



EYE ON THE MARKET

The Maltese Falcoin

On cryptocurrencies and blockchains

In this piece, we examine the adoption trends, capital flows and use cases for cryptocurrencies and blockchains. Use cases include crypto as a store of value, cross border remittances, decentralized finance, non-fungible tokens and blockchain adoption in financial services.

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The Maltese Falcoin: on cryptocurrencies and blockchains

First let me try and anticipate some of your questions.

- **Yes, I am turning 60 this May.** This obviously renders me too old to comment on this topic
- **Yes, I understand creative destruction.** Hundreds of companies have been removed from the S&P 500 since 1980 due to distress, mostly inflicted by more innovative competitors. We maintain a lot of creative destruction trackers; see Appendix B
- **Yes, I follow the changes taking place that break down barriers.** We track the plummeting cost of information storage, improvements in CPU processing speeds, increases in 5G download speeds and gains in artificial intelligence and machine learning. These factors have lowered barriers of entry for new companies to challenge incumbents in a variety of sectors, particularly financial services. See Appendix C
- **Yes, I showed this piece to crypto and blockchain professionals.** Their rebuttals appear in Section 8
- **Yes, I know this is 28 pages** but it's a quick read since there are a lot of charts
- **No, I did not anticipate the increase in crypto values from \$25 billion to \$250 billion to \$2.5 trillion (and now \$1.5 trillion),** and I recognize that I am late to this
- **No, I am not going to extensively cover the technical jargon involved.** If you would like to read up on mempools, cryptographic hash puzzles and Merkle roots, there are two advanced primers in Appendix A
- **No, I am not going to address issues other than the investment rationale for crypto and blockchain use cases.** Others have written on mining energy intensity, on whether crypto is "good or "bad" for society, on illicit crypto transactions and on crypto's impact on Central Banks trying to retain control over broad money, inflation and employment. Such topics are beyond the scope of this piece
- **No, I don't speak for anyone at JP Morgan other than myself.** If you disagree with the opinions and data expressed here, don't hold anyone else accountable for them

OK, let's begin.

Cryptocurrency market cap

US\$, trillions



Source: TradingView, JPMAM. February 2, 2022.

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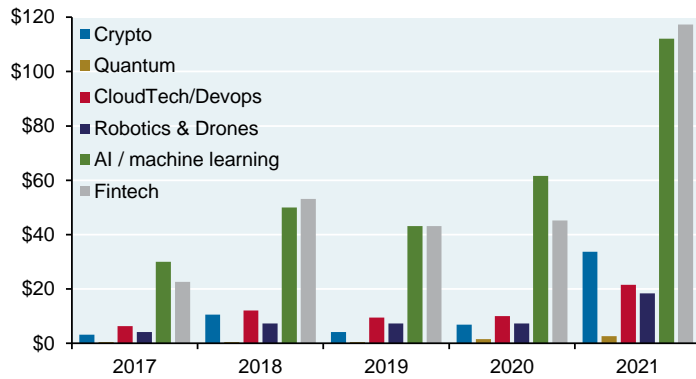
[1] One thing’s for sure: there’s a ton of money pouring into crypto and blockchain investments

If you believe that mobilization of capital is a can’t-miss way of assessing the future, you can stop reading here and conclude that crypto-related investments are bound to succeed. As shown below, venture capitalists have been plowing money into crypto at an accelerating pace, rivaling other innovation categories. The year 2021 was a particularly strong year for capital raising; average pre-IPO valuations for crypto and blockchain investments are now much higher than for VC investments overall. I’m often told that some of the most successful, brilliant minds in Silicon Valley are working on crypto and blockchain solutions, and many of them have impressive track records of delivering returns to institutional and individual investors. Even so, I’m more interested in what *happens* to the capital and its long-run returns than on its mobilization.

A breakdown of VC investments in crypto shows ~40% in trading, investing and lending businesses; ~20% in Web 3.0 applications and NFTs; ~10% in custody; and the remainder in a variety of businesses focused on compliance, mining and data security.

Venture capital investments by sector

US\$, billions

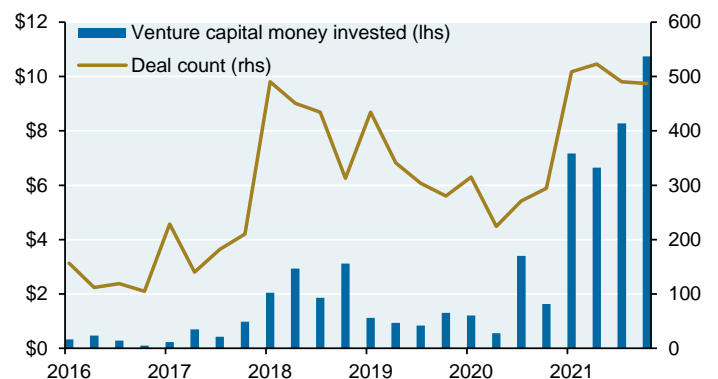


Source: Pitchbook, Galaxy Digital Research. January 2022.

Venture capital investments in crypto and blockchain

US\$, billions

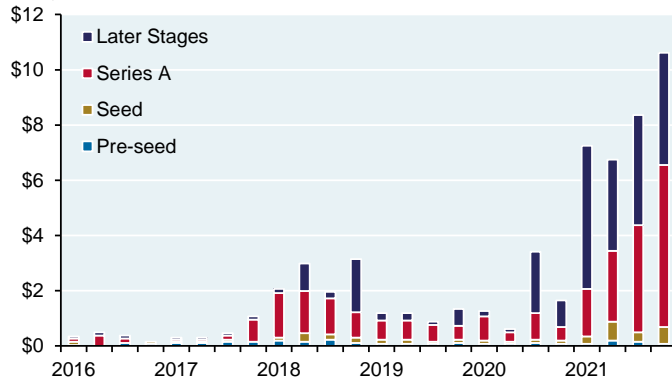
Number of deals



Source: Pitchbook, Galaxy Digital Research. January 2022.

VC money invested in crypto & blockchain by stage

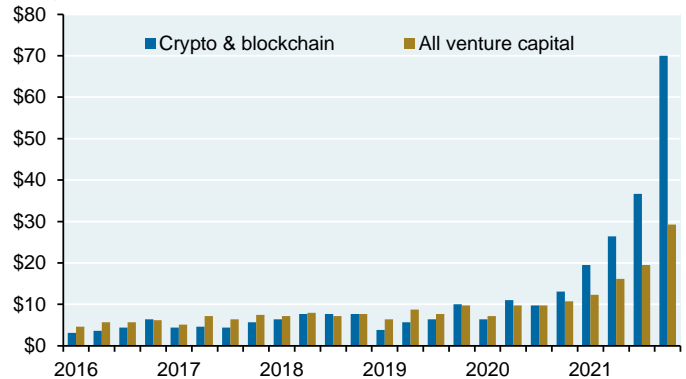
US\$, billions



Source: Pitchbook, Galaxy Digital Research. January 2022.

Crypto/blockchain vs all VC pre-money valuation

US\$, millions



Source: Pitchbook, Galaxy Digital Research. January 2022.



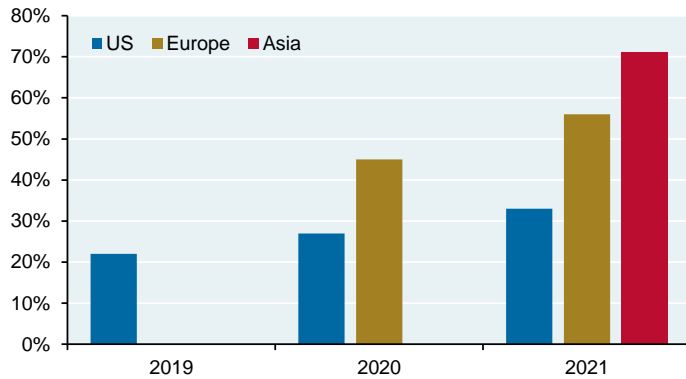
[2] Crypto adoption trends and attitudes

As shown below, crypto adoption is rising across investor types and regions. While institutional ownership has been low to-date, it is now growing. Bridgewater estimated that ~1 million Bitcoin (around 5% of total issued supply) are now held by institutional investors via custodial intermediaries¹. The last chart shows purchase intent in the future, which continues to rise. Note: missing bars are not zero, they represent data that was not published as part of the Fidelity study.

Some crypto adoption anecdotes: Square and Tesla combined invested nearly \$2 billion USD in Bitcoin, and Square and PayPal retail customers reportedly buy an amount equivalent to a majority of the new supply of Bitcoin entering the market each day².

Crypto adoption by region

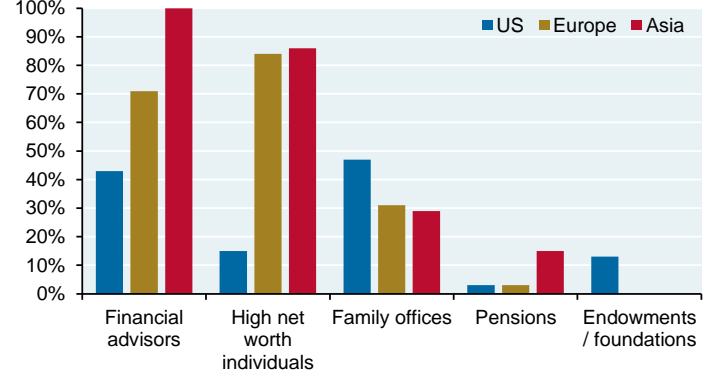
% of investors with digital asset allocations



Source: Fidelity Institutional Digital Assets Survey. September 2021.

Crypto adoption by investor type

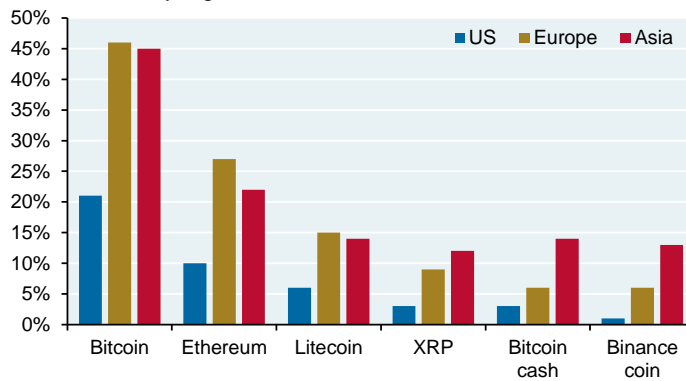
% of investors that own digital assets



Source: Fidelity Institutional Digital Assets Survey. September 2021.

Crypto ownership by digital asset

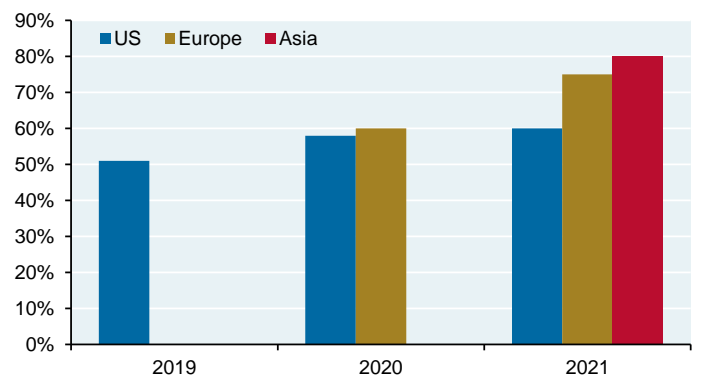
% of investors by region



Source: Fidelity Institutional Digital Assets Survey. September 2021.

Future purchase intent of digital assets

% of investors



Source: Fidelity Institutional Digital Assets Survey. September 2021.

¹ "Evolution of Institutional Investors' Exposure to Cryptocurrencies and Blockchain Technologies", Bridgewater Daily Observations, January 14, 2022

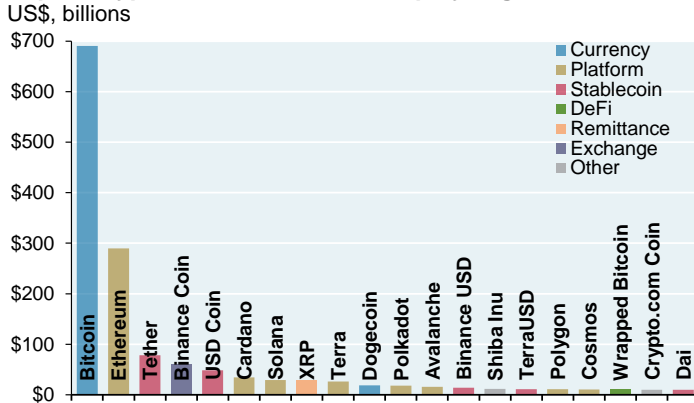
² "Feeling the heat from employees, Wall Street banks get closer to adopting bitcoin", CNBC, Feb 12, 2021 and "Square and PayPal may be the new whales in the crypto market as clients flock to bitcoin", CNBC, Nov 24, 2020



[3] Bitcoin and the “store of value” thesis

Let’s start with the most widely cited use case for digital currency: as a store of value, and let’s use Bitcoin as a proxy for it given its dominant market cap among all cryptocurrencies.

Top 20 cryptocurrencies market cap by segment

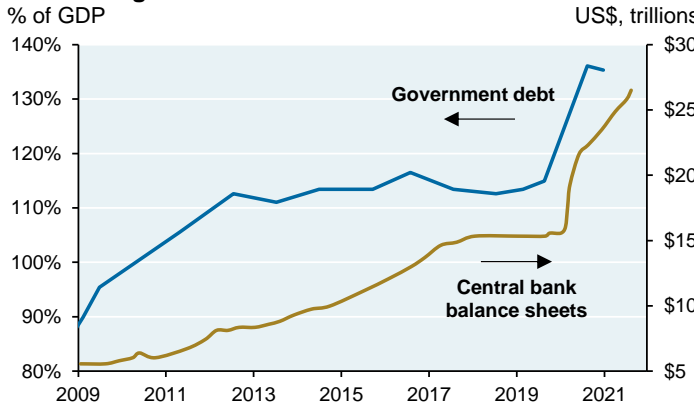


Currency: digital medium of exchange or store of value
Platform: blockchain ecosystem for DeFi applications
Stablecoin: cryptocurrency with fixed value
DeFi: allows peer to peer lending and exchanges without a centralized institution
Remittance: cryptoassets for cross border transfers
Exchange: cryptoassets facilitating cheaper transactions

Source: CoinMarketCap, CoinMetrics, JPMAM. January 25, 2022.

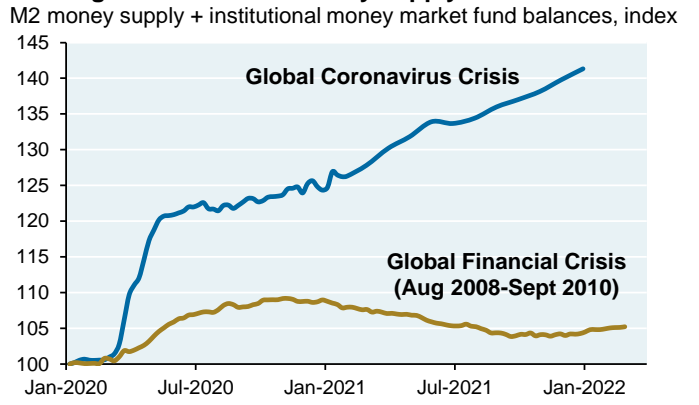
I understand why people are interested in cryptocurrencies with a fixed supply as a store of value. The developed world has drowned itself in debt and fiat money, and at a pace that dwarfs anything seen in the wake of the financial crisis in 2008. These are the kind of economic degradations that accompanied the end of prior world reserve currencies during the last millennia, and which accompanied the end of reserve currency status during ancient times as well. Central Banks and Treasuries have created a massive confidence void, and it would have been strange if some alternative to fiat money *didn't* appear on the scene.

Dev world government debt & central bank balance sheets



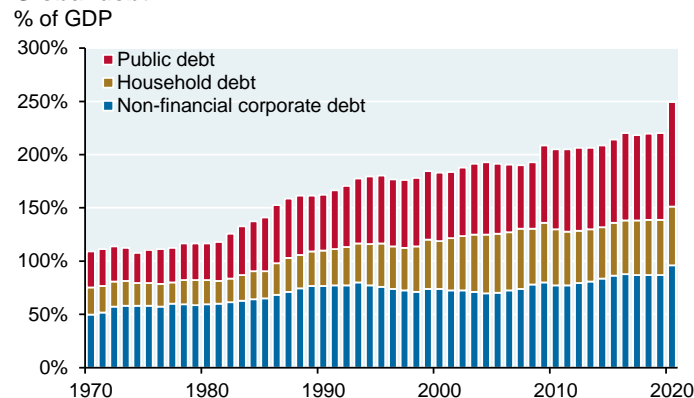
Source: JP Morgan Economic Research. November 2021.

Faster growth in the US money supply this time around



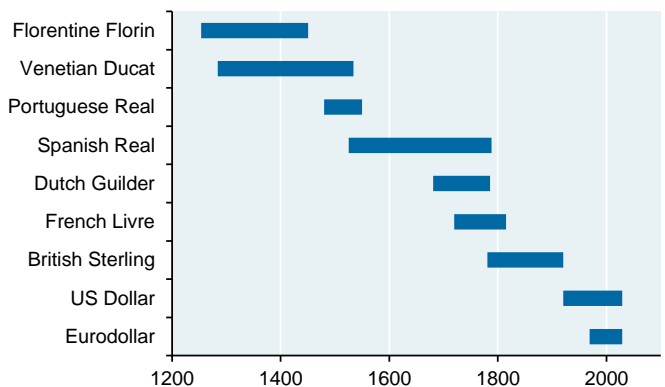
Source: St Louis Fed, ICI, J.P. Morgan Asset Management. Dec 2021.

Global debt



Source: IMF. 2020.

Major reserve currencies since 1250 AD



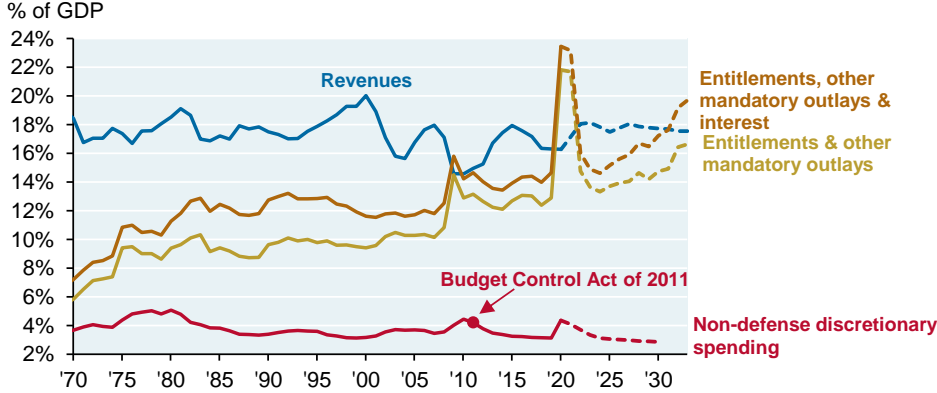
Source: BTCM Research. 2020.



A fiat currency reckoning may be drawing closer: by the year 2030, US Federal tax revenues will be exceeded by mandatory outlays on entitlements and interest. In other words, there will be no money left for non-defense discretionary spending which drives growth and productivity over the long run, other than through deficit spending. Irrespective of your opinion on Bitcoin, this is a bad sign and may create hard-to-anticipate upheavals in the economy and financial assets when its consequences are clearer.

As for the universe of potential Bitcoin buyers, think about it this way; what countries have *not* defaulted on their debts at some point, imposed exchange controls or confiscated assets? The non-defaulter list is a short one³: just the countries in the table, and many have very high levels of Federal debt.

Crossover point is coming in the next decade



Source: CBO, Budget and Econ Outlook, JPMAM. July 2021.

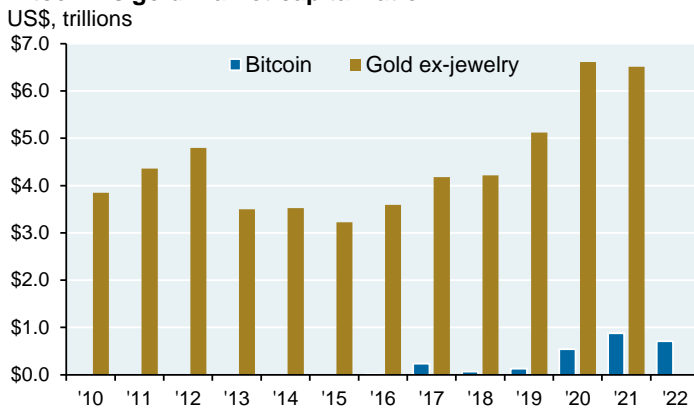
Country	National debt to GDP
Singapore	150%
United States	128%
Canada	114%
Belgium	113%
Finland	83%
Netherlands	76%
Australia	66%
Malaysia	62%
Norway	61%
South Korea	49%
Denmark	48%
Hong Kong	46%
Thailand	45%
New Zealand	43%
Taiwan	37%

Source: Central government sources. 2020.

So, what about Bitcoin as a store of value complement to gold?

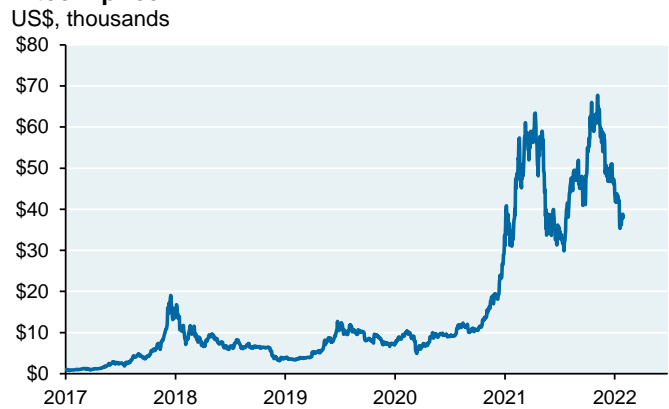
Some are skeptical about the ability of digital currencies to emerge as a viable store of value in just a few years since it took thousands of years for gold to do so, and only after gold had been used for its intrinsic value for centuries before that. **I don't agree; such logic is too rooted in the past and does not account for rapid behavioral changes common in the post-war era.** I accept the notion that a digital store of value could exist; the proof statements I need are the following: (a) more and more people use it as such; (b) its volatility settles into a range consistent with store of value investing; and (c) it goes up or remains stable when systemic risks and/or inflation are rising. On (a), Bitcoin is beginning to capture a larger subset of store-of-value investments when compared to the value of gold; that's consistent with the crypto adoption trends cited on page 3.

Bitcoin vs gold market capitalization



Source: TradingView, World Gold Council. February 2, 2022.

Bitcoin price



Source: Bloomberg, JPMAM. February 2, 2022.

³ "This time is different: eight centuries of financial folly", Carmen Reinhart and Ken Rogoff, 2009

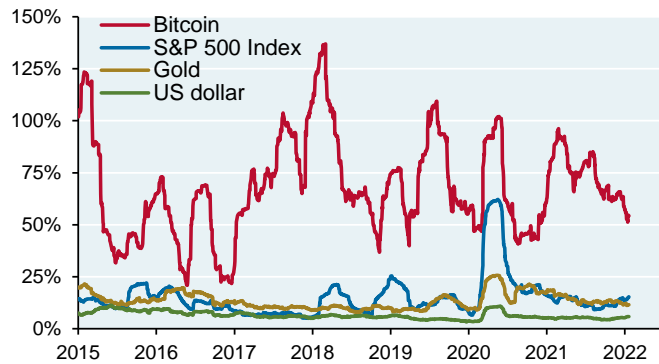


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The problem is that (b) and (c) do not support the Bitcoin “store of value” thesis, as illustrated below. Bitcoin’s volatility continues to be ridiculously high, and its volatility often rises when equity market volatility is rising too. Just as importantly, I don’t have a valuation model to apply to Bitcoin or other cryptocurrencies and I’m unconvinced by ones I have seen so far. Metcalfe’s Law, for example, states that the value of a network increases with the square of the number of users or nodes. This has proven to be a useful tool in assessing valuation differences across crypto-currencies at a point in time, but less useful in assessing or predicting absolute price levels (i.e., is Bitcoin cheap or expensive at \$50k)? For investors other than crypto hedge funds, crypto price levels are usually more important than relative crypto prices. Goldman Sachs has done interesting work on Metcalfe’s law and relative crypto valuations, shown below in the fourth chart⁴.

Bitcoin volatility vs S&P 500, gold and US dollar

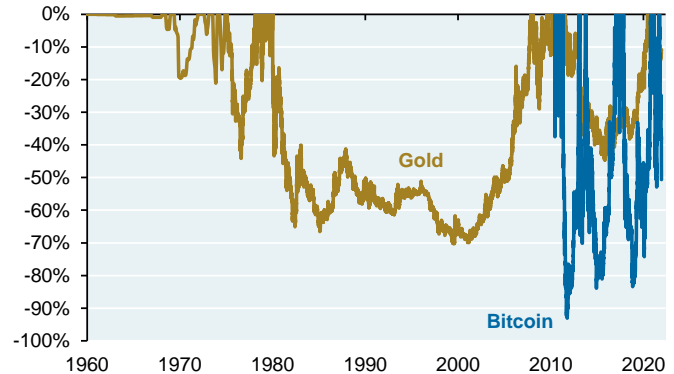
Rolling 3-month daily volatility, annualized



Source: Bloomberg, JPMAM. January 25, 2022.

Gold vs Bitcoin drawdowns

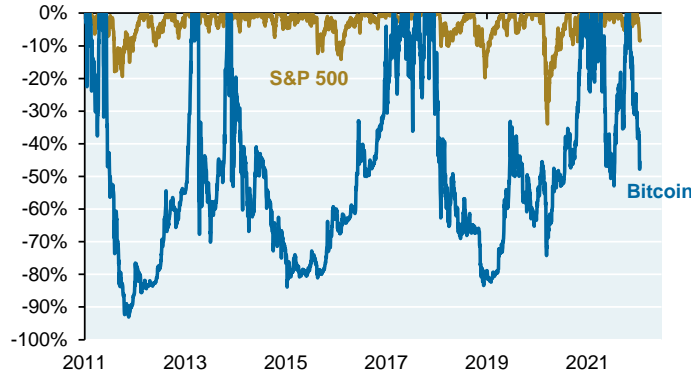
%, decline from prior peak



Source: Bloomberg, JPMAM. January 24, 2022.

S&P 500 vs Bitcoin drawdowns

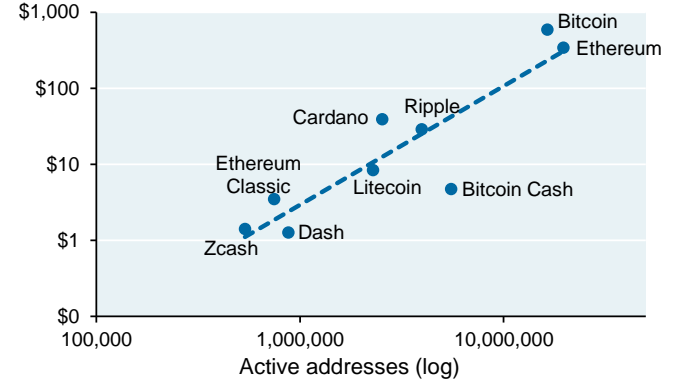
%, decline from prior peak



Source: Bloomberg, JPMAM. January 25, 2022.

Metcalfe's Law: Valuation vs network size

US\$, billions, crypto market cap (log)



Source: GS. July 2021. Excludes addresses w/ small balances as % of supply.

A prior version of this report indicated a very high level of bitcoin ownership concentration. The updated data below from Glassnode show a less concentrated distribution:

Bitcoin ownership concentration

Miners	Exchanges	>5k BTC	1k-5k BTC	500-1k BTC
10%	13%	13%	18%	7%
100-500 BTC	50-100 BTC	10-50 BTC	1-10 BTC	<1 BTC
12%	5%	9%	9%	5%

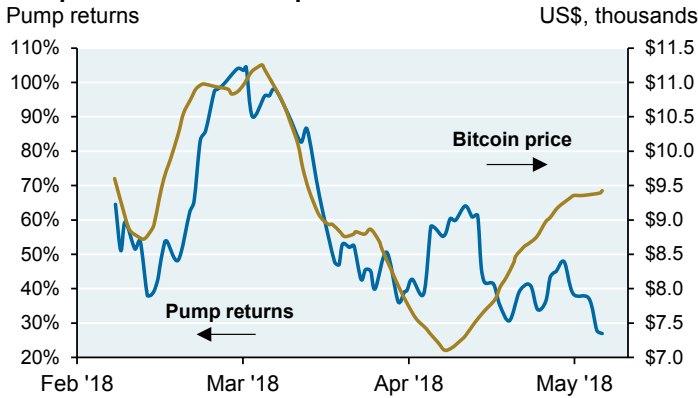
Source: Glassnode. February 2021.

⁴ “Cryptocurrency Valuation and Network Size”, Zach Pandl and Isabella Rosenberg, Goldman Sachs Economics Research, July 19, 2021



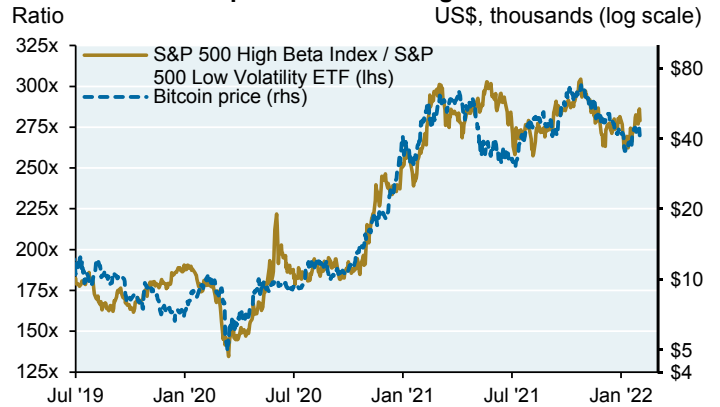
Better than Metcalfe’s Law: Bitcoin prices closely track the performance of higher Beta stocks relative to lower volatility stocks. This does not look like a very good store of value argument to me.

Pump returns vs bitcoin price



Source: Dhawan and Putnins (UTS). November 2021.

Bitcoin vs relative performance of high Beta stocks



Source: Bloomberg, Cornerstone Macro, JPMAM. February 17, 2022.

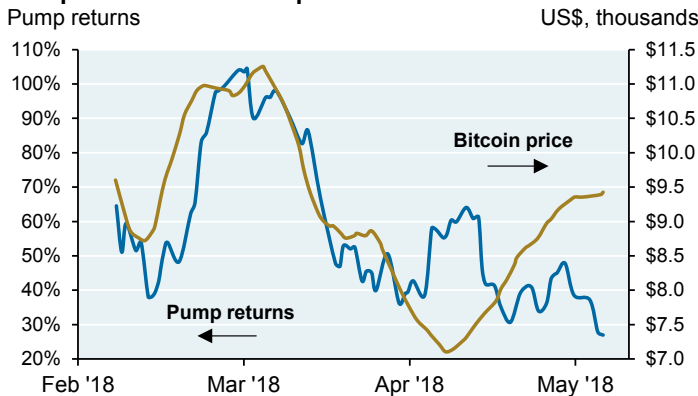
Another partial driver of crypto volatility: the existence of “pump and dump” schemes, as identified in a 2021 paper from the University of Technology in Sydney and the Stockholm School of Economics⁵.

Main findings appear below. Such schemes and other activities that would be prohibited in regular securities markets are by definition not illegal on decentralized blockchains.

- The authors identified 355 cases of pump and dump schemes within a six month period in 2018, generating trading volumes that were 10x-15x higher than normal
- The pump and dump schemes generated an average peak return of 65% (i.e., returns to the first seller after the distorted buying is completed)
- These schemes involved 23 million people across 2 exchanges and 197 different cryptocurrencies
- The frequency of pump and dump schemes in crypto dwarf the occurrence of such events in equity markets; a prior study found just 142 events across 11 years in equities

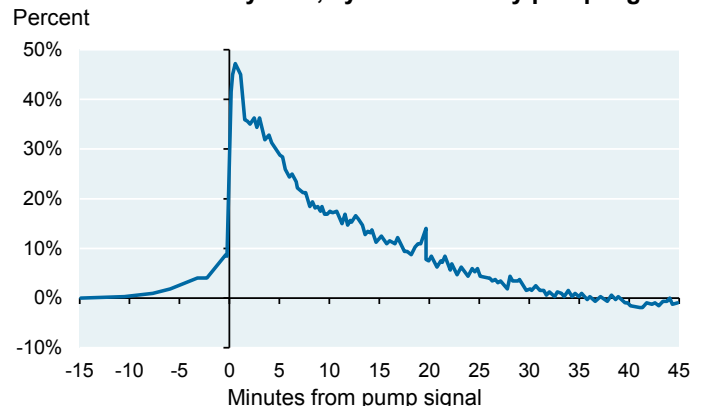
The charts below illustrate the connection between pump and dump schemes and Bitcoin’s price at the time, and the average cumulative return experienced during a typical scheme over a 45 minute period.

Pump returns vs bitcoin price



Source: Dhawan and Putnins (UTS). November 2021.

Cumulative return by time, synchronized by pump signal



Source: Dhawan and Putnins (UTS). November 2021.

⁵ “A new wolf in town? Pump-and-dump manipulation in cryptocurrency markets”, Anirudh Dhawan (Sydney) and Talis Putnins (Stockholm), November 2021

**In addition to pump and dump schemes, there are other issues that can also affect crypto price volatility⁶:**

Miners attacking exchanges. Smaller blockchains can be attacked by their own miners in what is known as reorganization attacks or “51 percent attacks” and if they are not paid, they can roll back prior transactions (2021 Verge example in which 200 days of transactions were invalidated). Ethereum Classic and Bitcoin Gold have been attacked as well

Front-running by miners (“miner-extracted value”, or MEV) in which value is essentially confiscated from other blockchain participants. Most MEV has reportedly occurred on the Ethereum network, and is considered by researchers to be endemic to blockchains

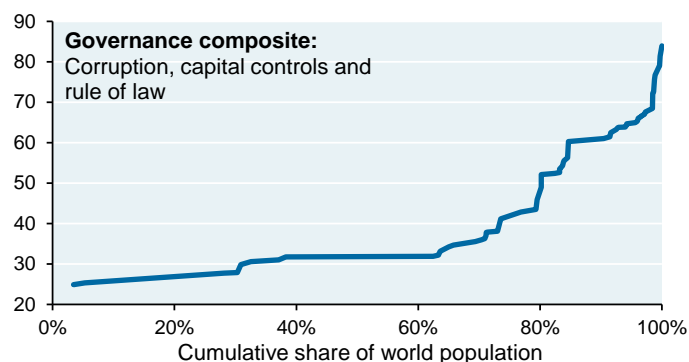
Cartel risks. Proof-of-Stake protocols, which is what Ethereum will be switching to (more on that later), can be subject to “validator cartels” in which consolidation of power allows validators to decide what transactions will be confirmed or not

Frequent inflation bugs which mint new coins before they’re supposed to (Bitcoin, Bitcoin Private, Stellar)

Regulatory risks affecting prices. Uniswap, Synthetix and Compound are effectively pseudo-equities since they provide token holders with claims on future cash flows generated on DeFi protocols. These are not registered as securities even though they sure act like them (see box below). Stay tuned...

News stories on hacking/theft. Bitcoin cannot be destroyed and will survive as long as the network does. But that doesn’t mean that *your* Bitcoin cannot be stolen. The techniques used include “cryptocurrency account takeovers”, SIM swapping, an SMS relay service, malware that stores keystrokes, etc. Just last night, a blockchain bridge between Ethereum and Solana was hacked with \$326 million in Ethereum stolen according to Bloomberg and CNBC reports

However, these might be considered “first world problems” by citizens in emerging countries with poor governance. As shown below, the world governance curve is a steep one: very large shares of the world’s population live in countries rife with corruption, capital controls and/or compromised rule of law, and where cryptocurrency might be appealing either as a store of value or as a medium of exchange (a topic we address next) given conditions they’re faced with.

Most of the world's population lives in countries with poor governance, Governance composite score (100 = strongest)

Source: World Economic Forum, Cato, Fraser Institute, JPMAM. 2020.

On pseudo-equity tokens

“As the time of writing, the aggregate market cap of tokens in the decentralized finance space is \$85 billion, with Uniswap, Synthetix, and Compound the largest pseudo-equity tokens. Many of these DeFi tokens endow token holders with some rudimentary governance rights as well as either implicit or direct claims on cash flows generated through DeFi protocols. None of these pseudo-equity tokens backstopping DeFi are registered as securities, circulating instead on decentralized financial infrastructure like Uniswap (and in some cases, on centralized crypto exchanges). If securities regulators deemed such pseudo-equity tokens to be unregistered securities and pursued not only their issuers and promoters but also the venues upon which they trade, the financing and governance model of these DeFi projects would be significantly impaired”. *Source: Jeng (footnote 8), page 30*

⁶ “DeFi Protocol Risks: the Paradox of DeFi”, Linda Jeng, Georgetown University Law Center, August 6, 2021



What about Bitcoin as a medium of exchange?

Bitcoin is currently not a medium of exchange other than in a few niche cases. The declining number of Bitcoin transactions per day and the spikes in execution costs bear no resemblance to any functioning fiat currency. As a result, a Bitcoin valuation thesis based on it being used as a medium of exchange makes little sense, at least as Bitcoin exists right now. In a forthcoming article in *Quantitative Finance*, Nassim Taleb at NYU argues that transactions in Bitcoin can be more expensive to execute than those done using African mobile phones⁷. Some analysts also note that Bitcoin uses a “secure hash” algorithm which is more than twenty years old, one which the US Department of Defense and firms like Microsoft found to be too weak for cyber-protection, decommissioning its use in the early 2010s⁸.

It has been twelve years since Bitcoin was created, and Taleb states that there are few prices fixed in Bitcoin other than the 3 Bitcoin cost of a permanent residence in El Salvador. “Prices fixed in Bitcoin” means something different than “merchants who accept Bitcoin”. While the latter is rising, the merchant’s Bitcoin price simply adjusts to reflect the price of the goods or services in fiat currency terms, and most merchants quickly hedge their Bitcoin exposure. As a result, merchant acceptance tells us nothing about the viability of an ecosystem whose wages, prices and assets are denominated in Bitcoin. The only items that appear to be priced in Bitcoin or linked directly to it are....other cryptocurrencies.

One last point. Layer-2 improvements refer to upgrades and applications which reduce cost and latency on blockchains. Even if such improvements occurred on the Bitcoin blockchain, unless Bitcoin’s volatility collapses, its medium of exchange usage will continue to be very low.

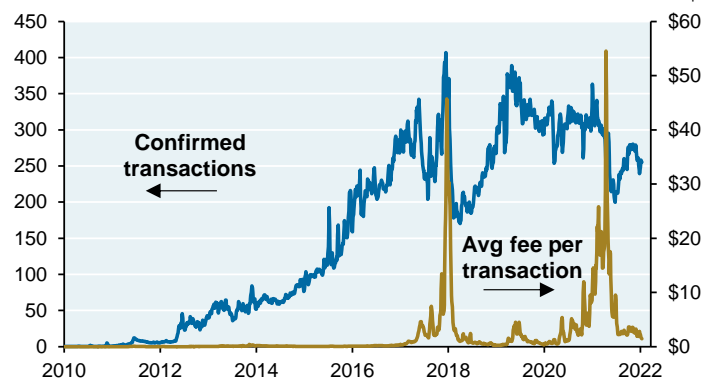
Bitcoin transactions per day

Confirmed transactions, thousands



Bitcoin transaction volume vs fees

Thousands



⁷ “Bitcoin, Currencies, and Fragility”, Nassim Nicholas Taleb (NYU), July 4, 2021

⁸ “Bitcoin’s social cost and regulatory responses”, Bindseil et al, ECB, January 2022

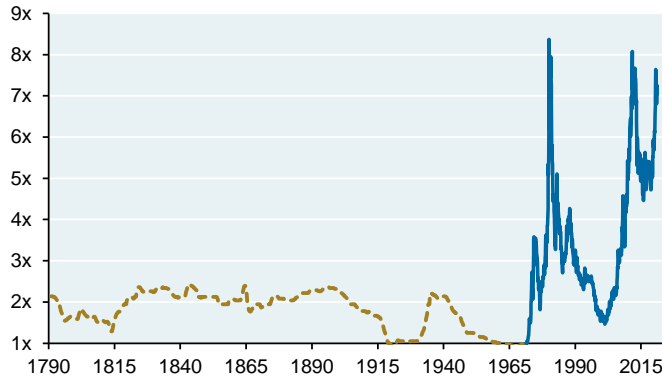


Some comments on gold as an inflation hedge, or as some other hedge

While we’re talking about Bitcoin and gold, remember that gold hasn’t been a reliable inflation hedge either for over a century. As shown in the first chart, from the year 1790 to 1900 gold worked very well as an inflation hedge: the real price of gold (i.e., gold prices adjusted for inflation) was very stable. However, since the year 1900 and in particular after the end of the gold standard, real gold prices have gyrated all over the place, indicating that it was a poor inflation hedge. Gold doesn’t work well as a currency hedge either; changes in Emerging Market Central Bank gold reserves may actually be a better determinant of gold prices⁹. If gold appears to be a hedge for anything, it’s the *fear* of inflation, or the *fear* of financial instability as proxied by changes in government deficits (see third chart).

Real price of gold since 1790

Ratio, Gold price / US Consumer Price Index



Source: Bloomberg, NBER, JPMAM. December 2021.

Real price of gold since the advent of US futures trading

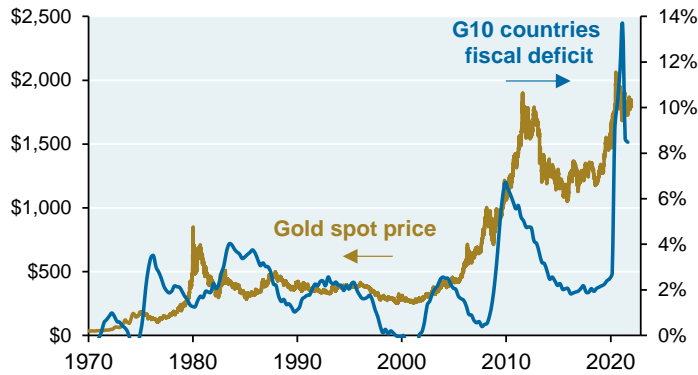
Ratio, Gold price / US Consumer Price Index



Source: Bloomberg, JPMAM. December 2021.

Gold prices vs developed markets deficit

\$/oz % of GDP, trailing 4-quarter average



Source: Bloomberg, central government sources, JPMAM. February 2, 2022.

⁹ “The Golden Dilemma”, Claude Erb and Campbell Harvey (Duke/NBER), May 2013.



[4] Cross-border remittances

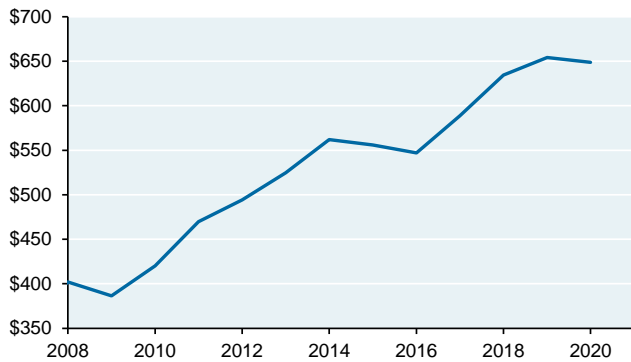
Cross-border remittances have ranged from \$500 to \$600 billion per year over the last decade. The largest recipient countries appear below. Currently, most remittances are made via wire transfer or bank transfer. The CEO of Moneygram estimates that only 1% of remittances are now sent via crypto¹⁰, although other estimates are higher. The third chart shows the declining cost of cross border remittances through traditional networks, where remittance-weighted costs have fallen to around 5%.

Will families sending remittances start using crypto instead to save money? Perhaps, but recipients would need bank accounts in the destination country to be able to convert from crypto to cash. The second chart also shows the share of people with bank accounts, last estimated by the World Bank in 2017 (they are likely higher now). For people with bank accounts, off-ramp costs from crypto to fiat are equal to the cost of converting from dollar-based stablecoins (see next page) to local currency, and then any cost of withdrawing that fiat. The table below shows rough estimates of these costs from industry sources for a few high remittance countries. Even if these estimates are low, current remittance costs appear to be much higher.

Bottom line: the use of stablecoins for cross-border remittances is negligible now but seems set to rise (in countries that allow them) by those with bank accounts given frequently higher costs of traditional channels. This view is augmented by the fact that remittance senders tend to own crypto at a higher rate than the general population¹¹. **To be clear, this would be deflationary for remittance companies like Western Union¹², and not much a driver of rising crypto valuations given the use of stablecoins in this use case (see box on page 13).**

World personal remittances received

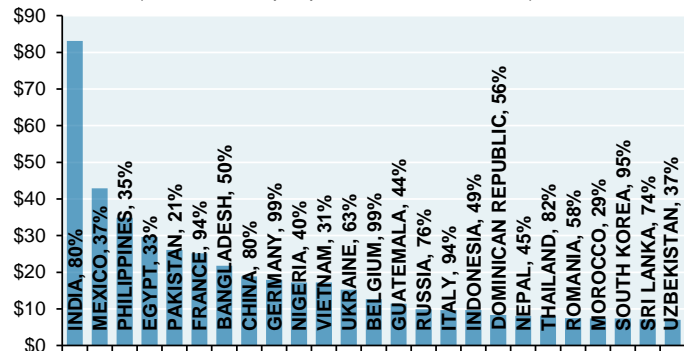
US\$, billions



Source: World Bank. 2020.

Personal remittances and bank account ownership

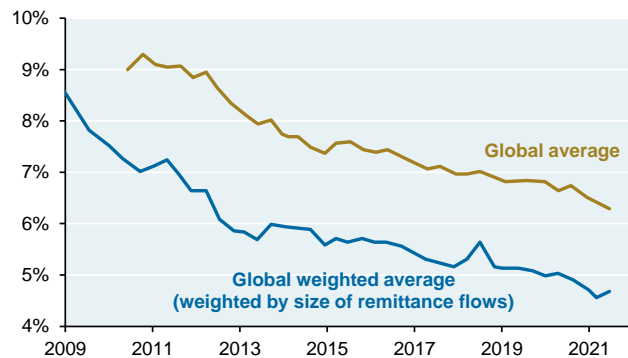
US\$, billions (with share of people with bank accounts)



Source: World Bank, JPMAM. 2020.

Global remittance costs

% of remittance amount



Source: World Bank. Q2 2021.

Select stablecoin off-ramp costs to fiat

	Transaction fee	Withdrawal fee	Total fee	Source
India	0.2%	0.0%	0.2%	CoinDCX
S Africa	0.2%	0.0%	0.2%	Luno
Mexico	0.1%	0.0%	0.1%	Bitso
Brazil	0.7%	0.0%	0.7%	Mercado Bitcoin
Philippines	0.5%	1.6%	2.1%	PDAX

Source: JPMAM. February 2022.

¹⁰ "Great Expectations of Crypto for Cross-Border Payments", Alex Holmes (MoneyGram), September 14, 2021

¹¹ PYMNTS Cross Border Remittance Report, September 2021

¹² See Atlanta Federal Reserve Bank payments risk analyst comments in "A Mexican Crypto Startup Wants to Make Cash Remittances Cheaper", Bloomberg Business Week, November 30, 2021



For remittance receivers without bank accounts, crypto execution costs can be much higher even when they are possible at all via Bitcoin->fiat ATMs. According to Coin ATM Radar, there are only 2 such ATMs in all of India, 11 in Mexico and 13 in the Philippines. Most Bitcoin->fiat ATMs charge around 5% to convert Bitcoin into fiat currency (and around 10% to convert fiat into Bitcoin). As a result, the current remittance use case for crypto relies on bank account ownership, which in many EM countries is rising.

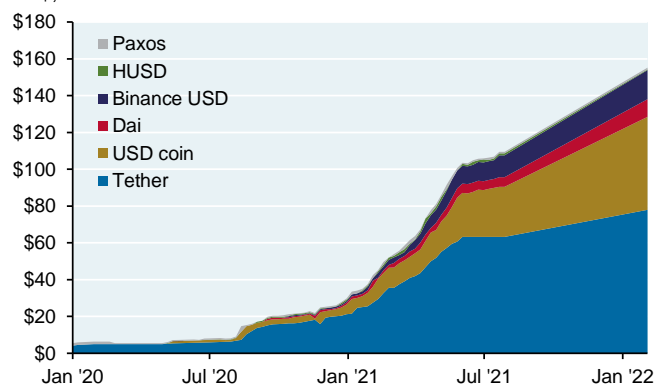
What might change? Moneygram announced that it's working on a project with Bitcoin ATM operators to offer Bitcoin->fiat conversions at 4% which could be used by those without bank accounts, and a partnership with the Stellar Development Foundation to allow users to convert from stablecoins to cash and back.

Understanding Stablecoins

Stablecoins are a way to gain access to blockchain protocols without taking on crypto price risk. Stablecoins are linked to a reserve of external assets, and in most cases, the entity developing the stablecoin owns reserves equal to the number of stablecoins in circulation. As a result, they should generally be redeemable close to par. There are questions about the reliability of certain stablecoin reserves; some remind me of SIVs from 2008¹³. But if stablecoin risks can be controlled, they could be used for cross-border remittances and reduce volatility that recipients are exposed to with traditional crypto. To reiterate, there are few implications in this use case for most crypto prices (see box on next page). USD coin and Tether stablecoin prices are shown below. Note that their price volatility has declined with higher participation.

Select stablecoin market capitalization

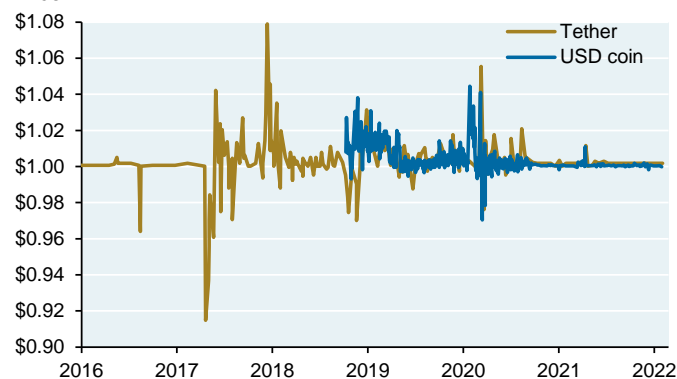
US\$, billions



Source: CoinDesk, CoinMarketCap, JPMAM. February 3, 2022.

USD Coin vs Tether stablecoin prices

Price



Source: CoinMarketCap. February 2, 2022.

Update: the US Federal Reserve issued a report in January 2022 on digital money and payment systems. The Fed is debating the risks and benefits of creating a Fed-backed US\$ stablecoin which would not entail any liquidity or reserve risks, and which would provide a firmer foundation for innovation in the digital payments space than private stablecoins.

¹³ **Stablecoins** are often described as being backed by “reserve assets.” However, there are no standards regarding composition of stablecoin reserve assets, and information made publicly available is not consistent as to content or frequency. Stablecoins differ in the riskiness of their reserve assets; some hold all reserve assets in deposits at insured depository institutions or in US T-bills, and others holding riskier reserve assets such as commercial paper, corporate and municipal bonds and other digital assets.

Example: **Tether's** first published reserve breakdown showed 49% backing by “unspecified commercial paper”. When Wells Fargo withdrew support for Tether in the spring of 2017 and its convertibility was temporarily suspended, Tether traded as low as 92 cents on the dollar.

**Will stablecoin access fees be a material source of income for Ethereum and other token holders?**

As stated above, stablecoins are generally backed 100% by liquid reserves and therefore do not result in any speculation on their prices. The larger centralized stablecoins such as USDC are not their own blockchains but instead are tokens that are created on multiple chains. Stablecoin users have to pay for blockchain ledger verification via “gas” access fees (see page 17) paid to that network. Some argue that such gas fees will be a material part of the value proposition for host network cryptos like Ethereum when/if such fees are distributed to token holders. However, stablecoin users are likely to migrate to the cheapest blockchain protocols such as Solana or Polygon. Gas fees are also dependent on computational complexity; stablecoin transfers are very low complexity compared to swaps, NFTs and DeFi. As a result, stablecoin use looks like a rather weak valuation pillar for cryptocurrency.

Some unanswered remittance questions

The Ripple effect. Ripple reported fivefold growth in remittance transactions between 2019 and 2020. But if that’s the case, **why is Ripple still trading so closely with Bitcoin, as shown below?** Wouldn’t Ripple’s separate and distinct use case result in a separate and distinct return profile from Bitcoin? It hasn’t so far. From what we can tell, Ripple has been working with banks to help them build infrastructure to make cross-border payments but few are using Ripple’s actual cryptocurrency to execute them.

Bitcoin vs Ripple price

Source: Bloomberg, JPMAM. February 2, 2022.

Government regulations. There are increasing calls for stablecoin regulations in the US according to the Bank Policy Institute. And while the Mexican crypto company Bitso reports handling 2.5% of all remittances sent from the US to Mexico, Mexican authorities have stated that crypto assets are not legal tender and are not considered currencies under current laws, and that financial institutions operating with them are subject to sanctions¹⁴. There’s a good chance that crypto remittances will eventually be subject to “travel rule” regulations that require identification of sources and destinations of funds to ensure monitoring for money laundering and sanctions. See Appendix A for the latest on government crypto regulations.

The Silvergate nexus. What systemic risks are posed by **Silvergate**, a San Diego bank with \$5.5 billion in assets and \$5.0 billion in crypto deposits (Q4 2020)? Silvergate has emerged as a key nexus connecting traditional banks and the digital currency industry. While a small number of mature crypto firms have relationships with the largest banks, most crypto firms rely on Silvergate and other small community banks to settle the US\$ fiat leg of crypto-fiat trades¹⁵.

¹⁴ “Mexico says cryptocurrencies are not money, warns of risk”, Reuters, June 28, 2021

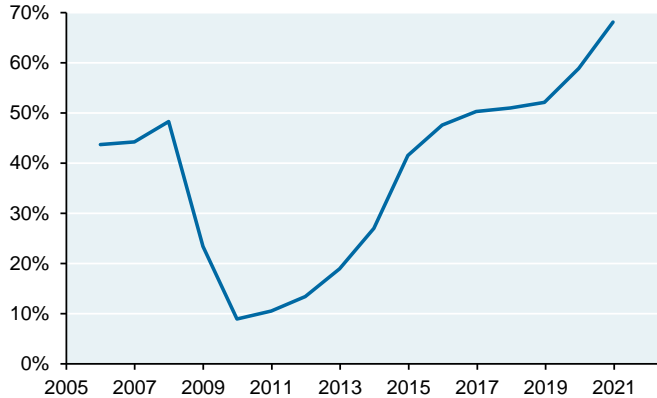
¹⁵ “DeFi Protocol Risks: the Paradox of DeFi”, Linda Jeng, Georgetown University Law Center, August 6, 2021



[5] Decentralized Finance

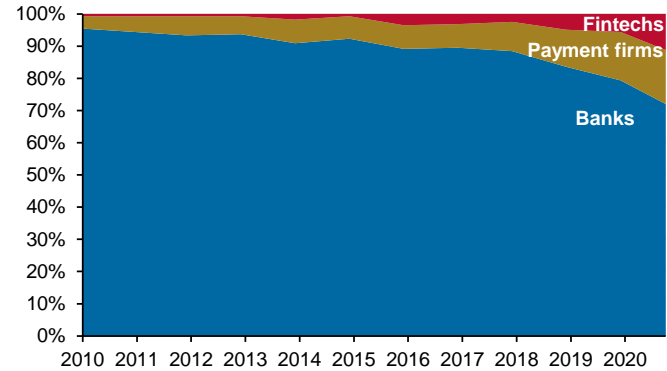
Decentralized Finance (DeFi) refers to activities that disintermediate financial services by migrating them to permission-less blockchains. Its advocates typically see the financial system as rife with inefficiencies, bloated costs and structural inequalities that DeFi can exploit. To be clear, disintermediation of banks is happening on multiple fronts. The non-bank share of US mortgage originations continues to rise, and as shown in the second chart, payment firms and fintech firms continue to take market share away from banks. Paypal’s market cap is greater than Goldman Sachs, Morgan Stanley, Citigroup and Amex, and Stripe’s latest pre-IPO valuation is over \$100 billion. But the ability of crypto-based blockchains to displace banking activities is a little more complicated, as this section will review.

Nonbank share of mortgage originations



Source: Inside Mortgage Finance, WSJ. June 2021.

Top 500 global banks, payment and fintech firms
% of market cap



Source: The Economist. October 7, 2020.

Around two thirds of DeFi activity currently takes place on the Ethereum network given its ability to host “smart contracts” which encode terms and conditions that are executed on it (the next chart shows the number of smart contracts executed). Ethereum trades not only as a store of value, but also as a token whose value is influenced by the number of people using that blockchain. **This highlights an important difference vs Bitcoin:** once Ethereum completes the migration from Proof of Work to Proof of Stake (see box and page 17), Ethereum token holders will have the opportunity to participate in “staking” (ledger verification) activities which could provide them with a yield on their tokens, as well as possibly sharing in network access “gas” fees. **This income component is the key investment thesis behind many investments in crypto projects on programmable public blockchains using Proof of Stake ledger verification.** Such projects often involve efforts to perform instant settlement, freeing up working capital and reducing back office costs.

Ethereum daily verified contracts

Total verified contracts per day, 7 day avg



Source: Etherscan, JPMAM. February 1, 2022.

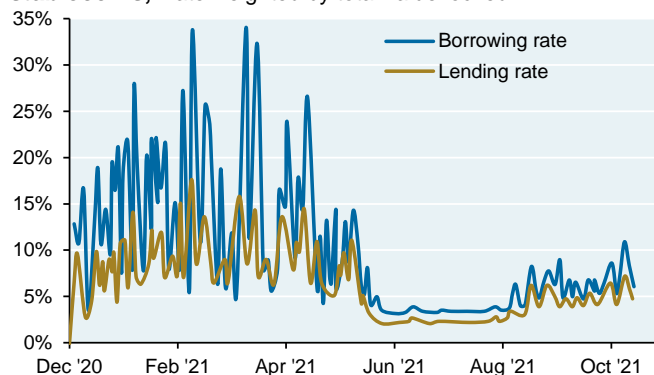
Proof of Work vs Proof of Stake

Blockchains require ledger verification by “validators” who are paid in that blockchain’s native token to do so. Proof of Work involves crypto miners competing to perform ledger verification using energy-intensive computers to solve complex mathematical puzzles. Proof of Stake involves validators simply being selected to perform ledger verification. On the Ethereum blockchain, the selection process will be random but also influenced by the number of tokens owned, leading to centralization of ledger verification activity. Proof of Stake is considered both faster and more scalable than Proof of Work.



Currently there’s around \$100 billion “locked up” in DeFi activities. This refers to the amount of crypto collateral deposited in DeFi applications; this measure is imperfect due to double-counting and leverage. While some high yields have been offered by some DeFi lending platforms with temporary incentives¹⁶, CryptoVantage and Coinbase quote current unleveraged DeFi lending yields at 4%-5%. Analysts at Goldman Sachs were able to dig through some complex online data and derive similar borrowing and lending rates for stablecoins on the Aave platform¹⁷. Once more participants joined in the summer of 2021, Aave’s rates declined. The largest DeFi protocols (Aave, Uniswap, SushiSwap and Compound) earned over \$2 billion in user fees and spreads in 2021.

Aave DeFi protocol lending and borrowing rates for stablecoins, Rate weighted by total value locked



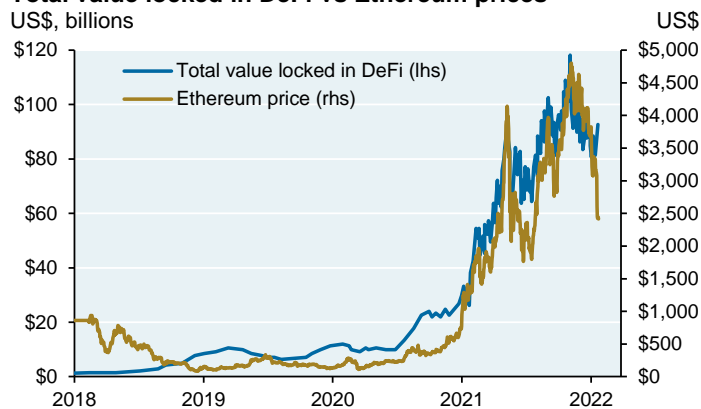
Source: Aave, The Graph, GS. October 22, 2021.

DeFi in the News: \$100 mm proposed fine on blockchain lender BlockFi (February 2022)

BlockFi is reportedly set to pay a \$100 million fine to settle SEC allegations that the crypto lending firm illegally offered products to crypto owners promising high interest rates. The SEC is probing whether such accounts are securities that should be registered with regulators. SEC Chair Gensler has argued that some crypto firms are offering financial services without adhering to investor-protection rules that banks, brokers and other entities have to comply with.

Yes, but what kind of lending is actually taking place here? From what we can tell, most DeFi lending is simply over-collateralized crypto loans to other holders of crypto so that the latter can either (a) buy more crypto, or (b) obtain liquidity against appreciated crypto holdings without incurring capital gains taxes. **Either way, it does not appear to be the kind of lending activity that could survive a large sustained decline in crypto prices themselves.** As shown below, there’s a close connection between the total value of DeFi lending and Ethereum’s price. Like Ripple vs Bitcoin, so many things in the crypto world are correlated to each other.

Total value locked in DeFi vs Ethereum prices



Source: DeFi Pulse. January 25, 2022.

¹⁶ DeFi protocols can become an overnight success by offering temporary incentives that are way above market. One example is **SushiSwap**, whose lending balances rose from a few thousand dollars to one billion dollars almost overnight in September 2020.

¹⁷ “*Opportunities and Risks in Decentralized Finance*”, Zach Pandl and Isabella Rosenberg, Goldman Sachs Economics Research, October 22, 2021

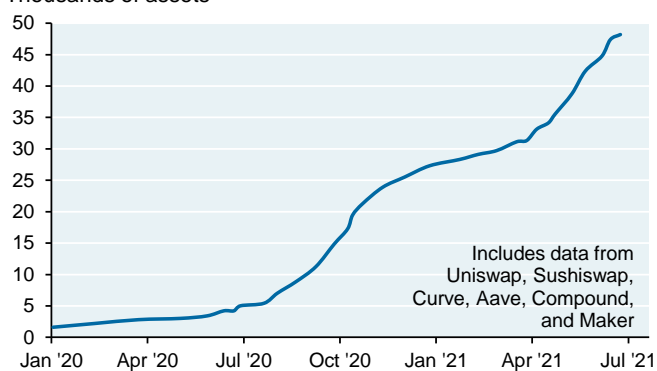


Collateralized lending on blockchains cannot eliminate the presence of bad actors or bad data. Some of its characteristics might terrify participants in traditional collateralized lending pools:

- **Crypto collateral may not be dedicated and assigned solely to the activity against which it is posted.** In other words, crypto collateral can be “rehypothecated” to back multiple activities¹⁸. If you don’t remember what that word means, type “rehypothecation” into Google along with the words “financial crisis”
- **Unreliable valuations** of crypto assets posted as collateral. Some protocols do not restrict the kind of crypto assets that can be used as collateral. While a lot of collateral is stablecoins, some is not. There were 50,000 distinct crypto assets accepted as collateral in DeFi applications last July. Coin Metrics concedes that pricing data in DeFi liquidity pools on certain assets can be “manipulated and ultimately undermine value measurements”, and that “it is possible to use on-chain exchanges to estimate their current price, but there’s no guarantee that they are traded with enough frequency to give accurate prices”¹⁹
- **DeFi markets are NOT trustless.** Participants in DeFi markets inherently trust the programmers of the protocols they engage with, *and* other protocols linked to those protocols. In other words, seemingly distant protocols can cause problems such as fraud. DeFi fraud exceeded \$10.5 billion in 2021, up from \$1.5 billion in 2020²⁰. Main DeFi vulnerabilities are (a) programming design errors that hackers exploit, and (b) theft from DeFi founders and developers who turned out to be crypto-criminals. As much as you might try, you cannot prevent humans from defrauding and stealing from each other, even on the blockchain. There’s also no DeFi-FDIC.

Distinct assets used as collateral in DeFi

Thousands of assets



Source: Coinmetrics. July 2021.

Smart contracts may eliminate the need for lawyers, banks, brokers and exchanges involved in traditional finance. However, some smart contracts will still depend on external data sources to function. For example: if a smart contract is a derivative that depends on the price of an underlying asset, the smart contract might have to pull that from a Bloomberg feed or some other live source. This has led to “oracle attacks” in which bad actors attempt to influence a reference price to create riskless arbitrage or trigger liquidations.

¹⁸ “Rehypothecation: the myth of locked collateral”, Coin Metrics, July 2, 2021

¹⁹ “Collateral type variety: the myth of Value”, Coin Metrics, July 27, 2021

²⁰ “Decentralized Finance Fraud in 2021 Is Up 600% Over 2020, Topping \$10.5 Billion, Research Finds”, The Ascent.com, November 25, 2021

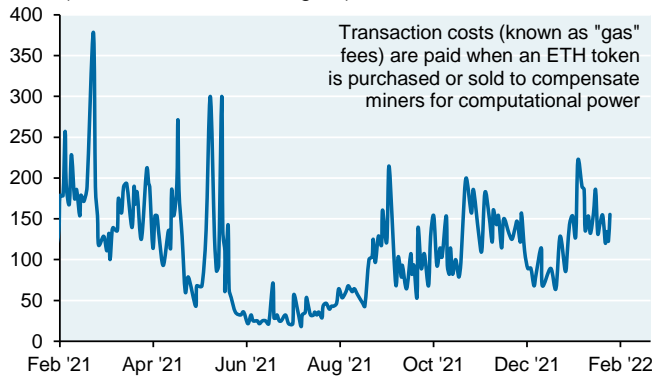


What’s next for Ethereum and other programmable public blockchains?

The Ethereum network can be an expensive place to transact, and Ethereum doesn’t communicate well with other blockchains. The first chart below shows the transaction “gas” fees that users pay to access the network. Since the beginning of 2021, Ethereum’s competitors have been gaining ground as shown in the second chart.

Ethereum average daily transaction costs

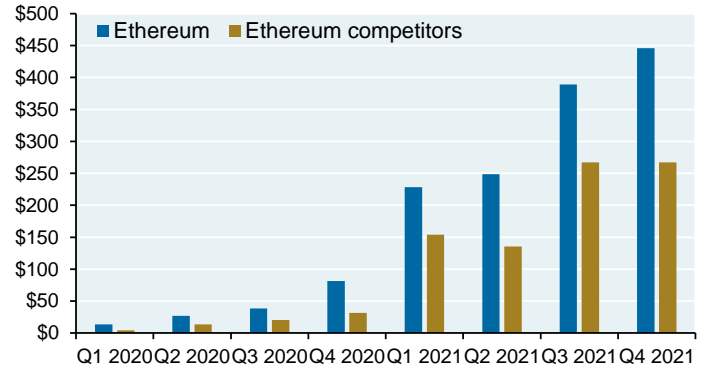
Gwei (1 ETH token = 1 billion gwei)



Source: ycharts.com. February 1, 2022.

Ethereum vs Ethereum competitors market cap

US\$, billions



Source: CoinMarketCap.com, J.P. Morgan. January 7, 2022.

Why might some Ethereum competitors be thriving²¹? Financial ledger applications and related protocols are slow; see transaction processing speeds in the table. Some of Ethereum’s competitors aim to improve upon it, such as Solana whose developers claim 50,000 transactions per second. Other competitors like Cardano aim to be more scalable, while Pokadot aims to be more interoperable. There’s an endless list of others, including Avalanche, Hedera and Algorand. Like anything else in the venture capital world, only a few will survive; figuring out the likely winners early on could be a very rewarding endeavor.

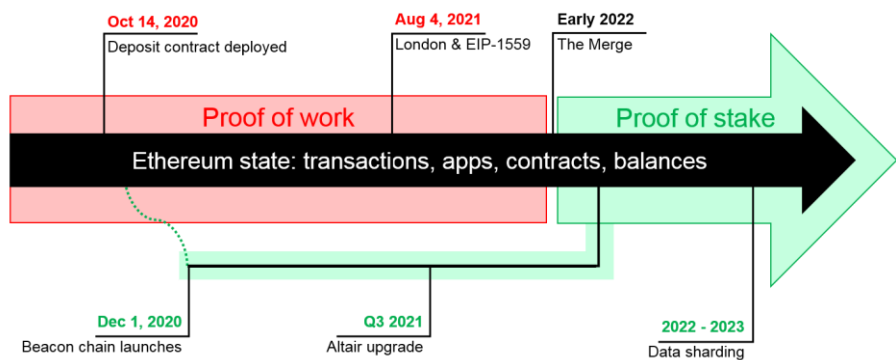
The Ethereum upgrade scheduled for 2022 entails a shift from Proof-of-Work to Proof-of-Stake and should improve its scalability, speed, cost and energy efficiency. The image below illustrates how this transition may occur. Some contacts tell us they are already experiencing 100x-1000x improvements in transaction costs and latency from something called “zero knowledge proof” Layer-2 offerings on the Ethereum blockchain. One apparent pre-requisite for blockchain professionals: use as much obtuse jargon as possible.

Processing speeds of financial infrastructures

Currency	Transactions per second
Bitcoin	7
Ethereum	15
Paypal	56,000
VISA	45,000
Ripple	1,500
EOS	8,000

Source: Zorba et al (Hacettepe University). November 2020.

Ethereum’s projected upgrade path



Source: Honeycomb Digital. 2022.

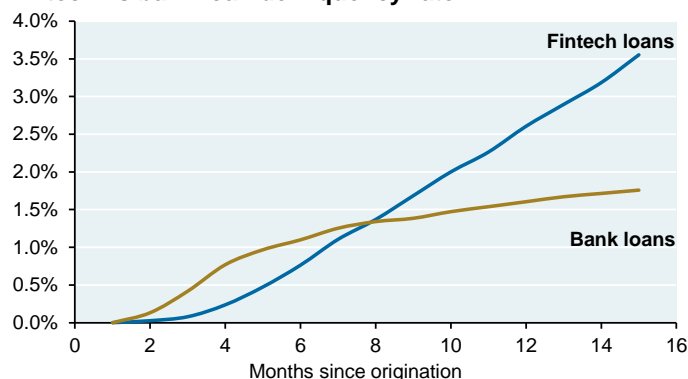
²¹ For more on Ethereum competitors see pages 24-30 in “Cryptocurrency Markets: Crypto-101 and the State of the Crypto Markets”, JP Morgan North America Equity Research, Ken Worthington, January 7, 2022



Many DeFi advocates anticipate a future world of peer-to-peer *uncollateralized* lending on blockchains, allowing crypto holders to lend and cut out fees charged by banks for credit scoring, monitoring and payment. **Good luck with that.** Fintech lending holds some clues since the industry uses AI tools to make uncollateralized lending decisions, and that’s how peer-to-peer crypto lending applications might work as well. **Recent data on Fintech shows higher loan delinquency rates than traditional bank loans**, mostly a function of weaker underwriting standards. See Lending Club, whose stock has declined by 65% from its recent peak despite the use of AI and machine learning credit models derived from 150 billion cells of data.

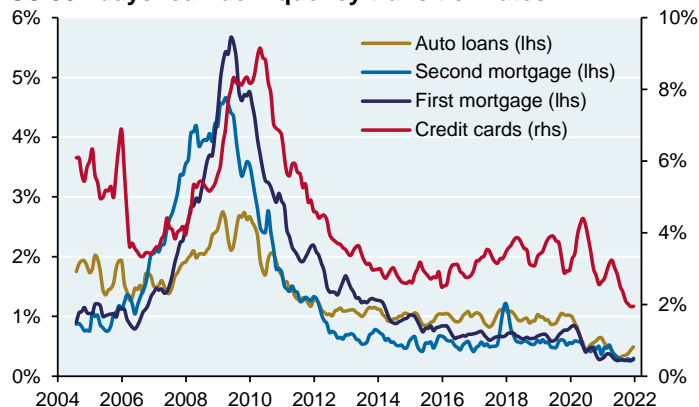
Remember: **Fintech lenders have primarily been operating at a time of rising household incomes, lots of gov’t stimulus and very low household delinquency rates.** The real test will occur next time there’s a recession that is unaccompanied by supplemental income payments, foreclosure moratoria and PPP loans. For an industry whose primary competitive advantage is **speed²²** rather than access or cost, that’s the real test.

Fintech vs bank loan delinquency rate



Source: "Fintech Borrowers: Lax-Screening or Cream-Skimming", Di Maggio (HBS) & Yao. 2020.

US 90+ days loan delinquency transition rates



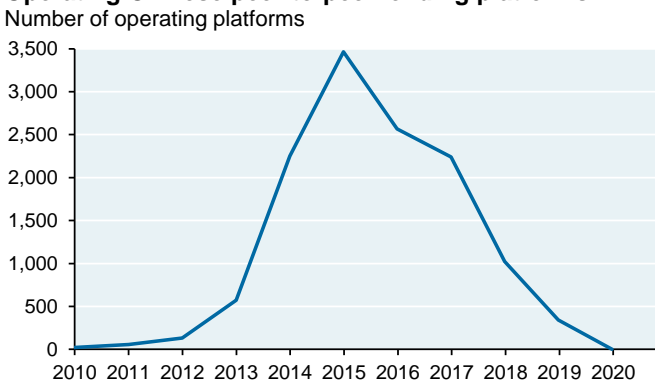
Source: S&P Dow Jones Indices, Experian. December 2021.

US home foreclosures



Source: Bloomberg, Federal Reserve. Q3 2021.

Operating Chinese peer-to-peer lending platforms



Source: "The Fall of Online P2P Lending in China", Huang and Wang (CUHK). January 2021.

China is a reminder of how peer-to-peer lending manias can go off the rails. Chinese P2P lenders promised returns of 8%-12% to depositors compared to 2.75% on 3 year bank deposits. High default rates and increased regulation led to the demise of Chinese P2P lending platforms, which at their peak in 2017 were extending 2.8 trillion RMB in credit. Some platforms ended up absconding with the cash, and many had difficulty returning money to lenders. By August 2020, Chinese retail investors had lost \$115 billion on their P2P activities.

²² **Speed kills?** In a survey by “buy now pay later” lender Klarna, **50% of users** said that it’s too much trouble to type in a bank account number or social security number to qualify for a loan (!!). Firms active on Alibaba’s platform can fill out a credit application in 3 minutes, the approval takes 1 second and the process involves zero human interaction. And from Square: “You’ll usually know if you’re approved right away!”

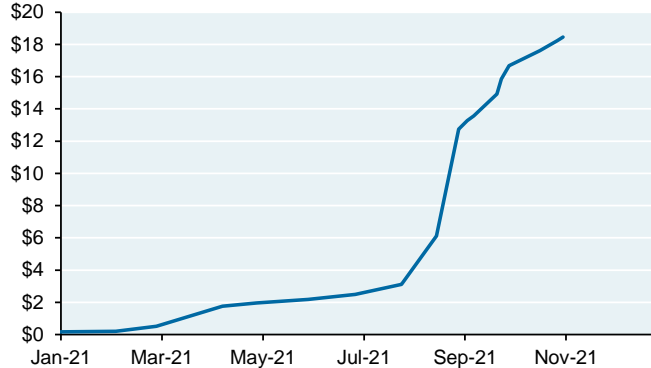


[6] Non-fungible tokens and the art market

DeFi uses tokens that are fungible and divisible across users. Non-fungible, indivisible tokens (NFTs) are a type of unique digital certificate that is registered on a blockchain to record ownership of any asset. They're best known for digital collectibles in art²³ and music, and also in gaming. The appeal of NFTs include the ability of artists to sell their work to buyers in a global market, and the ability to retain ownership rights over their own works as well as resale and royalty rights. As you are all aware by now, the NFT art market exploded in 2021: transaction volumes were reported to have hit \$20 billion last year. That compares with a global art market whose sales have fluctuated from \$50 to \$70 billion per year over the last decade.

2021 cumulative NFT art sales

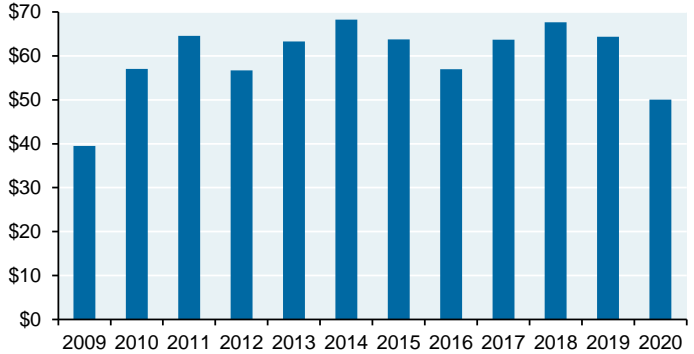
US\$, billions



Source: cointelegraph.com. November 2021.

Global art market sales

US\$, billions

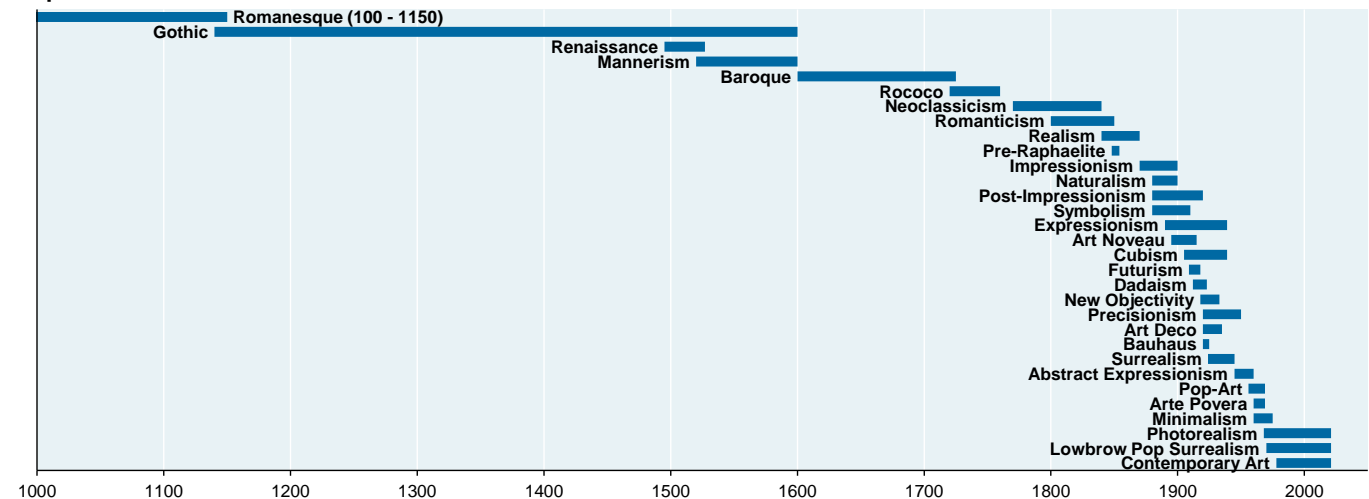


Source: Arts Economics. 2021.

Many of you will be tempted to dismiss the NFT market as a place of rampant and misguided speculation.

You may also look at works from top NFT sellers such as Mad Dog Jones, Pak and Beeple (now the third most expensive living artist behind Koons and Hockney) and conclude that they barely qualify as art at all. Oddly enough, I wouldn't dismiss the NFT art phenomenon that quickly. For many centuries Romanesque, Gothic and Baroque styles dominated the art scene among collectors. But look what happened in the twentieth century: new art movements rose to prominence much more frequently, and many of these works retained substantial value for decades after that. In other words, tastes and cultural preferences evolve more quickly now.

Art period timeline



Source: art in Context. September 2021.

²³ **An NFT is only a marker to digital art.** Given the limited capacity of a token on most public blockchains, an NFT points to a location on the cloud where the actual art sits. If that cloud service failed, the NFT's value could be compromised.



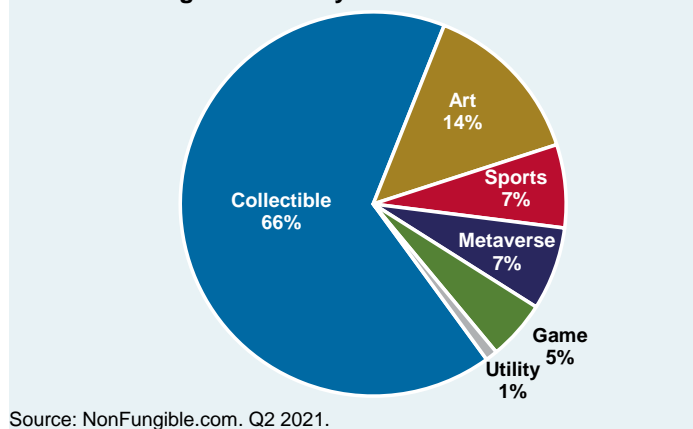
I don't really understand the appeal of digital art. Am I supposed to pester friends and family into looking at it on my phone? However, **I don't get some of the most expensive physical art of the last half century either;** I find works by Cindy Sherman, Damien Hirst and Christopher Wool to be inaccessible and boring. And that's the point; just because you might not appreciate the artistic merit of Bored Ape Yacht Club NFTs, that doesn't mean others won't. Between Feb 2020 and April 2021, the curated NFT art platform Nifty Gateway offered 145,000 works for sale, and sold 95% of them at an average price of \$1,200.

The greater the interest in NFTs that reside on the Ethereum network, the more Ethereum tokens that NFT purchasers have to acquire to own them. As a result, the NFT art and collectible market is a use case driving some investors to accumulate Ethereum tokens. I'm just not sure how they get comfortable that the preferred domicile for NFTs won't change to some other blockchain venue in the future. **There's also the fact that NFTs can now be bought and sold on normal payment rails via credit cards, which separates the notion of "on-chain" data and digital assets (i.e., no need for Ethereum). OpenSea, which has 97% NFT market share, is reportedly close to accepting fiat on their platform²⁴.**

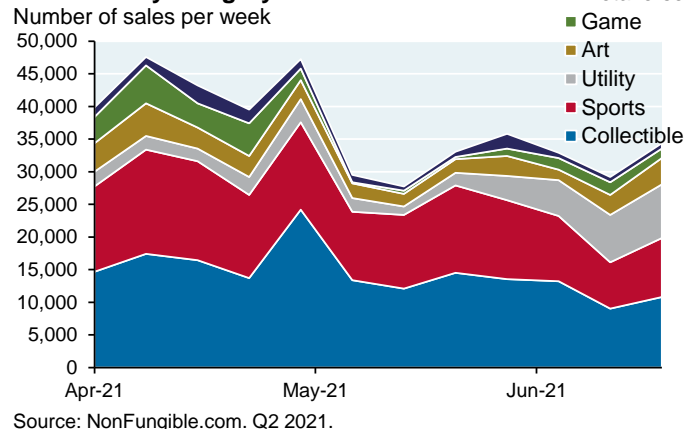
One Achilles heel of the NFT market: just as Bitcoin ownership is **highly concentrated**, the same is true for the NFT art market. A study of the SuperRare NFT art platform revealed that just four collectors owned most of its works with only three degrees of separation between them and the 16,000 works of art they collected²⁵. This is a very high degree of insularity, even for standards of the art market. The study also found that the secondary market was even more concentrated than the primary market. **More evidence of NFT art concentration:** an analysis of transactions between April and September 2021 found that the top 17% of NFT art owners controlled 81% of them²⁶. In the long run, concentration is rarely a good thing for investors.

To be clear, art is just a subset of the broader NFT market. The largest segment by value is a category called "collectibles" which mostly refers to personal avatars, some of which are algorithmically generated. Examples include CryptoPunks and Meebits that can be used in virtual reality environments. While it might seem strange that young people are willing to invest so much money in virtual status symbols, prior generations certainly spend a lot of money on physical status symbols of their own. The cost of women's high-end handbags (i.e., Hermes Birkin bags²⁷) is more disturbing to me than the price of a scarce virtual avatar. Gaming is described by some as an important use case for NFTs, but I am frankly too exhausted at this point to go into more detail.

NFT market segmentation by value



NFT sales by category



²⁴ "OpenSea confirms acquisition of Dharma, sets sights on fiat onramps", Frank Chaparro, The Block, January 18, 2022; "How OpenSea Captured 97% Of The NFT Market", Tim Fries, The Tokenist, November 11, 2021.

²⁵ "The art market often works in in secret. Here's a look inside", Albert-Laszlo Barabasi, NYT, May 7, 2021

²⁶ "An analysis of 7,020,950 NFT transactions on the Ethereum blockchain", Moonstream, October 22, 2021

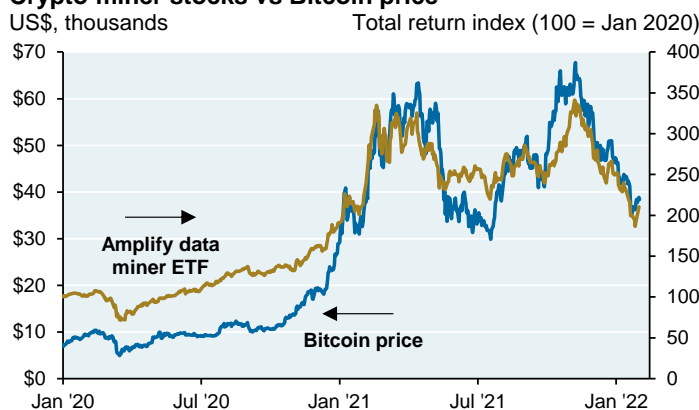
²⁷ Birkin bags can cost \$40,000 or more, although some can be found on the resale market for between \$12,000 and \$18,000. A study released in 2017 found that these bags appreciated by 14% per year over the last 35 years (Business Insider, June 30, 2021). Birkin bag supply is limited and controlled...**just like many digital avatars.**



[7] Financial services crypto and blockchain activities

There's a lot of crypto and blockchain activity going on at banks, asset managers, transaction processors and custodial firms. Let's start by describing what they are NOT trying to do: replicate the volatility of **crypto mining businesses**. As shown below, an ETF of crypto mining stocks looks just like another version of Bitcoin, a risk/return profile which is of little interest to large financial services firms.

Crypto miner stocks vs Bitcoin price



Source: Bloomberg, JPMAM. February 2, 2022.

Let's separate crypto and blockchain activities of financial services firms into three major categories.

Crypto trading accounts and custody

Goldman, JP Morgan, Morgan Stanley, State Street, US Bank and Fidelity are offering or exploring the ability to offer customers tools to trade cryptocurrencies, cash-settled futures and derivatives linked to them, and/or custodial services. Deutsche Bank is working on a trading and token issuance platform, and Susquehanna trades Bitcoin, Ether, Bitcoin Cash and Bitcoin futures its client base. The CME launched Bitcoin futures trading in 2017 and have added Ether futures. **The common denominator: very little principal risk in cryptocurrency**, with the goal of profiting from increased adoption, trading, hedging and lending by their customers.

Payments channels

Visa announced the launch of a Universal Payments Channel to support transactions between stablecoins and central bank digital currencies, enabling blockchain interoperability. Reading between the lines:

- Most large merchants incur an average of 0.78% interchange fees on debit cards²⁸ and 2.00% interchange fees on credit cards. If their customers were to use crypto instead, these interchange fees currently paid by merchants to issuing banks would go away. Visa is trying to ensure that it would still earn its 0.03%-0.18% card network fee in this scenario
- Since merchants are the ones saving money, customers might need incentives to use crypto instead. This is particularly true for credit card users who value points and rewards they receive. So, what would be the cost to merchants of building and integrating a crypto ecosystem, plus the cost of consumer incentives and a system for detecting fraud and handling chargebacks? Would such costs be well below the interchange fees merchants are now paying to banks? I'm not sure, but that window looks pretty tight
- **Since the most likely token for this use case is a stablecoin, there are few crypto valuation implications to think about.** Another example of where crypto adoption <> crypto appreciation

²⁸ This is a spending weighted average of 0.56% interchange fees charged by the largest regulated banks whose interchange fees are capped, and 1.18% charged by smaller banks whose fees are not capped. These averages are based on the average debit card purchase of \$40. Source: Federal Reserve.



Blockchain ledger systems designed to reduce processing costs or create new functionality

To reiterate, **blockchain adoption often has nothing to do with crypto valuations**. Let me use an example from our own firm to explain why. JP Morgan built a repo system on a blockchain with more than \$200 billion in transactions cleared to date. Other broker-dealers participate and more are joining. The important things to keep in mind here:

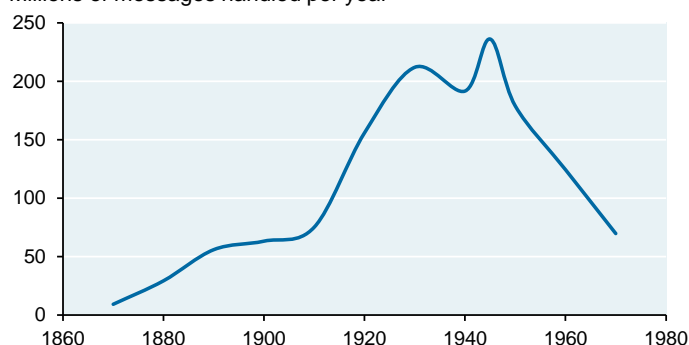
- This is a **permissioned, private blockchain**. In other words, it is not a public blockchain where anyone can participate and/or analyze the transactions taking place
- This permissioned, closed system is based on trust and **does not require any mechanism to reward miners for verifying ledger transactions**. Verification tasks are performed via software built onto the blockchain
- The unit of information exchange is a JP Morgan Coin whose value is unchanged irrespective of how often the network is used
- The primary purpose of this particular blockchain is not to save costs, but to add functionality that did not exist before: the ability to execute intraday repo transactions instead of having to execute them overnight
- **As a result, adoption of a permissioned, private blockchain using internally created stablecoins does not imply or result in increased value for any token anywhere**

There are also examples outside financial services: Walmart uses the blockchain to digitize its food supply chain and ensure safety of merchandise. Alibaba uses the blockchain to track e-commerce order movements. Real estate companies might adopt the blockchain to automate routine tasks and listings, and insurers might adopt the blockchain to improve fraud detection and recordkeeping. **But these examples do not validate crypto use cases, they validate blockchain use cases**. It remains to be seen if decentralized ledgers are the cost saving gold mines they are described to be. Even if they are, the value of permissioned, private blockchains would accrue to shareholders of companies using them, and also to IBM, Oracle and Microsoft and other enterprise blockchain vendors that design them; but not to any token holders.

For these firms, the blockchain is simply another cost-saving or productivity tool in the long history of such innovations. Carrier pigeons were used in the Middle Ages to transmit data related to commerce and navigation. The telegraph began to replace carrier pigeons in the 1830's, transmitting electrical signals over wire laid between stations; although as shown below, carrier pigeons were still used by soldiers during the Second World War. The telephone, fax and internet followed the telegraph, each obviating its predecessor. During each cycle, most incumbent *providers* of each service disappeared but incumbent *users* of these services simply switched to the next one that came along. JP Morgan, Walmart and Alibaba are examples of the latter.

The life cycle of the Telegraph

Millions of messages handled per year



Source: "Historical Statistics of the United States", "Report of the Superintendent of the Census for December 1, 1852". 2018.

British soldiers in the south of England train a carrier pigeon to deliver messages during World War II, August 1940



Source: FPG/Hulton Archives/Getty Images



[8] Rebuttals to this piece

I circulated this piece to a few people involved in the crypto and blockchain venture capital universe for their thoughts. Here are their unedited anonymous responses.

Not enough discussion of future income streams associated with crypto

Most people are unaware of the utility that certain cryptocurrencies possess. The ability of some blockchains to solve real economic and commercial problems through blockchain distributed ledger technology will convince people that there is a fundamental, rather than a speculative, value to cryptocurrencies. As newer blockchains move from Proof-of-Work to Proof-Of-Stake consensus mechanisms, the networks behind these cryptos will provide an income component in that the revenues the networks derive from fees will be proportionally spread to the coin holders themselves and thereby making the economics of these crypto projects similar to those of corporations. Also: blockchain projects are not just being developed for financial services, but for almost every industry in the S&P 500, including energy, retailing, data management, real estate and healthcare.

This piece is the equivalent of judging the value of the internet in 1995

The innovation around human-scale applications has just started. Judging the Internet in 1993-1995 would have missed at least 95% of the market value still to come: the idea that a search engine could be worth \$1 trillion, a “cloud computer”, a global scale social network, etc. I think part of technology isn't to simply do what was being done before better, but to create wholly new experiences previously unimaginable prior to these disruptions.

Remember the electricity wars of the 1800's

The first stage of any innovation cycle is development of infrastructure. The high value applications come later. That's what happened during the electricity wars when future use cases were vastly underestimated, even by the likes of Junius Spencer Morgan (father of JP Morgan) who thought electricity was a fad and that kerosene lamps worked just fine. The infrastructure we are building today will transform many parts of the global financial system over the next 25 years.

Too US-centric

Too much focus on the developed world. In the developing world, financial institutions are less well organized (i.e., less able to enlist lobbyists and politicians to defend existing business lines against fintech and crypto competitors), and they pass along higher costs of capital and charge more for financial services (more exposed to innovation). Emerging economies are where a lot of the most profitable crypto use cases will emerge.

No discussion of generational wealth transfer and changing investment preferences

While the piece does a good job comparing gold and bitcoin, it misses perhaps the largest catalyst for money moving out of gold and into bitcoin as a store of value: generational wealth transfer. In the U.S. alone, \$70 trillion will be handed down from Boomers to Gen X and Millennials over the next 20 years. It is not unreasonable to expect that a disproportionately large percentage of what was allocated by Boomers to historical store of value investments – such as gold, art and real estate – will find its way into bitcoin once that money is transferred to the younger generation.

Not enough discussion about what the future might look like

It is difficult to predict the evolution of Web3 and Public blockchains. Having the ability to transact P2P, across the world, in real time with a low cost would be beneficial to all. However, it is too early to say whether public blockchains will achieve that outcome given how nascent the technology is and how fragmented regulatory and monetary frameworks are across the world. We are in the Napster era of crypto; you can see the promise but it is clunky and not really in the clear from a regulatory perspective. It is hard to say what the Spotify of crypto and public blockchain may look like one day.



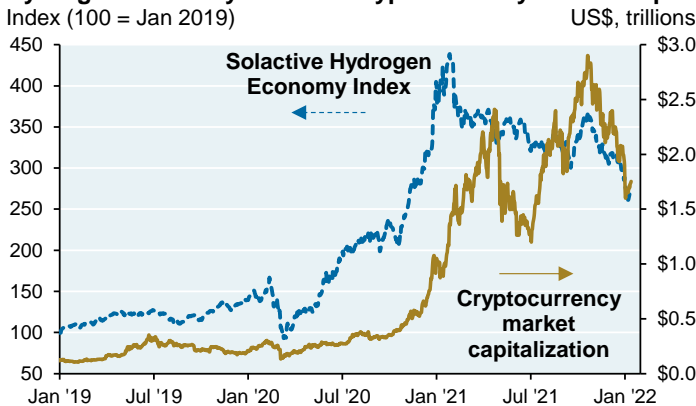
[9] Conclusions: The Maltese Falcoin

There are investment choices in the world of innovation: genetic medicine, the Metaverse, robotics, renewable energy, crypto/blockchain, etc. Each is said to be transformational by its true believers. Regarding advocates and their passion, crypto use cases remind me of debates on the hydrogen economy. There are examples of hydrogen projects, but what will its scale ultimately be? Which companies will actually make money and how many will go to zero? Are some valuations way ahead of themselves, setting investors up for disappointment?

Some hydrogen use cases make sense²⁹ but energy investors are pricing in a lot more than that, and **that’s how I feel about crypto valuations too**. Some crypto use cases will endure but valuations assume broader and faster adoption. I’m tempted by the store of value thesis given the degradation of money but have no crypto valuation tools to time my investment, and its volatility and market concentration are hard to manage. Remittances and permissioned, private blockchains with limited cryptocurrency value implications are the use cases that seem most likely to survive in the world I inhabit. The success of permissionless public blockchains which could yield income for token holders is the big question. It is the most coherent argument I came across while working on this project, but: the higher the access fees, the higher the impediments for users who would migrate to the blockchain to reduce costs in the first place. I don’t know how that tension gets resolved.

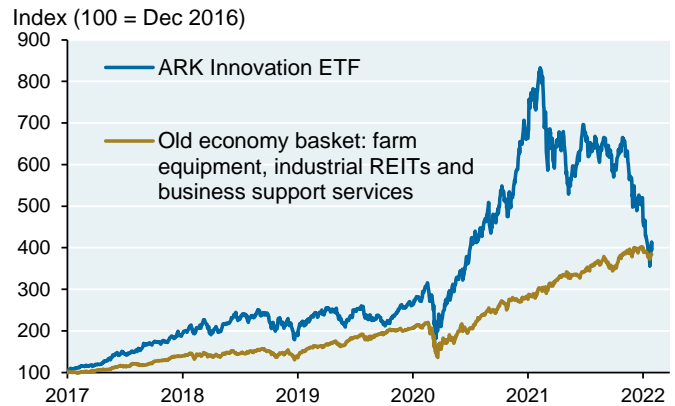
The bold visions on the rebuttals page are worth thinking about, but there’s both a time and a price for innovation. As shown below, one widely cited innovation ETF has now converged with a decidedly “old economy” basket of agricultural farm equipment, business support services (uniforms, mops and cleaning supplies) and industrial REITs. While aggregate crypto valuations have declined by one trillion dollars from their peak, I think the price discovery process is still ongoing.

Hydrogen Economy Index vs cryptocurrency market cap



Source: Bloomberg, TradingView, JPMAM. February 2, 2022.

The Tortoise and the Hare



Source: Bloomberg, JPMAM. February 2, 2022.

²⁹ **Hydrogen use cases:** commercial back-up power in remote locations where it’s too expensive to extend the grid and which rely on diesel generators; non-electrified residential and commercial rail; and maybe one day in the distant future, primary steel production using hydrogen as a reducing agent instead of carbon. There’s excitement about new shipping engines that can be powered via liquid ammonia instead of heavy and light fuel oil. However: the round-trip efficiency of converting liquid ammonia made from renewable “green” hydrogen into power via fuel cells may be just 11%-19%.



In the 1941 movie *The Maltese Falcon*, Mary Astor and Sydney Greenstreet try desperately to obtain the long-lost statue of a golden falcon encrusted with rare jewels, produced in the 1500's as tribute to Charles V of Spain. They finally get their hands on the statue, but the one they obtain is a fake. Astor hired detective Humphrey Bogart to protect her, but Astor had also secretly killed Bogart's partner. At the end, Bogart decides to turn Astor in to the police despite having fallen in love with her. She begs him not to, and he replies:

"I won't play the sap for you...I won't because all of me wants to – regardless of consequences – and because you've counted on that with me the same as you counted on that with all the others..."

As it relates to my own money, that's how I feel about cryptocurrency right now. I won't be buying it even though part of me wants to, regardless of consequences, since that's what some crypto holders have been counting on from the beginning. I would take another look if crypto valuations and the companies linked to them plummeted to deeply distressed values. But until then, the most widely discussed use cases and the valuations at which they're trading are still the "stuff that dreams are made of"³⁰.

Michael Cembalest, JP Morgan Asset Management



Source: Warner Brothers, AF Archive, Alamy.com

³⁰ Bogart's last line in the film, describing what the fight over the statue was all about.

**Appendix A: Regulatory update³¹**

- India may prohibit crypto-asset activities of individuals including it as a store of value, unit of account or means of transfer with violations by individuals being possibly sanctioned by arrest. The bill might include non-custodial wallets, an area of the Bitcoin network that is largely unregulated. However, the bill has not yet been presented to the Parliament
- Religious leaders in Indonesia have forbidden Muslims to use Bitcoin and other crypto assets. The MUI deemed crypto assets as having elements of “uncertainty, wagering and harm”
- The Chinese central bank announced that all transactions of crypto-assets were illegal, effectively banning Bitcoin and other crypto-assets entirely
- In November 2021, Sweden proposed an EU wide ban of proof-of work crypto-assets like Bitcoin due to their energy consumption
- The UK’s FCA prohibited activities of crypto-exchange Binance and issued a warning to consumers and on crypto-assets
- In December 2021, Australia introduced draft legislation aiming at licensing crypto-exchanges and activities in crypto-assets
- In the US, the President’s Working Group on Financial Markets, comprising the Secretary of the Treasury and the Heads of all the key US financial regulators, argued for greater regulation and more federal oversight of custodial wallet providers. The SEC also rejected a bitcoin-based exchange traded fund in November 2021 due to concerns of possible price manipulation. However, the SEC recently gave the green light for a first futures-based Bitcoin ETF despite rejecting the Bitcoin spot market ETF. The OCC requires banks to have controls prior to engaging in crypto-assets business and must receive a non-objection.
 - In December 2021, a bipartisan group of US Senators wrote a letter to Treasury Secretary Yellen asking her to restrict tax reporting requirements to digital asset brokers only, and not miners, stakers or other participants in the digital asset food chain, citing the importance of the US remaining a leader in financial innovation
- EU regulation will target intermediaries offering services in crypto-assets, require intermediaries to apply AML/CFT measures and forbids anonymous crypto asset wallet accounts. However, German legislators adopted in July 2021 a “Fondstandortgesetz”, which allows German investment funds for institutional investors (“Spezialfonds”) to invest up to 20 percent into crypto assets

Crypto and blockchain advanced primers

“A primer for blockchain”, Lawrence Trautman and Mason Molesky (George Washington University), January 2019

“Blockchain and other Distributed Ledger Technologies”, Gilles Hilary (Georgetown University), November 2020

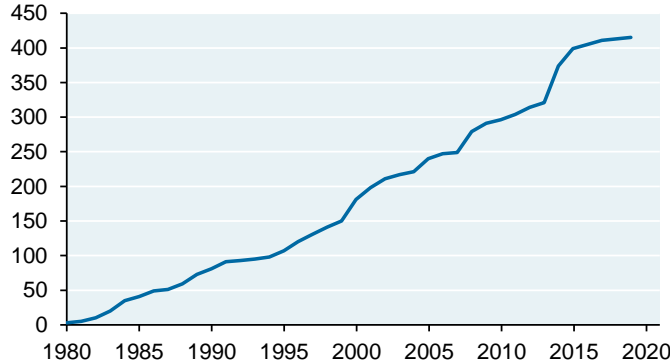
³¹ *“Bitcoin’s social cost and regulatory responses”*, Bindseil et al, ECB, January 2022



Appendix B: Tracking creative destruction

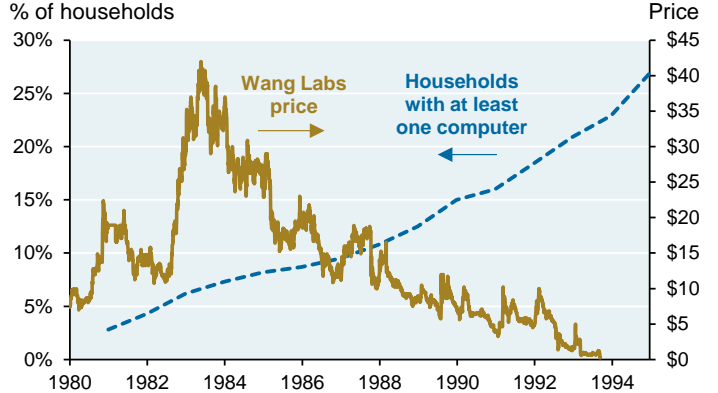
The best time to sell Wang Labs, newspaper stocks, DSL stocks and electronics retailers was when they were still on top; in other words, when the PC, digital advertising, greater demand for data consumption and e-commerce were still in their infancy.

Cumulative number of companies removed from the S&P 500 due to distress, 1980-2019



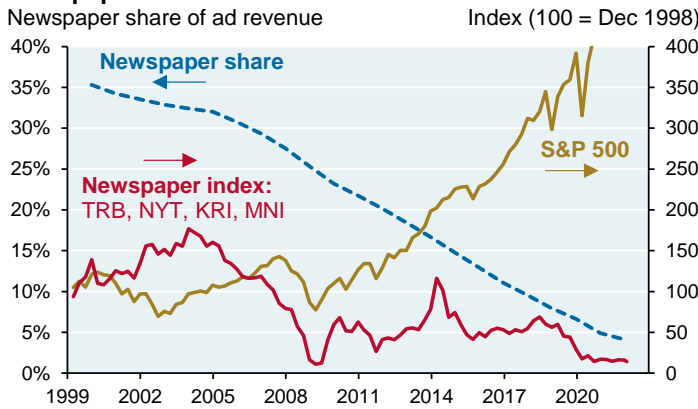
Source: Bloomberg, Factset, J.P. Morgan Wealth Management. 2019.

Wang Labs and the demise of data processing equipment



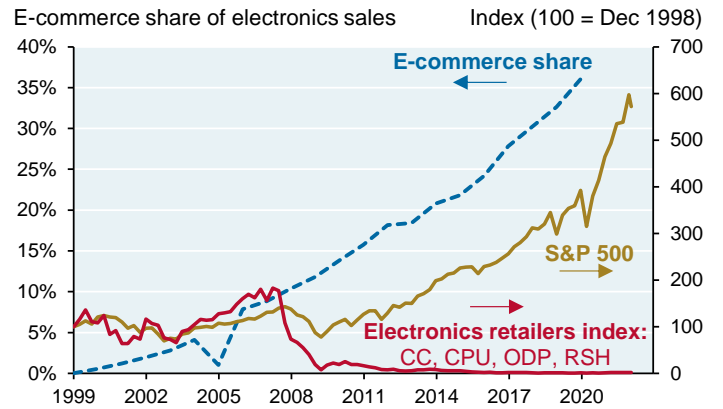
Source: Factset, IBISWorld, JPMAM. 2022.

Newspapers



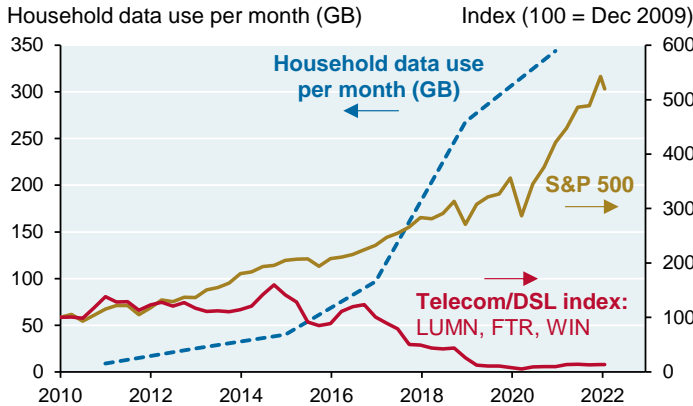
Source: Bloomberg, GroupM, JPMAM. February 2, 2022.

Electronics retailers



Source: Bloomberg, Factset, Census, JPMAM. February 2, 2022.

Wireline telecom stocks



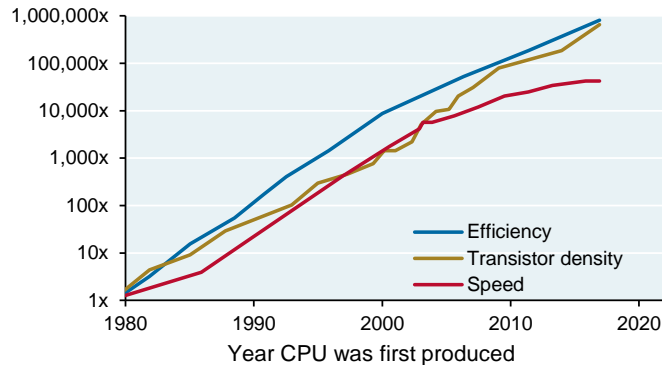
Source: Bloomberg, Factset, FCC, JPMAM. February 2, 2022.



Appendix C: Improvements in the Metaverse

CPU improvement rates

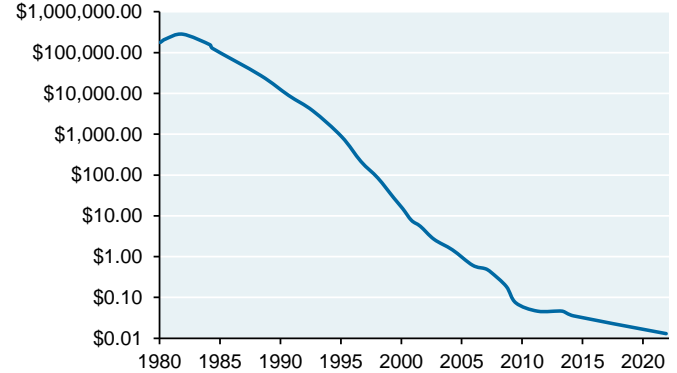
Improvement, multiple of 1979 value (log scale)



Source: Georgetown Center for Security and Emerging Technology. April 2020. Source: AI Impacts, DiskPrices, JPMAM. 2021.

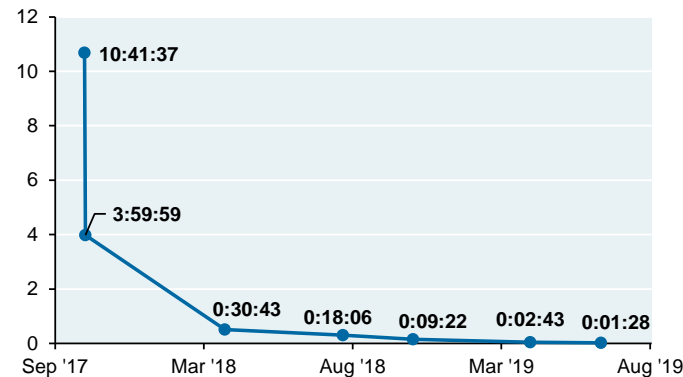
Cost of information storage

US\$, hard drive cost per gigabyte (log scale)



Time to train an AI model to classify images

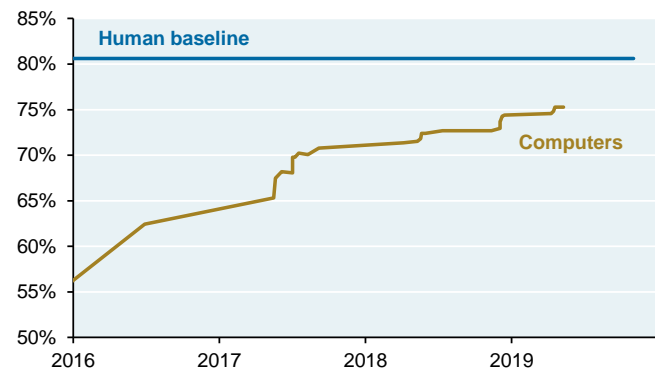
Hours



Source: Stanford Human-Centered Artificial Intelligence Institute. 2019.

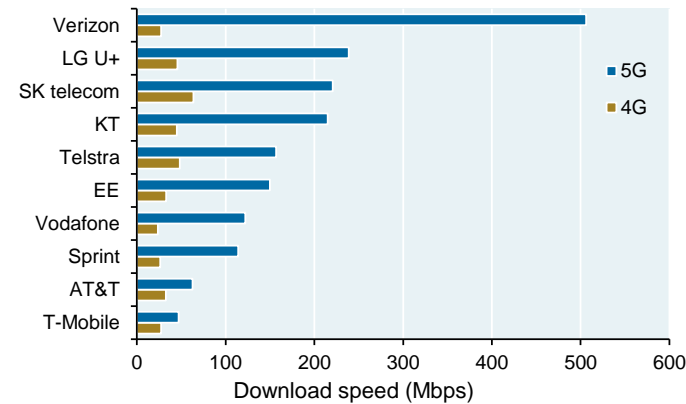
Image identification accuracy vs human baseline

% accuracy



Source: Stanford Human-Centered Artificial Intelligence Institute. 2019.

5G vs 4G: average download speed



Source: Opensignal. April 2020.

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