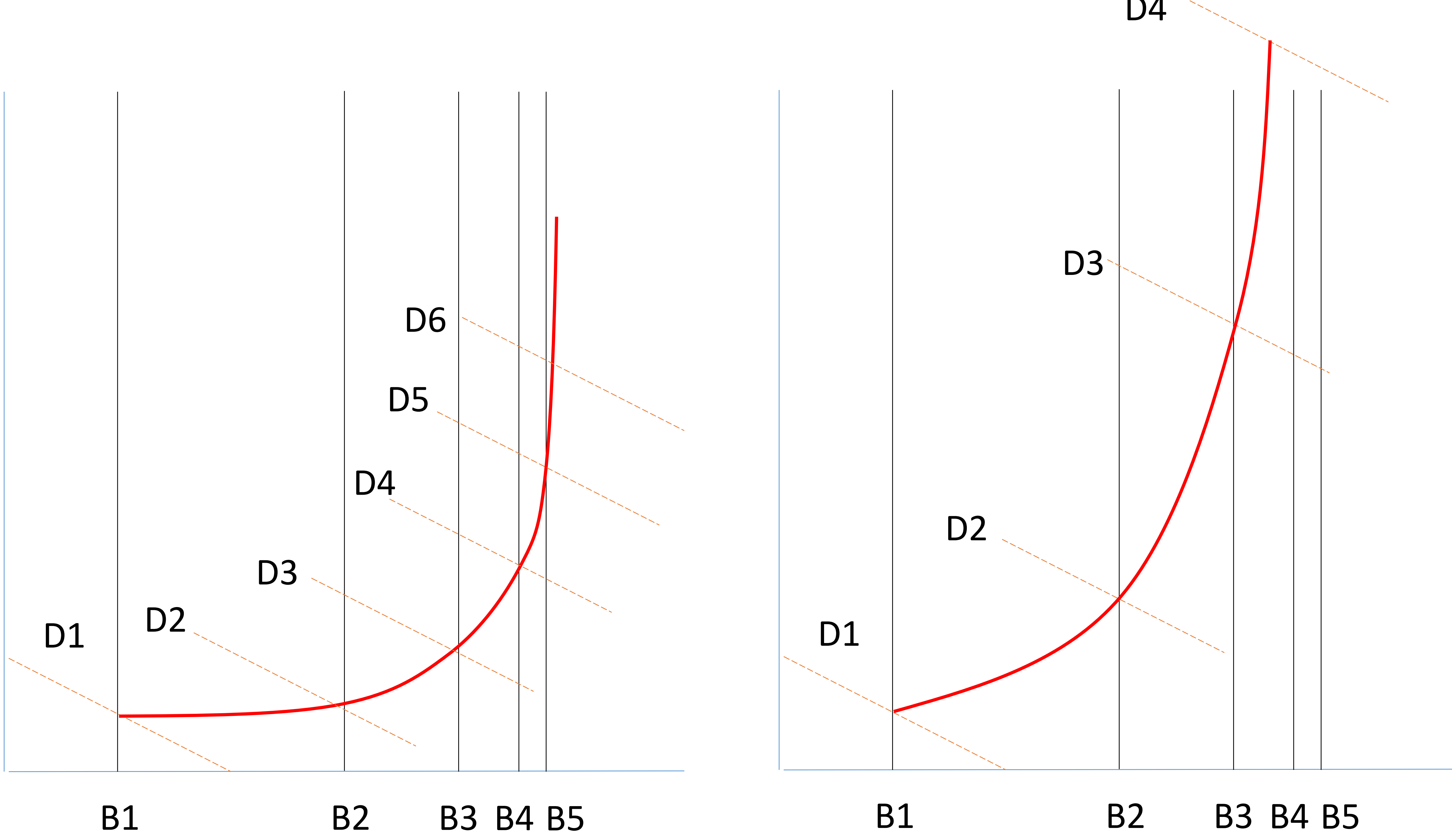
Cryptocoin Supply Evolution using Bitcoin Model





Supply and Demand Characteristics

- Supply is perfectly inelastic at each moment in time
  - It does not measure rising marginal costs as for most goods and services
- Supply shifts to the right at an exponentially declining rate
- Even if demand increased at a constant rate, eventually the rate of demand increase will exceed the rate of supply increase and prices have nowhere to go but up!
- If demand is euphoric and increases at an increasing rate we find a behavioral bubble on top of a structural bubble
- Volatility will increase accordingly



D1
D2
D3
D4
D5
D6
B1
B2
B3
B4
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D1
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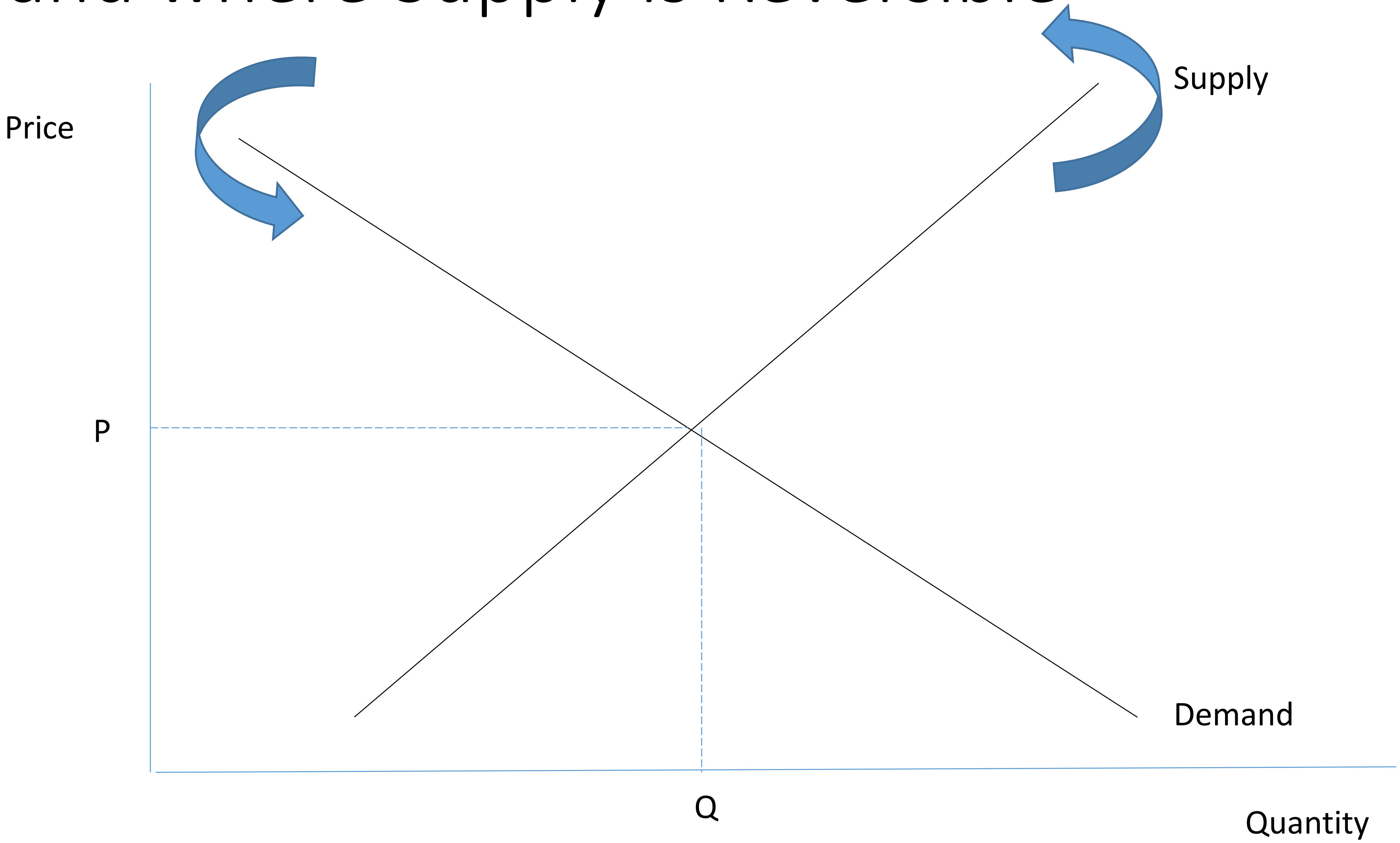
B4
B5

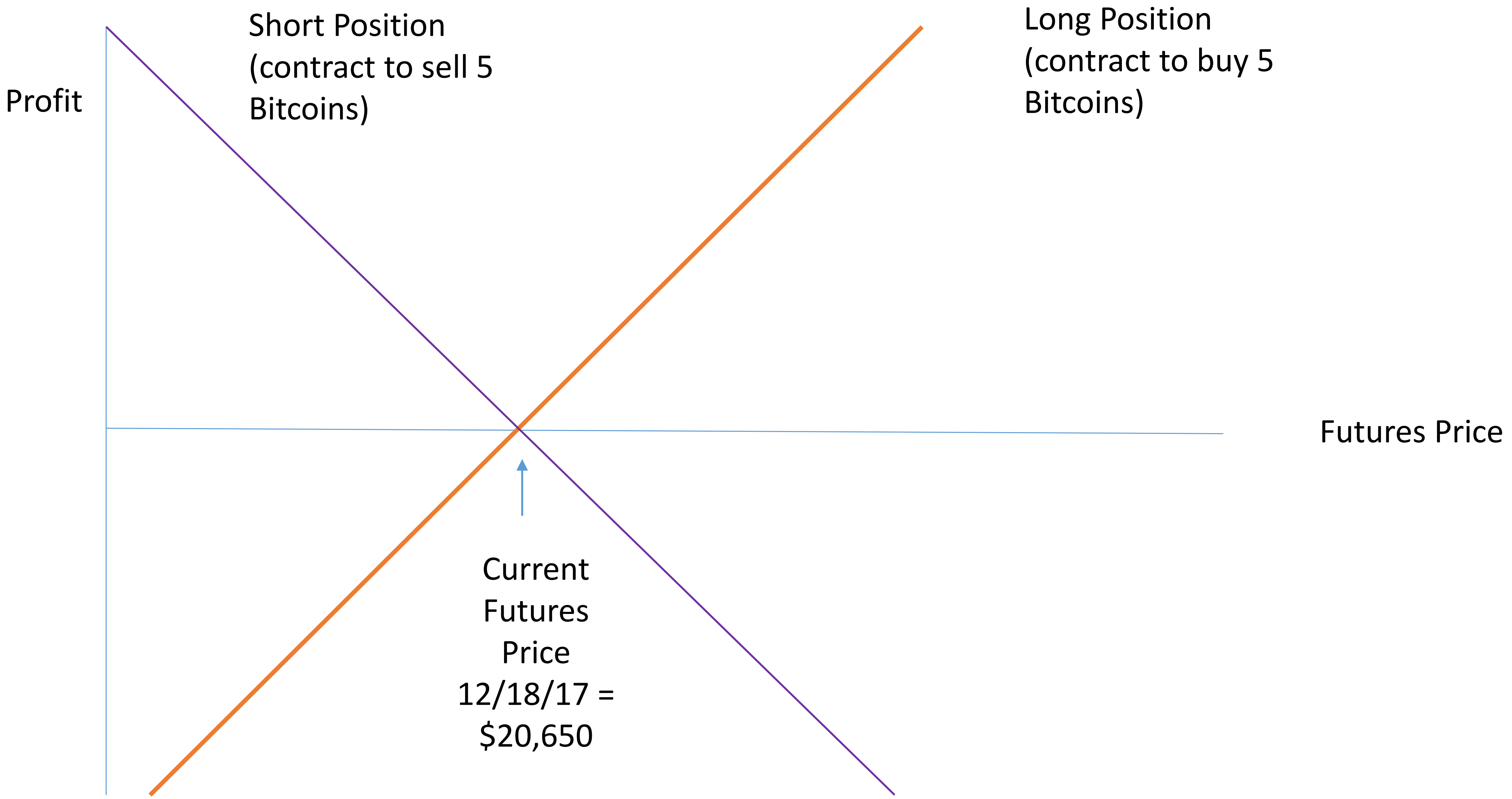
Compare to Conventional Supply and Demand where Supply is Reversible



CME Futures on Bitcoin

- Dec 18th, 2017 CME opened first Bitcoin Futures contracts
- Contracts allow investors to buy or sell 5 bitcoins without actually owning bitcoin, or to hedge long positions in bitcoin if owned
- Futures contracts based on a self-monitored index of bitcoin from various cryptoexchanges
- "*Market participants should take note that the relatively nascent underlying cash markets and exchanges for bitcoin remain largely unregulated markets over which the CFTC has limited statutory authority. There are concerns about the price volatility and trading practices of participants in these markets*…. CFTC Commissioner J. Christopher Giancarlo

Futures contracts



Futures Transactions

Date	Futures Price	Contract Value	Jack (Short)	Jill (Long)
			Mark to Market / Margin Account	
18/12/17 (open)	20,650	103,250	0	0
18/12/17 (close)	19,060	95,300	7,950	-7,950
22/12/17	13,900	69,500	33,750	-33,750
29/12/17	14,470	72,350	30,900	-30,900
01/05/18	16,415	82,075	21,175	-21,175
01/15/18	13,895	69,475	33,775	-33,775
01/22/18	10,750	53,750	49,500	-49,500

Hedging

- Futures contracts are to provide risk management strategies (Hedging) and transparent price discovery
  - Transparent price discovery unlikely without fundamental value
  - What about hedging effectiveness?
- Use the Minimum Variance Hedge Ratio

$$Log\left(Y_{Bitcoin}\right) = a + h\log\left(X_{Ripple}\right) + e$$

$$h = \frac{Covariance\left(Log\left(Y\right), Log\left(X\right)\right)}{Variance\left(Log\left(Y\right)\right)}$$

Ripple h= 0.612,
Etherium h= 0.483,
Dodge h=0.861

Not Good

Summary

- Cryptocurrency is a new type of asset
  - It is not a security
  - It is not a commodity
  - It is not a currency
- Futures contracts cannot provide transparent price discovery because there is no transparency in fundamental value
  - It is all emotional
- It is a bubble by design, it is fractional and unhedgable in the conventional sense – it defies common laws of supply and demand
  - No other tradeable asset has irreversible supply
- Futures contracts can hedge bitcoin, but generally cannot be used to hedge other cryptocurrencies