Julius Bär

NEXT GENERATION

BLOCKCHAIN & CRYPTOCURRENCIES
IS THIS THE FUTURE OF MONEY AND DATA?

- The blockchain investment landscape has cooled in the last two years and we do not expect a substantial trend change as issues such as the 'blockchain trilemma' continue to hold the technology back for the time being.
- The cryptocurrency (crypto) market exhibits an oligopolistic structure, with Bitcoin and Ethereum taking clear leadership positions. Proof-of-work is the dominant form of consensus mechanism, but might lose ground to proof-of-stake in the future.
- Empirically, Bitcoin has strongly correlated with equities during market downturns, putting diversification arguments into question. It has exhibited risk characteristics in the form of drawdowns and volatility that are higher than the absolute majority of investment vehicles, making Bitcoin primarily a speculative investment but not yet a store of value.
- We examine the value chain of blockchain and crypto companies and map firms in the areas of semiconductors, crypto mining operators, crypto exchange and brokerages, and blockchain ecosystem companies. Large established firms with noteworthy investments into the blockchain and crypto universe are unlikely to find this a substantial stock-price needle mover. We are sceptical on the business prospects of the mining companies in the medium- to long-term. Investments in blockchain ecosystem companies are likely to behave much more like venture capital investments rather than traditional equities.

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DIGITAL DISRUPTION
The phenomenon of digitalisation, led by the proliferation of computing power and greater internet connectivity, is affecting every corner of our lives.

Introduction

The story of blockchain and cryptocurrencies[1] started in 2008, the year the whole world faced a financial crisis of unprecedented proportions. It was the year of the fall of the American bank Lehman Brothers, the year of the mortgage crisis, and strong rises in the unemployment rate. Confidence in the economy and in the banking sector in particular sank to an all-time low and there were demonstrations against the banks and governmental agencies. Meanwhile, under the pseudonym of Satoshi Nakamoto, the Bitcoin blockchain white paper was published, introducing a system that could make the entire existing financial system obsolete. The ill will towards the actors of the financial crisis is not just visible in accompanying forum posts and the white paper, but is even reflected in the Bitcoin blockchain itself, as the following message is hidden in the Genesis block: "chancellor on the verge of second bailout for banks". The message was taken from a newspaper article that outlined the possibility of a second rescue package for United Kingdom banks in less than half a year.

Now, more than 12 years later, we reflect on the blockchain technology and cryptocurrency (crypto) landscape as it is today and make projections for the future. We first examine the blockchain-related investment landscape, before mapping the crypto market along dimensions of market capitalisation, consensus mechanism, exchange-rate regime, encoded monetary policy, and smart contract capability. Afterwards, we present a short empirical analysis of Bitcoin from an investment perspective. Finally, we examine the corporate value chain of the blockchain and crypto-related universe, starting with relevant semiconductor firms, crypto mining firms, crypto exchange and brokerages, blockchain ecosystem companies, as well as established firms with noteworthy investments into the blockchain and crypto universe. The Bitcoin blockchain has not replaced the legacy financial system as Nakamoto envisioned, but what about other blockchain ventures and other cryptocurrencies? Will they create massive societal change and uproot the financial system?

[1] Investments in virtual currencies are exposed to elevated risk of fraud and loss and to price fluctuations

The blockchain investment landscape

The hype around funding in the blockchain space has shown definite signs of cooling down in recent years. Even after the record-setting cryptocurrency prices of late 2017, funding for blockchain-related projects declined according to calculations by US technology website VentureBeat. The most recent 2020 figures are not even half the level of 2017. Simultaneously, we have observed the share of funding to companies that are only in their 'seed stage' diminish, indicating to us that investors have higher bars for investing now than they did a few years ago.

The top three funding events in 2020 were for Bakkt, Paxos Trust Company, and Chainalysis. Bakkt is owned by Intercontinental Exchange (ICE), which, in turn, is the parent company of the New York Stock Exchange. Bakkt offers Bitcoin storage solutions that then allow institutional investors to speculate on the price of Bitcoin in the form of futures contracts. The main difference between Bakkt and CME Group Bitcoin futures is that the Bakkt version offers physical settlements in Bitcoin, while the one from CME Group is cash based. Basically, Bakkt is pretty much the complete antithesis of how Nakomoto envisioned Bitcoin as a centralised method for established institutional financial firms to speculate on price fluctuations, often doing so on margin.

Paxos Trust Company offers cryptocurrency enterprise solutions, such as securities settlement, trade flow monitoring, and crypto brokerage specifically aimed at institutional investors. Its crypto brokerage is, for example, utilised by Revolut and PayPal. Besides that, the company operates two stable coins: Pax Standard is its first regulated stable coin, and is backed by the US dollar; PAX Gold is its second stable coin, and is backed by physical gold.

Chainalysis is a company that, as the name already suggests, provides analysis concerning blockchain-related transactions. It provides services on tracking movement across different currencies and aims to link real-world entities to cryptocurrency activity. Chainalysis primarily tries to address the needs of financial firms and regulatory agencies.

Terms explained

THE BLOCKCHAIN REFRESHER

A **blockchain** is a distributed, public database. It consists of blocks of data that are linked to each other in chronological order. An easy analogy is a novel. The data is like the text, a page is like the block, and the bookbinding is like the chain.

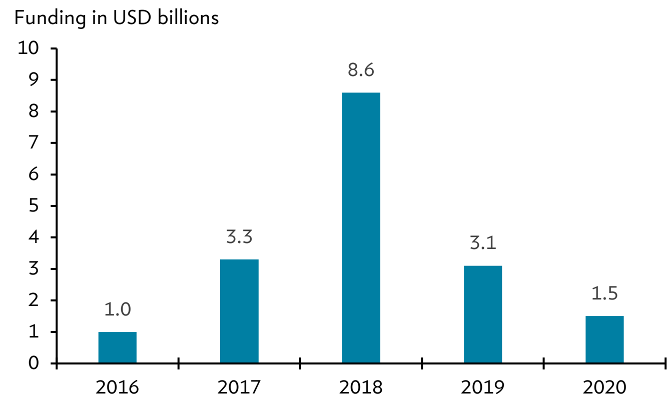
Cryptocurrency is the name given to digital means of payment based on cryptographic tools such as blockchains and digital signatures. As a payment system, they are intended to be independent, distributed and secure. The most famous cryptocurrency is Bitcoin.

A **smart contract** is neither 'smart', nor an actual 'contract'. It is a software program stored on the blockchain. Think of it as a stored procedure in the database world. If certain conditions are met, the procedure is carried out automatically.

Tokenisation could potentially enable any asset, both tangible as well as intangible, to be turned into a digital token. This token then allows for the digital transfer of ownership without the need for centralised institutions. The field of NFTs (non-fungible tokens) is an example of tokenisation.

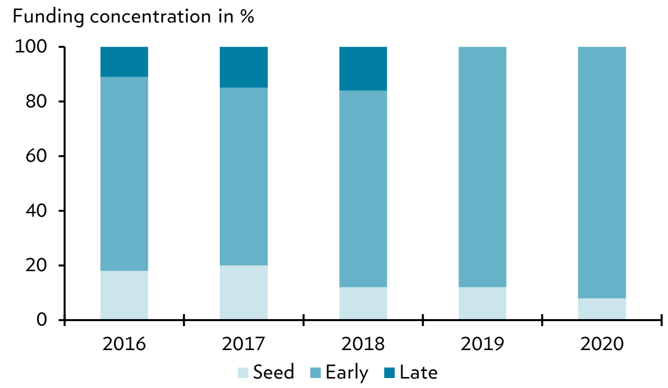
It is quite telling to us that all three of the biggest funding events of last year were by companies that are much more focused on generating revenues out of the current system of cryptocurrencies than working on any type of new technological vision meant to change the world as we know it. We stand by our rather critical assessment that we made roughly two years ago. We continue to see non-crypto blockchain as an interesting concept, with a number of interesting potential niche applications. However, it does not offer truly revolutionary characteristics because of technical limitations such as the 'blockchain trilemma', which we will elaborate more on in a later segment of the report.

Funding for blockchain investments seem to have peaked



Source: VentureBeat, Julius Baer

Seed stage investments are diminishing



Source: VentureBeat, Julius Baer

Cryptocurrency market overview

Here, we take a look at the following five distinguishing mapping features concerning the cryptocurrency landscape consecutively. These are market capitalisation, consensus mechanism, exchange rate regime, monetary policy, and smart contract capability.

Market capitalisation

When it comes to market capitalisation (cap) distribution in the cryptocurrency space, it is very much a story of Bitcoin and Ethereum versus everyone else. As of today, the market cap of Bitcoin is a bit more than three times the size of the Ethereum, and Ethereum is roughly four times as large as the next cryptocurrency by market cap. In effect, Bitcoin is roughly 12 times larger than the third most highly valued cryptocurrency.

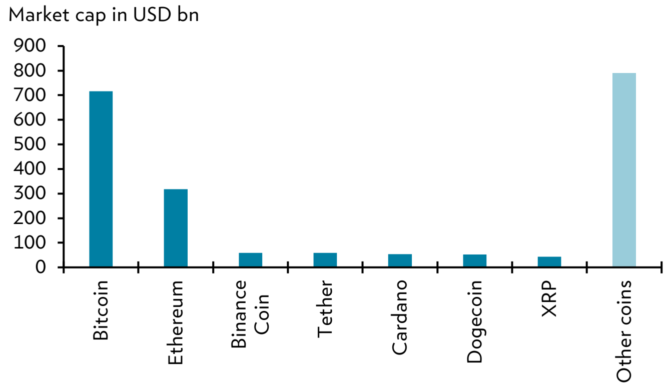
The Herfindahl-Hirschman Index (HHI) is a methodology used to assess market concentration. It is calculated as the sum of the squared market shares of each constituent and can therefore generate a value from close to zero up to 10,000. The US Department of Justice defines anything below 1,500 as a competitive marketplace and anything above 2,500 to be a highly concentrated marketplace.

$$\mathrm{HHI} = \sum_{k=1}^{n} (market\ share)_k^2$$

While the HHI was not created to measure concentration in a crypto market, it can nonetheless be used to quantify this concentration. As of early May 2021, the HHI value of the cryptocurrency market stood above 2,000, which, according to the model, highlights a market that has strong characteristics of a small domineering duopoly.

The current level of market cap distribution inside the cryptocurrency space has been more or less stable over time. Bitcoin has dominated for most of the market's history. This is also the reason why some individuals have even just bundled all cryptos that are not Bitcoin under the term 'altcoin'.

Cryptocurrency market has strong duopolistic structure



Source: Coinmarketcap.com (data as of 19.05.2021), Julius Baer

Consensus mechanism

The consensus mechanism sets the ground rules that govern how the blockchain operates. It tells us how a decision is made, which transactions are treated as legitimate, and how these are processed. The main consensus mechanisms are:

- **Proof-of-work**
  The so-called crypto miners solve computer-intensive mathematical problems and are awarded the right to produce ('sign') the next block. The more computing power individuals contribute, the higher the chances are that they will be awarded the right to generate the next block and earn a block reward. The majority of cryptocurrencies are based on this technology, such as Bitcoin, Bitcoin Cash, Litecoin, Dogecoin, Ethereum (currently), Ethereum Classic, and Tether.

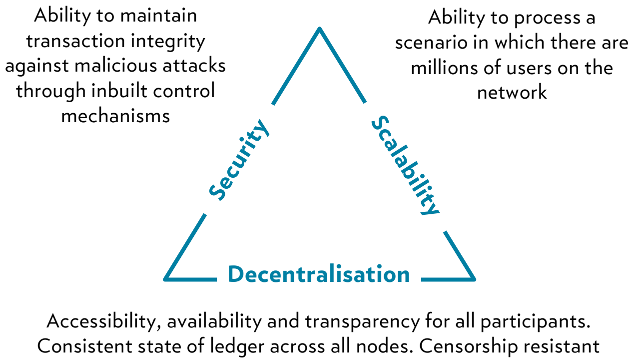
- **Proof-of-stake**
  Unlike proof-of-work, this consensus mechanism algorithm is not computing-intensive and therefore not very energy intensive. A weighted random selection is used, with the weights of individual participants determined by their participation wealth ('stake'). Ethereum currently hopes to transition to this mechanism in the next few years.

- **Delegated proof-of-stake**
  This variant on how a blockchain network reaches a consensus on which participant is allowed to generate the next block is based on a weighted random selection. The weights of the individual participants are determined from the duration of their participation and/or their stake. The right to sign blocks is thus effectively delegated to these elected representatives. Some of the most prominent cryptos using this method are EOS, Steem und Tronix.

- **Others**
  There are many other consensus mechanisms, such as proof of capacity, proof of elapsed time, proof of identity, proof of authority, and proof of activity. However, they are hardly ever used in practice, at least until now.

All cryptocurrencies currently face one massive technical challenge, called the 'blockchain trilemma'. For any type of decentralised financial solution to really be able to replace our current fractional banking system, it needs to be three things: safe, decentralised, and scalable. However, the blockchain trilemma states that more often than not, cryptocurrencies will be forced to sacrifice one of these aspects for the sake of the other two, and are therefore not able to truly replace our financial system adequately.

The blockchain trilemma



Source: Steemit, ReverseAcid, Julius Baer

The biggest cryptocurrency is Bitcoin and it scores well concerning safety and decentralisation, but has massive difficulties when it comes to scalability. Depending on certain factors, Bitcoin only manages between 5–15 on-chain transactions per second. This is a far cry from what is necessary to act as a useful global payment solution. Visa and Mastercard are already capable of processing tens of thousands of transactions per second. Projects such as the Lightning Network try to solve the scalability issue by creating a so-called layer 2 solution. However, these types of off-chain solutions potentially raise the question as to whether they compromise the safety of transactions as not all are then recorded on-chain, which brings us back to the trilemma. Other proposed solutions to Bitcoin's on-chain scalability are still not very user-friendly, which hinders their appeal at least in the short term. At various stages, members of the Bitcoin community have also proposed increasing the block size to allow for more transactions per second. One such 'disagreement' in 2017 led to the split of Bitcoin into Bitcoin and Bitcoin Cash. Bitcoin Cash's block size is 8 megabytes and can do maybe five times as many transactions as Bitcoin. However, that is still way too few to operate as a global payment solution.

Bitcoin does not possess adequate on-chain scalability.

While Bitcoin manages to score well on two of the three points in the Blockchain trilemma, this does not necessarily hold true for all proof-of-work-based cryptocurrencies. A 51% attack is an attack vector in proof-of-work-based networks. Attackers try to raise at least 51% of the computing power, or 'hash rate' (the measuring unit of the processing power of a crypto network) to be more precise. With the majority of the network hash rate, the attacker would be able to perform double spends or reverse transactions, for example. They would be able to enter any transaction they wanted to, thereby completely undermining the security of the network. For cryptos with very high hash rates, like Bitcoin, it is extremely unlikely that one party will ever control 51% even temporarily, but the same cannot be said about cryptocurrencies with much lower prominence. Feathercoin, Vertcoin, Bitcoin Gold, Verge, Grin, Firo, and even Ethereum Classic have all suffered from 51% attacks in the past. Many of the small proof-of-work-based cryptocurrencies operate in an environment where they are definitely decentralised, but where both their scalability as well as their security are not absolutely guaranteed.

Ethereum sits in a very interesting spot right now. This cryptocurrency uses a proof-of-work algorithm and currently manages about 15 transactions per second (which is far too few for a global payment solution). However, Ethereum is pushing for bold changes to solve scalability. Serenity, a.k.a. Ethereum 2.0, is that attempt and will be rolled out in phases. Phase 0 was already released in December last year and saw the launch of the Beacon chain, which is based on a proof-of-stake mechanism instead of the proof-of-work algorithm. Proof-of-stake means that the amount of computing power needed to validate transactions will be massively reduced, which is great news for the environment. Potentially, Phase 1 will follow this year and introduce sharding, which splits the blockchain into smaller partitions known as 'shards'. These operate in parallel, portioning the database to create faster transaction speed before syncing in the Beacon chain. The current number of shard chains that can be used is still up for debate. Current estimates point towards 64 shards, which would raise transaction speed throughout dramatically.

Probably in about two years' time, Phase 2 will be released, which plans to implement Ethereum WebAssembly (eWASM), which is an upgrade to the smart contract execution layer. Even though these developments look promising, investors should be made aware of a number of yellow flags. The proof-of-stake consensus mechanism is not without its critics. This mechanism has been described as the equivalent of allowing only the very richest people in your country to vote for president. In addition, since individuals can earn by staking their cryptocurrency 'coins', it means that rich individuals will be able to earn more, systemically increasing inequality.

Ethereum is very interesting from the perspective that the developer community behind it is actively searching for solutions to address the blockchain trilemma and is not afraid to fundamentally change how the Ethereum blockchain operates. This is in pretty stark contrast to the dominant forces behind Bitcoin. The community behind Bitcoin has always been very focused on keeping the original vision intact and all changes that have been made over the last 12 years are only minor in nature. As of today, we get the impression that Ethereum is still aiming to become a global payment solution, while Bitcoin seems to be rather content as being seen much more like a speculation object and a 'digital gold' rather than a functional currency.

Another interesting concept comes from the recently launched cryptocurrency Chia, which uses a proof-of-space-and-time consensus mechanism. Instead of allocating tokens (such as with proof-of-stake) or computing power (such as with proof-of-work), the miners allocate hard-drive space in the mining process. The idea is that this will prove much more energy efficient compared to proof-of-work. While Chia is not the first crypto to try this concept (there are already Storj, Siacoin, Filecoin, and others), it is an interesting venture because it is co-authored by the creator of the communication protocol BitTorrent, has received seed money from the privately owned US Venture Capital company Andreessen Horrowitz, and is one of the most user-friendly blockchain offerings.

Opinion

ENVIRONMENTAL IMPACT OF BITCOIN VS GOLD

Some investments indeed have a direct and measurable climate footprint: precious metals and cryptocurrencies. Here, investors buy a physical product or service that entails a trail of environmental and social challenges. We can calculate this climate impact using the following logic:

- Supply chain activity: Gold supplies are roughly 3,300 tonnes from mines and 1,200 from scrap annually. For cryptocurrency coins, the main activity is the power consumption of the 'miners'. Assuming that Bitcoin accounts for the lion's share, because of its popularity and particularly power intense process, Cambridge University's Bitcoin Index offers a guide to the activity level. The latest reading is roughly 15 gigawatts or twice Switzerland's annual power consumption.
- Supply chain footprint: Leading gold miners report around 15 tonnes of greenhouse gas emissions (CO2e) per tonne of gold produced. Scrap refining is a fraction of this, likely around 1 tonne. The majority of Bitcoin 'mining' happens in China, where coal is dominant, and has an approximate climate trail of around 0.8 tonnes CO2e per megawatt.
- Investor's impact: Most investment flows are in and out of vaults, some are purchases from a refinery. Thus, gold's climate footprint is a discount of that from mining or refining. Based on the visible volume flows, we apply a discount of 0.5. For crypto currencies, all proof-of-work transactions entail 'verification' or 'mining' activity so there is no discount that can be applied.

In sum, based on these simplified assumptions, purchasing a Bitcoin at today's prices has roughly a similar climate impact to a return flight Zurich–Berlin (200kg CO2e). Purchasing a standard bar of gold has roughly a similar climate impact to eating a decent hamburger or a Swiss cheese fondue (10kg CO2e).

This analysis of the environmental impact of Bitcoin vs gold was carried out by Norbert Rücker, Head of Next Generation and Economics Research

Exchange-rate regime

There are two major types of exchange-rate regime when it comes to cryptocurrencies – free-floating and pegged.

As the name suggests, free-floating cryptocurrencies are not tied in value to any specific reference point, their prices can float freely. The majority of cryptocurrencies are set up in this fashion. Bitcoin is the most prominent example of a free-floating crypto. It was specifically designed that way because the author intended for it to work as a medium that is not value-wise tied to the 'old' system of US dollars, or gold, or similar, in any fixed capacity. Free-floating cryptocurrencies often have the concept to create an entirely new payment system and/or investment type. Only because of the free floating of Bitcoin was it possible for the crypto to increase by thousands of percentage points in US-dollar-denominated value over circa the last 12 years. The majority of free-floating cryptocurrencies do not have any fixed value anchor and, as such, both a performance of -100% as well as +infinity is theoretically possible.

On the other side of the spectrum, there are cryptocurrencies that are pegged to a reference value. A variety of things might operate as a reference point, however, the US dollar and gold are currently the most prominent. These coins are often referred to as 'stable' coins. However, that name might be misleading as the value of the coins or tokens are often just stable in reference to their reference point. A gold-focused stable coin is likely going to be just as volatile as an ounce of gold, which might not look very stable when viewed through a more daily-use-oriented reference point, such as the cost of a basket of consumer goods.

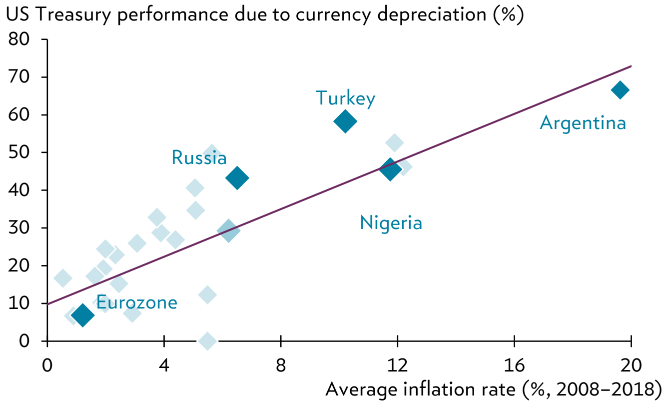
Stable coins are pegged to a reference point, such as gold or the US dollar.

The most famous, or infamous, stable coin is Tether. This is the only stable coin that is in the top ten of all cryptocurrencies by market capitalisation. Tether claims to be backed 1:1 by the US dollar, however, this has been doubted on multiple occasions. John Griffin and Amin Shams published a paper in the Journal of Finance concluding that Tether cannot adequately be backed completely by US dollars. The company behind Tether is currently under criminal investigation concerning whether it participated in a price manipulation of Bitcoin. Most recently, on 23 February 2021, New York Attorney General Letitia James stated that she believes that Bitfinex and Tether deceived clients and markets by overstating reserves and hiding approximately USD850m in losses around the globe. We would advise any client who considers holding Tether to be extremely careful in their due diligence before deciding that Tether is the supposedly pegged-to-the-US-dollar exposure that they are searching for.

The second very high profile stable coin is still in its concept phase and we wrote a Research Focus (Digital Payments: Libra – The Future of Money) on it nearly two years' ago. It is, of course, Facebook's foray into the crypto space. Since last summer, the name of the upcoming stable coin has changed from Libra to Diem. Facebook's crypto wallet concept has also changed its name from Calibra to Novi, which some cynics have referred to as a pretty superficial attempt in trying to give the illusion that Facebook is not the dominant force behind both the cryptocurrency as well as the wallet.

There have been other changes that were not as superficial as a name change. Many of the problems we predicted for the then-called Libra have come back to haunt the project, and have led to big structural changes under the hood in how the cryptocurrency is supposed to operate. The highlighted problems concerning the global currency basket have been solved through abandoning the concept of a global currency basket and, at least, in a first stage, only launching a US-dollar-backed cryptocurrency, with an option of launching independent other cryptocurrencies that will also only be backed by a single existing currency. The original white paper of the-then Libra also spoke of a relatively quick transition from a 'permissioned' (needs prior approval before use) to a 'permissionless' (a public system, normally used by cryptocurrencies) blockchain infrastructure. We doubted the feasibility of that step happening any time soon and the updated December 2020 version of the white paper now states that a transition to permissionless is no longer planned. Not having a permissionless system means that the Diem blockchain will not be a decentralised system. This is again a good example of the blockchain trilemma. Between safety, scalability, and decentralisation, you can only really chose two. As also highlighted in our previous Research Focus, there are number of potential upsides for Diem, particularly in the emerging markets. First, since Diem will be pegged to the US dollar, it will offer certain store-of-value characteristics for individuals living in countries with very high degrees of inflation. High levels of inflation strongly deteriorate a currency's purchasing power, as individuals from Turkey, Nigeria, and Argentina were unfortunate enough to witness during the last decade. Second, since many individuals in the emerging markets have access to a smartphone, but not a bank, Diem might help to integrate the underbanked. Third, Diem has the potential to substantially lower cross-border transaction fees, particularly of remittances, which would provide a large benefit to emerging markets. A recent news article suggested that Diem could launch a pilot phase in the latter part of 2021. We consider this realistic, as quite a bit of development time has passed since the initial announcement of the digital asset venture and because the ambition of the project has been massively scaled back in the meantime.

High inflation increases attractiveness of foreign currencies



Source: Bloomberg Finance L.P., Julius Baer

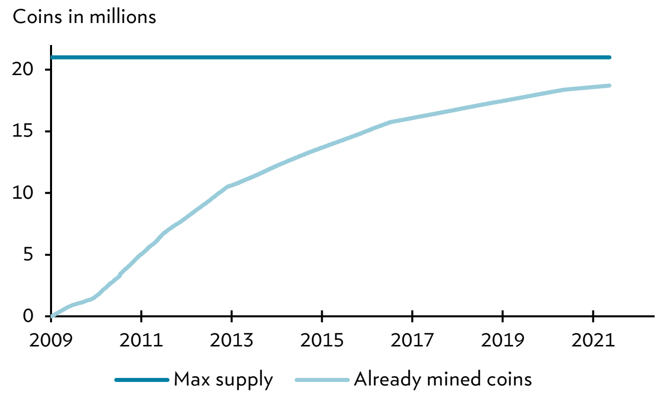
Monetary policy

Two major types of monetary policy regime can be distinguished in the cryptocurrency space, cryptos that have a limited supply and cryptos that do not.

Unlike with fiat currencies such as the US dollar or the Swiss franc, the supply of some cryptocurrencies like Bitcoin cannot be readily adjusted by humans, but instead follows a fixed set of rules that are hard-coded into the blockchain. In Bitcoin's example, one rule is that the amount of newly issued Bitcoins per block decreases by 50% after a fixed number of blocks until 21 million coins are mined. There will never be more than 21 million Bitcoins in circulation and, as of May 2021, roughly 90% of the entire maximum supply of Bitcoin has already been mined.

Every event where the block reward of Bitcoin decreases by 50% is called a halving event. The next such event will happen in early 2024 and some argue that it will be positive for Bitcoin prices due to the fact that it symbolises the finite and therefore scarce nature of Bitcoin and because the returns after the previous two halvings were highly positive.

Bitcoin monetary policy



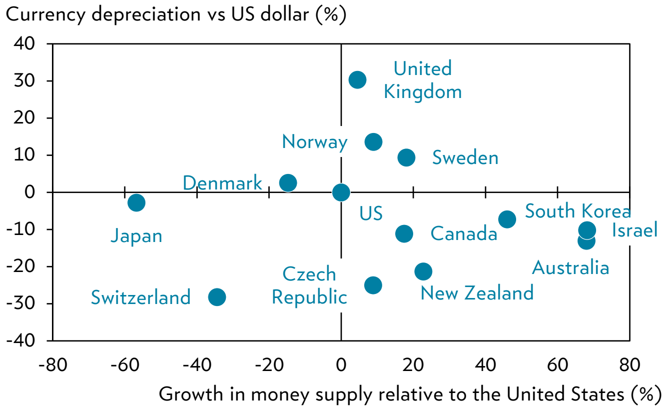
Source: Datastream, Julius Baer; Max = maximum

While we do not rule out the chance that the halving could turn into a self-fulfilling prophecy – if enough people believe Bitcoin should go up in price, they will buy Bitcoins where after it actually will go up in price – we do not read too much into the halving from a fundamental perspective for four reasons. First, a sample size of three is not statistically significant. The impressive performance of Bitcoin during the 12 months after the previous two halvings might just be a lucky coincidence, especially since the Bitcoin price is extremely volatile. Second, the halving is not an unanticipated event. If there were something special about the event from a price point of view, savvy crypto investors would have already arbitraged it away a long time ago. Third, declines in money supply do not necessitate the price appreciation of a currency. Impact factors such as the velocity of money and the general attitude towards a currency are also key influencing factors. Fourth, and building on the previous point, Bitcoin derives its value entirely from network effects, suggesting that demand is the dominant driver of prices, not supply.

To further highlight the point that we are convinced that lower monetary supply growth does not necessitate price appreciation, we have examined the regular currency market over a period of 20 years. Our findings are that there is practically no correlation between monetary supply growth differentials and currency value adjustment. For example, while the monetary supply of the British pound has grown pretty much in lockstep with the US dollar, the pound has decreased roughly 30% in value versus the dollar in the same period of time. Another example is New Zealand. The 'kiwi' dollar has appreciated versus the US dollar by 20%, while its monetary base has been growing 20% faster than the one of the US dollar. This is the exact opposite of what should occur if there was a clear connection between monetary supply growth differential and currency depreciation.

While Bitcoin is the most prominent example of a free-floating cryptocurrency, it is by far not the only one. Binance Coin, XRP, Cardano, Litecoin, Bitcoin Cash, VeChain, Neo and many others only have a finite amount of coins that will ever be mined. Ethereum, Dogecoin, Polkadot, Tron, Monero and many others are examples of coins that do not have a maximum supply cap.

Money supply growth and currency movements show no link



Source: Datastream (data from 1998 to 2018), Julius Baer

The question of whether a maximum supply is good or bad is subjective. Some argue that a hard cap limits the supply, thereby making the coins more valuable. Another pro-maximum-supply argument is that it is a very transparent operating mechanism and that it goes well with estimated user adoption. Supply growth is high while many new users adopt the crypto and then goes down as the number of new users also goes down. The proponents of no-maximum-supply caps often argue that a bit of supply growth is a good thing for continued operations. Proof-of-work miners, for example, are reimbursed for their computer operations through a block reward (which is nothing else than monetary supply growth) and any transaction fee that transaction agents are willing to pay to have a higher chance of their transactions being processed in a reasonable time frame. If the supply growth goes down, the block reward goes down, meaning that transaction agents need to pay higher transaction fees for the same service, everything else being equal.

Stable coins such as Tether and USD Coin naturally do not have a maximum supply as they both act as a sort of cryptocurrency derivative of the US dollar. As the US dollar does not have a maximum supply, neither do Tether or USD Coin.

Smart contract capability

A smart contract is not smart and it is not a contract. It is instead more like a predefined process on the blockchain that is executed automatically if certain conditions are met.

Not all cryptocurrency blockchains are able to host/execute all types of smart contracts. Especially older cryptocurrencies such as Bitcoin, which are not Turing-complete (unable to recognise other data-manipulation rules sets), are unable to accommodate all types of smart contracts. As of today, Ethereum has essentially established itself as the destination of choice when it comes to smart contracts, with the most prominent being its ERC-20 crypto standard. As a side note, a majority of all non-fungible tokens (NFTs) are based on the ERC-721 standard, which is also based on the Ethereum ecosystem. A major application of smart contracts is in DeFi, which is short for decentralised finance. DeFi is utilised to enable banking services on the blockchain, such as trading, collateral guarding, lending, etc.

Terms explained

SOME TOP-OF-MIND CRYPTOS, OVERSIMPLIFIED

Bitcoin is the original proof-of-work cryptocurrency that started it all in 2009 and is still the one with the highest market capitalisation by far. Originally envisioned as a global financial system replacement, it is now treated more like a 'digital gold' by investors, due to its very low on-chain transaction count possibilities.

Litecoin is one of the earliest copycats of Bitcoin. Launched in 2011, Litecoin uses a slightly different hashing algorithm (Scrypt instead of SHA-256) and has a lower block confirmation time (2.5 minutes instead of 10 minutes), but is otherwise pretty much identical to Bitcoin. Anybody who considers Bitcoin to be 'digital gold' will potentially think of Litecoin as 'digital silver'.

Bitcoin Cash is a spin-off from the original Bitcoin, created as a way to solve Bitcoin's scalability issue by increasing the blockchain block size from 1 megabyte (MB) to 8MB. According to crypto exchange Gemini, Bitcoin Cash manages to process around 116 transactions per second on-chain. This is much more than Bitcoin, but is still miniscule compared to the thousands of transactions that Mastercard and Visa process in the same time.

Ethereum is the second largest cryptocurrency by market capitalisation. The main differentiator compared to Bitcoin is that the Ethereum blockchain is capable of hosting smart contracts. Furthermore, while Ethereum currently uses a proof-of-work mechanism just like Bitcoin, major resources are being deployed to shift this towards proof-of-stake.

Ethereum Classic exists because there was a bug in the first version of Ethereum that allowed hackers to steal a large portion of the outstanding Ether coin. The community was split on how to handle the situation. The majority decided to reverse all transactions related to the bug and sort of reset the blockchain to a bug-free state. This chain retained the brand 'Ethereum'. However, a minority of individuals thought that the blockchain should not be compromised and that all recorded transactions should be treated as legitimate. That second version of the blockchain was then branded 'Ethereum Classic'.

Dogecoin has been highlighted multiple times recently in tweets by Elon Musk and was created as a joke. Even its name is a reference to the meme of a Japanese dog breed. In terms of cryptocurrency, Dogecoin is more of a light-hearted redistribution game.

XRP is the cryptocurrency that is part of the Ripple real-time gross settlement system. XRP is often in the top ten, if not top five, cryptos by market capitalisation. The US Securities and Exchange Commission's legal proceedings against Ripple Labs related to its claim that XRP could be deemed a security started last December and are still ongoing.

Binance Coin is an ERC-20 token, based on the Ethereum network, which was launched along with the Binance platform itself after an initial coin offering (ICO). Originally, Binance Coin was created as a means of payment for transaction fees on the Binance Exchange. Since then, it has morphed into a free-floating crypto that now posts one of the highest market values.

An empirical analysis of Bitcoin

In this section, we will take a closer empirical look at the most prominent cryptocurrency, Bitcoin. Taking into account diversification, drawdown, volatility, and the fear-of-missing-out (FOMO) proxy perspective.

Diversification benefits during market corrections

Unlike bonds, equities, and commodities, the price of free-floating cryptocurrencies like Bitcoin cannot be approximated around any sort of tangible intrinsic value, but is rather purely defined by the network effect. When people exchange their fiat currencies for Bitcoins because they want to hold them as a store of value, or to speculate on price appreciations, or utilise them in day-to-day transactions, the price goes up, and vice versa. This has led to the theory that Bitcoins and other free-floating cryptocurrencies exhibit very little correlation with assets of different asset classes, and could therefore add value as a position in a portfolio from a diversification perspective. For the majority of time, returns of Bitcoins and equities have been neither consistently positively nor negatively correlated.

However, in early 2020, Bitcoin lost even more of its value than US equities. In fact, during the last four equity market corrections of more than 10%, Bitcoin has, on each occasion, also lost at least 10% of its value and, on three out of four occasions, noted steeper losses than equities – an indication that diversification benefits are non-existent when they are needed the most. From a limited number of observations, we can gauge that Bitcoin has been treated by the overall market just like other assets that are deemed as generally more risky, such as equities and high-yield corporate debt. Therefore, Bitcoin suffers during periods of heightened market uncertainty when a 'flight to safety' occurs, and safe-haven assets such as US Treasuries or gold profit in comparison to assets that are deemed more risky in nature.

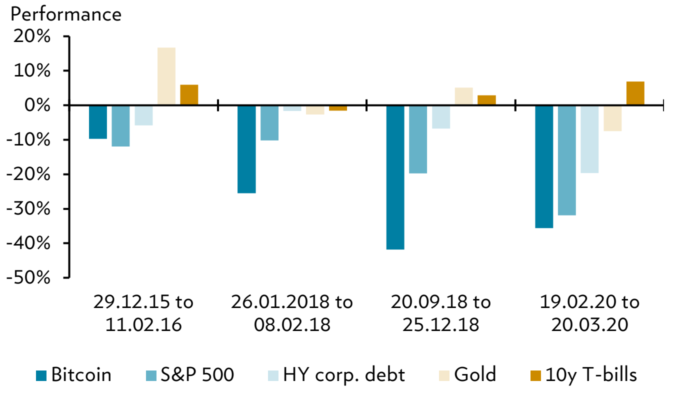
Historical drawdowns

While many individuals are aware of the massive drop in the value of Bitcoin and other cryptocurrencies during 2018, it is important to remember that this was 'not the only rodeo' that Bitcoin went through in its roughly 12-year history. On three occasions, or roughly every four years, the most prominent of cryptocurrencies experienced a peak to trough retreat of 70% or more. Equities have exhibited such a drawdown only once during the entire last century, after the peak of 1929. Of course, equities have also not exhibited the compound annual growth rate of Bitcoins during the last 12 years, or in any 12-year time frame during the last century. As of 20.05.2021, Bitcoin's current max drawdown stands at roughly 30%. While the recent decrease is certainly very eye-opening in dollar terms, historically speaking, it is not very special in percentage terms. The key takeaway is that Bitcoin has not only shown an extremely high return profile, but has done so with very high levels of risk and substantial temporary drawdowns.

Bitcoin has already on three separate occasions dipped by >70%, once roughly every four years.

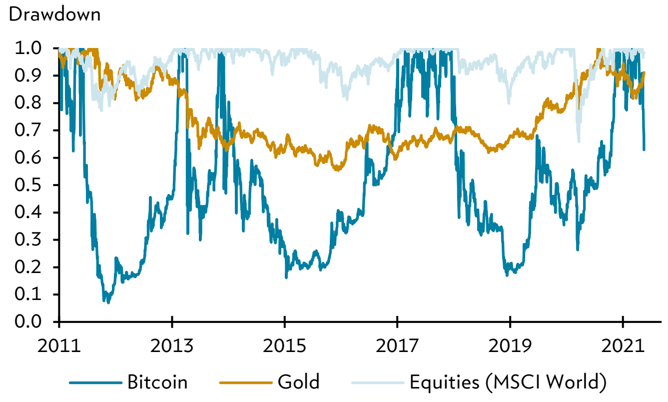
Drawdown charts are pessimistic charts in the sense that they only focus on the downside. They tell you about price declines versus previous peaks and tell the story of the frequency and the magnitude of price corrections. As such, they also answer the question, what would have happened in a worst-case scenario, if an investor bought at the absolute peak and sold at the absolute trough.

Whenever equities fell, Bitcoin fell as well



Source: Datastream, Bitstamp, Julius Baer; HY corp. = high-yield corporate Past performance and performance forecasts are not reliable indicators of future results. The return may increase or decrease as a result of currency fluctuations.

Bitcoin shows both massive gains and massive drops



Source: Datastream (data as of 19.05.2021), Bitstamp, Julius Baer. Past performance and performance forecasts are not reliable indicators of future results. The return may increase or decrease as a result of currency fluctuations.

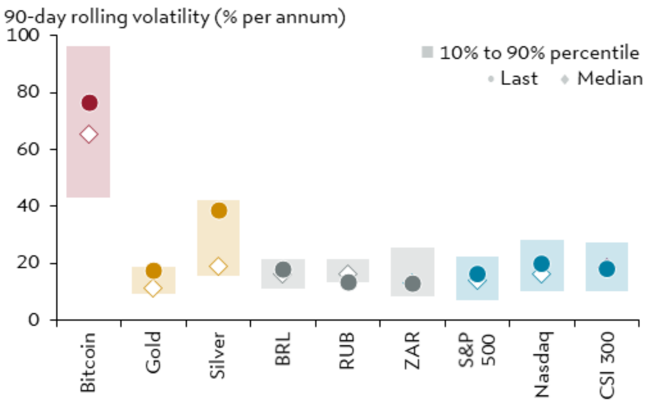
Observed price volatility

Bitcoin has a very clear and predefined monetary policy. Supply growth is currently always positive and small and, in the future, will steadily decrease down to zero. The supply side does not really have a strong impact on the volatility of Bitcoin. The volatility of Bitcoin is pretty much entirely driven by the demand side of the equation, and since Bitcoin is not linked to any real-world value, the demand side is almost entirely the result of market sentiment. Market sentiment, in turn, is the result of the story that market participants put the most faith behind. It is, therefore, no wonder that statements by important regulators or even tweets by famous individuals, such as Elon Musk, can have massive price implications for Bitcoin and thereby make the cryptocurrency extremely volatile. During 2017, it was the story of "Blockchain might change every facet of how corporations operate. We need to buy crypto right now!" and, as a result, Bitcoin increased by a factor of 20. When the story shifted to "Where are all the promised revolutionary use cases, maybe blockchain isn't the future", the price tumbled from around USD 20 thousand down to roughly USD 3.5 thousand. Fast forward in time and the story turned to "Central banks are unhinged. They are printing money in a coronavirus relief effort. We need to shelter with Bitcoin to protect us from inflation", and massive price appreciation happens again. The very recent worries on China prohibiting cryptocurrencies for payment usage and questions about the environmental impact have swung the perception pendulum back into negative territory. As a result, the price has swung down strongly. While the sentiment of tomorrow is nigh impossible to predict, it is likely that Bitcoin will react strongly and therefore continue to exhibit levels of volatility that make emerging market equities look tame in comparison.

The massive levels of volatility exhibited by Bitcoin highlight its failure as a store of value currency.

The massive levels of volatility exhibited by Bitcoin highlight its failure as a store of value currency. Few want to use a method of payment for day-to-day transactions that has value swings as wide as Bitcoin. Price stability is one of the most important cornerstones for a currency and Bitcoin has never been able to achieve it in its more than 12-year history.

Volatilities among asset classes



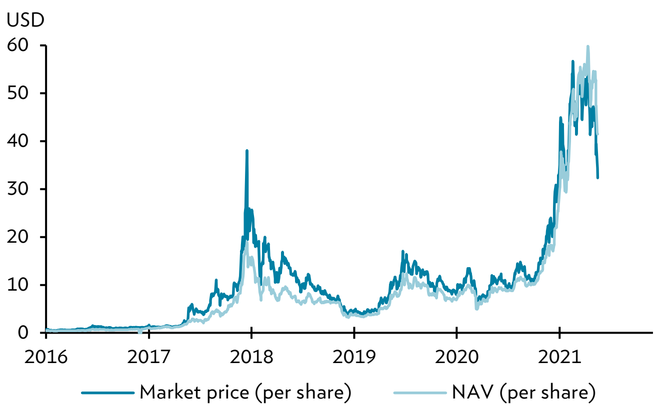
Source: Bloomberg L.P., Julius Baer. Past performance and performance forecasts are not reliable indicators of future results. The return may increase or decrease as a result of currency fluctuations.

Attempts to measure FOMO in Bitcoin

It has been a wild year for Bitcoin. First, it sold off even more than equities during the March 2020 coronavirus-related sell-off period, displaying once again that it tends to behave much more like a risk-on asset rather than a safe-haven such as US Treasuries or gold. Then, it started to rally and reached new record highs, before decreasing rapidly during the last few days. Neither recent technological change proposals nor changes in adoption can explain this rally. Suggested technological upgrades liked Merklized Abstract Syntax Trees, Schnorr signatures, and Taproot are all nice ideas, but they will not solve the main issue with Bitcoin that lies with its issues surrounding operating at massive scale. We have not witnessed the mass adoption of Bitcoin, measured as a share of transactions relative to local currencies, outside of countries that are faced with hyperinflation and economic collapse, such as Venezuela.

We mainly attribute the very strong performance in early 2021 to rising investment demand and take the Grayscale Bitcoin Trust* (GBTC) as the proxy to make that argument. GBTC is an open-ended US-based trust that manages USD 10.3bn in Bitcoins. It is one of the first and largest Bitcoin-investment products, providing a rather hassle-free exposure to the crypto. Due to its trust structure, the market price and net asset values can vary over time. A 10% premium means that investors are willing to buy the equivalent of USD 1 in Bitcoin for USD 1.1. They are willing to do so either because they believe that the premium will not shrink or because they believe prices will shoot up so much that the premium does not matter. In December 2020, we witnessed a market situation where investors were willing to pay a premium of roughly 30% during a pronounced price uptick phase, which is reminiscent of the FOMO atmosphere of late 2017. More recently, the situation has, however, completely reversed and, as of mid-May, the premium has shifted to a discount of roughly 22% as investors seem to be reversing their positions on environmental concerns and momentum trailing into the downwards direction.

Value of the GBTC* fund premium over time



Source: Bloomberg L.P. (data as of 19.05.2021), Julius Baer; NVA = net asset value. Past performance is not a reliable indicator for future performance. The return may increase or decrease as a result of currency fluctuations.

* GBTC is shown for illustration purposes only and does not imply any Julius Baer recommendation/investment view.

Predicting Bitcoin's future price moves
When trying to value the bond of a company, we can look at its balance sheet and, together with some predictions about default probabilities, we can make a pretty accurate estimate on what the fixed income security should be worth. When looking at real estate, we can inspect the building. Together with income estimates from rent, we can make a decent estimate on what that investment should be worth. Equities offer a similar picture. The value of a stock is a function of future company earnings discounted to today. We can estimate those earnings by looking at the products/services the company offers its customers and make estimates from there. What these three examples have in common is that we have tangible productive references on which to base our calculations upon when trying to predict the value of assets.

However, the majority of cryptocurrencies are entirely different. They tend to be nothing more than a combination of numbers. As such, all approaches to evaluating them tend to be very technical in nature. Examples are:

- **NVT ratio** (network value to transaction) divides the market capitalisation by the daily volume. Low ratio values are seen as buy signals.
- **MVRV ratio** (market value to realised value) divides the market capitalisation by the realised capitalisation. The latter is an approximation of the value paid for all coins in existence by making a sum of the market value of coins at the time they last moved on the blockchain. Low values are seen as buy signals.
- **Network momentum** is a technical way of analysing Bitcoin. Upwards price trends are a buy signal.
- **Difficulty ribbon** looks at mining difficulty bands. Compressing ribbons are a buy signal.
- **Stock-to-flow** is a commodity model that looks at supply growth and predicts price rises due to scarcity.

Our experts from the Technical Analysis[2] team have started covering five major cryptocurrencies, namely Bitcoin, Ethereum, XRP, Bitcoin Cash, and Litecoin. In research publications, such as the Technical Investment Strategy, Research Weekly, and The Wire, they will highlight what volume changes, seasonality effects, sentiment swings, and other factors will likely mean for the future price development of these five aforementioned cryptocurrencies.

Tokenisation

Earlier this year, an art object was sold at Christie's auction house for the equivalent of USD 69.4 million, placing its value in the ballpark of 'Untitled' by Mark Rothko and 'L'Allée des Alyscamps' by Vincent Van Gogh. The interesting aspect of this story is that most people had never heard of the artist Beeple before the sale took place, and because the sale was not about a physical painting or sculpture, but rather a piece of computer code.

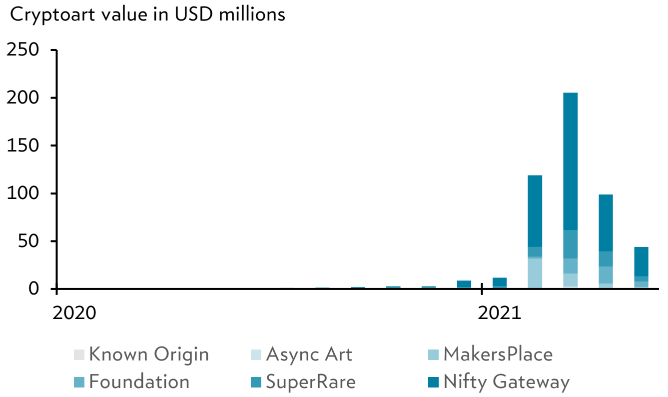
NFT stands for non-fungible token. NFTs are unique electronic identifiers that are stored and tracked on a blockchain, most often, the Ethereum blockchain in the form of ERC-20 tokens. The non-fungible aspect means they are unique. While one Bitcoin is very much equivalent to the next, no NFTs are the same. Proponents see therein the value proposition for NFTs, and the future of art, if not the internet as a whole. According to their vision, such sales would allow content creators to sell their work anywhere and access a global market. This could transform the rather illiquid space of art into a much more active trading platform and also lead to creative financing solutions, such as using art for escrow payment services or as collateral for decentralised loans.

Detractors say that NFTs open up the floodgates for fraud, since it takes very little effort to download someone's digital artwork, copy it, create a NFT, and then sell it to a gullible investor. According to advisory firm Statis Group, roughly 80% of all initial coin offerings in the 2017 initial coin offering (ICO) boom were scams and the fear is that something similar could happen now in the NFT space. Other detractors argue that the Van Gogh painting only retains its value because nobody can copy it on an atomic level. The same does not hold true with NFTs, as they do not necessarily prevent the possibility of a 1:1 copy. One could send a perfect copy of the USD 69.4 million artwork that was sold by Christie's by mail very easily. Furthermore, some have speculated that there is potential for 'wash trading' in the NFT space.

Is there a link between the record NFT sales and the price levels of Bitcoin? Yes and no. Yes, because sentiment towards cryptocurrencies likely received another boost because of the sale. No, because Bitcoin is not directly associated to such kinds of tokens. If we assume that NFTs were to manage to gain prominence, Bitcoin would not directly profit from increased demand as its blockchain does not have NFT capabilities. The potential winners would mostly be Ethereum, with its first-mover advantage, as well as some smaller coins that also have NFT capabilities, such as Cardano, Flow, and Bitcoin Cash.

The sale of Beeple's artwork for the equivalent of USD 69.4 million has kick-started a hype that has led to some quite bizarre and interesting pieces of digital content being sold. Taco Bell sold a cyberpunk version of a taco. CEO of Twitter Jack Dorsey sold a NFT of his first tweet for millions. Whistleblower Edward Snowden sold a NFT that is based on a digital photograph of him entitled 'Stay Free'. Also, someone managed to sell a NFT that is based on a 52-minute long collage of recordings of his flatulence for a bit more than USD 1,000. However, from a volume perspective, it seems that the market has already peaked.

Crypto art market already shows signs of having peaked



Source: Cryptoart.io, Julius Baer, Notes: May figures up until 17.05.2021

[2] Technical Analysis may be inconsistent with and reach different conclusions to fundamental analysis

Blockchain corporate positioning

In this segment, we look at the blockchain value chain, starting with the companies that manufacture the hardware used for the mining operations. We then look at the firms buying the mining hardware and operating it, before looking at the companies engaged in the trading and brokerage of cryptocurrencies, and those that aim to build financial services and software solutions around the blockchain and crypto ecosystem. Lastly, we take a quick glance at the large established companies that have dabbled at least a toe into the blockchain and crypto space.

Hardware manufacturers

There is an old saying going back to the California pioneer days. If you want to become rich from a gold mining rush, be the one who sells the shovels. The shovels in the crypto rush are not physical pickaxes, but rather application-specific integrated circuits (ASICs), field-programmable gate arrays (FPGAs), and graphics processing units (GPUs). ASICs are extremely tailor-made for specific tasks. Wherever usable, an ASIC crypto mining rig is going to outperform most GPUs easily in raw power and provide much better performance-per-watt figures from a resources perspective. However, since they are so tailor-made, they decrease massively in value if the next generation of ASICs makes a massive jump in performance-per-watt.

Not every type of mining hardware can be used on any type of proof-of-work-based cryptocurrency.

GPUs offer value when it comes to mining cryptocurrencies that are based on ASIC-resistant decryption algorithms, e.g. Monero. Furthermore, they offer the advantage that miners can resell them for a decent price to gamers on the secondary market when a new generation is released with enough of a strong leap in performance-per-watt. FPGAs fall in the middle between ASICs and GPUs. They tend to offer more flexibility in usage than ASICs but less than GPUs and they tend to offer worse performance-per-watt than ASICs but better than GPUs.

Overall, the ASIC- and FPGA-oriented firms tend to exhibit more of a pure-play character, since the majority use case for GPUs is playing video games, not crypto mining. The entire crypto-currency-related hardware-manufacturing segment has exposure to the threat that proof-of-work-based cryptocurrencies are going to lose out against cryptocurrencies that are built on consensus mechanisms that do not require massive computing power, such as proof-of-stake or proof-of-space. This threat is definitely real as Ethereum's product roadmap even has the transition from proof-of-work to proof-of-stake as a main goal.

Mining operations

We are see the crypto mining market as a very tough place to operate. Earnings are likely to remain extremely volatile as revenues are directly related to the market price of cryptocurrencies, which are very volatile in nature. Furthermore, the industry is in a weird position where there are both very high capacity expenditure demands and very low barriers of entry. Every person with a 'new-ish' gaming computer has the potential to mine some ASIC-resistant cryptos, which explains the very low barriers of entry. At the same time, rapid technological development and strong competition leads to a situation where earnings per Terahash (TH/s) of mining power is going to decrease at a decent pace if the price of cryptocurrencies does not go up. A proxy for that is the network difficulty that has been increasing at rapid rates for most cryptocurrencies.

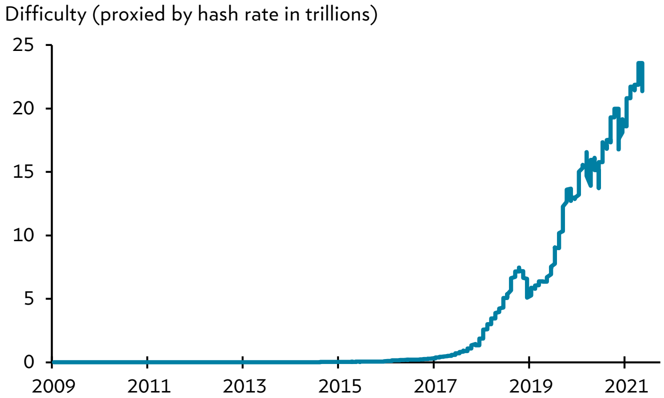
A further negative are the business operating risk governments. Proof-of-work cryptocurrencies have a very large climate footprint, and cryptocurrencies in general pose the threat of undermining the usefulness of the monetary toolbox of central banks. It is therefore not to be ruled out that some mining operations will face governmental scrutiny in the future. This is not just a theoretical threat. In March 2021, China decided to ban cryptocurrency mining in China's Inner Mongolia region. The majority of the companies in the mining operations space are small-capitalisation firms, which had negative 2020 operating margins.

Business positioning of hardware companies

Company	Exposure * Laggard I Leader	Rating (Equity)
More geared towards ASICs and FPGAs		
Bitmain	○○○I●●●	n.c.
TUL Corporation	○○○I●●○	n.c.
Global Unichip	○○○I●●○	n.c.
More geared towards GPUs		
AMD[1]	○○○I●○○	★★★★
Nvidia	○○○I●○○	Reduce
TSMC	○○○I○○○	n.c.

Source: Julius Baer. * Exposure ranges from ●●●I○○○ (strong laggard) to ○○○I●●● (strong leader). Please note the relevant equity information and Morningstar coverage (note[1]) may be found in the annex at the end of this publication; n.c. = not covered/n.l. = not listed; Julius Baer offers no recommendation and does not provide any advice on potential risks and opportunities.

Mining difficulty has increased massively



Source: Bitcoinity (data as of May 2021), Julius Baer

Just as with hardware manufacturing, the mining operations also have exposure to the threat that proof-of-work-based cryptocurrencies are going to lose out against cryptos based on other consensus mechanisms. This threat is likely to be much graver for the mining firms than the hardware companies. Nvidia and AMD can still sell their GPUs to gamers and the ASICs companies can shift production towards other types of semiconductors, but the operations of crypto mining firms would become practically worthless if proof-of-work coins were to switch their consensus mechanism or die out. The crypto-mining operations market is definitely only a place for investors with a lot of 'chutzpah'.

Business positioning of crypto mining companies

Company	Exposure * Laggard I Leader	Rating (Equity)
Hive Blockchain Technologies	○●●I○○○	n.c.
Bitfarms	○●●I○○○	n.c.
Hut 8 Mining Corp	○●●I○○○	n.c.
Marathon Digital Holdings	○●●I○○○	n.c.
Riot Blockchain	○●●I○○○	n.c.
Bit Digital	○●●I○○○	n.c.
Argo Blockchain	○●●I○○○	n.c.

Source: Julius Baer. * Exposure ranges from ●●●I○○○ (strong laggard) to ○○○I●●● (strong leader). Please note the relevant equity information and Morningstar coverage (note[1]) may be found in the annex at the end of this publication; n.c. = not covered/n.l. = not listed; Julius Baer offers no recommendation and does not provide any advice on potential risks and opportunities.

Crypto exchanges and brokerages

Coinbase is the largest US cryptocurrency exchange platform and also the first cryptocurrency-infrastructure provider in the US to go public. The company's listing gives a further push to the legitimisation and professionalisation of the cryptocurrency investment space.

As Coinbase is first and foremost an exchange platform, roughly 85%–90% of Coinbase's total revenue is tied to the price and volatility of cryptocurrencies. Exchanges tend to do better when volatility is higher, as members tend to trade more in such environments. Coinbase should also profit from a rise in the price of Bitcoin and other cryptocurrencies in general, as higher prices might generate more customer interest and therefore client and revenue growth. Conversely, a decrease in volatility and price of major cryptocurrencies would reflect badly on the company's earnings. There is also the question of whether Coinbase's margins are sustainable in the long run. Coinbase earns 0.54% on all cryptocurrency trades on its platform. According to data from Arbor Research and the Bank for International Settlements, if real currency markets were this inefficient, global banks would earn USD 32 billion per day just on foreign exchange (FX) trades, as the daily volume of FX markets is USD 6 trillion. It is questionable whether those margins are truly sustainable in the long run. As long as cryptocurrencies remain extremely volatile, a decent argument can be made that trading margins are not a prime concern for a decent percentage of customers. However, should prices start to exhibit less frequent wild swings, customers might start to look more closely at the fees they are paying on cryptocurrency transactions.

Regulation is a double-edged sword for the company and its competitors. On one hand, it is a threat to volume and volatility at Coinbase. A recent example is the central bank of Turkey's move to ban cryptocurrencies and other digital assets based on distributed ledger technology as a means of payment (since 30 April 2021). On the other hand, it might attract more clients by giving the space more safety and legitimacy. Gary Gensler was recently elected as the new Chair of the US Securities and Exchange Commission. He is very knowledgeable about cryptocurrencies and hopes are high that he might allow cryptocurrency exchange-traded funds to become possible in the US and push through other measures that would benefit that market. Since Coinbase's earnings are very strongly tied to the volatilities and prices of cryptocurrencies, any potential investment is going to be very risky and investors should carry out in-depth due diligence before taking the plunge.

Whether the substantial margins in the crypto trading space are sustainable remains to be seen.

Besides Coinbase, there are many smaller firms operating in the crypto-exchange and brokerages space. All market forces affecting Coinbase would affect these companies in a similar manner. Additionally, the smaller firms could potentially experience even higher levels of volatility in their stock price due to their generally more small-capitalisation nature.

Business positioning of crypto exchanges and brokerages

Company	Exposure * Laggard I Leader	Rating (Equity)
Coinbase	○○○I●●●	n.c.
Monex Group	○○○I●●●	n.c.
CME Group	○○○I○○○	Hold
GMO Internet	○○○I●○○	n.c.
Voyager Digital	○○○I●●●	n.c.
Plus500[1]	○○○I○○○	★★★
Intercontinental Exchange	○○○I○○○	Buy

Source: Julius Baer. * Exposure ranges from ●●●I○○○ (strong laggard) to ○○○I●●● (strong leader). Please note the relevant equity information and Morningstar coverage (note[1]) may be found in the annex at the end of this publication; n.c. = not covered/n.l. = not listed; Julius Baer offers no recommendation and does not provide any advice on potential risks and opportunities.

Blockchain ecosystem companies
A number of companies have dedicated themselves to building value-added services around blockchain technology and crypto assets. The majority of these firms offer services and products with rather short service track records. In addition, their business models are also often quite opaque. The most prominent of the below listed companies is Galaxy Digital Holdings, which offers crypto trade execution for its clients, has its own crypto prop ('tokens') trading desk, offers investment banking advisory solutions, financing solutions to crypto mining firms, and other services. Furthermore, almost all of the other companies in this area have quite small market capitalisations. An investment in one of the companies listed below would be very risky in nature and have more in character with venture capital investing than mature equity investing.

Business positioning of crypto exchanges and brokerages

Company	Exposure * Laggard I Leader	Rating (Equity)
Blockchain software companies		
DMG Blockchain Solutions	○○○I●○○	n.c.
BIGG Digital Assets	○○○I●○○	n.c.
Future Fintech Group	○○○I●○○	n.c.
Crypto-Banking and similar services		
Bitcoin Group Se	○○○I●○○	n.c.
Silvergate Capital	○○○I●○○	n.c.
Galaxy Digital Holdings	○○○I●○○	n.c.
Investview	○○○I●○○	n.c.

Source: Julius Baer. * Exposure ranges from ●●●I○○○ (strong laggard) to ○○○I●●● (strong leader). Please note the relevant equity information and Morningstar coverage (note[1]) may be found in the annex at the end of this publication; n.c. = not covered/n.l. = not listed; Julius Baer offers no recommendation and does not provide any advice on potential risks and opportunities.

Bigger corporations that are early adopters
A number of established firms have made commendable efforts in exploring what blockchain and crypto could mean for their businesses going forward. J.P. Morgan has created JPM Coin as a method to make settlements more frictionless. IBM has helped create the so-called Hyperledger platform. Facebook spearheaded the development of the stable coin concept Libra, which has since been rebranded as Diem. Softbank, through the Vision Fund, has invested in a number of blockchain-focused ventures. Payments-oriented firms like Square, PayPal, Visa, and Mastercard have all invested in the space and/or onboarded some type of crypto transfer and storing capabilities.

However, we have not seen any venture by any of the established firms that is likely going to create an entire new subindustry or radically redraw the existing business landscape. In our current assessment, blockchain technology implementation is unlikely to be a substantial stock-price needle mover for all the companies listed below. Similarly, Bitcoin and other cryptocurrencies are unlikely to substantially contribute to equity price changes for all of the firms, except one.

MicroStrategy decided to buy heavily into Bitcoin in the second half of 2020, spending north of USD1bn in the process. Since that announcement, MicroStrategy's Bitcoin holdings have started to make up most of the company's assets in US dollar terms. The company is therefore likely to trade more like a sort of Bitcoin exchange-traded fund (ETF) with a business-intelligence software company as a side venture, rather than as a regular stock of an information technology company.

Business positioning of established corporations

Company	Exposure * Laggard I Leader	Rating (Equity)
Square[1]	○○○I○○○	★
Oracle	○○○I○○○	Hold
Facebook	○○○I○○○	Buy
IBM	○○○I○○○	Hold
Softbank	○○○I○○○	Hold
Mastercard	○○○I●○○	Buy
Visa	○○○I●○○	Buy
JP Morgan	○○○I○○○	Hold
Paypal	○○○I○○○	Hold
Overstock[1]	○○○I●○○	★★★
MicroStrategy[1]	○○○I●●○	n.c.

Source: Julius Baer. * Exposure ranges from ●●●I○○○ (strong laggard) to ○○○I●●● (strong leader). Please note the relevant equity information and Morningstar coverage (note[1]) may be found in the annex at the end of this publication; n.c. = not covered/n.l. = not listed; Julius Baer offers no recommendation and does not provide any advice on potential risks and opportunities.

Central bank digital currencies (CBDCs)
Central bank digital currencies are often mentioned in connection with blockchain technology and cryptocurrencies. It has to be first and foremost stated that while it is possible that certain CBDCs might be based on a distributed ledger and, while some of them might utilise cryptographic algorithms to safeguard the users privacy and carry out transaction verification, this is by no means a necessity. In terms of central bank speak, CBDCs are a means by which a central bank decides to offer a digital monetary solution to individuals, nothing more and nothing less. When it comes to central bank projects, the one from the People's Republic of China is by far the most advanced.

China is in the later stages of its testing process for a central bank digital currency, which they have coined DC/EP (Digital Currency/Electronic Payment). While official statements concerning the launch are sparse, we are convinced that China will have such a digital currency in widespread use eventually and it will be one of the first countries in the world to do so. The three key reasons for this assessment are as follows:

First, China already has a very high penetration of digital payments through two dominant payment platforms offered by two technology giants, and most services already accept payment from these sources. According to some estimates, four out of five transactions are processed through these channels. Making the population switch from one digital payment form to another is much easier than getting a cash-centric society to adopt digital payments.

Second, from the perspective of China, the positives outweigh the negatives. On the positive side, CBDCs have a variety of economic benefits (e.g. faster processing speeds and lower transaction costs), legal enforcement benefits (e.g. anti-money-laundering and anti-terrorism-financing), health benefits (Covid-19 can survive for some time on physical surfaces such as cash notes), and potential central bank power benefits (e.g. facilitating the payment of a universal basic income, or more directly enforcing negative interest). On the negative side, since every transaction made with such a currency will potentially leave a digital footprint, there are legitimate concerns about the safeguarding of privacy. From a cultural and historical perspective, we project that China will be focusing primarily on the positives and will be less concerned about the negatives.

Third, China is one of the first large nations to put serious effort into the development of a CBDC. According to some sources, the planning started already six years ago. Multiple real-world tests have already taken place. Some 50,000 people in Shenzen received a DC/EP gift roughly worth USD 30 to test in October 2020. Since then, further tests were made with individuals in Suzhou and Shenzen. Large Chinese companies, such as Huawei and Tencent, have already been asked to provide services around DC/EP in the future, such as the provision of digital wallets. Furthermore, it fits into the agenda of the Communist Party, particularly in relation to the so-called 'new infrastructure'.

Central bank digital currencies are not a question of "if?", but rather a question of "when?"

China's digital currency is expected to be very different from Bitcoin and most other cryptocurrencies. While cryptocurrencies generally tend to have privacy and decentralisation at the core of their structural setup, we project that neither will be at the forefront when it comes to China's CBDC. This will likely focus on the aforementioned economic benefits of efficiency gains and will, in all likelihood, centre more control over money with the central bank, rather than decentralising it. Also, we assess that the main immediate goal of China's CBDC ambition is to replace physical cash payments with digital payments in China itself. As such, we do not consider the role of the US dollar as the dominant global currency to be threatened, at least for the foreseeable future.

China is, of course, not the only country looking into CBDCs. A 2021 survey by the Bank for International Settlements found that 86% of all central banks are actively researching the potential for CBDCs. Some notable examples are the Sand Dollar from the Bahamas, the e-Krona from Sweden, and the Bakong Project from Cambodia. Overall, we are convinced that CBDCs are the future and have the potential to bring physical cash to extinction, sooner or later.

Conclusion

The world of blockchains and cryptocurrencies has come a long way in the more than 12 years since Satoshi Nakamoto first published the initial Bitcoin white paper in 2008, at the height of the Great Financial Crisis.

While a great many innovations have been achieved since then, the biggest issue, the blockchain trilemma, has unfortunately stubbornly persisted and is still a major concern today. For any blockchain to truly work as a useful decentralised database, it needs to be three things: safe, decentralised, and scalable. However, the trilemma states that, more often than not, blockchains will be forced to sacrifice one of these aspects for the sake of the other two. It is for that main reason that we see the recent cool-down trend in funding for business-driven blockchain-related investments not just as a temporary blip, but rather as a baseline going forward.

When it comes to the market of cryptocurrencies, again the blockchain trilemma keeps us from really singling out any type of cryptocurrency as a clear winner. Proof-of-work cryptos like Bitcoin often suffer from terrible records when it comes to transaction scalability and environmental impact. Alternatives, such as proof-of-stake and proof-of-time-and-space cryptos are, in our assessment, the way forward, but they also need to overcome hurdles when it comes to decentralisation.

For investors in the cryptospace, it is important to note that there is no 'free lunch' and that there is a relationship between risk and return. Bitcoin has exhibited drawdowns in value of more than 70% roughly every four years during its existence. In recent years, it has also acted very much as a risk-on asset during periods of turmoil in the equity market. From our point of view, since the value of cryptos is, for the most part, entirely driven by network effects, cryptocurrencies primarily remain a speculative asset for risk-loving investors who do not fear the massive volatility, rather than a true safe haven.

When it comes to investments in equities of companies along the blockchain and cryptocurrency value chain, there is little we can outright recommend. Segments like the blockchain software companies are often still 'black boxes' that have much more in common with venture capital than with listed equities. Crypto mining operators are severely structurally challenged in our assessment. For large corporations with big investments in the segment, we conclude that their blockchain and crypto investments are not going to be big stock-price needle movers going forward.

Roughly two years ago, we called blockchain a solution in search of a problem. And, while we still make the same assessment for the majority of solutions available today, we do not rule out that the blockchain trilemma might be solved at some point in the future. If that were to occur, blockchain would be free to tackle and solve a lot more of its other problems.

Thematic equity overview

Company	Exposure * Leader I Laggard	Rating (Equity)	Consensus (Buy/Hold/Sell)	PriceCcy	Market cap. (USDbn)	Performance (%) 1m	3m	12m	5y	ISIN
Hardware manufacturers (ASICs, GPUs, related components)										
TUL Corporation	○○○I●●○	n.c.	Buy (0/0/0)	133.0TWD	0.21	-37	17	168	1150	TW0006150006
Nvidia	○○○I●○○	Reduce	Buy (35/6/2)	578.0USD	359.78	-5	-3	61	1204	US67066G1040
AMD[1]	○○○I●○○	★★★★	Buy (22/13/4)	76.8USD	93.31	-3	-14	36	1884	US0079031078
Bitmain	○○○I●●●	n.c.	n.c. (-/-/-) -	-	-	-	-	-	-	-
TSMC	○○○I○○○	n.c.	Buy (2/1/0)	159.3USD	259.90	3	4	33	58	US8923313071
Global Unichip	○○○I●●○	n.c.	Buy (7/2/2)	325.0TWD	1.56	-23	-26	45	359	TW0003443008
Crypto mining firms										
Hive Blockchain Technologies	○●●I○○○	n.c.	Buy (0/0/0)	3.1CAD	0.95	-24	-55	687	6040	CA43366H1001
Bitfarms	○●●I○○○	n.c.	Buy (1/0/0)	5.6CAD	0.67	31	-30	973	-	CA09173B1076
Hut 8 Mining Corp	○●●I○○○	n.c.	Buy (2/0/0)	5.1CAD	0.51	-28	-52	223	-	CA44812T1021
Marathon Digital Holdings	○●●I○○○	n.c.	Buy (1/0/0)	23.4USD	2.32	-30	-46	2713	-35	US5657881067
Riot Blockchain	○●●I○○○	n.c.	Buy (1/0/0)	25.6USD	2.15	-34	-64	911	599	US7672921050
Bit Digital	○●●I○○○	n.c.	Buy (0/0/0)	9.5USD	0.46	-19	-55	992	-	KYG1144A1058
Argo Blockchain	○●●I○○○	n.c.	Buy (0/0/0)	131.0GBp	0.71	-10	-54	2601	-	GB00BZ15CS02
Crypto exchanges and brokerage firms										
Coinbase	○○○I●●●	n.c.	Buy (9/4/0)	232.6USD	48.56	-28	-	-	-	US19260Q1076
Monex Group	○○○I●●●	n.c.	Hold (0/1/0)	763.0JPY	1.82	-17	-14	241	173	JP3869970008
CME Group	○○○I○○○	Hold	Hold (10/12/2)	212.8USD	76.44	3	9	19	121	US12572Q1058
GMO Internet	○○○I●○○	n.c.	Hold (3/4/0)	3040.0JPY	3.13	-8	-12	17	134	JP3152750000
Voyager Digital	○○○I●●●	n.c.	Buy (3/0/0)	21.6CAD	2.53	1	14	7755	-	CA92919V1085
Plus500[1]	○○○I○○○	★★★	Buy (2/2/2)	1530.5GBp	2.20	2	9	13	155	IL0011284465
Intercontinental Exchange	○○○I○○○	Buy	Buy (19/3/0)	111.5USD	62.72	-7	-2	19	112	US45866F1049
Blockchain software firms										
DMG Blockchain Solutions	○○○I●○○	n.c.	Buy (0/0/0)	1.0CAD	0.11	-30	-75	646	-	CA23345B2003
BIGG Digital Assets	○○○I●○○	n.c.	n.c. (-/-/-)	1.8CAD	0.28	-35	43	1567	67	CA0898041086
Future Fintech Group	○○○I●○○	n.c.	Buy (0/0/0)	2.8USD	0.21	-13	-67	164	48	US36117V1052
Crypto-Banking and similar services										
Bitcoin Group Se	○○○I●○○	n.c.	Buy (0/0/0)	43.0EUR	0.26	-13	-23	48	-	DE000A1TNV91
Silvergate Capital	○○○I●○○	n.c.	Buy (5/1/0)	107.3USD	3.02	-11	-37	621	-	US82837P4081
Galaxy Digital Holdings	○○○I●○○	n.c.	Buy (1/0/0)	23.6CAD	6.29	-37	47	1454	-	KYG370921069
Investview	○○○I●○○	n.c.	Buy (0/0/0)	0.2USD	0.69	0	32	649	721	US46183W1018
Big corporations that are early blockchain adopters										
Square[1]	○○○I○○○	★	Buy (28/17/5)	204.4USD	93.18	-17	-26	149	2077	US8522341036
Oracle	○○○I○○○	Hold	Hold (6/18/4)	79.0USD	227.57	0	29	49	100	US68389X1054
Facebook	○○○I○○○	Buy	Buy (50/6/3)	316.9USD	898.67	5	21	38	170	US30303M1027
IBM	○○○I○○○	Hold	Hold (5/10/3)	142.5USD	127.22	3	20	17	-3	US4592001014
Softbank	○○○I○○○	Hold	Buy (16/2/0)	8500.0JPY	134.57	-13	-18	87	178	JP3436100006
Mastercard	○○○I●○○	Buy	Buy (38/4/1)	364.7USD	361.60	-3	9	22	282	US57636Q1040
Visa	○○○I●○○	Buy	Buy (35/5/1)	226.0USD	498.51	1	10	17	191	US92826C8394
JP Morgan	○○○I○○○	Hold	Buy (18/7/3)	159.8USD	483.61	7	8	75	152	US46625H1005
Paypal	○○○I○○○	Hold	Buy (45/4/1)	248.4USD	291.88	-6	-13	65	562	US70450Y1038
Overstock[1]	○○○I●○○	★★★	Buy (5/0/0)	77.8USD	3.35	17	-23	320	378	US6903701018
MicroStrategy	○○○I●●○	n.c.	Buy (3/1/1)	486.2USD	4.74	-25	-50	301	171	US5949724083

[1] Covered by Morningstar research. Reference to Morningstar covered stocks does not constitute a recommendation by Julius Baer. Relevant equity information (e.g. analyst name) may be found in the annex. The Morningstar Equity Research Report can be requested free of charge via your Julius Baer Relationship Manager.

Source: Bloomberg Finance L.P., Julius Baer; m = month, Ccy = currency, Market cap = market capitalisation. **Note:** This list contains covered, non-covered (n.c.) titles by Julius Baer and non-listed (n.l.) titles. The selection of non-covered titles does not imply any recommendation by Julius Baer. *Exposure = Thematic exposure rating (or 'theme exposure rating', 'Next Generation rating', 'NG Rating'), which follows the Next Generation investment process, analysing a company's exposure to structural market growth in relation to a particular theme. Consensus rating compiled by Bloomberg. Data as at 19 May 2020.

Julius Baer equity coverage information

Company	Rating	Price	Target	Currency	Analyst
NVIDIA Corp	Reduce	562.63	415	USD	Cengizhan Sen
CME Group Inc	Hold	211.86	200	USD	Peter Casanova
Intercontinental Exchange Inc	Buy	110.74	130	USD	Peter Casanova
Oracle Corp	Hold	78.74	65	USD	Cengizhan Sen
Facebook Inc	Buy	313.59	380	USD	Roberto Cominotto
International Business Machines Corp	Hold	143.19	130	USD	Cengizhan Sen
SoftBank Group Corp	Hold	8470.00	10360	JPY	Jeco Tjandra
Mastercard Inc	Buy	360.98	420	USD	Roger Degen
Visa Inc	Buy	224.59	270	USD	Roger Degen
JPMorgan Chase & Co	Hold	161.11	155	USD	Roger Degen
PayPal Holdings Inc	Hold	244.63	220	USD	Cengizhan Sen

Source: Bloomberg Finance L.P., Julius Baer. Data as of 19 May 2021.

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Table of Morningstar covered equities mentioned in this publication

Topic	Equity	Rating	Fair value	Closing price	Analyst name	Date of issuance of Morningstar Qual./Quant. Equity report
Blockchain & Cryptocurrencies	Advanced Micro Devices Inc	★★★★	101.00	76.23	Abhinav Davuluri, CFA[1]	22.02.2021
Blockchain & Cryptocurrencies	Plus500 Ltd	★★★	1337.24	1481.50	No name[2]	10.05.2019
Blockchain & Cryptocurrencies	Square Inc	★	89.00	200.11	Brett Horn, CFA[1]	27.04.2020
Blockchain & Cryptocurrencies	Overstock.com Inc	★★★	76.09	75.17	No name[2]	08.10.2020

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MORNINGSTAR RESEARCH METHODOLOGY FOR VALUING COMPANIES

Morningstar qualitative equity reports overview

Overview
At the heart of our valuation system is a detailed projection of a company's future cash flows, resulting from our analysts' research. Analysts create custom industry and company assumptions to feed income statement, balance sheet, and capital investment assumptions into our globally standardized, proprietary discounted cash flow, or DCF, modelling templates. We use scenario analysis, in-depth competitive advantage analysis, and a variety of other analytical tools to augment this process. Moreover, we think analysing valuation through discounted cash flows presents a better lens for viewing cyclical companies, high-growth firms, businesses with finite lives (e.g., mines), or companies expected to generate negative earnings over the next few years. That said, we don't dismiss multiples altogether but rather use them as supporting cross-checks for our DCF-based fair value estimates. We also acknowledge that DCF models offer their own challenges (including a potential proliferation of estimated inputs and the possibility that the method may miss short-term market-price movements), but we believe these negatives are mitigated by deep analysis and our long-term approach. Morningstar's equity research group ("we", "our") believes that a company's intrinsic worth results from the future cash flows it can generate. The Morningstar Rating for stocks identifies stocks trading at a discount or premium to their intrinsic worth—or fair value estimate, in Morningstar terminology. Five-Star ★★★★★ stocks sell for the biggest risk-adjusted discount to their fair values, whereas One-Star ★ stocks trade at premiums to their intrinsic worth. Four key components drive the Morningstar rating: (1) our assessment of the firm's economic moat, (2) our estimate of the stock's fair value, (3) our uncertainty around that fair value estimate and (4) the current market price. This process ultimately culminates in our single-point star rating.

1. Economic Moat
The concept of an economic moat plays a vital role not only in our qualitative assessment of a firm's long-term investment potential, but also in the actual calculation of our fair value estimates. An economic moat is a structural feature that allows a firm to sustain excess profits over a long period of time. We define economic profits as returns on invested capital (or ROIC) over and above our estimate of a firm's cost of capital, or weighted average cost of capital (or WACC). Without a moat, profits are more susceptible to competition. We have identified five sources of economic moats: intangible assets, switching costs, network effect, cost advantage, and efficient scale.
Companies with a narrow moat are those we believe are more likely than not to achieve normalized excess returns for at least the next

10 years. Wide-moat companies are those in which we have very high confidence that excess returns will remain for 10 years, with excess returns more likely than not to remain for at least 20 years. The longer a firm generates economic profits, the higher its intrinsic value. We believe low-quality, no-moat companies will see their normalized returns gravitate toward the firm's cost of capital more quickly than companies with moats. To assess the sustainability of excess profits, analysts perform ongoing assessments of the moat trend. A firm's moat trend is positive in cases where we think its sources of competitive advantage are growing stronger; stable where we don't anticipate changes to competitive advantages over the next several years; or negative when we see signs of deterioration.

2. Estimated Fair Value

Combining our analysts' financial forecasts with the firm's economic moat helps us assess how long returns on invested capital are likely to exceed the firm's cost of capital. Returns of firms with a wide economic moat rating are assumed to fade to the perpetuity period over a longer period of time than the returns of narrow-moat firms, and both will fade slower than no-moat firms, increasing our estimate of their intrinsic value. Our model is divided into three distinct stages:
Stage I: Explicit Forecast
Stage II: Fade
Stage III: Perpetuity

3. Uncertainty around that fair value estimate

Morningstar's Uncertainty Rating captures a range of likely potential intrinsic values for a company and uses it to assign the margin of safety required before investing, which in turn explicitly drives our stock star rating system. The Uncertainty Rating represents the analysts' ability to bound the estimated value of the shares in a company around the Fair Value Estimate, based on the characteristics of the business underlying the stock, including operating and financial leverage, sales sensitivity to the overall economy, product concentration, pricing power, and other company-specific factors.
Analysts consider at least two scenarios in addition to their base case: a bull case and a bear case. Assumptions are chosen such that the analyst believes there is a 25% probability that the company will perform better than the bull case, and a 25% probability that the company will perform worse than the bear case. The distance between the bull and bear cases is an important indicator of the uncertainty underlying the fair value estimate.
Our recommended margin of safety widens as our uncertainty of the estimated value of the equity increases. The more uncertain we are about the esti-mated value of the equity, the greater the discount we require relative to our estimate of the value of the firm before we would recommend the purchase of the shares. In addition, the uncertainty rating provides guidance in portfolio construction based on risk tolerance. Our uncertainty ratings for our qualitative analysis are low, medium, high, very high, and extreme.

Low:	margin of safety for 5-star ★★★★★ rating is a 20%discount and for 1-star ★ rating is 25% premium.
Medium:	margin of safety for 5-star ★★★★★ rating is a 30%discount and for 1-star ★ rating is 35% premium.
High:	margin of safety for 5-star ★★★★★ rating is a 40%discount and for 1-star ★ rating is 55% premium.
Very high:	margin of safety for 5-star ★★★★★ rating is a 50%discount and for 1-star ★ rating is 75% premium.
Extreme:	Stock's uncertainty exceeds the parameters we have set for assigning the appropriate margin of safety.

4. Market Price

The market prices used in this analysis and noted in the report come from exchange on which the stock is listed which we believe is a reliable source. For more detail information about our methodology, please go to:
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Morningstar Star Rating for Stocks

Once we determine the fair value estimate of a stock, we compare it with the stock's current market price on a daily basis, and the star rating is automatically re-calculated at the market close on every day the market on which the stock is listed is open. Our analysts keep close tabs on the companies they follow, and, based on thorough and ongoing analysis, raise or lower their fair value estimates as warranted. Please note, there is no predefined distribution of stars. That is, the percentage of stocks that earn 5 stars can fluctuate daily, so the star ratings, in the aggregate, can serve as a gauge of the broader market's valuation. When there are many 5-star ★★★★★ stocks, the stock market as a whole is more undervalued, in our opinion, than when very few companies garner our highest rating. We expect that if our base-case assumptions are true the market price will converge on our fair value estimate over time, generally within three years (although it is impossible to predict the exact time frame in which market prices may adjust). Our star ratings are guideposts to a broad audience and individuals must consider their own specific investment goals, risk tolerance, tax situation, time horizon, income needs, and com-plete investment portfolio, among other factors. The Morningstar Star Ratings for stocks are defined below:

Five-Stars	★★★★★	We believe appreciation beyond a fair risk-adjusted return is highly likely over a multiyear time frame. Scenario analysis developed by our analysts indicates that the current market price represents an excessively pessimistic outlook, limiting downside risk and maximizing upside potential.
Four-Stars	★★★★	We believe appreciation beyond a fair risk-adjusted return is likely.
Three-Stars	★★★	Indicates our belief that investors are likely to receive a fair risk-adjusted return (approximately cost of equity).
Two-Stars	★★	We believe investors are likely to receive a less than fair risk-adjusted return.
One-Star	★	Indicates a high probability of undesirable risk adjusted returns from the current market price over a multiyear timeframe, based on our analysis. Scenario analysis by our analysts indicates that the market is pricing in an excessively optimistic outlook, limiting upside potential and leaving the investor exposed to Capital loss.

Other Definitions

Last Price: Price of the stock as of the close of the market of the last trading day before date of the report.

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Qualitative investment rating allocation as of 20/05/2021
(calculated by and derived from the investment universe of Julius Baer)

★★★★★	5 Stars	7.0%	★★★★	4 Stars	24.7%	★★★	3 Stars	38.2%
★★	2 Stars	20.7%	★	1 Star	9.4%			

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Morningstar quantitative equity reports overview

Overview

The quantitative report on equities consists of data, statistics and quantitative equity ratings on equity securities. Morningstar, Inc.'s quantitative equity ratings are forward looking and are generated by a statistical model that is based on Morningstar Inc.'s analyst-driven equity ratings and quantitative statistics. Given the nature of the quantitative report and the quantitative ratings, there is no one analyst in which a given report is attributed to; however, Mr. Lee Davidson, Head of Quantitative Research for Morningstar, Inc., is responsible for overseeing the methodology that supports the quantitative equity ratings used in this report. As an employee of Morningstar, Inc., Mr. Davidson is guided by Morningstar, Inc.'s Code of Ethics and Personal Securities Trading Policy in carrying out his responsibilities.

Quantitative Equity Ratings

Morningstar's quantitative equity ratings consist of: (i) Quantitative Fair Value Estimate, (ii) Quantitative Star Rating, (iii) Quantitative Uncertainty, (iv) Quantitative Economic Moat, and (v) Quantitative Financial Health (collectively the "Quantitative Ratings"). The Quantitative Ratings are calculated daily and derived from the analyst-driven ratings of a company's peers as determined by statistical algorithms. Morningstar, Inc. ("Morningstar", "we", "our") calculates Quantitative Ratings for companies whether or not it already provides analyst ratings and qualitative coverage. In some cases, the Quantitative Ratings may differ from the analyst ratings because a company's analyst-driven ratings can significantly differ from other companies in its peer group.

i. Quantitative Fair Value Estimate: Intended to represent Morningstar's estimate of the per share dollar amount that a company's equity is worth today. Morningstar calculates the Quantitative Fair Value Estimate using a statistical model derived from the Fair Value Estimate Morningstar's equity analysts assign to companies. For information about Fair Value Estimate Morningstar's equity analysts assign to companies, please go to:
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ii. Quantitative Economic Moat: Intended to describe the strength of a firm's competitive position. It is calculated using an algorithm designed to predict the Economic Moat rating a Morningstar analyst would assign to the stock. The rating is expressed as Narrow, Wide, or None.

Narrow	assigned when the probability of a stock receiving a "Wide Moat" rating by an analyst is greater than 70% but less than 99%.
Wide	assigned when the probability of a stock receiving a "Wide Moat" rating by an analyst is greater than 99%.
None	assigned when the probability of an analyst receiving a "Wide Moat" rating by an analyst is less than 70%.

iii. Quantitative Star Rating: Intended to be the summary rating based on the combination of our Quantitative Fair Value Estimate, current market price, and the Quantitative Uncertainty Rating. The rating is expressed as One-Star, Two-Star, Three-Star, Four-Star, and Five-Star.

Five-Stars	★★★★★	the stock is undervalued with a reasonable margin of safety. Log (Quant FVE/Price) > 1*Quantitative Uncertainty
Four-Stars	★★★★	the stock is somewhat undervalued. Log (Quant FVE/Price) between (0.5*Quantitative Uncertainty, 1*Quantitative Uncertainty)
Three-Stars	★★★	the stock is approximately fairly valued. Log (Quant FVE/Price) between (-0.5*Quantitative Uncertainty, 0.5*Quantitative Uncertainty)
Two-Stars	★★	the stock is somewhat overvalued. Log (Quant FVE/Price) between (-1*Quantitative Uncertainty, -0.5*Quantitative Uncertainty)
One-Star	★	the stock is overvalued with a reasonable margin of safety. Log (Quant FVE/Price) < -1*Quantitative Uncertainty

iv. Quantitative Uncertainty: Intended to represent Morningstar's level of uncertainty about the accuracy of the Quantitative Fair Value Estimate. Generally, the lower the Quantitative Uncertainty, the narrower the potential range of outcomes for that particular company. The rating is expressed as Low, Medium, High, Very High, and Extreme.

Low	the interquartile range for possible fair values is less than 10%
Medium	the interquartile range for possible fair values is less than 15% but greater than 10%
High	the interquartile range for possible fair values is less than 35% but greater than 15%
Very High	the interquartile range for possible fair values is less than 80% but greater than 35%
Extreme	the interquartile range for possible fair values is greater than 80%

v. Quantitative Financial Health: Intended to reflect the probability that a firm will face financial distress in the near future. The calculation uses a predictive model designed to anticipate when a company may default on its financial obligations. The rating is expressed as Weak, Moderate, and Strong.

Weak	assigned when Quantitative Financial Health < 0.2
Moderate	assigned when Quantitative Financial Health is between 0.2 and 0.7
Strong	assigned when Quantitative Financial Health > 0.7

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i. Last Price: Price of the stock as of the close of the market of the last trading day before date of the report.
ii. Quantitative Valuation: Using the below terms, intended to denote the relationship between the security's Last Price and Morningstar's quantitative fair value estimate for that security.

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Fairly Valued	Last Price is in line with Morningstar's quantitative fair value estimate.
Overvalued	Last Price is above Morningstar's quantitative fair value estimate.

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Quantitative investment rating allocation as of 20/05/2021
(calculated by and derived from the investment universe of Julius Baer)

★★★★★	5 Stars	0.5%	★★★★	4 Stars	5.7%	★★★	3 Stars	79.5%
★★	2 Stars	7.2%	★	1 Star	7.1%			

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adj.	adjusted	bps	basis points	c.c.	constant currencies
capex	capital expenditure	consensus	average analyst expectation	DM	developed market(s)
E	estimate	ECB	European Central Bank	EM	emerging market(s)
Fed	US Federal Reserve	FX	foreign exchange	FY	Fiscal year
GDP	gross domestic product	H1; H2	first/second half of the year	ISM	Institute for Supply Management
l.h.s.	left-hand scale	m/m	month-on-month	market cap.	market capitalisation
p.a.	per annum	PMI	purchasing managers' index	PPP	purchasing power parity
Ppt	percentage point(s)	q/q	quarter-on-quarter	Q1; Q2	first/second/third/fourth quarter
REIT	real estate investment trust	r.h.s.	right-hand scale	WTI	West Texas Intermediate
y/y	year-on-year	YTD	year-to-date		

Equity research

Frequently used abbreviations

CAGR	Compound annual growth rate	DCF	Discounted cash flow	EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation and amortisation	EPS	Earnings per share	EV	Enterprise value
FCF	Free cash flow	MV	Market value	PEG	P/E divided by year-on-year EPS growth
P/B	Price-to-book value	P/E	Price-to-earnings ratio	P/TBV	Price-to-tangible book value
ROE	Return on equity	ROI	Return on investment	ROIC	Return on invested capital
RoTE	Return on tangible equity				

Equity rating allocation as of 20/05/2021

Buy	46.7%	Hold	51.5%	Reduce	1.8%

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Buy	Expected to outperform the regional industry group by at least 5% in the coming 9-12 months, unless otherwise stated.
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Reduce	Expected to underperform the regional industry group by at least 5% in the coming 9-12 months, unless otherwise stated.

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Neutral	Expected to perform in line with regional or global benchmark indices in the coming 9-12 months, unless otherwise stated.
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