VALUATION IN THE METAVERSE

Digital Assets in Virtual Worlds

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Digital Assets in Virtual Worlds

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Bored Ape Yacht Club

If you could buy one of those for $100,000, would you? Which one?

A

B

C

Bored Ape Yacht Club

USD 200-250k

USD 620-670k

USD 110-135k

Approximate range over the last month, from https://www.nft-stats.com/collection/boredapeyachtclub

Topics Covered:

Intro – can you spot the wealthy Ape?

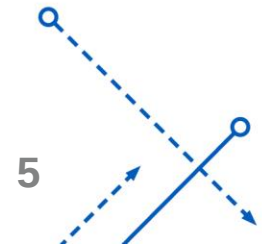
Virtual Worlds and the Metaverse

IFRS and Crypto assets

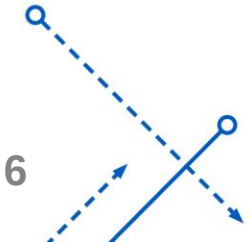
Valuing Tokens

Market Overview – Crytpocurrencies vs. Stablecoins

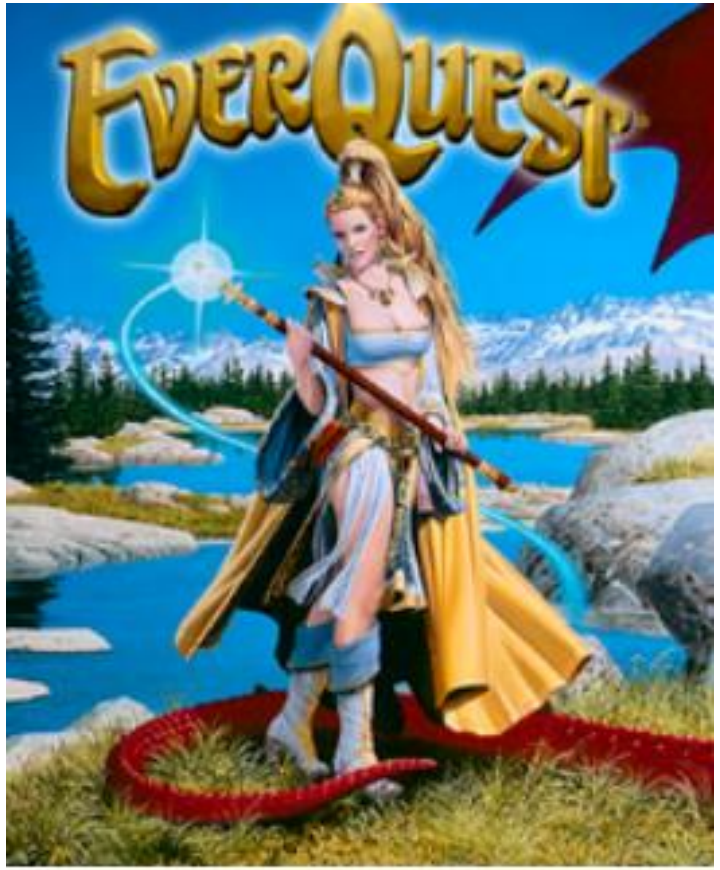
Concluding Remarks



Virtual Worlds & the Metaverse



EverQuest



Norrath

Everquest. Now ancient history in gaming… By Edward Castranova (2001):

In March 1999, a small number of Californians discovered a new world called Norrath, populated by an exotic but industrious people. About 1.2m people call this place their permanent home, although some 60,000 are present there at any given time.

*The nominal hourly wage is about **USD 3.42 per hour**, and the labors of the people produce **a GNP per capita of $2,266 somewhere between that of Russia and Bulgaria** [Norrath was at the time the 77th richest country in the world].*

*A unit of Norrath's currency is traded on exchange markets at USD 0.0107, higher than the Yen and the Lira. The economy is characterized by extreme inequality, yet life there is quite attractive to many. The population is growing rapidly, swollen each each day by hundreds of emigres from various places around the globe, but especially the United States. Perhaps the most interesting thing about the new world is its location. Norrath is a virtual world that exists entirely on 40 computers in San Diego. Unlike many internet ventures, virtual worlds are making money -- with **annual revenues expected to top USD 1.5 billion by 2004** -- and if network effects are as powerful here as they have been with other internet innovations, virtual worlds may soon become the primary venue for all online activity.*

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=294828

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Entropia Universe

Planet Calypso ($ 6,000,000)

march 3, 2017 by errantappelant

Planet Calypso is a **Sci-fi MMO** with a **Real-Cash economy**. Planet Calypso is the largest and most active world inside Entropia Universe.

First you arrive on Calypso as a colonist. The rebuilding of the planet after the robot wars is at hand. Your role is to help create a solid foundation for the human civilization.

You can explore the wilderness, outposts and cities. Hunt animals, mine for resources or fight the Robot enemy. You can even battle other colonists in Player versus Player (PvP) combat.

You can also develop professions such as crafting, tailoring, beauty, piloting, event management, and many more.

You can build communities, share special moments. Maybe even find love...

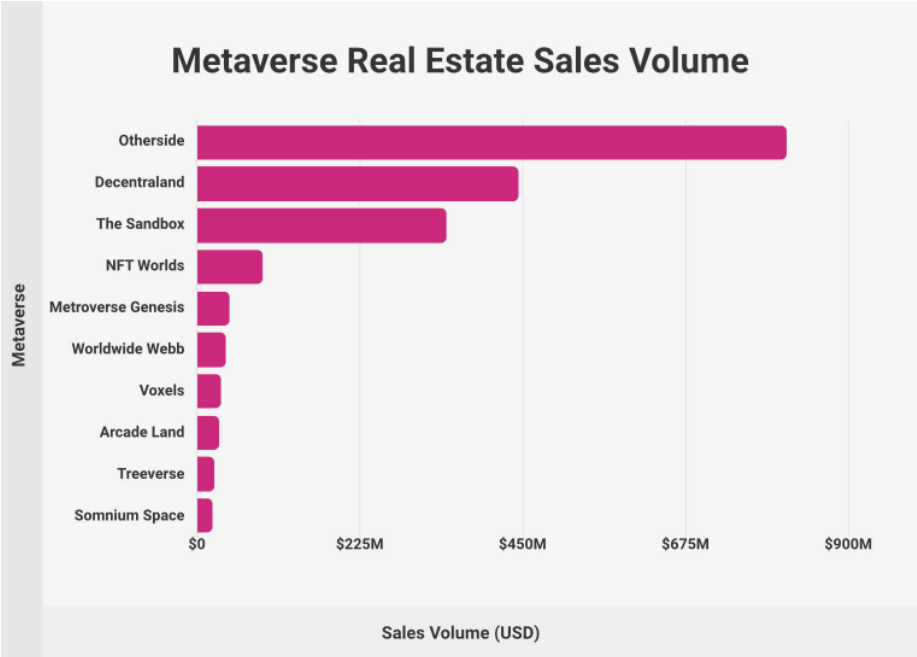
Or you can put your entrepreneurial skills to the test and try to make a living through business, trade and investments.

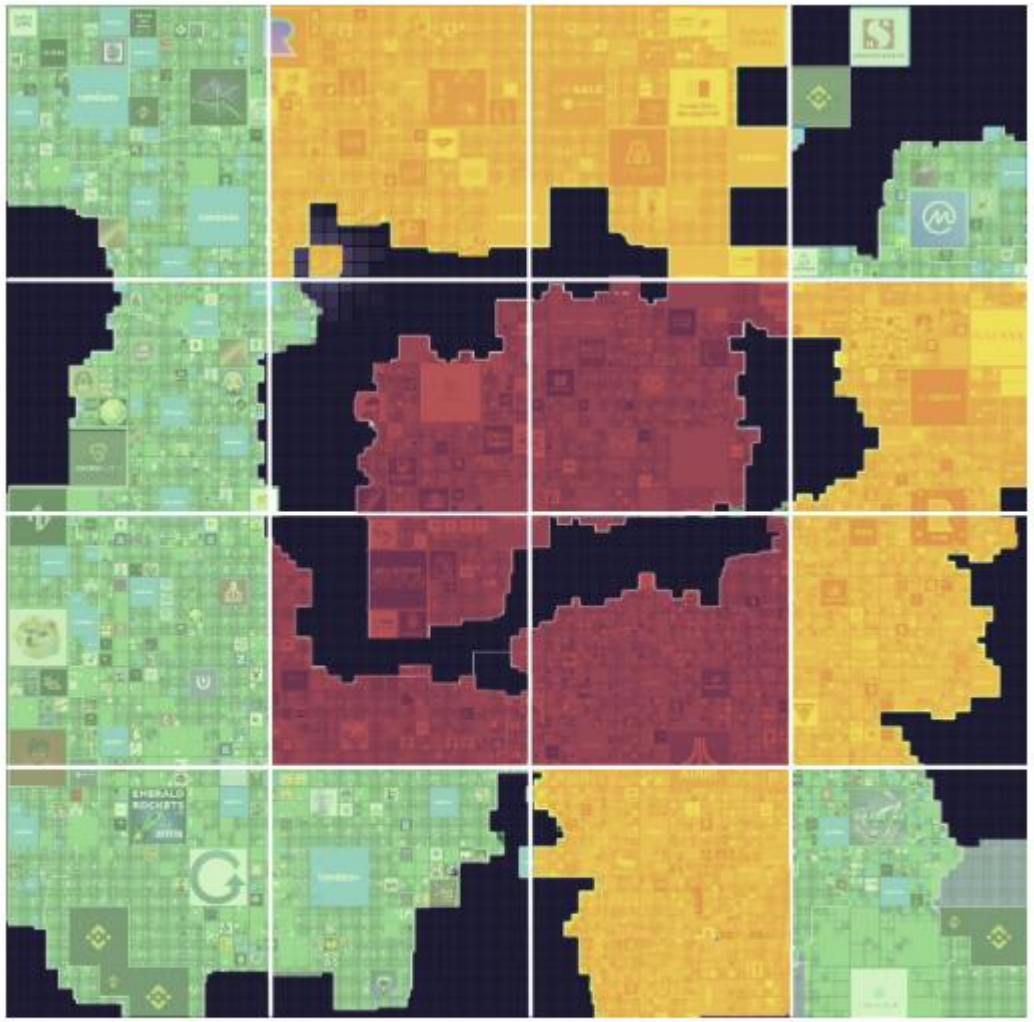
Annual report
for

mindark®

MindArk PE AB (publ)
(Corporate identity SE - 556640-4769)
Financial year 2017

Virtual Land
~ $1.4 bn/year,
~ 250k transactions





Less than 3.75ETH	Between 3.75 and 4.25	More than 4.25 ETH
(~$11,000)	(~$11,000-$13,000)	(~$13,000)

https://courses.cfte.education/wp-content/uploads/2022/01/Metaverse_Real_Estate_Market_CFTE_Report_2022.pdf

Virtual Worlds, Real Economics

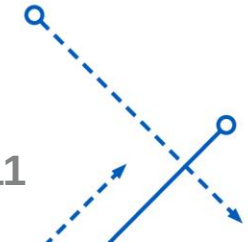
The economics of virtual worlds are intriguing

Economics is the study of how agents allocate limited resources

→ What happens to classical econ theory when resources are infinite?

Yet, there are also common problems resembling “real world” economies

- Inflation
- Real estate crises



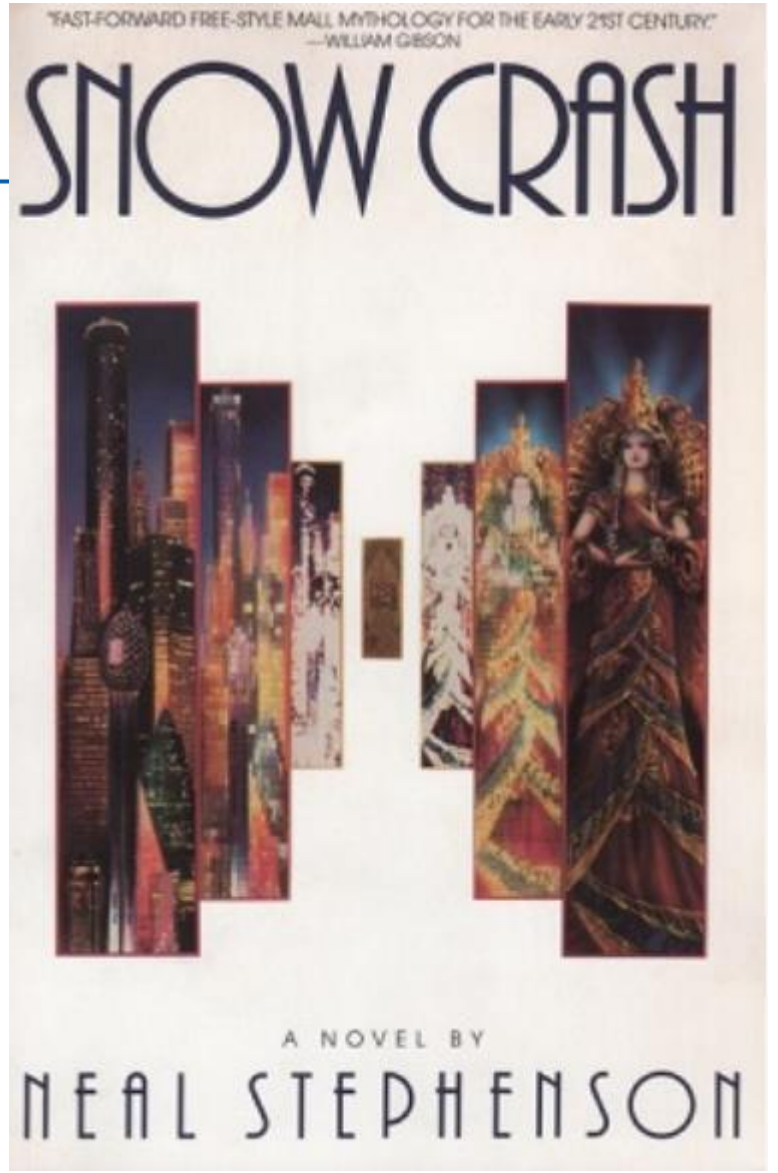
Virtual Worlds → Metaverse

The new buzzword is the “metaverse”

Oct 2001 – Facebook rebrands as “Meta”

In science fiction, the "metaverse" is a hypothetical iteration of the Internet as a single, universal, and immersive virtual world that is facilitated by the use of virtual reality (VR) and augmented reality (AR) headsets. In colloquial usage, a "metaverse" is a network of 3D virtual worlds focused on social and economic connection (Wikipedia)

Media: Snow Crash by Neal Stephenson, The Matrix, Ready Player One by Ernest Cline



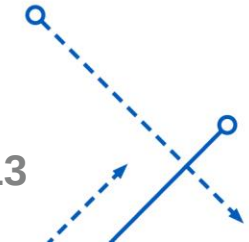
NFTs and Property Rights

To link worlds in the metaverse, assets have to be portable

The biggest issue for these early gaming worlds are property rights

The items you buy, the entire world, belongs to the game producer

Non-fungible tokens are, possibly, the solution to this latent property rights issue



NFTs and Property Rights

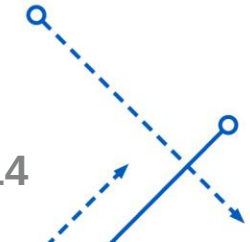
Non-fungible tokens (NFTs) allow for smart contracts

A **smart contract** is a program stored on a blockchain that automatically enforces specific actions once predetermined conditions are met

A **blockchain**, in turn, is a system in which a record of transactions is maintained across computers that are linked in a peer-to-peer network

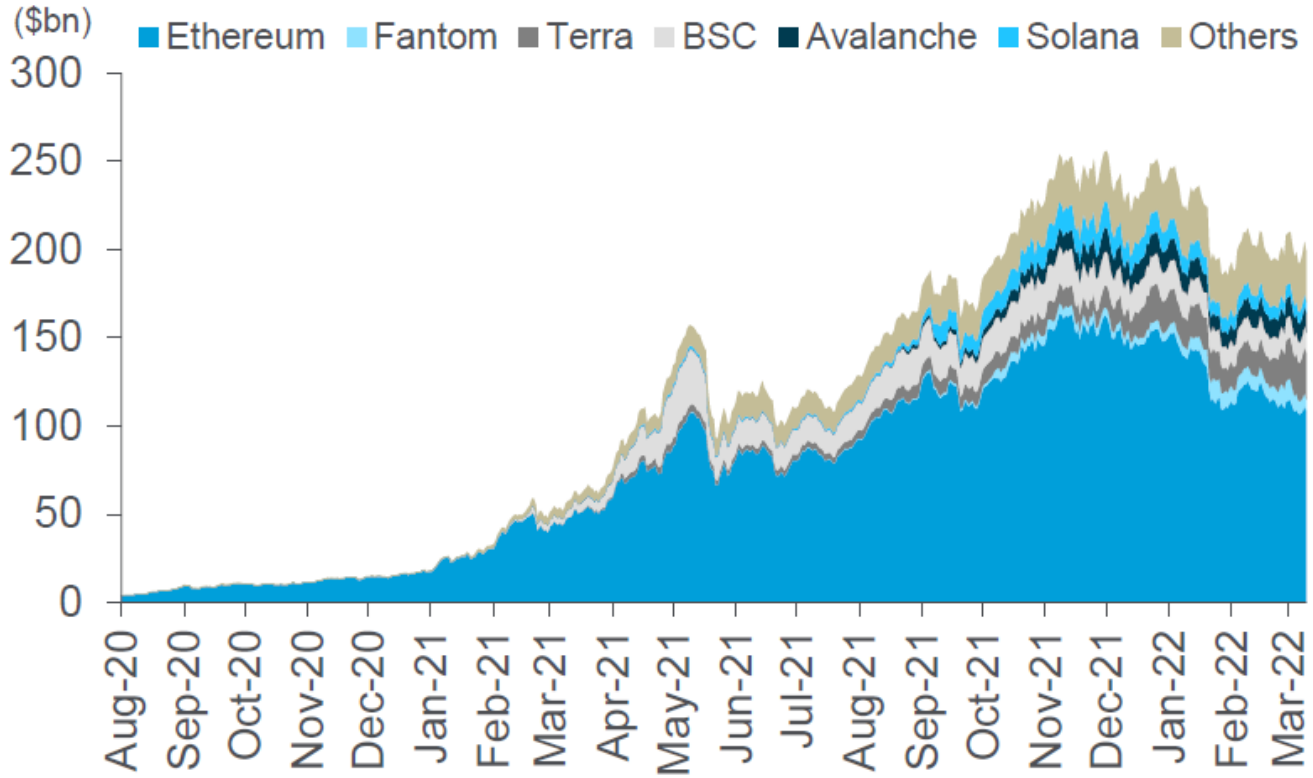
So a token could allow a smart lending contract – on a given day, the token (plus some interest repayment) would automatically be returned to the lender's account

A virtual land NFT could allow for a virtual plot of lend to be sold, rented, gifted, inherited, leased, mortgaged, etc.



NFTs and Property Rights

Figure 48. DeFi Value Locked by Category (Net)



Source: DeFiLlama, Citi Global Insights

Digital Assets

Figure 42. Top Gaming Tokens by Market Capitalization (as of March 29, 2022)

Name		Market Capitalization	Volume (24-hr)	Circulating Supply
Decentraland	MANA	$5,050m	$507,781,990 (185,101,676 MANA)	1,840,876,568 MANA
Axie Infinity	AXS	$4,140m	$737,008,742 (10,843,634 AXS))	60,907,500 AXS
The Sandbox	SAND	$4,091m	$773,401,296 (217,258,393 SAND))	1,149,278,952 SAND
ApeCoin	APE	$3,981m	$1,196,538,289 (83,408,630 APE))	277,500,000 APE
Gala	GALA	$1,895m	$1,136,447,709 (4,183,822,994 GALA)	6,977,205,436 GALA

Source: Coinmarketcap, Citi Global Insights

Digital Assets

Figure 31. Top NFT Sales on Decentraland

	NFTs	Price (US$)	Price (MANA)
1.	Fashion Street Estate	$2.42 million	618,000 MANA
2.	Lady Bug (Plaza)	$1.32 million	510,000 MANA
3.	Official District	$1.19 million	425,000 MANA
4.	Massive Genesis Plaza	$1.08 million	210,000 MANA
5.	VentureEstates	$1.03 million	300,000 MANA

Note: Decentraland (MANA) is an Ethereum token that powers the Decentraland virtual reality platform.
Source: DappRadar.com, Citi Global Insights

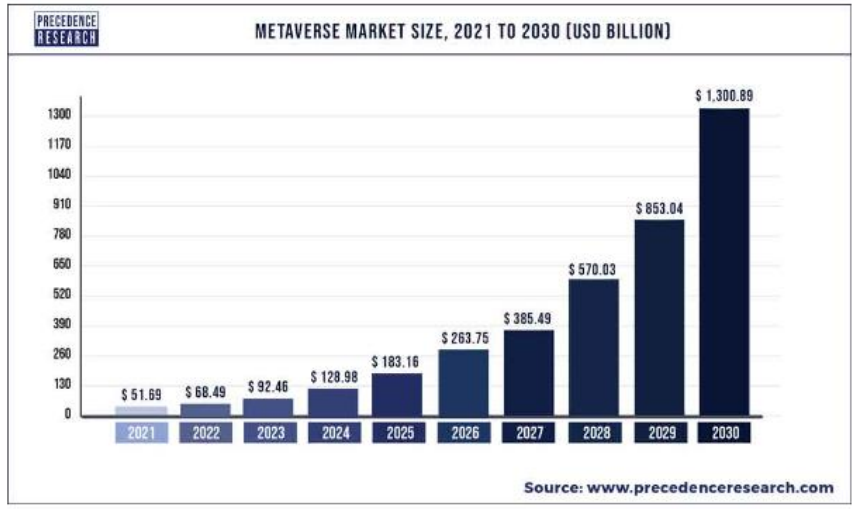
Digital Assets

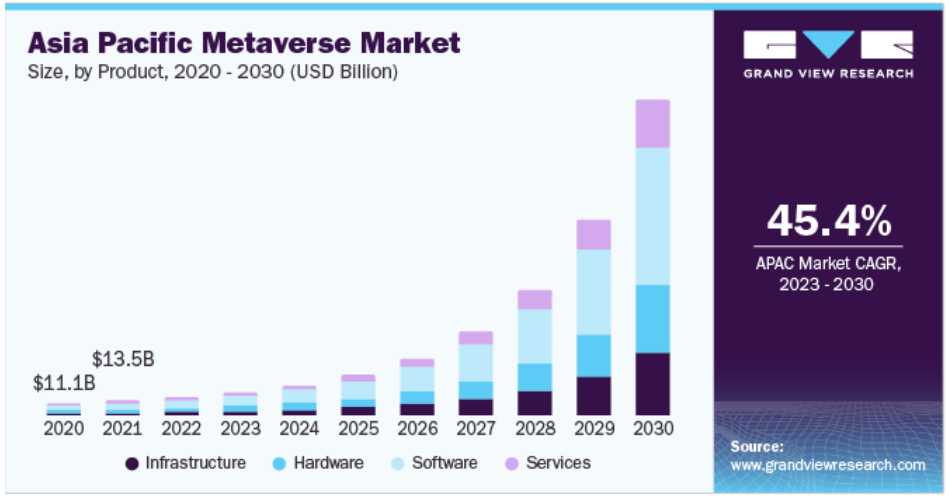
Figure 28. Selected Prominent NFT Sales, 2021

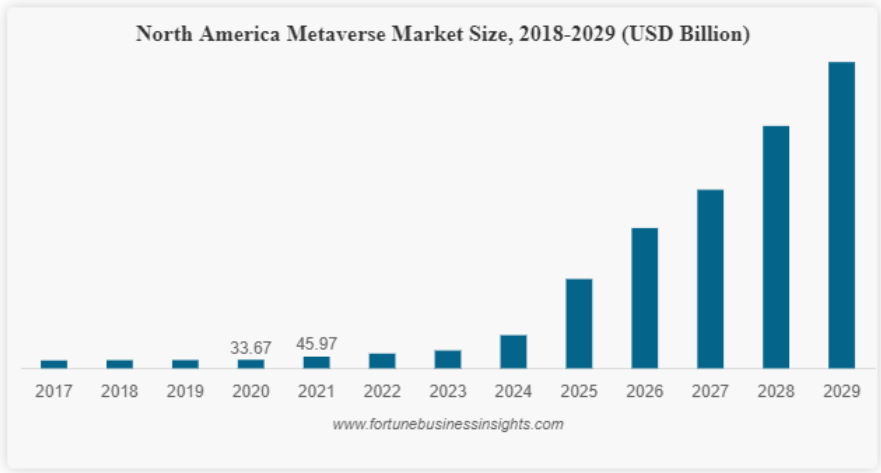
	NFTs	Price (US$)	Price (ETH)
1.	Beeple's Everydays: The First 5000 Days	$69.3 million	-
2.	Human One	$29.0 million	-
3.	BAYC and BAKC Bundle	$26.2 million*	-
4.	CryptoPunk #4156	$10.4 million	2,500 ETH
5.	COVID Alien	$11.7 million	-
6.	CryptoPunk #7804	$7.56 million	4,200 ETH
7.	CryptoPunk #3100	$7.51 million	4,200 ETH
8.	Right-click and Save As guy	$7.09 million	1,600 ETH
9.	Ringers #109	$6.94 million	2,100 ETH
10.	CryptoPunk #8857	$6.64 million	2,000 ETH

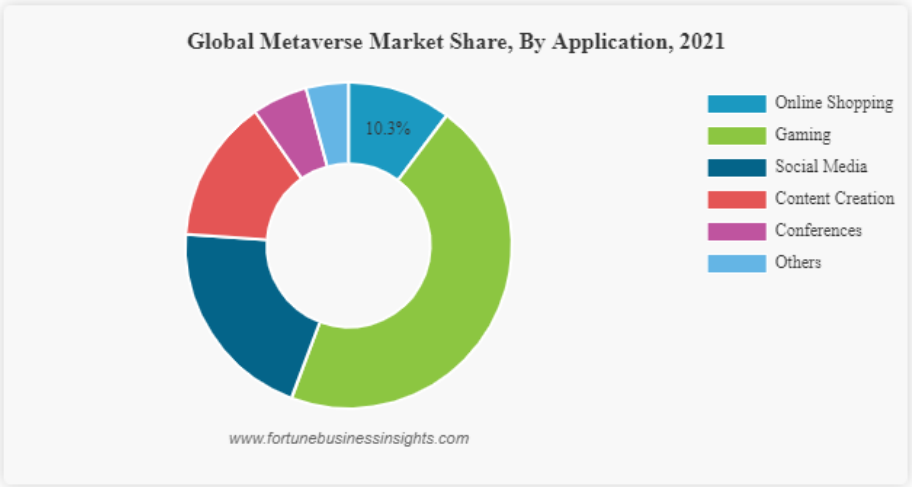
* 101 BAYC = $24.4 million and 101 BACK = $1.8 million
Source: DappRadar.com, Citi Global Insights

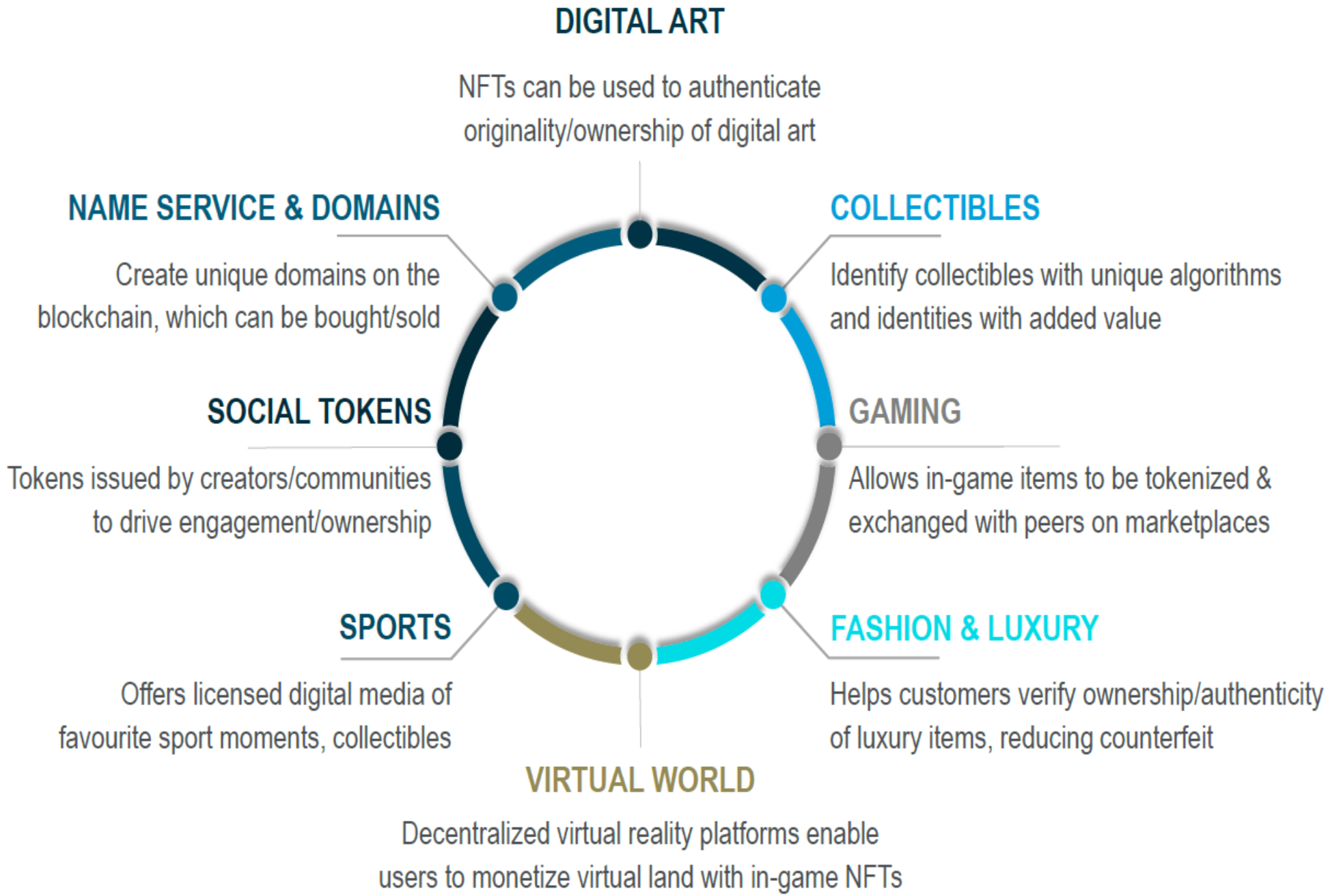
Virtual Worlds and the Metaverse





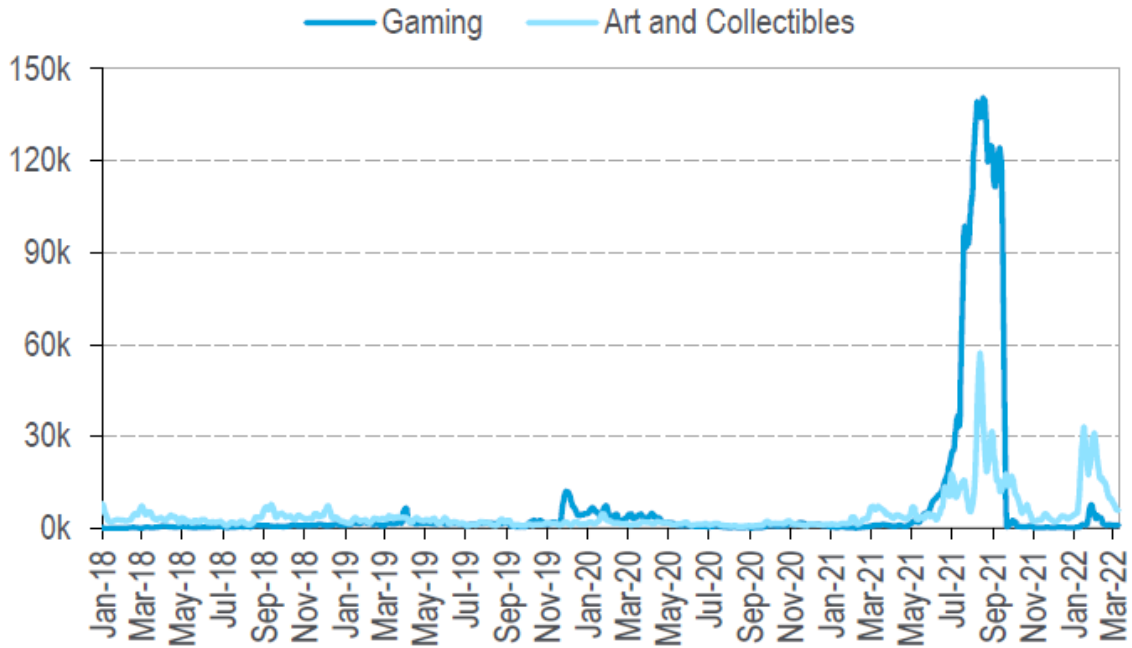






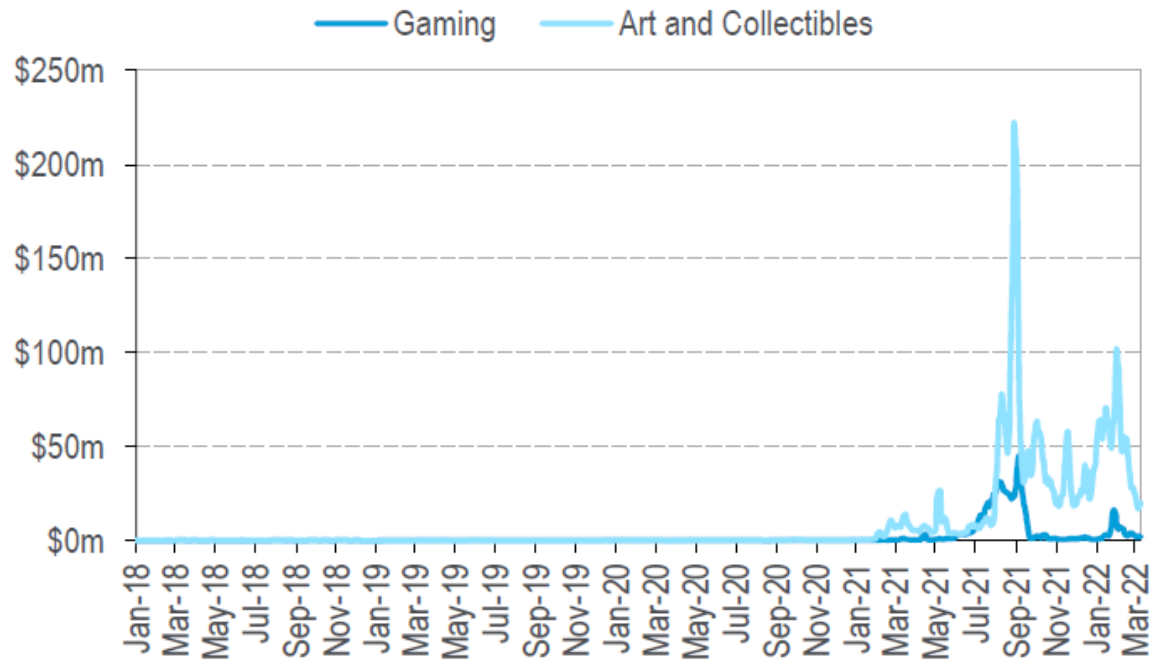
Source: 101 Blockchains, NonFungible.com, Citi Global Insights

Figure 29. Number of NFT Sales by Category (7-Day Moving Average)



Source: NonFungible.com

Figure 30. US$ Spent on Completed NFT Sales by Category (7-Day Moving Average)



Source: NonFungible.com

Digital and Virtual Assets

- Cryptocurrencies
- NFTs and other tokens

- Virtual land
- Loot boxes and other in-game items

- Books and music (who owns the ebook on your Kindle, btw?)

Virtual Worlds and the Metaverse

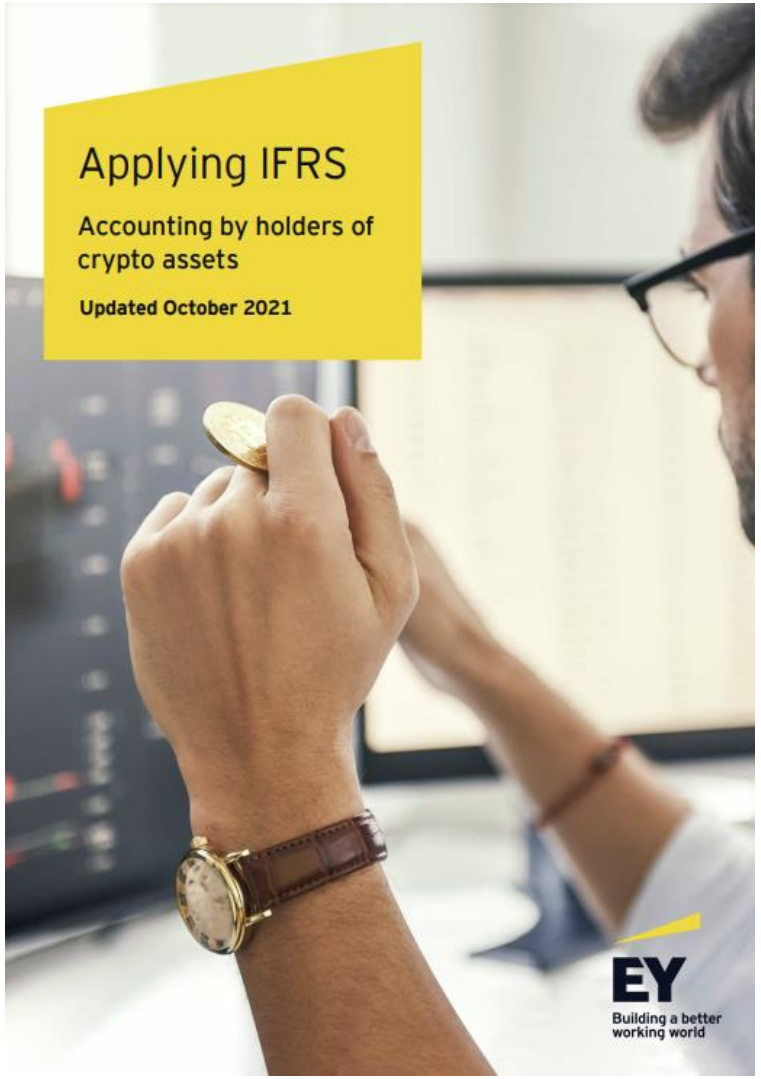
Figure 3. Sizing the Metaverse Economy in 2030 ($ trillions)

Metaverse TAM, 2030 ($ trillions)		Digital Economy as % of GDP			
		15%	20%	25%	30%
Metaverse as % of Digital	10%	1.9	2.6	3.2	3.8
	20%	3.8	5.1	6.4	7.7
	30%	5.8	7.7	9.6	11.5
	40%	7.7	10.2	12.8	15.3
	50%	9.6	12.8	16.0	19.2

Assumptions: (1) Global GDP of $127.9 trillion in 2030, based on IMF growth forecasts; (2) Digital as % of GDP in 2025 of 24.3% (Oxford Economics); (3) Metaverse as a % of Digital based on the scenarios above.

Source: IMF, Citi Global Insights

IFRS – Accounting for Crypto-assets


Applying IFRS
Accounting by holders of crypto assets
Updated October 2021
EY
Building a better working world

Cryptocurrencies

The IFRS IC defined a **crypto-asset** as a "digital or intangible assets that is issued and/or transferred using distributed ledger or blockchain technology using cryptographic techniques"

and a **cryptocurrency** as:

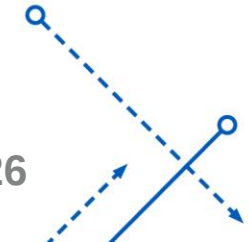
a) a digital or virtual currency recorded on a distributed ledger that uses cryptography for security,

b) not issued by a jurisdictional authority or other party, and

c) does not give rise to a contract between the holder and another party

Bitcoin, for example, would meet this definition

Cryptocurrencies represent a subset of crypto-assets



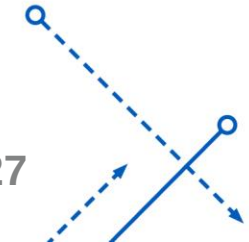
Cash

IAS 7 – Cash is “cash on hand and demand deposit”

IFRS is not clear on the definition of cash

It is generally defined by function:

1. Medium of exchange
2. Unit of account
3. Store of value



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It is generally defined by function:

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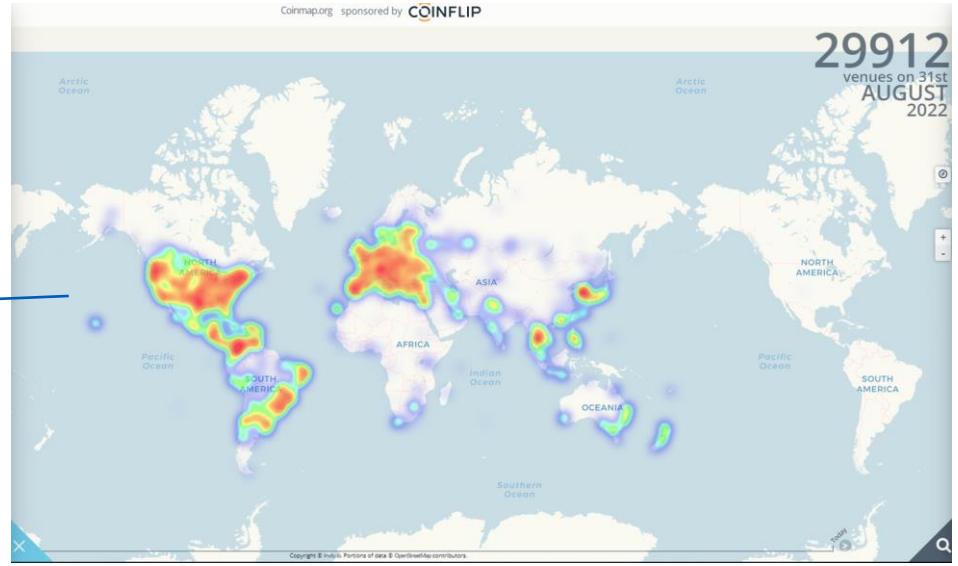
2. Unit of account
3. Store of value

Is Bitcoin a Real Currency? An Economic Appraisal

23 Pages • Posted: 2 Dec 2013 • Last revised: 2 Nov 2014

David Yermack
New York University (NYU) - Stern School of Business

Date Written: April 1, 2014



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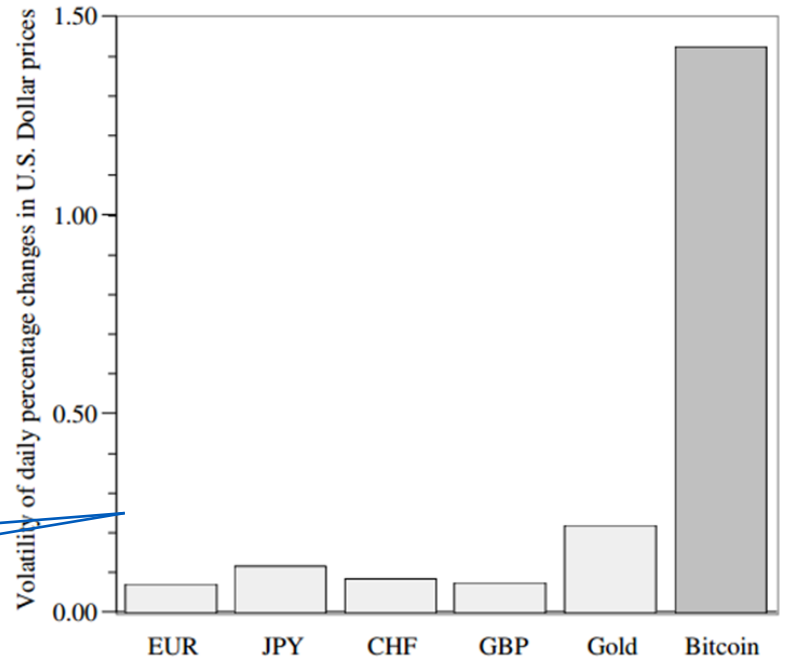
2. ~~Unit of account~~
3. ~~Store of value~~

Figure 2
Volatility of bitcoin compared to major currencies and gold
The figure shows the volatility during the year 2013 of the percentage change in daily exchange rates for four major currencies, gold, and bitcoin, all measured against the U.S. dollar.



With the exception of El Salvador accepting Bitcoin as legal tender, the low volume of transactions and high volatility mean that **crypto-assets do not meet the functional definition of cash**.

Cash equivalents

IAS 7 – Crypto-assets currently **do not meet the definition of cash equivalents** because they are generally, among others, not convertible to known amounts of cash, nor are they subject to an insignificant risk of change in value

Financial Instruments

IAS 32 – “any contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity”

The key is the “contract” aspect – gold is not a financial instrument, for example

A crypto-asset that gives access to goods and services is not a financial instrument unless those goods and services are “financial assets” or cash (so a crypto-asset that gives access to cloud storage is not a financial instrument)

Blockchain is not enough to meet the definition – there has to be a contractual relationship between parties

So **a crypto-asset is a financial contract if it entitles the holder to goods, services, or financial instruments and has an identified counterparty**

Financial Instruments – Equities and Derivatives

A crypto-asset is an **equity instruments** if it involves the contractual right to a residual interest in the net assets of an identifiable entity

A crypto-asset is a **derivative** if:

1. Its value changes according to a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index pf prices or rates, credit rating or credit index, or other variable not specific to a party of the contract
2. It requires no initial investment or a small initial investment
3. Settles at a future date

Inventory

IAS2 does not require inventory to be tangible

The standard is:

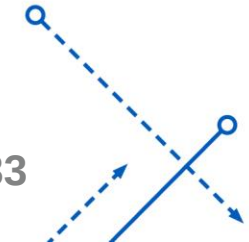
- Held for sale in the ordinary course of business;
- In the process of production for such sale; or
- In the form of materials or supplies to be consumed in the production process or in the rendering of services.

So a commodity broker-dealer could hold crypto assets as inventory

Note that it explicitly excludes financial instruments

Inventory is usually recorded at the lower of

1. Cost (which here is often mining) OR
2. Net realizable value



Intangible Asset

IAS 38 “a resource controlled by an entity as a result of past events; and from which future economic benefits are expected to flow to the entity”.

The IASB considers that the essential characteristics of intangible assets are

that they:

- Are controlled by the entity
- Will give rise to future economic benefits for the entity
- Lack physical substance
- Are identifiable

Cryptocurrencies and other crypto-assets generally meet the definition of intangible assets

Intangible Asset

Cost model

Amortization – usually, life is assumed to be indefinite, so no amortization

Revaluation

IFRS allows for revaluation if fair value can be determined by reference to an active market, or "a market in which transactions for the asset or liability take place with sufficient frequency and volume to provide pricing information on an ongoing basis"

Indirect valuation is usually not acceptable.

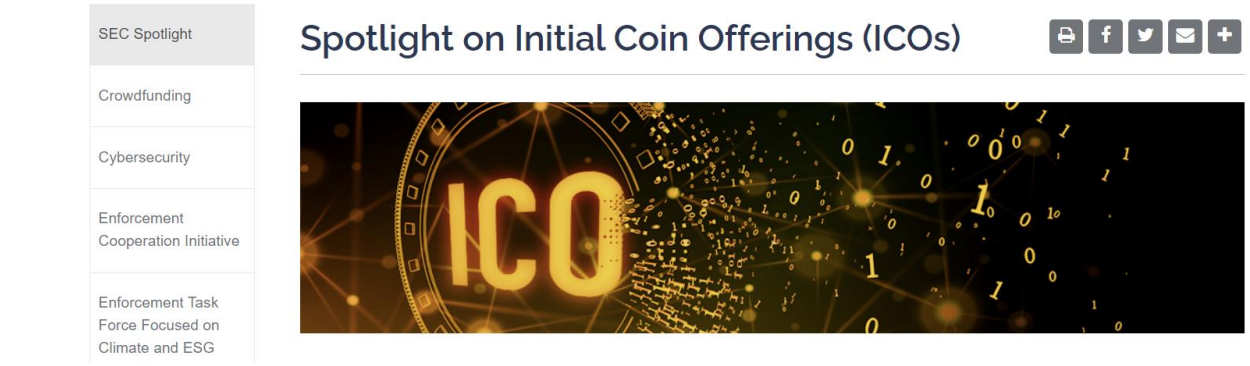
Valuing Tokens: Security, Utility, Cryptocurrency

Three Main Types of Crypto-Assets

1. Security Tokens
2. Utility (MAG) Tokens
3. Cryptocurrencies

The majority fall under (2) and (3)

Security Token



The token represents economic interest in the issuing business, similar to common equity

Securities are usually sold in an Initial Coin Offering (ICO). That is essentially an IPO (see US SEC ruling in July 2017 on Distributed Autonomous Organizations)

The ICO will include the presentation of an “ICO White Paper” which should detail the token’s holders right to receive distributions of profits

Security Token – Market Valuation

Secondary market trading provides prices, but you need:

1. Convertibility to fiat
2. Liquidity (discount if necessary)

Time Horizon Choice

Beware of volatility – choosing the right time-frame matters (high volatility means that we probably want a longer timeframe, but then trends come into play…)

Months, not days – and robustness testing

Security Token – Market Valuation

For a new token, you need to rely on “comparables” (or “comps”)

EY recommends a “scorecard” approach:

- the stage of the project’s technological and commercial development
- the quality and experience of the team behind the project
- the size of the addressable market and
- the uniqueness of the project

Then, adjust for liquidity and conversion fees, other exit costs

Security Token – Income Valuation

Discounted Cash Flows (DCF)

The value of an asset should reflect the present value of the cash flows it will generate in the future, discounted back at a rate that reflects the level of risk of the project

$$\mathrm{DCF} = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_n}{(1+r)^n}$$

DCF = discounted cash flow
CF_i = cash flow period i
r = interest rate
n = time in years before the future cash flow occurs

Security Token – Income Valuation – Discount Rate

Discount rate – can't use CAPM…

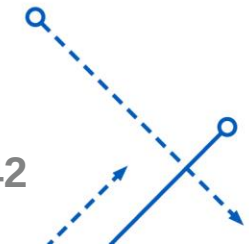
Use VC investor hurdle rate

- Databases (Pitchbook, Preqin)
- Surveys

Should again adjust with a "scorecard" of qualitative factors (IP risk, funding risk, geopolitical risk, founder risk, etc.)

Note that these rates are usually very high, compared to our public-firm WACC estimates – so it is common to see 20-30% - and even as high as 40%

"Harvard Magic Discount Rate" for crypto: 20%



Security Token – Income Valuation

The numerator…

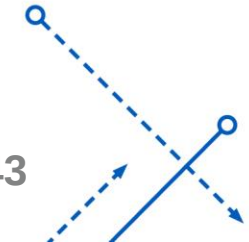
This is the hard part.

Plenty of research indicates that firms are over-optimistic about their own prospects.

No silver bullet…

It all starts from “market size times market share”

But both are hard to estimate and very project-specific



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Valuing REN

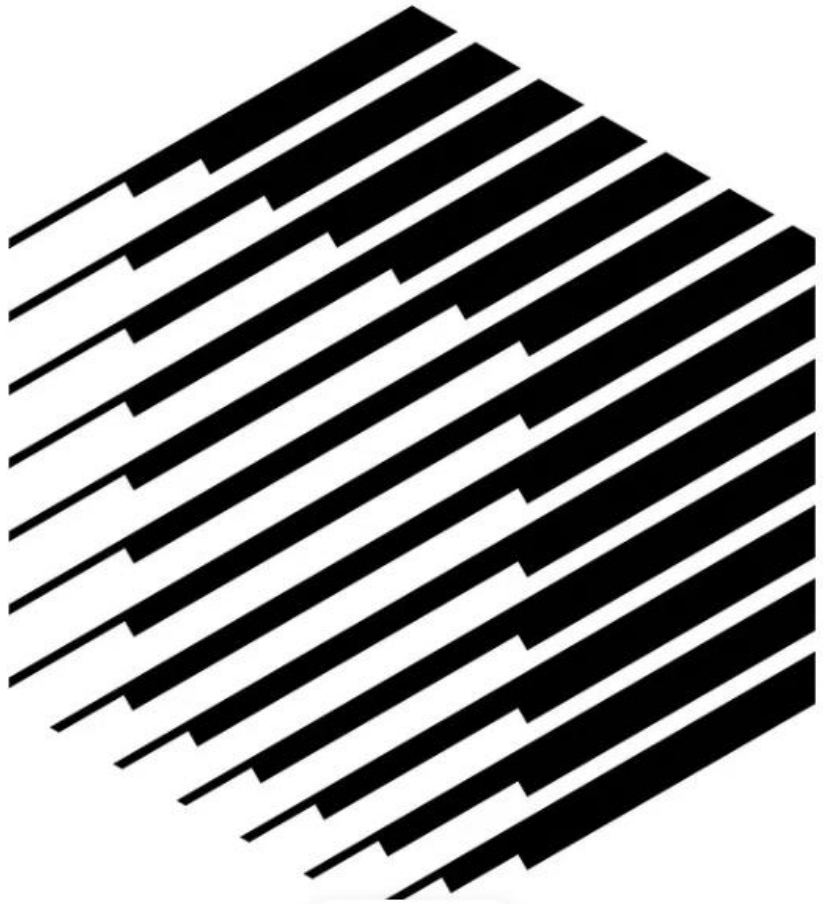
John Todaro – Medium.com

In our flagship report on Republic Protocol (REN), my partners and I at Blocktown Capital built out a DCF model to value the REN token. Republic Protocol is a decentralized dark pool platform in which nodes run a simple matching process and in turn for their work receive trading fees from the network. The primary incentive to own REN tokens, is to be able to stake these tokens to be eligible to run a node, and hence receive fees. We can treat these fees as a cash flow paid out to token holders. Below, we run through how a DCF model is then used to find a fair token price today for REN. Note that this type of model can be used for any fee paying network in which fees are paid out to token holders.

Greymatter Capital
Jun 2, 2018 · 22 min read · Listen

Republic Protocol: Analysis and Valuation

Full Report by James Todaro, Joseph Todaro and John Todaro



Valuing REN

First, we need to assume certain growth rates of the platform which lead us to expected future cash flows. See our full report for why we used the below assumptions. Note that the assumptions below were for our bull case scenario for REN. In our full report, we also run through a base case scenario. Link here: Blocktown Capital REN Report & Valuation

Year	2018	2019	2020	2021	2022
Total market volume (billions USD)	8,000	14,000.00	21,000.00	28,350.00	35,437.50
REN mkt capture	0.00%	0.15%	0.45%	1.0%	1.7%
Fee rate	0.40%	0.40%	0.34%	0.29%	0.25%
Fees paid to REN nodes (billions USD)	0	0.0840	0.3213	0.8222	1.5061
Number of darknodes	5000	5000	5000	5000	5000
Revenue per dark node	$ -	$ 16,800.00	$ 64,260.00	$ 164,430.00	$ 301,218.75

The key aspect in the above table, is the estimate of cash to be paid to nodes projected over the next five years. Using the formula for DCF, PV = [CF1 / (1+r)1] + [CF2 / (1+r)2] + … + [CFn / (1+r)n] + TV, we can discount our cash flows back to present day to arrive at a Present Value (PV) for the REN network.

PV = Present cash flow value

CF1 = Cash flow at the end of year 1

CF2 = Cash flow at the end of year 2

CFn = Cash flow at n specified year

r = Discount or required rate of return

TV = Terminal Value

Valuing REN

In any DCF model, we must discount our cash flows back to the present day as a dollar next year is not worth the same as a dollar today. One key point to note, is that all expected cash flows are not treated equally. We must build in a risk measure. The more uncertain an expected cash flow is, the more we should discount it. Presently, there is no appropriate risk rate in the digital asset marketplace that can be used as a benchmark. As such, in our report we borrowed from other financial markets. In Series A equity funding rounds for venture capital, the generally accepted rate is between 30–50% per annum. As a digital asset platform with certain technological components that remain unproven, Republic Protocol has a relatively high risk profile so we settled on a similar discount rate of 40%.

Lastly, in our DCF model, we need to include those fees paid after the five year period. We modelled the REN platform to last into perpetuity, as is appropriate in the equity markets. To achieve this, we used the Gordon Growth Method to find a Terminal Value, TV. We conservatively projected out a sustained growth rate of 2% (g = 0.02), inline with mature company estimates and developed countries' GDP estimates. Using the Gordon Growth formula below:

TV = [year 5 cash flow * (1+g)/(r-g)]

TV = 1,506,093,750*(1.02)/(0.4–0.02) = 4,042,672,697

Adding up our yearly cash flows and terminal value, we arrive at the below summation:

0 + 42,857,142 + 117,091,836 + 214,012,390 + 280,034,686 + 4,042,672,697 = 4,696,668,753

Finally, by dividing our total network cash value (4,696,668,753) by the number of circulating tokens (519,094,022), we arrive at a dollar price per REN of 9.05 USD. That is, with our assumptions and best case scenario forecasts, REN should be valued at 9.05 USD per token.

Valuing REN

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Utility Tokens

The developer creates a “miniature economy” in which the token is the accepted legal tender; the tender is sold to fund the venture.

The value of the token depends on the demand for goods or services on the platform.

Note that NFTs used to assign ownership of virtual land or other virtual goods would fall under the designation of “utility tokens”

Valuation depends on liquidity and stage of development.

Utility Tokens - Valuation

Market based – if liquid and transparent

Cost based

- Mining provides a floor estimate (but utility tokens often can't be mined)
- Compare cost of provided goods/services to fiat currency cost of similar goods/services

- Quantity Theory of Money

Quantity Theory of Money

16th Century – Nicolaus Copernicus and Jean Bodin

18th Century – David Hume

20th Century – Irving Fisher

But still controversial…

$$M \times V = P^{**} \times Y^{*}$$

The formula states that the money supply (M) times money velocity (V) equals price level (P) times the volume of goods and services transacted in the economy (Y).

*In practice, real gross domestic product (GDP) is substituted into the equation as a measure of volume.

**Note: the price level (P) should not be equated with the price of a token, which we subsequently define as p.

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Quantity Theory of Money

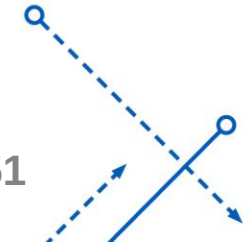
(M) Money Supply: *total # of tokens* × *float*

Float adjusts for issuer reserves (long-run should be 100%)

(V) Money Velocity: the inverse of the average period during which a token is held by an address

Really hard to estimate for "traditional" assets – but really easy to do with a blockchain!

Might need to rely on comparables if not traded



By the Way… Transaction Volume and Fraud…

According to nonfungible.com, the 365 days ending in mid-March 2022 witnessed 16.8 million number of sales, totaling $18.4 billion in value.

However, we need to take the above statistics with a pinch of salt. “Wash trading,” which is executing a transaction in which the seller is on both sides of a trade, is rampant in the NFT space (essentially selling the asset to oneself). This practice artificially inflates the asset’s value and provides a misleading picture of liquidity. On-chain sales history boosts the success rate of flipping an NFT (buying for a low price and selling it quickly for a profit).

Further, the NFT market is highly concentrated. As per the 2021 NFT Market Report from Chainalysis, over 2,000 individual NFT collections on the marketplace OpenSea have had a secondary sale, but only 250 collections account for 80% of these secondary sales.

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Quantity Theory of Money

(Y) Goods and Services: $D \times s$

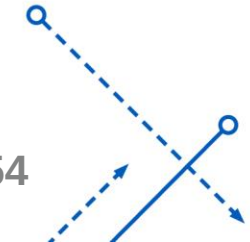
This is the "GDP" of the model economy

D is the total possible market (in fiat currency terms)

Hard to define; VCs ask "what is the industry the company is disrupting"?

s is the market share

Both *D* and *s* should be estimated with reference to probabilistic distributions, either under scenario analysis or Monte Carlo simulations



Quantity Theory of Money

Rearranging,

$$p = \frac{1}{P} = \frac{D \times s}{M^* \times f \times V}$$

p = token value
s = market share
V = token velocity

P = price level
M*= total token supply

D = market size
f = float factor

An increase in price level P means the token is losing value (inflation)

$$p = \frac{1}{P} = \frac{D \times s}{M^* \times f \times V}$$

p = token value
P = price level
D = market size
s = market share
M*= total token supply
f = float factor
V = token velocity

Quantity Theory of Money - Timing

QTM refers to some sort of "steady state equilibrium"

In other words, we are estimating the size of the market and market share that the token might eventually achieve at some future point in time

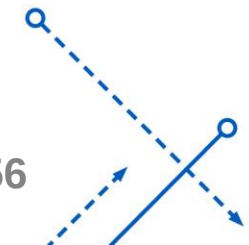
The token value estimate then is for this "future point in time"

We can bring it back to present time by simple time-value of money adjustment

$$\text{Present Value (PV)} = \frac{\text{Future Value (FV)}}{(1 + \text{Discount Rate})^{\text{Number of Periods}}}$$

Discount rate? Under scenario or Monte Carlo, the risk is reflected there – use risk-free rate

If not, use VC hurdle rate, as discussed before



Cryptocurrencies - Valuation

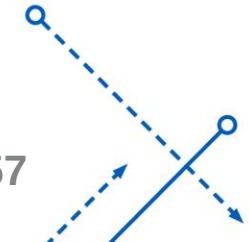
QTM – the problem is “Y”

The total market for a “general purpose” coin is the global economy.

So the relevant Y is the share of the global economy captures by the particular cryptocurrency. Hard to estimate in any objective function.

Is Bitcoin “digital gold”?

QTM works for currencies being used as a mean of payment, not as a perpetual storage of value.



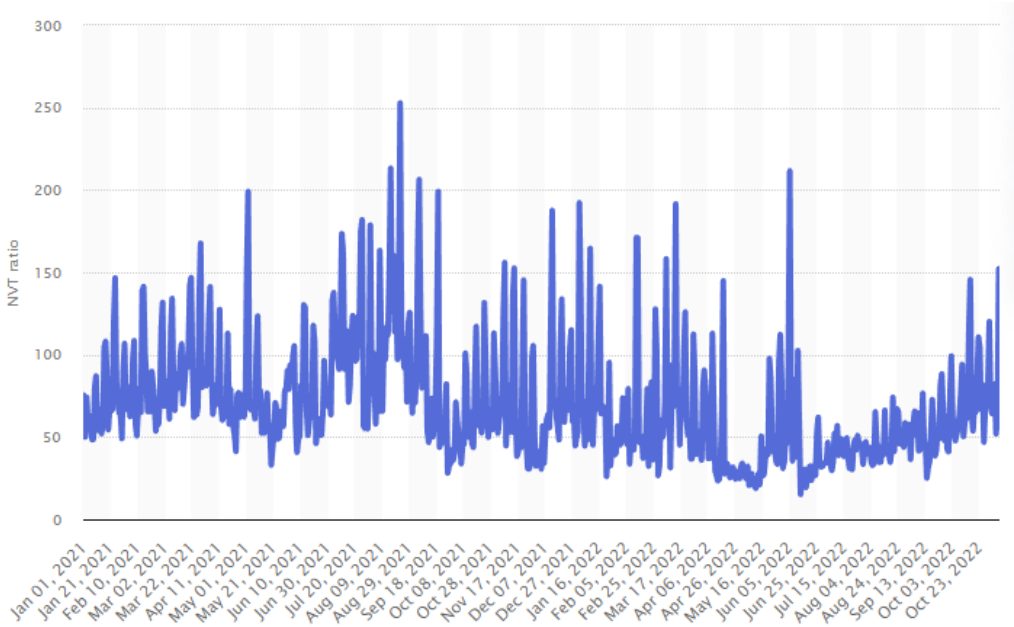
Cryptocurrencies – Valuation – Network Value

Network Value to Transaction (or NTV)

Network value is the market cap (*price per coin* $\times$ $number\ of\ coins\ oustanding$)

Transactions – traded volume (usually daily, in USD)

Bitcoin NTV:



Cryptocurrencies – Valuation – Network Value

NTV can be computed for "similar" cryptocurrencies

Then use this average times the transaction value for your coin to estimate a fair aggregate market size. Divide by the number of coins to get a price per coin.

Or it can be used in the time series (more commonly)

For example, this tries to find a "fundamental price range" for BTC on 7/15/19

First, estimate high and low NVT values over the previous year

Then, multiply the transaction value for 7/15/19 times the two extremes to get a range estimate

Figure 1: Valuations Price Ranges

https://21shares.com/research/state-of-crypto-5

Cryptocurrencies – Valuation – Network Value

NTV – Network Value to Transaction Value

NVRV – Network Value to Realized Value

NVHR – Network Value to Hash Rate (hash rate is a measure of computational power used by miners)

NVML - Network-Value-to-Metcalfe's-Law

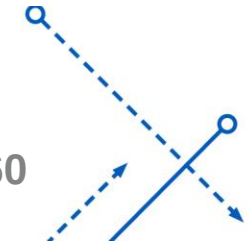
the value of a network is proportional to the square of the size of the network

$$NVML = \frac{\text{Network Value}}{(\text{Active Addresses})^2}$$

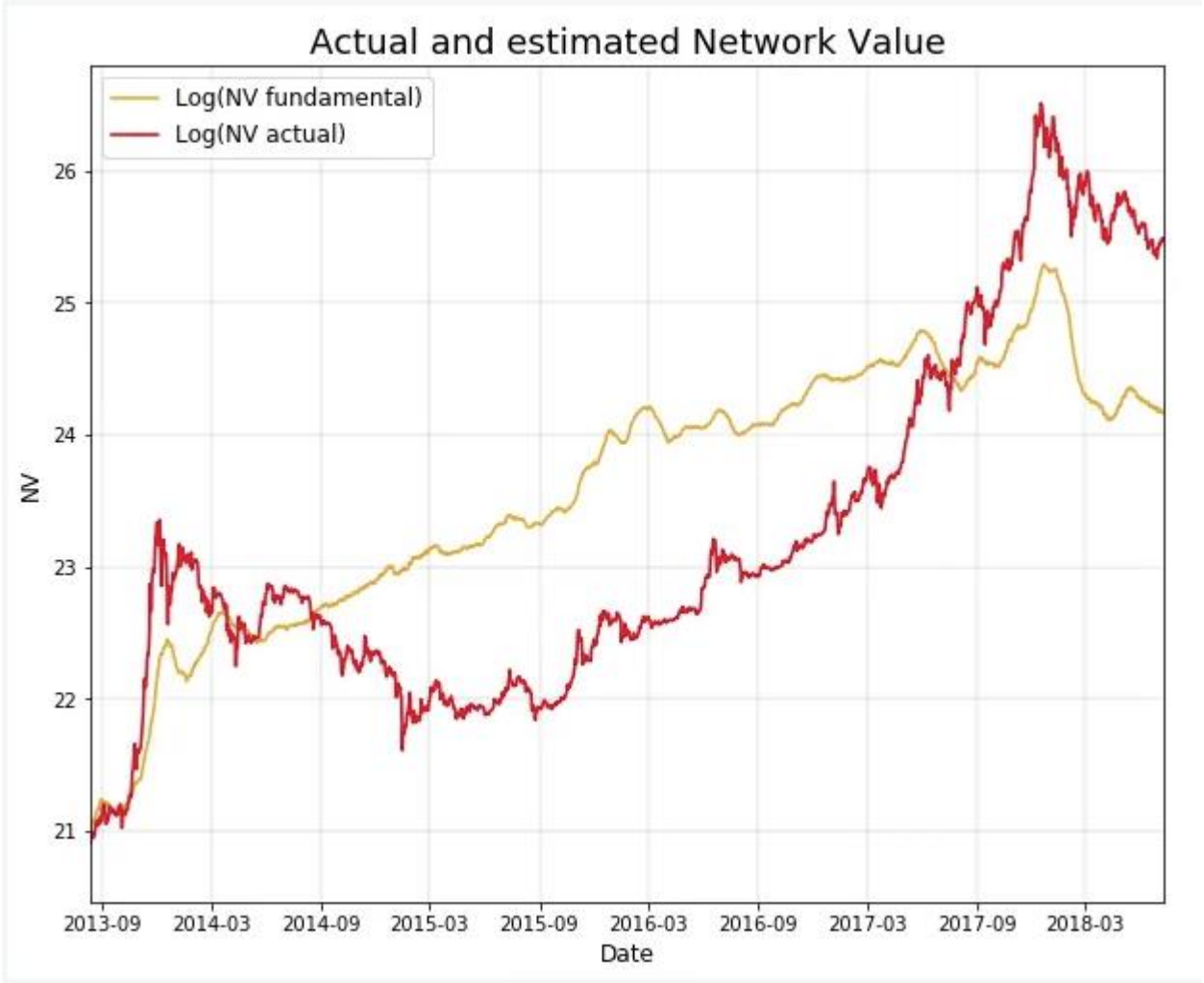
NVOL - Network-Value-to-Odlyzko's-Law

$$NVOL = \frac{\text{Network Value}}{(\text{Active Addresses}) * \log(\text{Active Addresses}) * 1000}$$

the value of a network is proportional to the number of active addresses times the log of the number of active addresses



Cryptocurrencies – Valuation – Network Value – Metcalfe's Law



https://medium.com/@federicoagustincaccia/analyzing-blockchain-networks-with-metcalfes-and-odlyzko-s-laws-735d7488a18f

Cryptocurrencies – Valuation – Cost of Mining

In an efficient market, value should be closed to cost

This is NOT an efficient market… so I would not put much stock into this

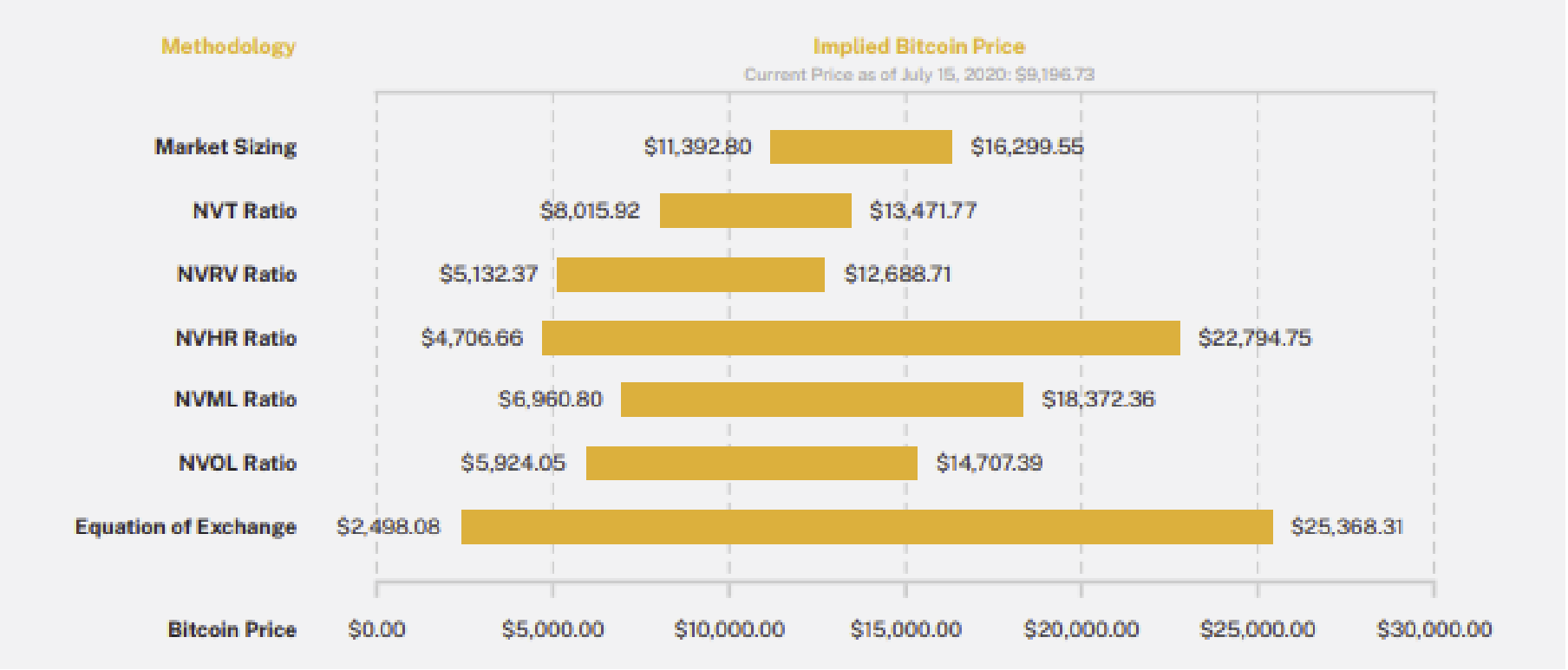
But here is the "Amun AG" model

$$\text{BTC/day}^* = \frac{\theta(\beta * \rho)}{\delta} \qquad E_{day} = (\text{price per kWh} * \theta * \text{W per G H/s}) * \left(\frac{GH}{1000}\right) \qquad \rho^* = \frac{E_{day}}{\text{BTC/day}}$$

BTC/day* - The expected amount of Bitcoin one can expect to earn per day.
Network Value - The total dollar value of all the circulating units of the given crypto asset. It is equivalent to the market capitalization of a stock.
ρ - The hash power employed by a miner.
δ - The Bitcoin mining difficulty.
θ - Is a constant representing the normalized probability of a single hash solving a block divided by the number of seconds in a day $\frac{2^{32}}{3600 * 24}$
Price per kWh - The average cost of electricity.
W per GH/s - The efficiency of the mining equipment used.
GH - Is a constant representing the hash power generated by a single miner – 1000.
β - The reward for mining a block.

Source: Amun AG

Cryptocurrencies – Valuation – BTC Example



https://21shares.com/research/state-of-crypto-5

Art Tokens - Valuation

Bored Ape Yacht Club Rarity Explorer

@BoredApeYC Discord Website OpenSea LooksRare EtherScan

NFTs sold	Trading volume	Bored Ape Yacht Club Value
last 7 days	last 7 days	Average price last 7 days
149	$16.5M	$111k

Bored Ape Yacht Club Floor Price	Total Supply	Owners
Lowest Ask Price	Number of tokens	Number of owners
Ξ60	9,998	5,797

Recent Bored Ape Yacht Club sales


Bored Ape Yacht Club sold for $693k 16 days ago


Bored Ape Yacht Club sold for $690.3k 16 days ago


Bored Ape Yacht Club sold for $263.7k 4 days ago


Bored Ape Yacht Club sold for $221.2k 30 days ago

10th percentile price	Median price	90th percentile price
last 7 days	last 7 days	last 7 days
$101k	$108k	$125k

Ten percent of the Bored Ape Yacht Club sales were for $101k or less, half of the sales were for less than $108k and the highest ten percent were sold for $125k or higher.

Bored Ape Yacht Club Price Chart

https://www.nft-stats.com/collection/boredapeyachtclub

Art Tokens - Valuation

Top Selling Bored Ape Yacht Club NFTs of the last 30 days

	NFT	Date	Price
1	 Bored Ape Yacht Club	16 days ago	$693k
2	 Bored Ape Yacht Club	16 days ago	$690k
3	 Bored Ape Yacht Club	4 days ago	$264k
4	 Bored Ape Yacht Club	30 days ago	$221k
5	 Bored Ape Yacht Club	30 days ago	$221k
6	 Bored Ape Yacht Club	16 days ago	$207k
7	 Bored Ape Yacht Club	30 days ago	$193k
8	 Bored Ape Yacht Club	24 days ago	$189k
9	 Bored Ape Yacht Club	13 days ago	$176k
10	 Bored Ape Yacht Club	13 days ago	$176k

https://www.nft-stats.com/collection/boredapeyachtclub

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Art Tokens - Valuation

Value is linked to rarity

For example, only 46 (of 10,000) bored apes have gold fur, which makes them rare and tends to increase value

Regressing prices on rarity will give an estimate of the value of “unit of rarity”

https://www.nft-stats.com/collection/boredapeyachtclub

On OpenSea

Bored Ape Yacht Club

About Bored Ape Yacht Club

The Bored Ape Yacht Club is a collection of 10,000 unique Bored Ape NFTs— unique digital collectibles living on the Ethereum blockchain. Your Bored Ape doubles as your Yacht Club membership card, and grants access to members-only benefits, the first of which is access to THE BATHROOM, a collaborative graffiti board. Future areas and perks can be unlocked by the community through roadmap activation. Visit www.BoredApeYachtClub.com for more details.

Traits and Properties

MOUTH	HAT	EYES	BACKGROUND	FUR
Bored Party Horn	Bayc Flipped Brim	Bored	Army Green	Blue
1% have this trait	2% have this trait	17% have this trait	12% have this trait	5% have this trait

#5116 Rank #123

Trait	Value	Score
Fur	Trippy	+126.6
Clothes	Caveman Pelt	+60.6
Eyes	Scumbag	+42.6
Mouth	Bored Unshaven	+6.4
Background	Army Green	+8.0
Hat	King's Crown	+126.6
Earring		+1.4
Total		372.4

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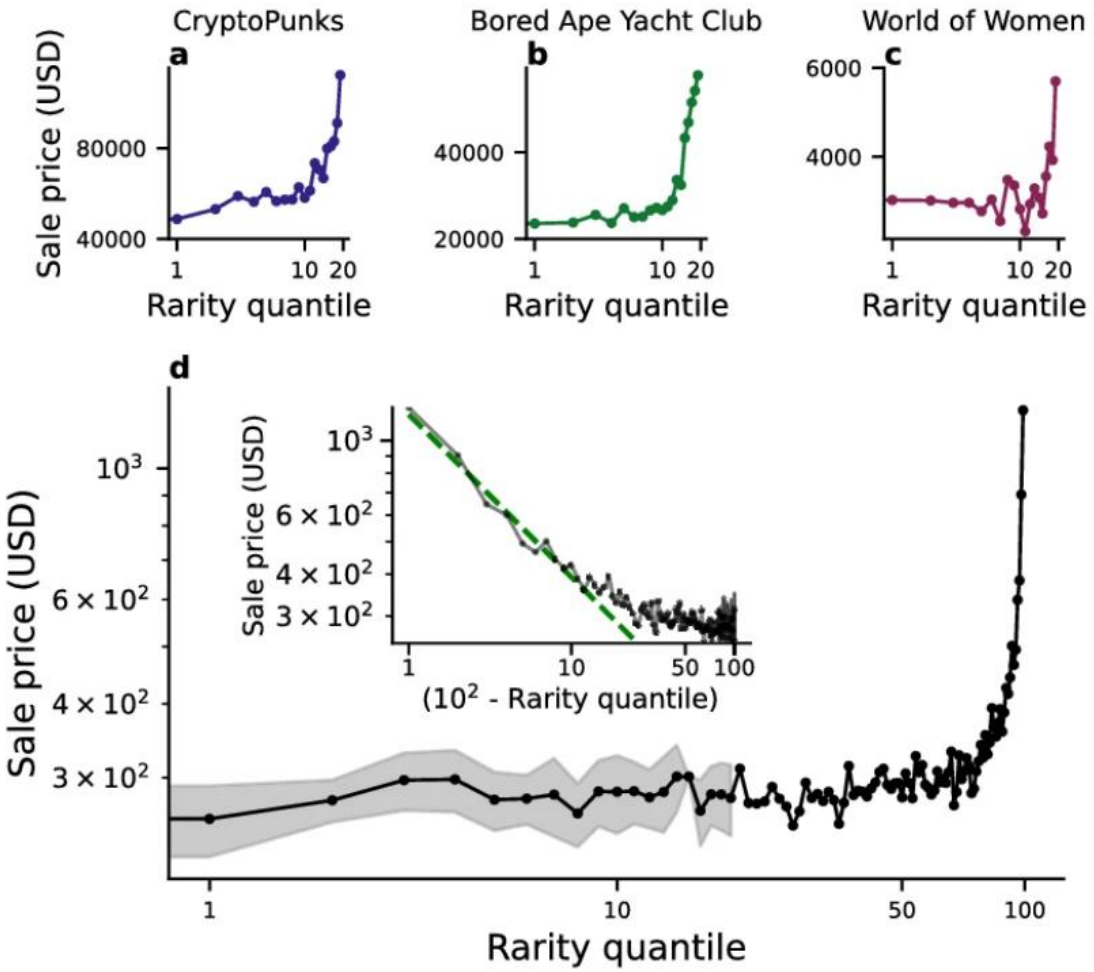
Art Tokens - Valuation

Article | Open Access | Published: 16 August 2022

Heterogeneous rarity patterns drive price dynamics in NFT collections

Amin Mekacher, Alberto Bracci, Matthieu Nadini, Mauro Martino, Laura Alessandretti, Luca Maria Aiello & Andrea Baronchelli

Scientific Reports **12**, Article number: 13890 (2022) | Cite this article



Valuation Approach Summary

Valuation approach	Security tokens	Utility tokens and cryptocurrencies
Market approach	▸ Quoted prices ▸ Comparable tokens	▸ Quoted prices ▸ Comparable tokens

Income approach	▸ Possible
	▸ Key considerations:
	  ▸ Forecasts
	  ▸ Discount rates
		▸ Not applicable

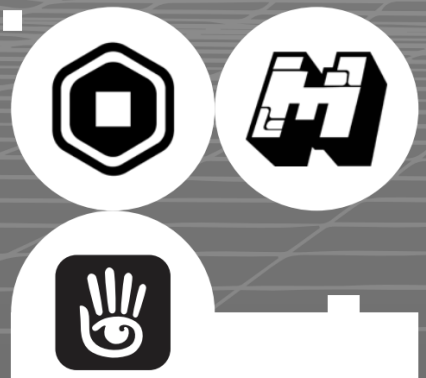
Cost approach	▸ Not applicable	▸ Opportunity cost of utility ▸ Cost of generation (e.g., mining)

QTM	▸ Not applicable	▸ Possible
		▸ Practical aspects:
		  ▸ Estimation of equation terms
		  ▸ Time value of money

https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/emeia-financial-services/ey-the-valuation-of-crypto-assets.pdf

Cryptocurrencies Vs. Stablecoins

In-Game Tokens

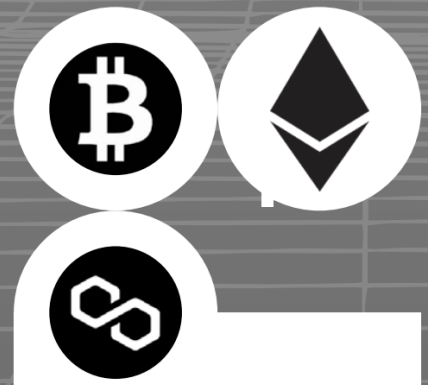


Examples
Robux, Minecraft, Linden dollars

Key Use Cases
Gaming

Limitations
Withdrawal Limits, Centralized Platform T&C, No Interoperability

Cryptocurrency



Examples
Bitcoin, Ethereum, Polygon, etc.

Key Use Cases
Virtual lands, NFTs, Gaming, DeFi

Limitations
Volatility, Energy Usage (Proof-of-Work based), Anonymity and AML Concerns

Stablecoins

Examples
USDT, USDC, Dai, BUSD

Key Use Cases
DeFi, International Payments, Settlement Currency for Trading, Entertainment, Shopping, Tourism

Limitations
Anonymity and AML Concerns, Collateralization Requirements

CBDCs

Examples
e-CNY, e-Naira, Sand Dollar

Key Use Cases
Domestic Payments, Targeted Subsidies, Public Affairs, Healthcare, Tourism

Limitations
Predominant Domestic Use Case a Challenge on Open Metaverse

Fiat Money (Current)

Examples
USD, GBP, EUR, CNY

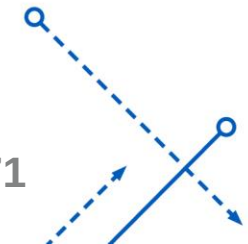
Key Use Cases
Traditional Financial Services, Credit Cards for Consumer Protection-Linked Use Cases

Limitations
Non-Tokenized, Account-Based, Micro-Payments Tough

Cryptocurrencies

- Bitcoin (BTC): BTC was created in 2009 by a programmer or group of programmers under the pseudonym of Satoshi Nakamoto and is described as a peer-to-peer electronic cash system that facilitates payments without a financial intermediary. Today it is the largest crypto asset, and it operates on its own Bitcoin blockchain.
- Ether (ETH): ETH is the second-largest crypto asset by market cap and was launched in 2015. Its blockchain, Ethereum expands the use case to "programmable money," smart contracts, tokens, and ICOs.
- XRP: XRP is another popular cryptocurrency. Together with its blockchain, it is designed to support payment use cases and process transactions at a fast speed. Ripple Labs controls almost half of the supply of the asset, albeit stored in vaults that release up to one billion XRP tokens a month, and 15% of the unique node list validators, which makes XRP a bit different from Bitcoin and Ether.
- Binance coin (BNB): BNB, along with the Binance Exchange, (one of the world's largest exchanges), was launched in 2017 and has many use cases on the Binance blockchain.

https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation



Stablecoins

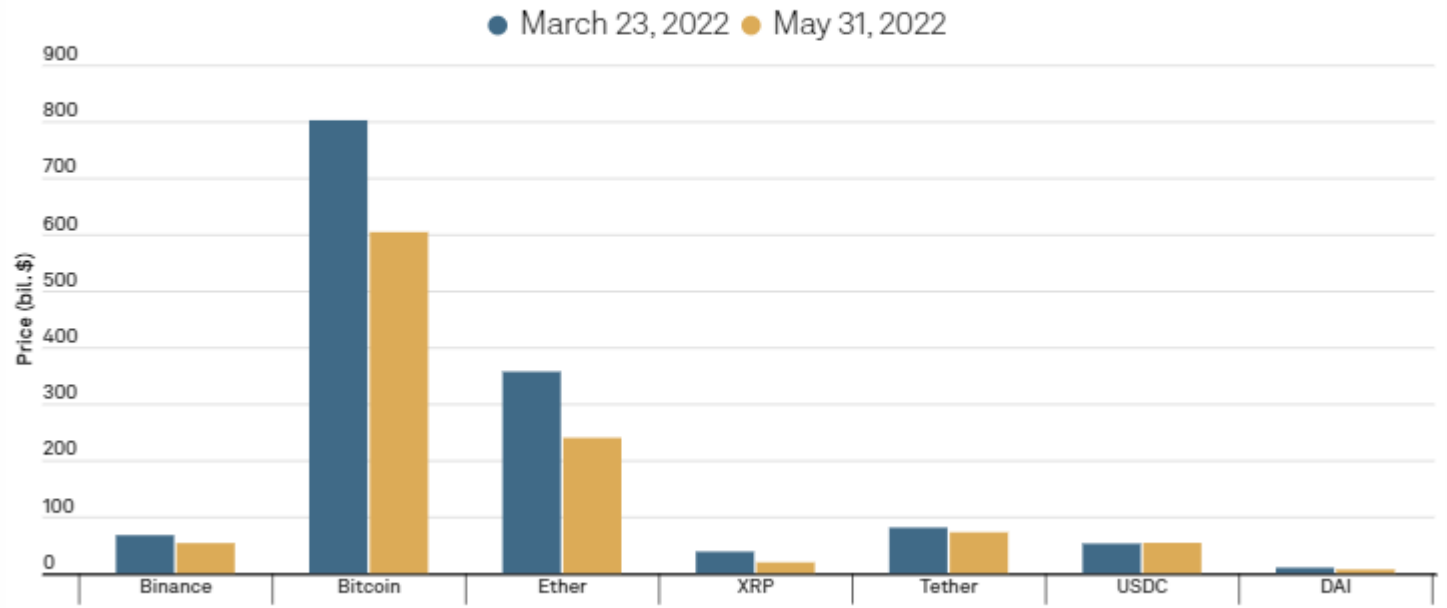
- Tether (USDT): USDT is the largest stablecoin by market capitalization ($67.5 billion) and is pegged to the U.S. dollar.
- USD Coin (USDC): USDC is the second-largest stablecoin ($51.7 billion). Tether and USD Coin are centralized fiat-collateralized stablecoins, meaning that each token is backed by one dollar in reserve assets. They are backed by cash and cash equivalents and financial assets, including certificates of deposits, U.S. Treasuries, commercial paper, and certain bonds.
- Multi-collateral Dai (DAI): DAI is a decentralized cryptocurrency pegged to the U.S. dollar ($6.9 billion in market cap). Unlike USDT and USDC, DAI is backed by crypto collateral and uses an algorithm based on margin trading to govern and maintain its peg. DAI coins aim to protect their peg by being overcollateralized.

https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

Market Cap

Chart 4

Market Cap Snapshots



Sources: S&P Global and CoinCodex.

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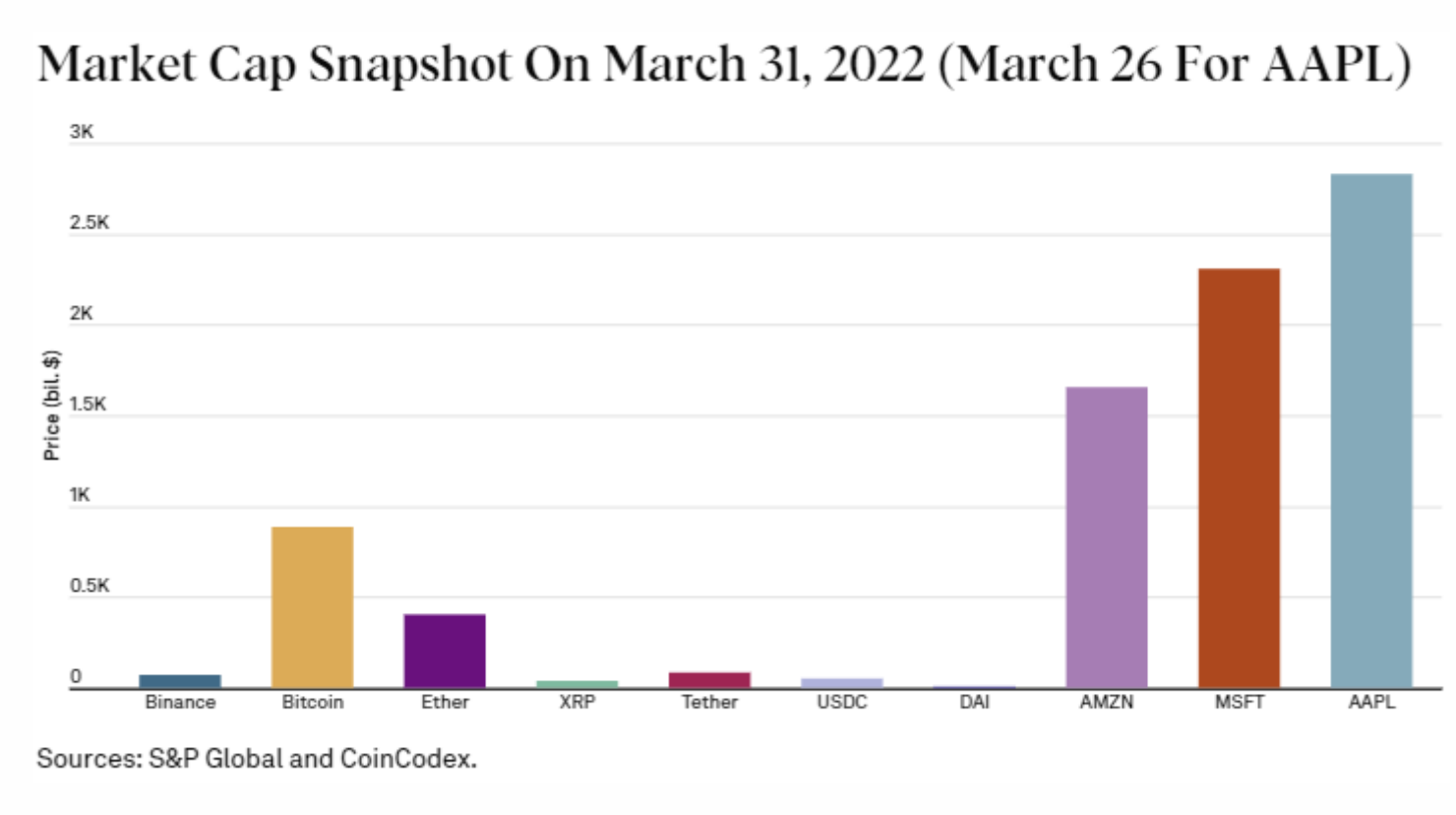
Market Cap



https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

Price Stability

Table 1

Stablecoins Price Summary (U.S. $) Oct. 2018-Aug. 2022

	Tether	USDC	DAI
Min	0.97	0.98	0.95
Max	1.02	1.06	1.06

Sources: S&P Global and CoinCodex.

Table 2

Crypto Assets Price Summary (U.S. $)

	Binance (2017-2022)	Bitcoin (2010-2022)	Ether (2015-2022)	XRP (2013-2022)
Min	0.68	0.05	0.44	0.003
Max	677.17	67,500.02	4,819.16	3.36

Sources: S&P Global and CoinCodex.

https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

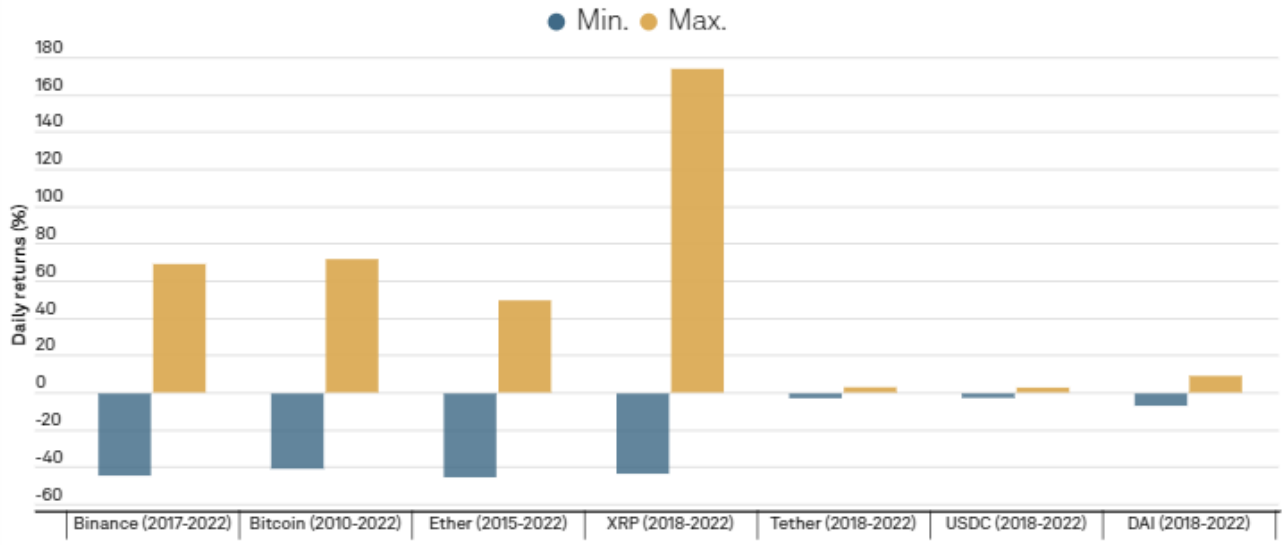
Price Stability

Worst Single-Day Price Decline

Asset	Date	Price change (%)
Binance	March 12, 2020	(44.11)
Bitcoin	March 12, 2020	(40.43)
Ether	March 12, 2020	(45.02)
XRP	April 3, 2017	(43.12)
Tether	April 1, 2021	(2.52)
USDC	December 15, 2018	(2.34)
DAI	April 8, 2019	(6.60)

Sources: S&P Global and CoinCodex.

Crypto Assets Daily Percent Returns Summary

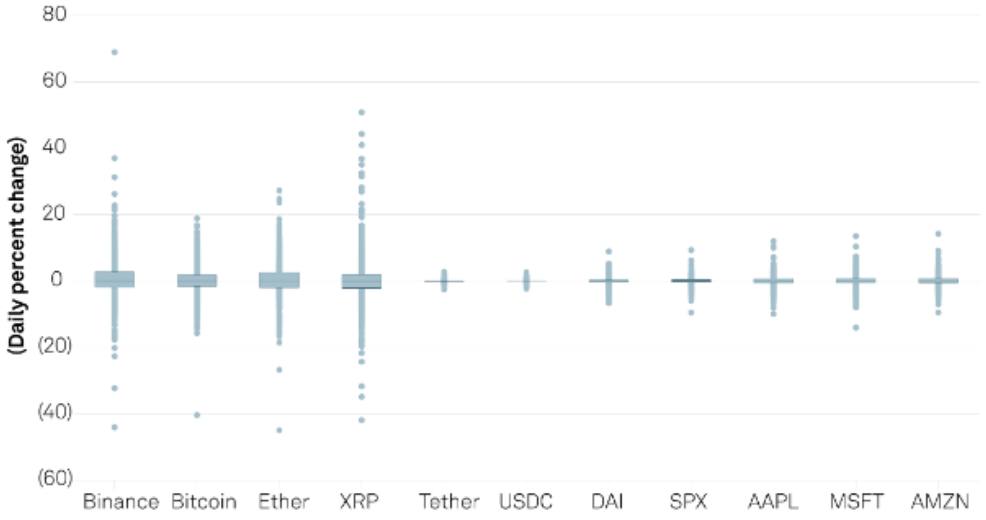


Sources: S&P Global and CoinCodex.

https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

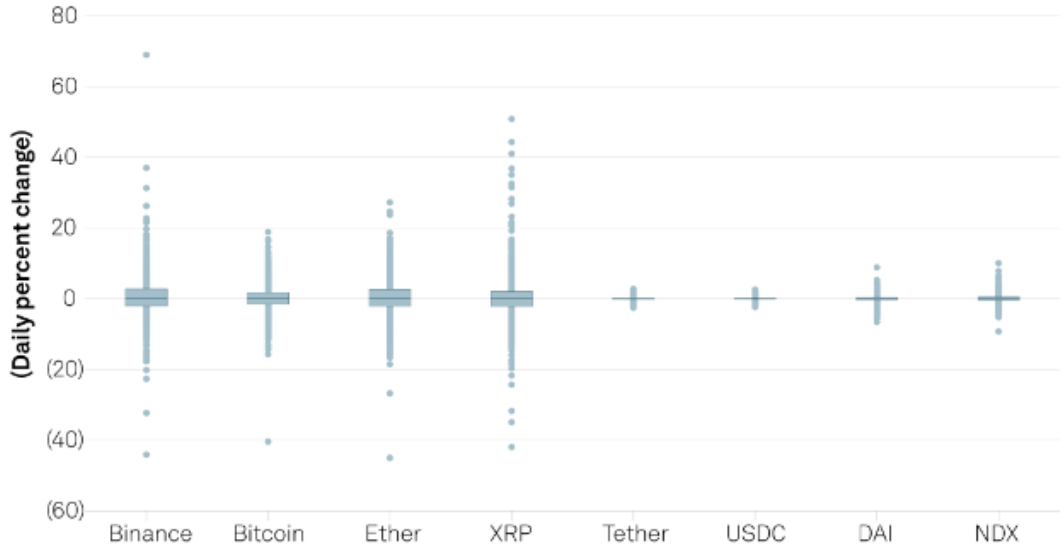
Volatility

Daily Returns For Crypto Assets, SPX And Top Three SPX Holdings (2018-2022)



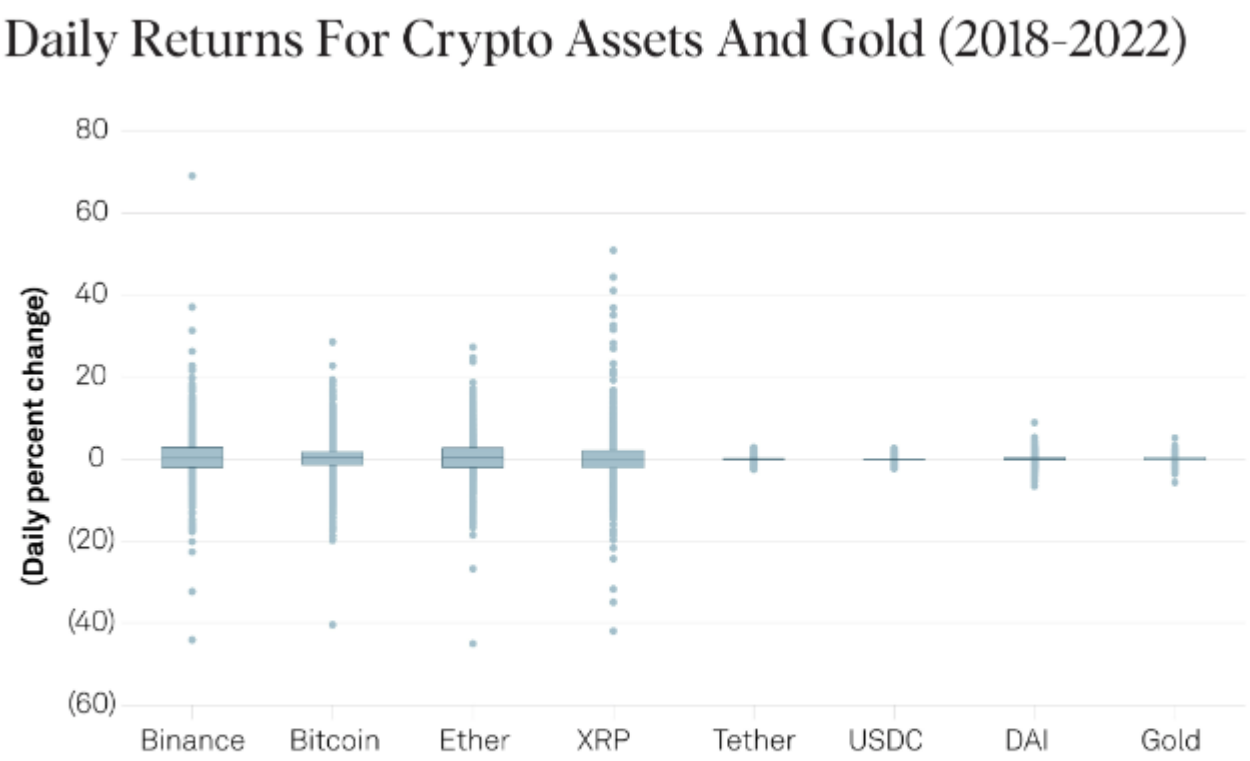
Note: the horizontal lines mark the first, second and third quartile of daily returns.
Sources: S&P Global, and CoinCodex.

Daily Returns For Crypto Assets And NDX (2018-2022)



https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

Volatility



https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

Correlation with Gold

Correlation Of Crypto Assets To Gold

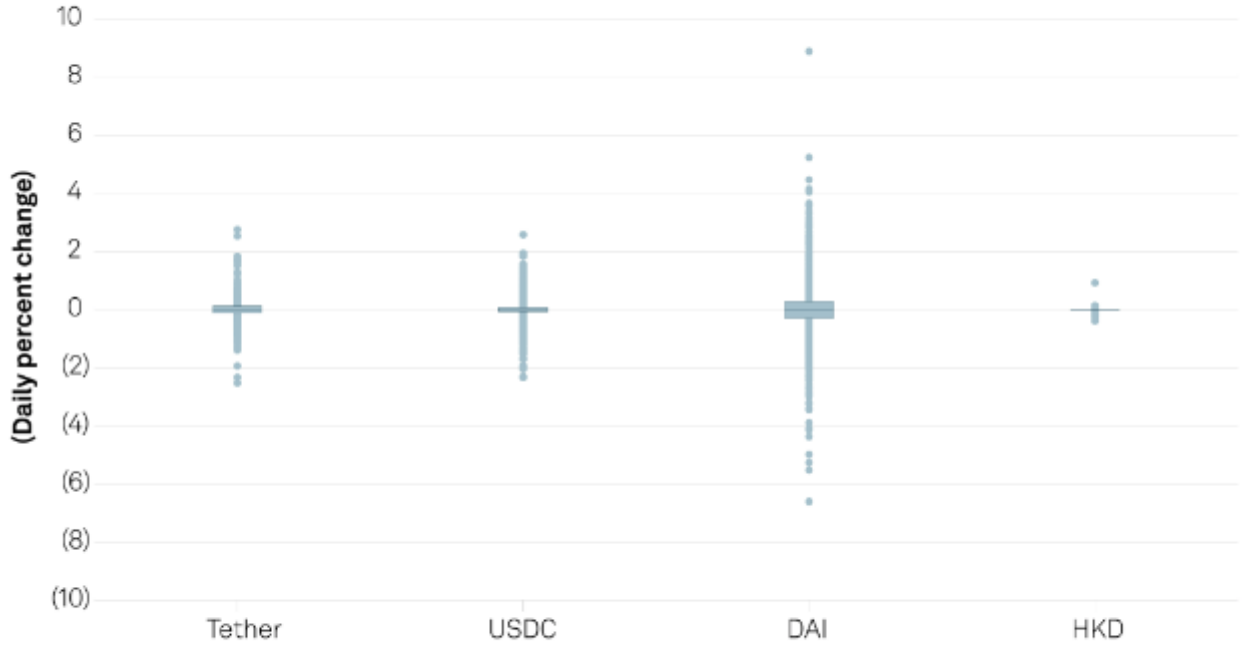
	Gold
Binance	0.09
Bitcoin	0.11
Ether	0.09
XRP	0.04
Tether	(0.01)
USDC	(0.01)
DAI	0.01

Sources: S&P Global and CoinCodex and Bloomberg.

https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

Volatility

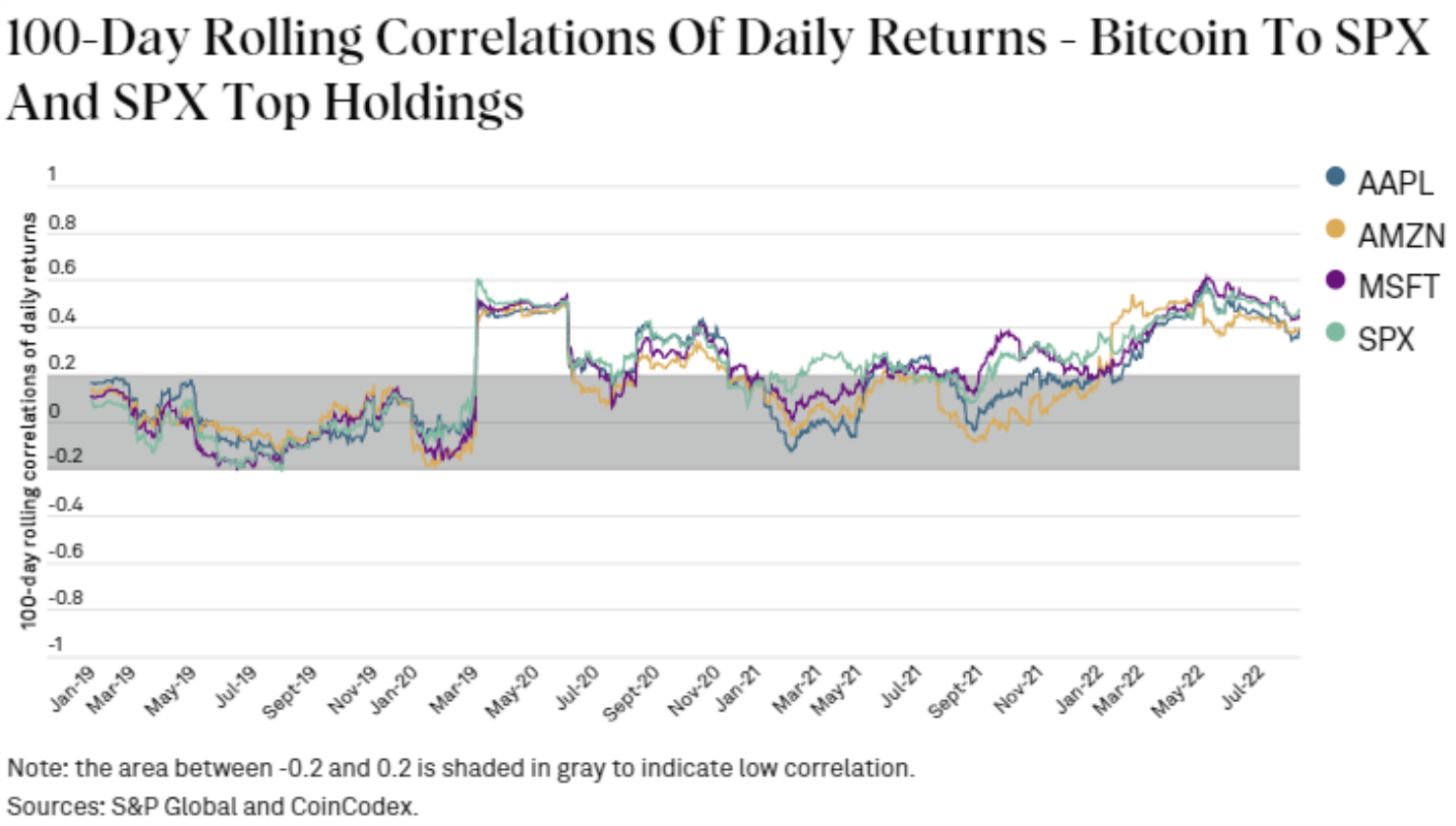
Daily Returns For Stablecoins And Hong Kong Dollar (2018-2022)



Note: the horizontal lines mark the first, second and third quartile of daily returns.
Sources: S&P Global, CoinCodex and Bloomberg.

https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

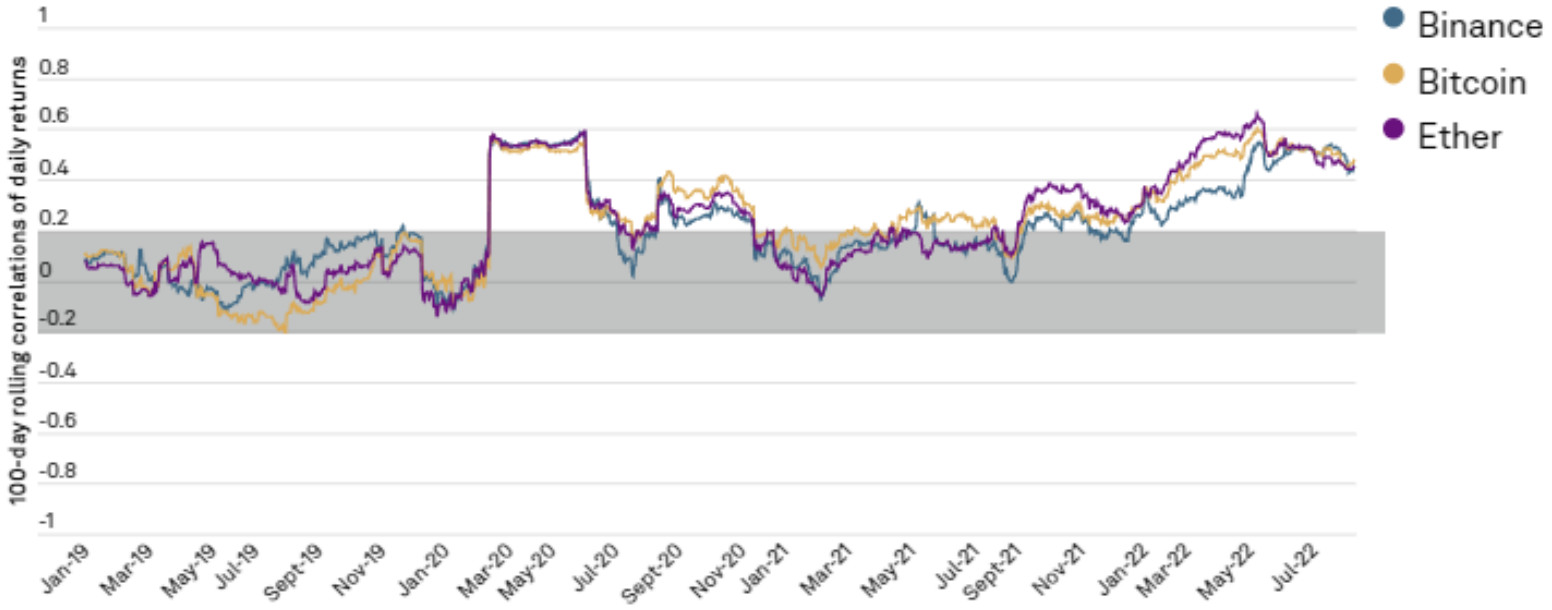
Correlations



https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation

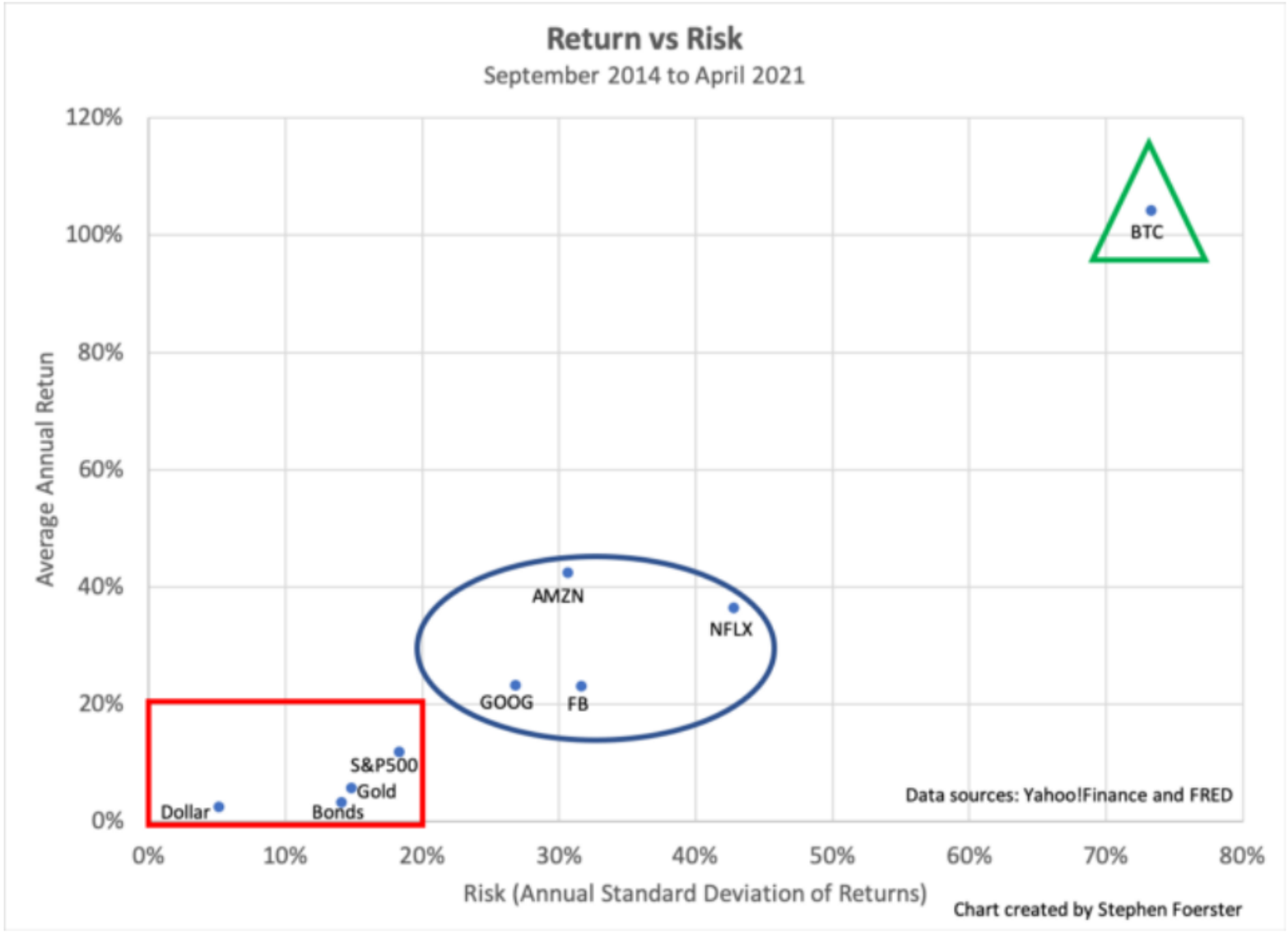
Correlations

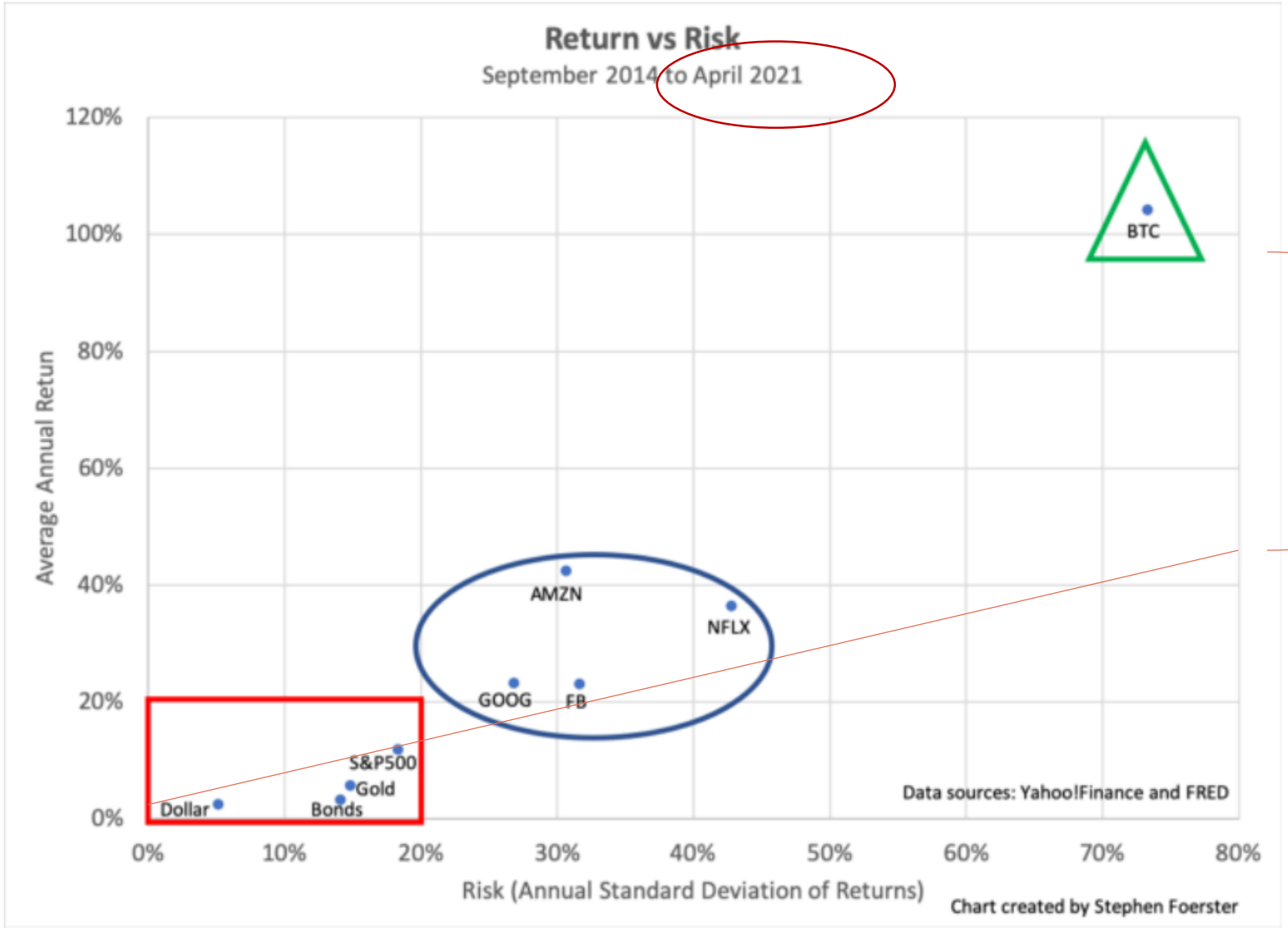
100-Day Rolling Correlations Of Daily Returns - Crypto Assets To NDX



Note: the area between -0.2 and 0.2 is shaded in gray to indicate low correlation.
Sources: S&P Global and CoinCodex.

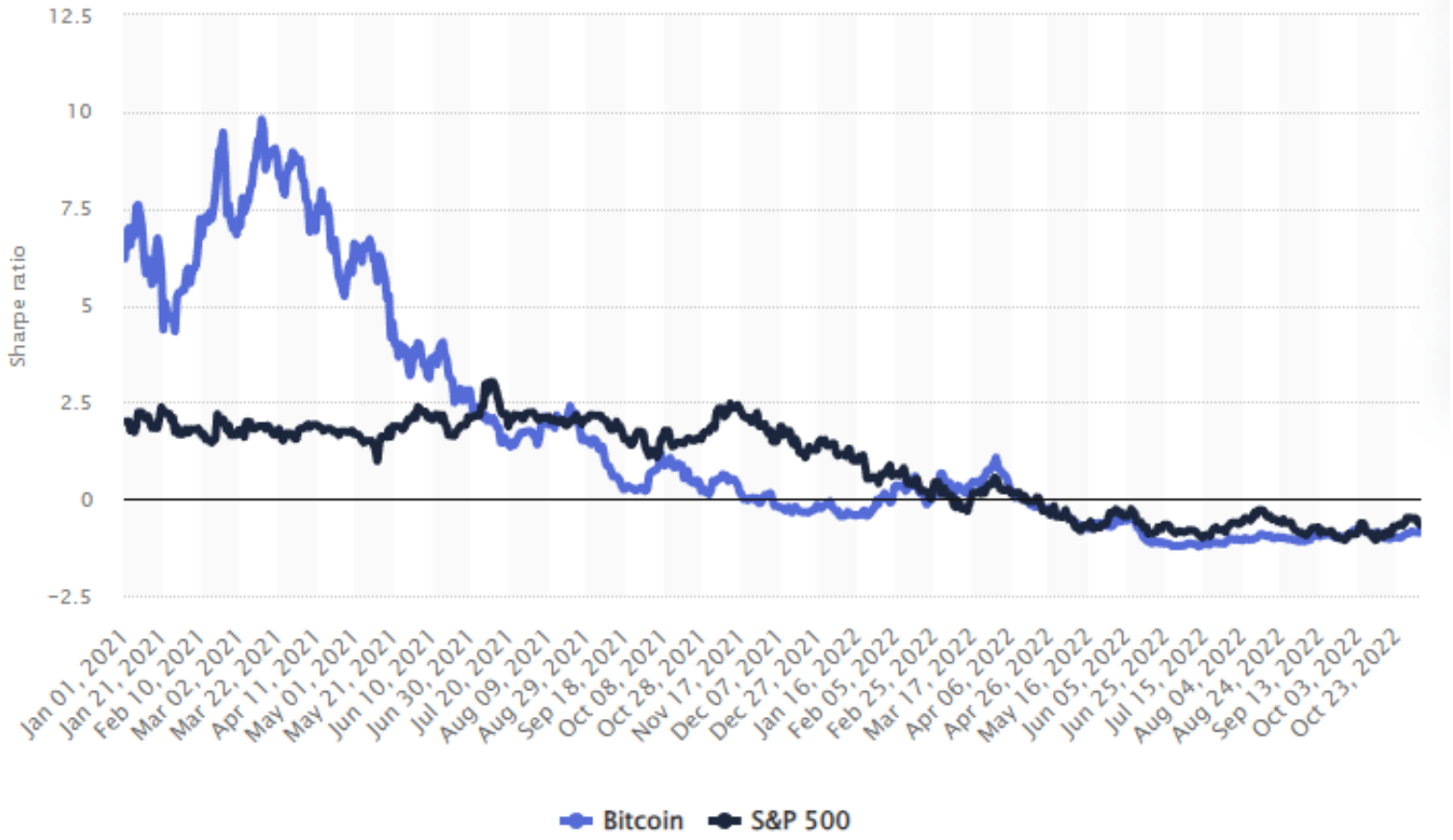
https://www.spglobal.com/en/research-insights/featured/special-editorial/understanding-crypto-valuation


Return vs Risk
September 2014 to April 2021
120%
100%
80%
60%
40%
20%
0%
Average Annual Retun
BTC
AMZN
NFLX
GOOG
FB
S&P500
Gold
Bonds
Dollar
0%
10%
20%
30%
40%
50%
60%
70%
80%
Risk (Annual Standard Deviation of Returns)
Data sources: Yahoo!Finance and FRED
Chart created by Stephen Foerster



Even on a risk-adjusted basis, BTC outperformed

BTC Sharpe Ratio



Sharpe Ratio Formula

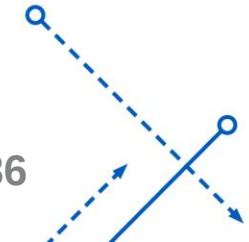
$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

R_p = return of portfolio
R_f = risk-free rate
σ_p = standard deviation of the portfolio's excess return

INSIDER

https://www.statista.com/statistics/1343495/bitcoin-sharpe-ratio/

Concluding Remarks



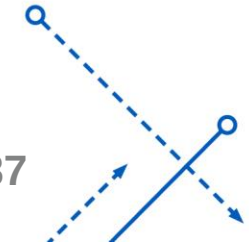
Solutions and Problems

Function → utility → value

Ask a lot of questions about function to figure out utility

But the core is – what problem does this asset solve?

Crypto-assets are often “solutions in search of problems”



Unsustainable Business Models

A business that generates negative free cash flow “forever” is not “hard to value given current techniques”

It’s worthless, or worse

A lot of the “new economy” is built on “selling a dollar for eighty cents”

In Summary

Study contiguously, update frequently

- Everything changes quickly
- High volatility

Do not trust what is out there

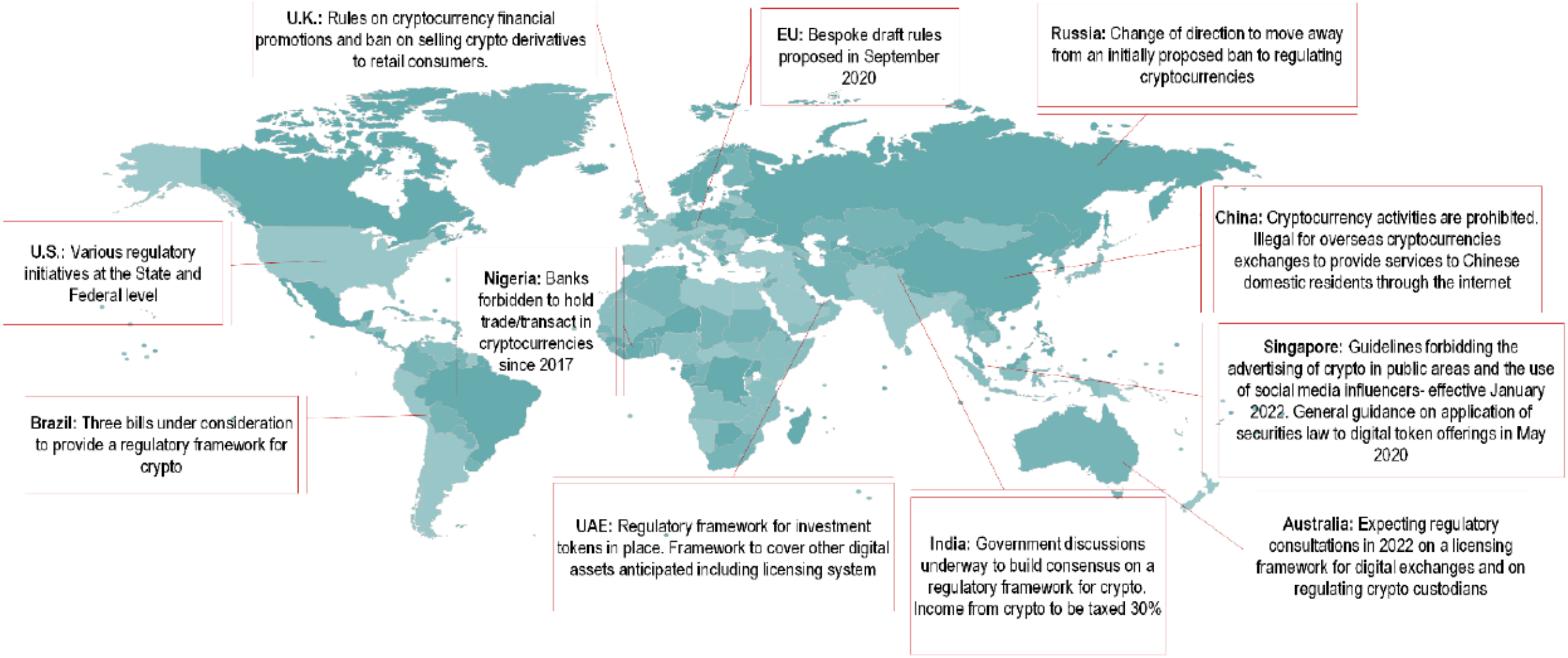
- outdated info
- over-optimistic assessments
- fraudulent reporting

Extensive robustness testing, scenario analysis, Monte Carlo Simulations

Geography matters

- jurisdiction is not always straight-forward
- Utility varies dramatically

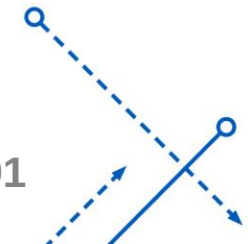
Figure 53. Legal Status of Cryptocurrencies Around the World



Source: Citi Global Insights

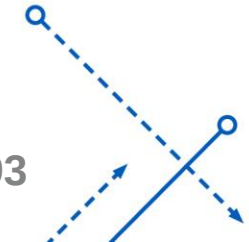
Thank You

Please send comments and questions to veljkofo@buffalo.edu



Additional Slides

Developing Markets



University at Buffalo
School of Management

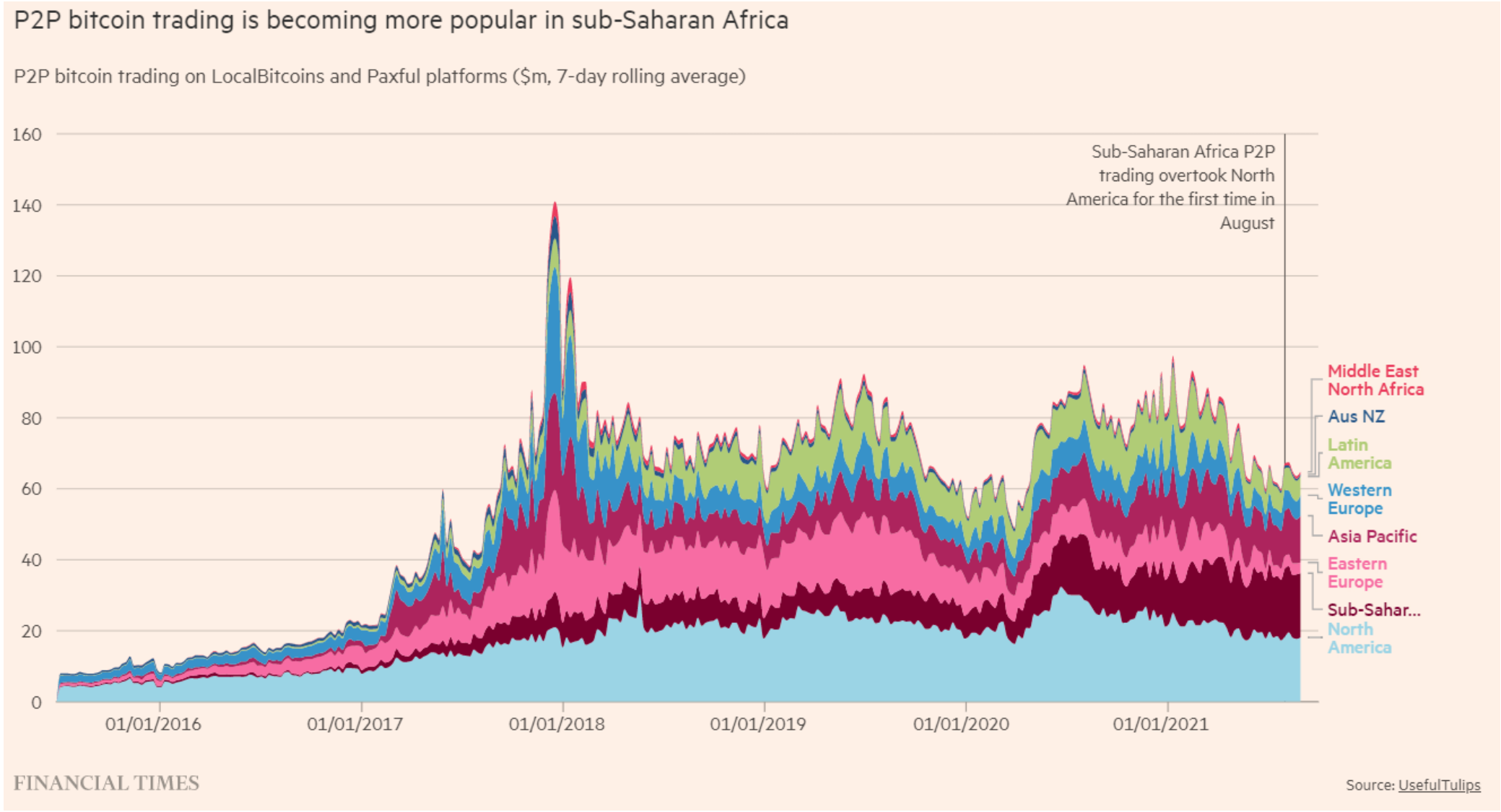
The Big Read Cryptocurrencies + Add to myFT

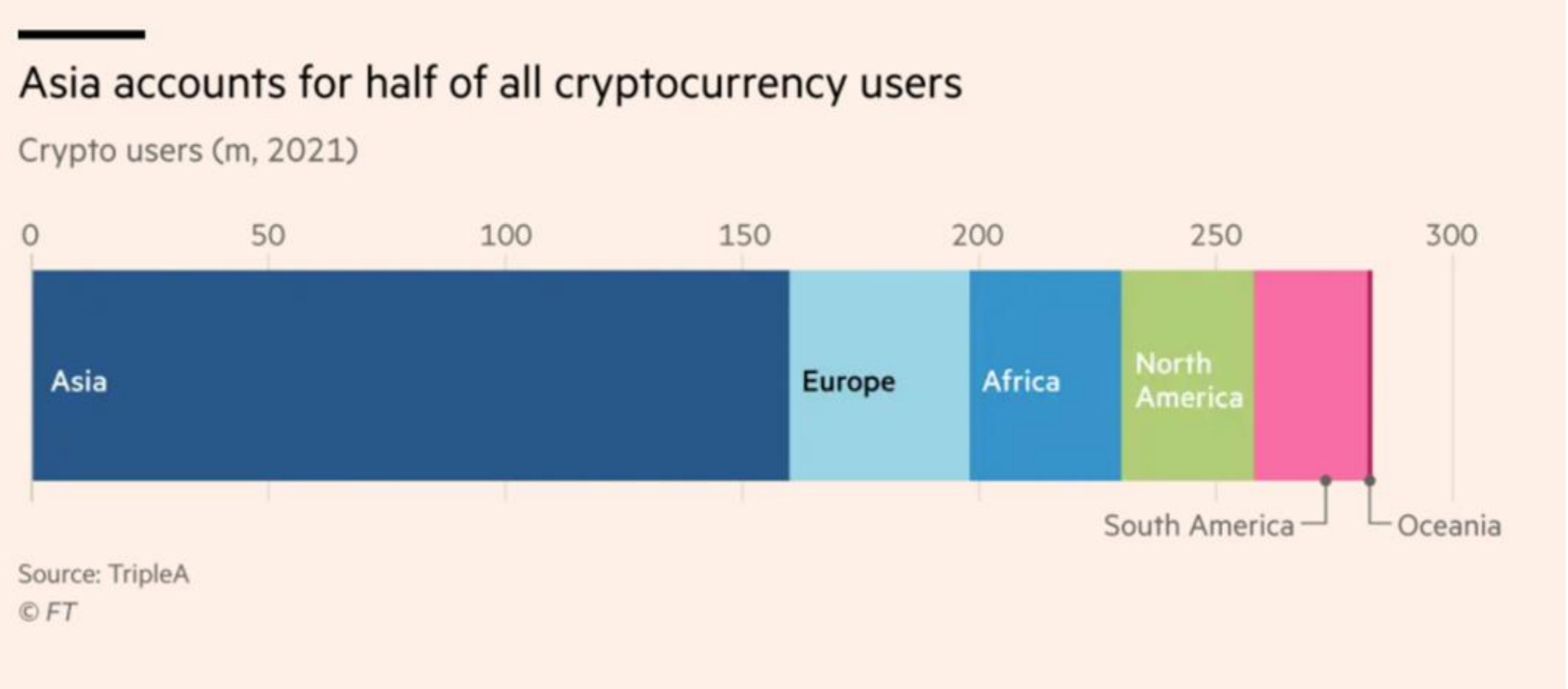
Cryptocurrencies: developing countries provide fertile ground

Sometimes dismissed as a fad in advanced economies, crypto holds more appeal in countries with a history of financial instability

"Emerging markets are fertile ground for cryptocurrencies, often because their own are failing to do their job. **As a store of value, as a means of exchange and as a unit of account, national currencies in some developing countries too often fall short**. Unpredictable inflation and fast-moving exchange rates, clunky and expensive banking systems, financial restrictions and regulatory uncertainty, especially the existence or threat of capital controls, all undermine their appeal."

"According to the World Bank, **the cost of sending $200 to countries in sub-Saharan Africa averaged 9 per cent of the transaction value** in the first quarter of 2020, the highest of any world region, and can go into double digits in some places. **On peer-to-peer crypto networks, however, these fees are typically about 2-5 per cent**, according to LocalBitcoins."


P2P bitcoin trading is becoming more popular in sub-Saharan Africa
P2P bitcoin trading on LocalBitcoins and Paxful platforms ($m, 7-day rolling average)
160
140
120
100
80
60
40
20
0
Sub-Saharan Africa P2P trading overtook North America for the first time in August
Middle East North Africa
Aus NZ
Latin America
Western Europe
Asia Pacific
Eastern Europe
Sub-Sahar...
North America
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
FINANCIAL TIMES
Source: UsefulTulips


Asia accounts for half of all cryptocurrency users
Crypto users (m, 2021)
0
50
100
150
200
250
300
Asia
Europe
Africa
North America
South America
Oceania
Source: TripleA
© FT


Vietnam has the highest level of crypto adoption
Global crypto adoption index score
0
0.2
0.4
0.6
0.8
1.0
Vietnam
India
Pakistan
Ukraine
Kenya
Nigeria
Venezuela
US
Argentina
Colombia
Togo
Thaliand
China
Brazil
Philippines
South Africa
Russia
Ghana
Tanzania
Afghanistan
High income
Upper-middle income
Lower-middle income
Low income
The index measures adoption of cryptocurrency by country across three metrics: total cryptocurrency value received, retail activity and peer-to-peer trading volume, weighted by population of internet users and purchasing power per capita.
Source: Chainanalysis; World Bank
© FT

Regulatory Risk

Control over the supply of money is a powerful political tool

(which is why central banks should stay independent)

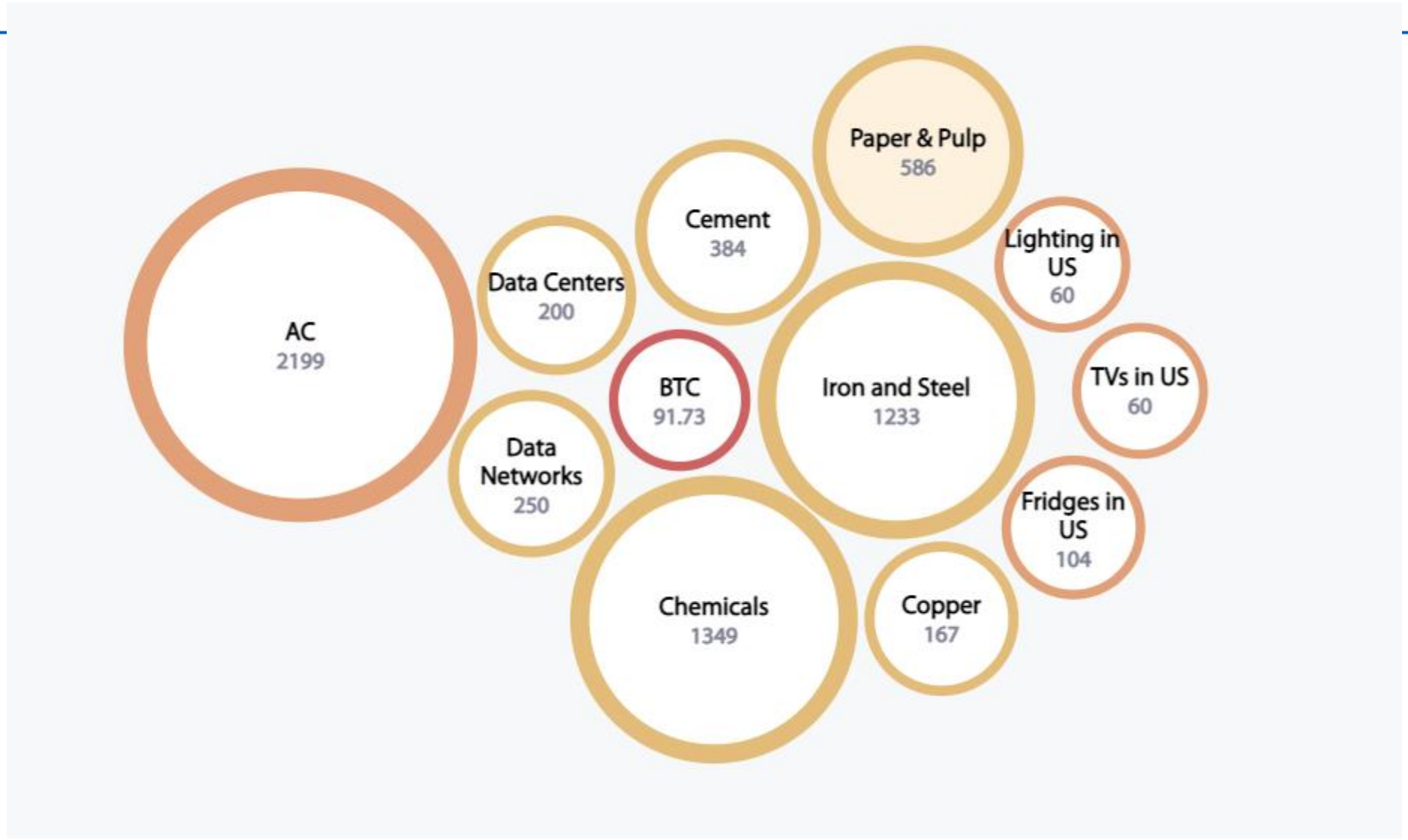
Print money → lower cost of capital→ more positive NPV projects → jobs → electoral victory

Despite the illusion of political independence, politicians do exert control – and they are not keen on giving that up

Europe is already waging a “war on cash”

And China just lunched a “digital renminbi”

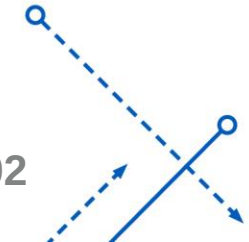
Energy Use



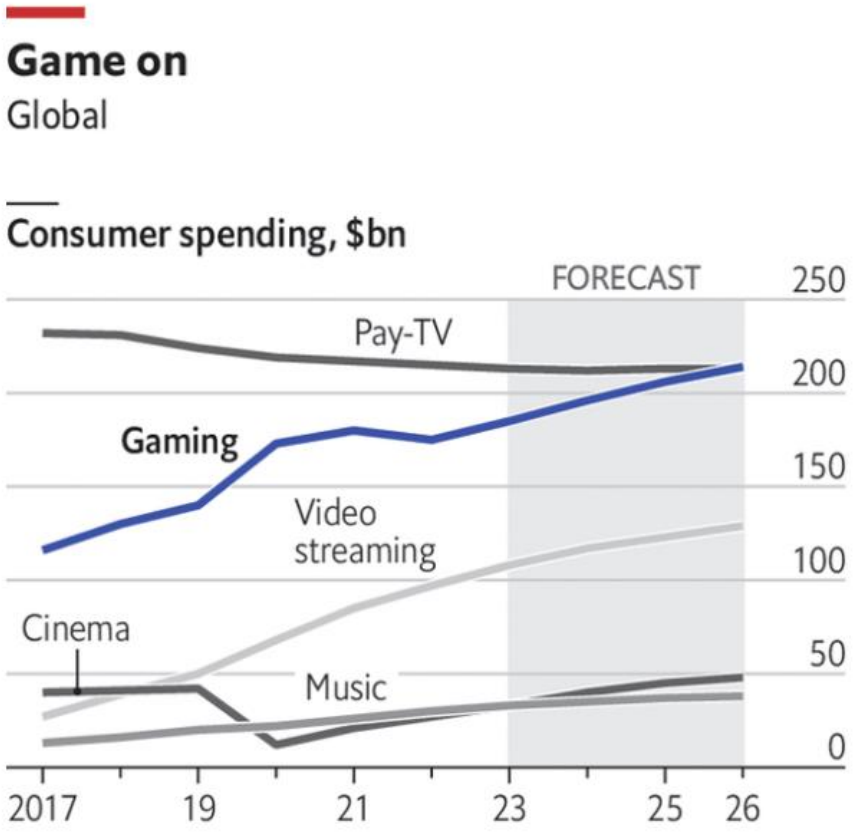
https://cbeci.org/cbeci/comparisons?utm_source=morning_brew

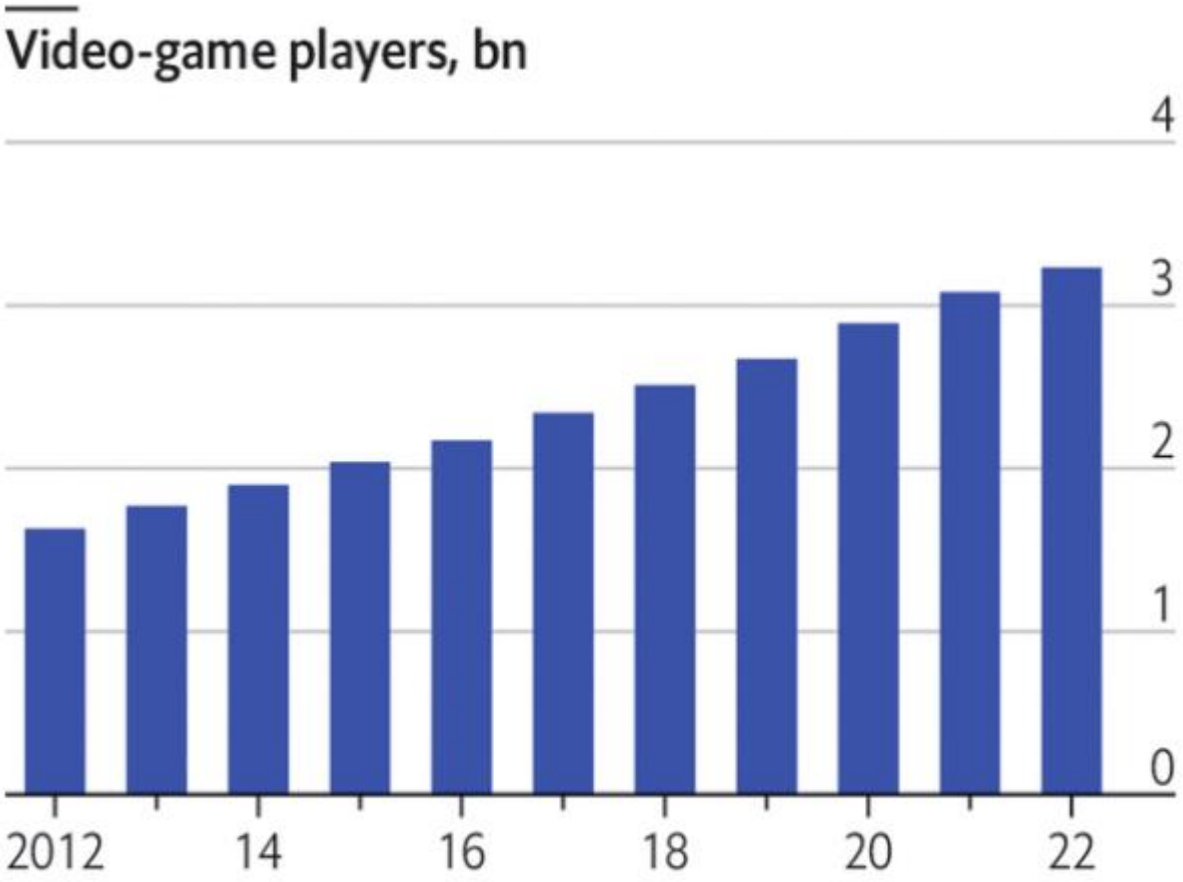

Country Ranking
Country comparisons are, for better or for worse, the most common type of comparison. They are frequently used in the public debate to support positions of concern about the scale of Bitcoin's electricity consumption.
Finland
84.2
TWh per year
Kazakhstan
91.7
TWh per year
Bitcoin
91.7
TWh per year
Philippines
93.4
TWh per year
Netherlands
110.7
TWh per year
Source
U.S. Energy Information Administration, Country Data, 2019 est. (or most recent available year)

More…



Gaming


Game on
Global
Consumer spending, $bn
FORECAST
250
200
150
100
50
0
Pay-TV
Gaming
Video streaming
Cinema
Music
2017
19
21
23
25
26


Video-game players, bn
4
3
2
1
0
2012
14
16
18
20
22
Sources: Omdia; Newzoo
The Economist