Morgan Stanley

Client Conversations & Primers

Bitcoin: A New Technology

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This material has been prepared for informational purposes only, based on publicly available factual information. It does not provide individually tailored or general investment advice whatsoever. It has been prepared without regard to the individual financial circumstances and objectives of persons who receive it. Investors seeking to evaluate particular investments and strategies in Bitcoin or other virtual currency products must seek the advice of their independent advisors. The appropriateness of a particular investment or strategy will depend on an investor's individual circumstances and objectives.

Buying, selling and using Bitcoin or other virtual currency products is highly speculative and may result in substantial losses in a short period of time. Risks include:

- Digital currency such as Bitcoin or other virtual currency products is not legal tender. No law requires companies or individuals to accept the currency as a form of payment. Instead, Bitcoin or other virtual currency-products use is limited to businesses and individuals that are willing to accept them. If no one were to accept digital currencies, Bitcoin and other virtual currency products would very likely become worthless.
- The exchange rate of Bitcoin or other virtual currency products versus the USD historically has been very volatile and the exchange rate could drastically decline. For example, the exchange rate of Bitcoin versus the USD has dropped more than 50% in a single day. Bitcoins may be affected by such volatility as well.
- Platforms that buy and sell Bitcoin or other virtual currency products can be hacked, and some have failed. In addition, like the platforms themselves, digital wallets can be hacked. As a result, consumers can—and have—lost some or all of their holdings of digital currency.
- Bitcoin or other virtual currency product transactions can be subject to fraud and theft. For example, a fraudster could pose as a Bitcoin exchange, Bitcoin intermediary or trader in an effort to lure you to send it digital currency, which is then stolen.
- Unlike US banks and credit unions that provide certain guarantees of safety to depositors, there are no such safeguards provided to digital wallets by their providers or regulators.
- Payments in Bitcoin or other virtual currency products are irreversible. Once you complete a transaction, it cannot be reversed. Purchases can be refunded, but that depends solely on the willingness of the vendor-recipient to do so.
- In part because of the anonymity Bitcoin and other virtual currency products offer, it has been used in illegal activity, including drug dealing, money laundering and other forms of illegal commerce. Abuses could impact legitimate consumers and speculators; for instance, law enforcement agencies could shut down or restrict the use of platforms and exchanges, limiting or shutting off entirely the ability to use or trade Bitcoin or other virtual currency-products.
- As a recent invention, Bitcoin and other virtual currencies do not have an established track record of credibility and trust. Bitcoin and other virtual currencies are evolving.

Additional information regarding the potential risks associated with Bitcoin and other virtual currencies is available in FINRA and SEC Investor Alerts, links to which appears below:

http://www.finra.org/newsroom/2014/finra-issues-new-investor-alert-bitcoin-more-bit-risky

https://www.investor.gov/additional-resources/news-alerts/alerts-bulletins/investor-alert-bitcoin-other-virtual-currency

Source: Morgan Stanley Wealth Management Global Investment Office

Table of Contents

Bitcoin: A New Technology and a Controversial Asset

As of February 2, 2021

- Since 2017, **the popularity of Bitcoin and other cryptocurrencies has surged**, bringing the topic and debate over validity and uses into the finance, business, and media spotlight. Cryptocurrencies are virtual currencies with no physical form that operate on a peer-to-peer basis without a central authority such as the Federal Reserve. They are digital in that unlike the US dollar, they have no physical form and do not have a central repository.
- **Cryptocurrencies and the technology behind them such as blockchain are not one and the same**. Blockchain is a chronological chain of records that are linked together and protected by cryptography and then shared with everyone involved in the process—**essentially a public spreadsheet. This technology can potentially have many viable applications outside of cryptocurrencies**, including payment verification, securities clearing and settlement, and supply chain management.
- **A new currency, a new type of gold, or a speculative fad? People value and define cryptocurrencies in different ways.** Regardless of classification, **cryptocurrencies remain an experimental concept that is not regulated or backed by any central bank worldwide and has no tangible intrinsic value.**
- **Regulatory concerns around cryptocurrencies will remain in focus and will need to be sorted out over the coming months and years**. Amid the concerns are anti-money laundering (AML) issues due to the anonymous nature of cryptocurrencies. **Real issues and challenges exist around cryptocurrencies including governance, transparency, exchangeability, anonymity, volatility, fraud, manipulation, and hacking.**
- **This educational publication will focus on Bitcoin, which is currently the largest and most popular cryptocurrency**.
  - Bitcoin is a **digital cryptocurrency that allows users to make peer-to-peer transactions without the use of a trusted third party by using algorithms to verify transactions** and utilizes blockchain technology. It is decentralized, meaning there is no one server, organization, or computer that "runs Bitcoin."
- While the future of Bitcoin and other cryptocurrencies remains to be seen, **the concept and technology behind them may influence innovation going forward.**

Source: Morgan Stanley Wealth Management Global Investment Office

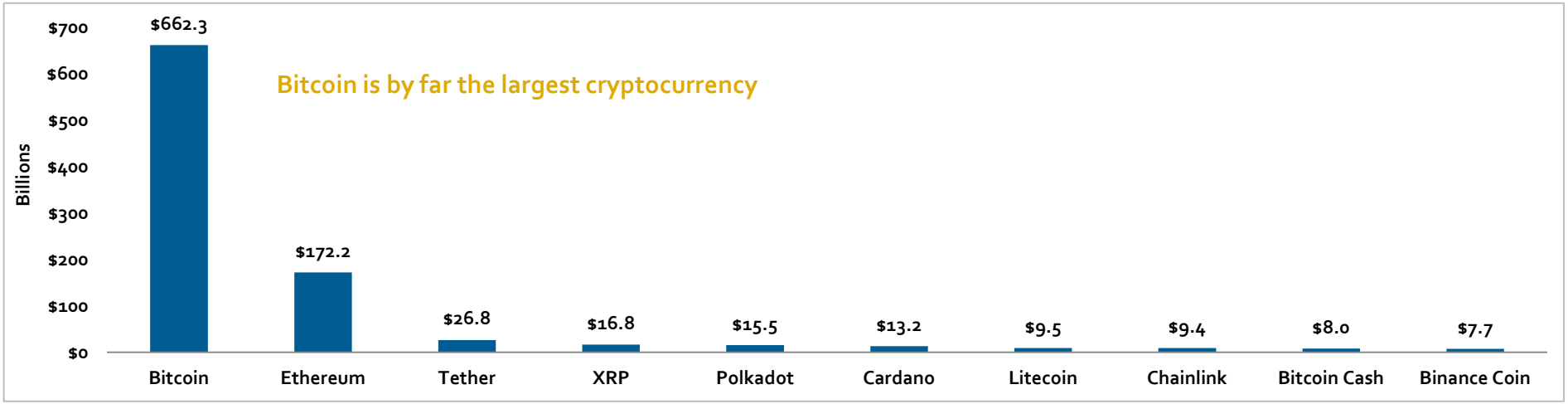
What Are Cryptocurrencies?

As of February 2, 2021

- **Cryptocurrencies are virtual currencies with no physical form** that operate on a peer-to-peer basis without a central authority such as the Federal Reserve. They are digital in that unlike the US dollar, they have no physical form and do not have a central repository.
- **The decentralized nature of cryptocurrencies requires computers to use cryptography**, computerized encoding and decoding of information, to verify transactions and attempt to prevent counterfeiting.
- Unlike traditional currencies, which use a trusted third party such as a credit card company or bank to verify that the funds are available to complete a transaction, **cryptocurrencies rely on a network of computers to confirm the transaction and that the spender has the coins to transfer**. When a transaction is initiated, it is broadcast to the network where it awaits verification from computers that solve an algorithm to determine if the transaction is legitimate.
- **This presentation focuses on Bitcoin[1], the largest cryptocurrency, though more than 1,000 others exist**. Some could be classified more as currencies; some more as equities; and others somewhere in between.

Top 10 Cryptocurrencies by Market Capitalization or Total Network Value

As of February 2, 2021



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Source: Coinmarketcap.com, Morgan Stanley Wealth Management Global Investment Office. Note: 1. This is not a recommendation or endorsement of Bitcoin or any other cryptocurrency.

How Are Cryptocurrencies Created and Funded?

As of February 2, 2021

There are currently over 1,000 various cryptocurrencies in existence today. Four of the most popular ways cryptocurrencies are created and funded include: donations; Initial Coin Offerings (ICOs); Treasury systems; and "forking."

Donations	• **Some cryptocurrencies (like Bitcoin) rely on donations** (both monetary and programming time) from users to continue to evolve their ecosystem
Initial Coin Offering	• **Initial Coin Offerings (ICOs) or Initial Exchange Offerings (IEOs) occur when new coins or tokens are sold to the public** to fund a project in what is called a crowdsale. Early backers hope that the coin will be successful and rise in value • ICO and IEOs have ignited a debate over securities regulation[1]
Treasury System	• **A Treasury system distributes newly minted coins (inflation)** to developers, marketers, or other organizations that submit proposals • Certain Treasury systems hold a vote among certain large stakeholders to decide which submitted initiatives should be funded
Forking	• **A "fork" occurs when developers create a copy of the existing blockchain and code, make adjustments, and release the new cryptocurrency**. Before they allow others to use the network, they create enough coins for themselves to fund development • This recently happened when Bitcoin developers disagreed on the size of each block on the blockchain, resulting in a new cryptocurrency with larger blocks

Source: Bitcoin.org, CoinDesk, Morgan Stanley Wealth Management Global Investment Office. Note: 1: "Investor Bulletin: Initial Coin Offerings," U.S. Securities and Exchange Commission, July 25, 2017.

Which Are the Most Valuable Cryptocurrencies?

As of February 2, 2021

These top 5 cryptocurrencies account for ~85% of the market cap of all Cryptocurrencies

1. **Bitcoin** - $662B – The first, and most liquid cryptocurrency with the largest market capitalization. Primarily used as a store of value and for making censorship-resistant payments. Many advocates market Bitcoin as Digital Gold because of the low growth in supply.

2. **Ethereum** - $172B – The second most liquid cryptocurrency. The Ethereum network is a decentralized cloud-based software that creates a virtual computer that allows third parties to create applications (called smart contracts) that run on the "computer." These application developers use Ether, the currency of the network, to pay the network for the processing power and data storage their applications require.

3. **Tether** - $27B – Tether is a token that represents one US dollar. As the leading "stablecoin," tether generally has very little volatility, though it has ranged between $0.92 and $1.06 since 2017. The company behind Tether, Bitfinix, a cryptocurrency exchange, claims it has $1 in bank accounts for each unit of tether.

4. **XRP** - $17B – Ripple is a payment network that allows for quicker and cheaper cross-border payments. One of the currencies that can be used on the network is ripple, XRP, though it is not required.

5. **Polkadot** – $16B – Polkadot is a heterogeneous multi-chain interchange network, meaning it can process many transactions on several chains in parallel "parachains." This allows for interoperability with any data or asset type, not just tokens, to establish a decentralized and private web controlled by its users. The network is secured by a highly sophisticated user-driven governance system.

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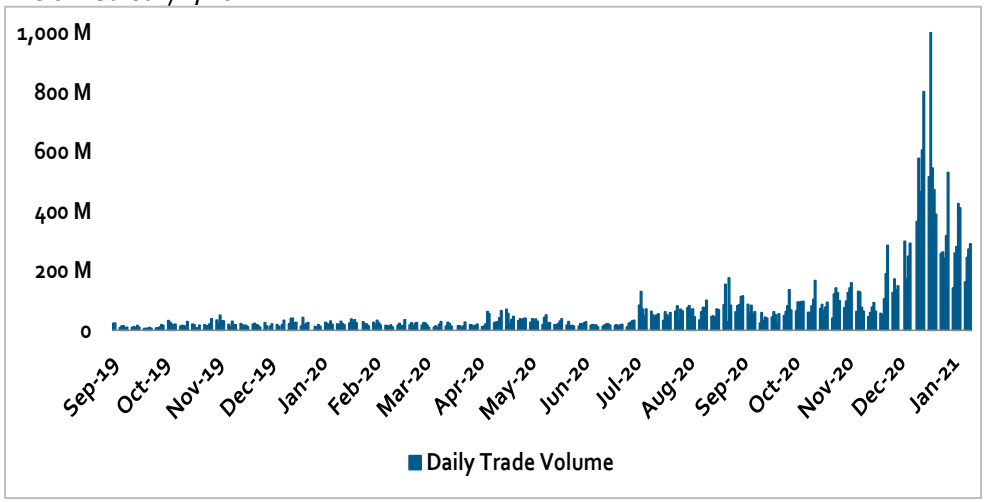
Source: Coinbase. This is not a recommendation or endorsement of Bitcoin or any other cryptocurrency.

Interest in Bitcoin Sparks After 2020 Rally

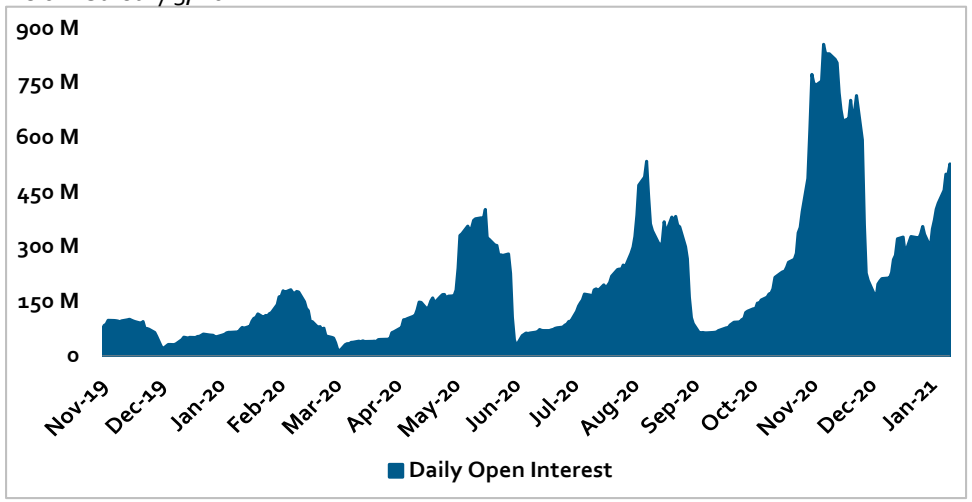
Daily Volume[1]

As of February 1, 2021



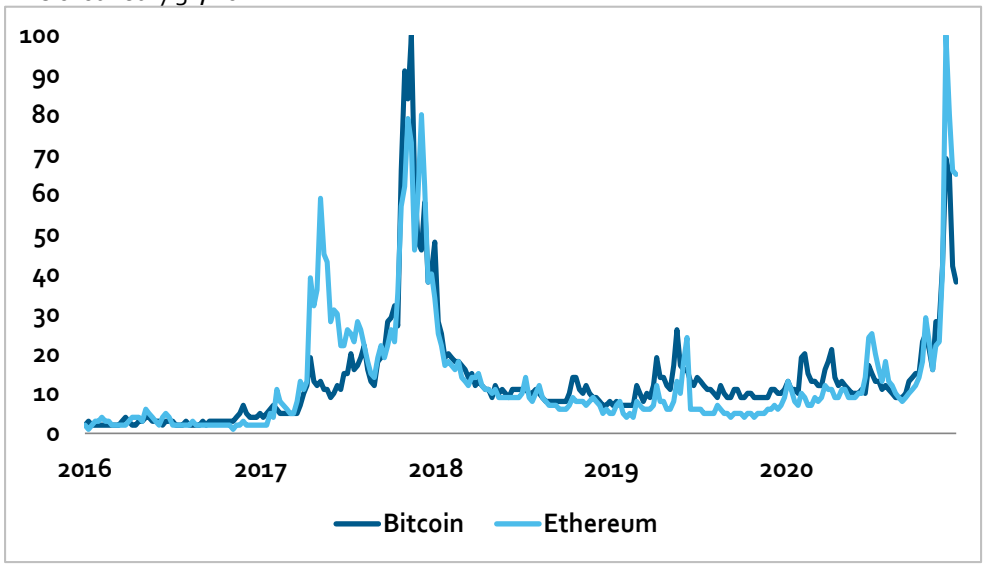
Daily Open Interest[1]

As of February 3, 2021



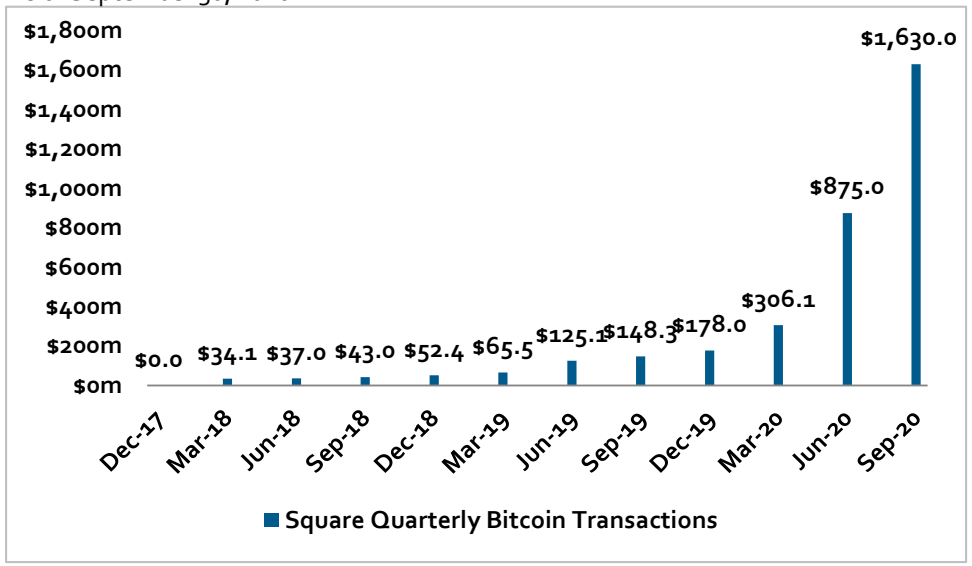
Google Trends Searches for Top Two Cryptocurrencies

As of January 31, 2021



Bitcoin Transactions on the Square Platform

As of September 30, 2020

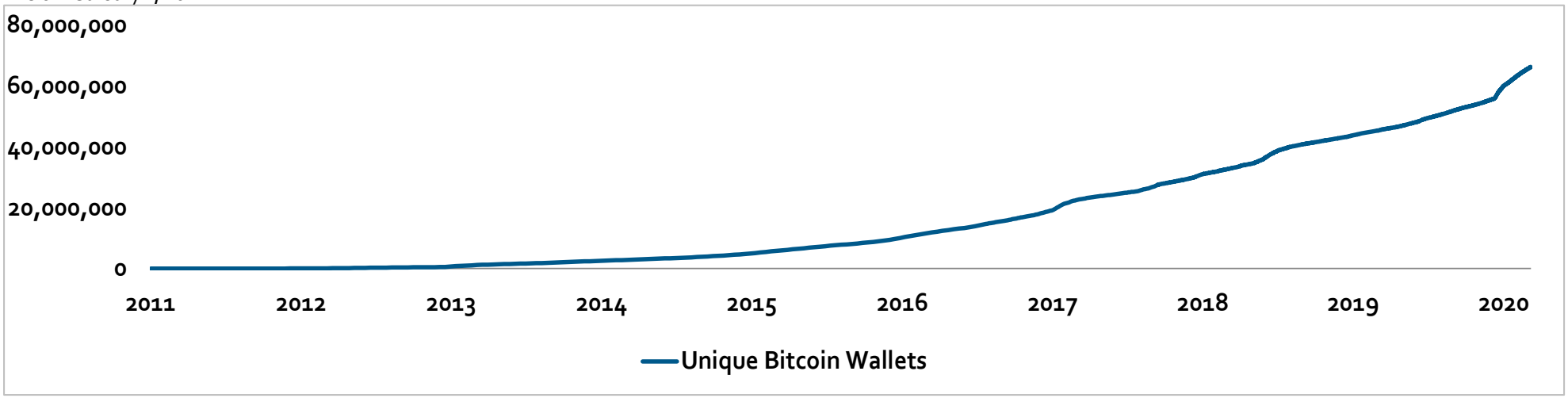


Source: Google Trends, Bloomberg, Square, Note 1. Weekly Volume and Open Interest from Bakkt and CME. This is not a recommendation or endorsement of Bitcoin or any other cryptocurrency.

Is Bitcoin Being Used?

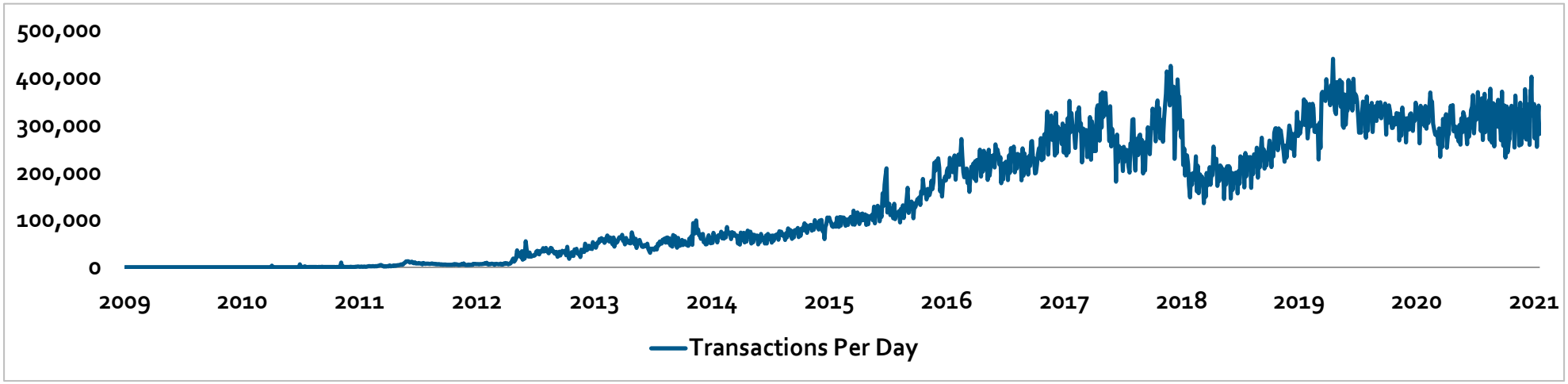
Unique Bitcoin Wallets

As of February 1, 2021



Bitcoin Transactions per Day

As of February 1, 2021



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Source: Blockchain.com, Morgan Stanley Wealth Management Global Investment Office. This is not a recommendation or endorsement of Bitcoin or any other cryptocurrency.

What Is Bitcoin?

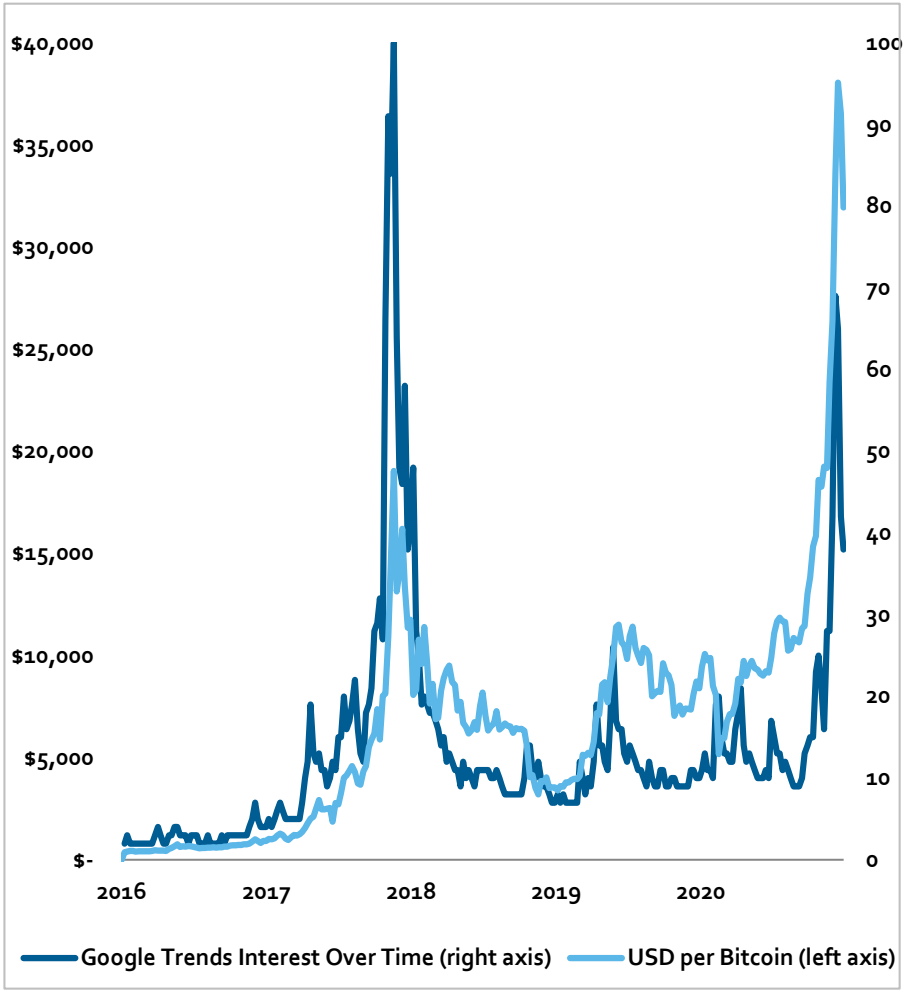
Bitcoin Overview

As of February 1, 2021

- **Bitcoin is a digital cryptocurrency** that allows users to make peer-to-peer transactions without the use of a trusted third party by using algorithms to verify transactions
- Bitcoin was invented in 2009 by Satoshi Nakamoto, an anonymous person or organization
- There is a **fixed amount of 21 million bitcoins** that can be created. Close to 18.5 million have been mined so far
- The design is public; **no one person/group owns or controls Bitcoin**, and anyone can participate
- It is decentralized, meaning there is no one server, organization, or computer that "runs Bitcoin." Rather, different stakeholders control different aspects of Bitcoin
- The **Bitcoin network** includes two main components:
  - The actual currency, bitcoin
  - Technology behind the transaction verification, the blockchain

Bitcoin Price Spiked in 2017, Surged Again in 2019

As of January 31, 2021

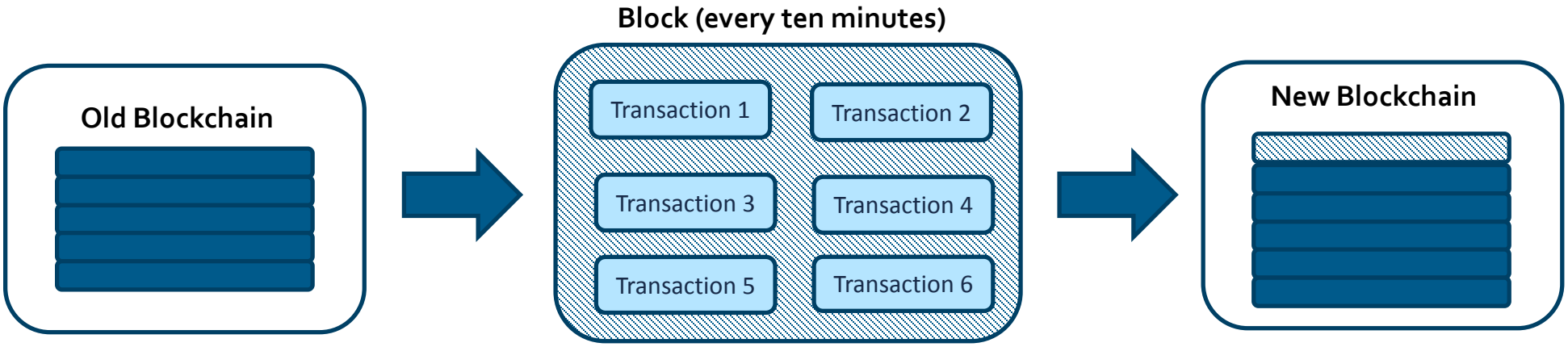


Source: Bloomberg, Google Search Trends, Morgan Stanley Wealth Management Global Investment Office. Note: Per Google Trends: Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. Likewise a score of 0 means the term was less than 1% as popular as the peak.

Bitcoin Uses Blockchain for Transaction Verification

The Bitcoin blockchain is a record of all the Bitcoin transactions that have ever occurred. Each account balance at any point in time and each transaction between two accounts are stored on the blockchain. There are thousands of copies of the file on computers around the world. As long as a copy of the blockchain exists, the Bitcoin system can continue to function. The blockchain allows Bitcoin to be decentralized. Since there is no one server or computer that holds a master copy of the chain, a hacker, government or other organizations would have to alter the data in multiple locations. However, this does not entirely insulate the process from theft, as third parties such as exchanges and wallets that interface with blockchain technology have been hacked recently.

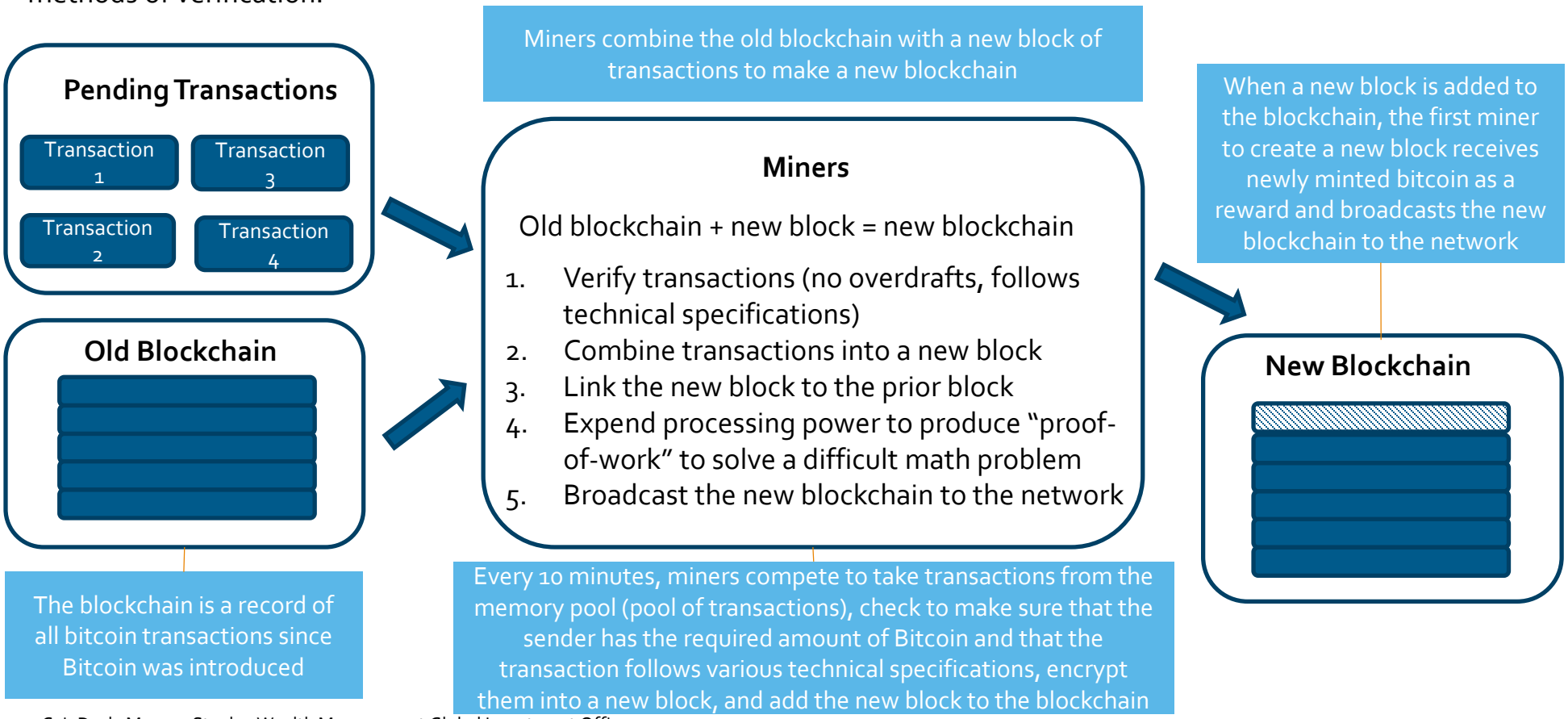
What are blocks? The Bitcoin blockchain file is currently a ~275 gigabyte file containing around 636,000 blocks and growing, with over 545 million transactions. A new block is created roughly every 10 minutes. Each block includes the most recent Bitcoin transactions. In a process called "mining," new transactions are checked to confirm that the sender has the required amount of bitcoin (no overdrafts) and that the transaction follows various technical specifications. The new block is then added to the blockchain.



Source: CoinDesk, Blockchain.info, Morgan Stanley Wealth Management Global Investment Office

Miners: The Computers Behind the Bitcoin Network

Miners are the computers that make the Bitcoin network run and as a reward they are awarded newly minted bitcoin. Roughly every 10 minutes, miners check pending transactions to confirm that the sender has the required amount of Bitcoin and that the transaction follows various technical specifications. The first miner to create a new block that is accepted by the nodes (computers on the network) has their new block added to the blockchain, making the chain one block longer. The miner receives bitcoin as a reward for its work. Most cryptocurrencies are mined, but there are other methods of verification.



Source: CoinDesk, Morgan Stanley Wealth Management Global Investment Office

Bitcoin Is Decentralized; No One Party Controls Entire Network

The decentralized nature of Bitcoin means no one party controls the entire network. There are complex economic relationships between various parties that may encourage users to follow the rules. However, some portions of the network are more centralized (software developers, miners, fiat gateways) than others potentially increasing concentration risks. Below we compare the various stakeholders:

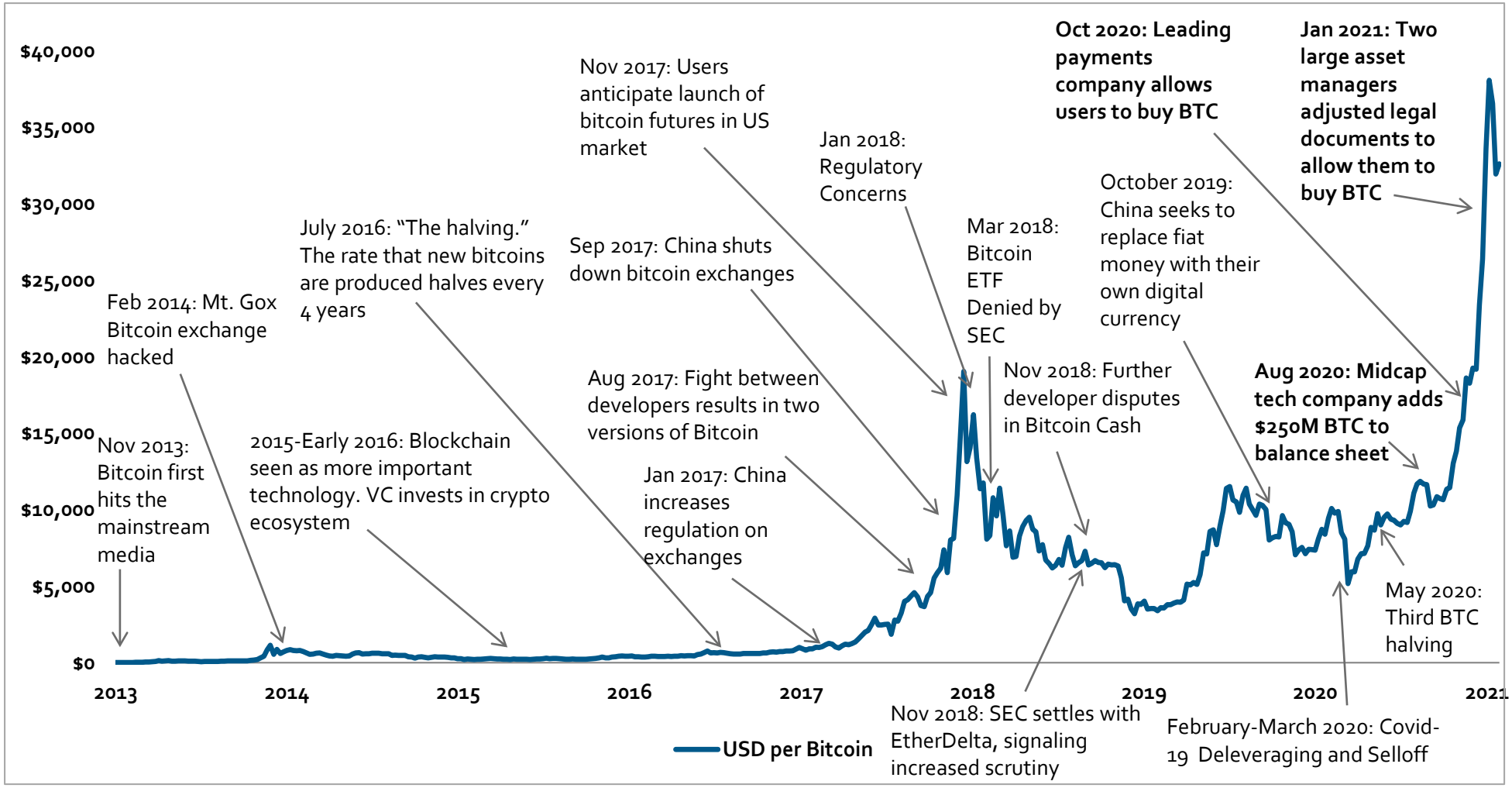
Stakeholder	What They Do	How Decentralized?
Software Developers	All bitcoin software is open source. Bitcoin Core software, the most popular version, verifies transactions (no overdrafts, follows technical specifications), and includes a wallet to store coins. **Anyone can contribute, test, or verify the code** but roughly 100 developers contribute to "Core"	**Roughly 97% of nodes** (computers connected to the network) run "Bitcoin Core" nodes, but there are six teams with more than 25 nodes and at least 12 versions of software
Node Operators	Nodes (computers connected to the network) hold complete copies of the blockchain, **run software that validates for issues** like double spending, and relay transactions to miners	**There are roughly 11,400 public nodes on the Bitcoin network**. Node operators choose which developer's Bitcoin software to run
Miners	Anyone can theoretically download free software and mine bitcoin. Miners take transactions from nodes, verify transactions, combine them into blocks, and broadcast the new blockchain to the network	Processing power and electricity are the main inputs to mining. **Currently, 10 groups mine ~90% of the blocks with the largest group mining ~16%**
Fiat Gateways	**Fiat gateways allow currency to be electronically exchanged for bitcoins**. Fiat gateways include domestic and international exchanges, bartering sites that allow people to meet up and exchange cash for bitcoin, and bitcoin ATMs	**The top 10 exchanges globally account for around 85%** of bitcoin trades versus all fiat currencies – roughly $200 million is traded per day
Owners	**Bitcoin owners store their money in a "digital wallet."** Owners can store bitcoin with third parties such as exchanges or wallet providers, hardware wallets similar to USB drives, or on their computers or mobile devices	Bitcoin ownership is hard to estimate because people can have many different accounts. **Based on data from the two largest wallet providers there are 30+ million accounts**

Source: Coin Dance, Blockchain.info, Morgan Stanley Wealth Management Global Investment Office

Institutional Adoption of Bitcoin in 2020 and 2021 Drives Price

Bitcoin Price

As of January 31, 2021



Source: Bloomberg, Morgan Stanley Wealth Management Global Investment Office

What Factors Might Impact Bitcoin's Price?

The price of cryptocurrencies is impacted by supply and demand. Below are a few components that may factor into the price of Bitcoin:

Factors That May Impact Bitcoin Pricing

Network effects, Accessibility, & Liquidity	• **As usage of Bitcoin increases,** it may become available and traded in more places • There are ways to convert traditional currencies to Bitcoin and back • Some exchanges have talked about or are in the process of creating (or have created) investment products based on Bitcoin
Uses	• **Cryptocurrencies can be used to transact in goods and services, though acceptance is currently limited** • Can be used to send money across borders at very low costs and anonymously. This also creates anti-money laundering and fraud risks • It can also reduce fees associated with country-to-country remittances
Speculation	• **Recent price trends have encouraged speculation** that has likely contributed to demand but is unpredictable. Bitcoin speculation is extremely risky
Limited Supply	• The current **supply and the rate of growth is set by code** that can only be changed by consensus among holders, nodes, miners, and software developers • Some view Bitcoin as a store of value due to its limited supply, however, others do not see it as a legitimate store of value for a combination of reasons, including its limited history, risk of replacement by other technology, and lack of price stability
Risks	• Exchanges and platforms could be hacked, government regulations can change, prohibitions could be enacted, prices can vary from exchange to exchange, and rumors could impact the price

Source: Morgan Stanley Wealth Management Global Investment Office

Regulations that Control Exchangeability Will Be a Headwind for Bitcoin

Regulatory Concerns

- Different countries and even different agencies within countries have **varying levels of acceptance and classification of Bitcoin and other cryptocurrencies.** For example, the Chinese central bank previously banned banks from accepting Bitcoin. These issues may be sorted out over the coming months and years.
- There are **anti-money laundering (AML) concerns due to the anonymous nature of cryptocurrencies**.
- Cryptocurrencies have also been used for and associated with illegal activities, such as Ponzi schemes and misleading and fraudulent disclosures.
- Bitcoin and other cryptocurrencies **have also been used to circumvent capital controls**, or limit how much of a currency can leave a country.
- Due to the inherent decentralized nature of cryptocurrencies, **governments could view them as a threat to traditional monetary policy and the ability to finance government operations.**
- Start-ups have been raising money through unregulated Initial Coin Offerings (ICOs) and Initial Exchange Offerings (IEOs), where investors exchange money for virtual coins, **raising questions and concerns on whether or not ICOs are securities offerings that should be regulated by the Securities Exchange Commission (SEC).** The SEC has said most ICOs are likely securities and should be regulated.
- Some cryptocurrencies and unregulated ICOs have been associated with fraudulent claims.

Source: Morgan Stanley Wealth Management Global Investment Office

How to Classify Bitcoin: Key Differences Between Payment Networks, Cryptocurrencies, and Traditional Currencies

At this stage, there are material differences between Bitcoin/cryptocurrencies and traditional currencies and payment networks, as noted below, and risks unique to Bitcoin/cryptocurrencies. Other differences not discussed here may also impact cryptocurrencies' classification and utility.

Topic	Payment Networks	Cryptocurrency	Traditional Currency
How do you use it?	Swipe card, scan phone, or use electronic payment software	Transfer or pay electronically using software	Cash, credit card, debit card, wire transfer
How is it created?	Companies build payment networks and coordinate multiple parties	A fixed amount is created using computers (miners)	Central government authority and regulated banks
Who verifies transactions?	Owner of the payment network	Network of decentralized computers (miners)	Trusted third party such as banks
Who keeps records of the transactions?	Banks and merchants that use the network	An encrypted public file—the blockchain	Trusted third party such as banks
Where can it be stored?	Credit cards stored by user, software stored on electronic or mobile device	Online "wallets" or offline in "hardware wallets"	Cash, banks
How do you obtain it?	Apply for credit card or download software and link to an account	Online exchanges, barter, wages, mining	Wages, investing, inheritance, etc.
How is it regulated?	State, local, national entities	Unclear & often conflicting regulatory environment with different levels of government and agencies having different views	National Government

Please see important disclosures immediately following the cover page and also on page 21 for additional drawbacks and risk considerations.

Source: Morgan Stanley Wealth Management Global Investment Office

Key Differences Between Cryptocurrencies and Precious Metals

Below are some of the material differences between cryptocurrencies and precious metals, as well as risks unique to cryptocurrencies. Other differences not discussed here may also impact cryptocurrencies' classification and utility.

	Cryptocurrencies	Precious Metals
History	The largest cryptocurrency was invented in 2009	Precious metals have been used as a store of value for centuries
Mining	The largest cryptocurrency creates new coins through mining, a software process	Thousands of tons of precious metals are mined each year
Scarcity	Cryptocurrencies typically have a fixed supply. For example, 21 million bitcoins can be created	Precious metals are finite resources; amount depends on the natural environment
Usability	Transfer or pay electronically using software	Store of value, medium of exchange, industrial applications
Volatility & Liquidity	Cryptocurrencies are more volatile and have less liquidity	Precious metals are less volatile and have more liquidity
Risks & Drawbacks[1]	Limited acceptance and potential for further declining acceptance; potential technology flaws; regulatory oversight uncertainty; concerns around account security; relies on electricity and internet connectivity; market manipulation potential; highly speculative and risk of substantial loss in short amount of time	Storage/transportation costs; physical property is stolen; changing regulations

Note: 1. Please see important disclosures immediately following the cover page and also on page 21 for additional drawbacks and risk considerations.
Source: Bitcoin.org, CoinDesk, Morgan Stanley Wealth Management Global Investment Office

Is Bitcoin "Money" as Traditionally Defined?

While Bitcoin does have some of the Fed's characteristics of money, other traits do not argue for its use as a currency.

Characteristic	Bitcoin	US Dollar
Durability	Bitcoin is digital and able to be kept online or offline. It has lasted 8 years but could break at any time	Paper money is durable and can last a long time. The USD has lasted 47 years since leaving the gold standard
Portability	Able to transfer online or download to USB device	Able to carry easily or transfer dollars
Divisibility	Can be divided up to 8 decimal places currently	Various denominations ($100, $50, $20, etc.)
Uniformity	All bitcoins are uniform	Certain denomination is uniform in shape and value
Limited Supply	The current code caps the supply at 21 million and could only be changed through a "fork"	Controlled by the Federal Reserve
Acceptability	Currently not widely accepted but able to be converted to other currencies in some venues	Widely accepted
Other Characteristics Do Not Argue for Bitcoin's Use as a Currency		
Volatility	Much more volatile than USD & even EM currencies	Little volatility vs other developed markets currency
Regulatory Uncertainty	Illegal in some countries, different regulations globally (AML, securities laws, tax)	Mostly recognized as "legal tender" globally; established regulatory environment
Universal Acceptance	There are no regions where it is universally accepted	Accepted universally in home country
Backing	Not backed by anything other than faith in the code	Backed by faith in the US government, foreign currency reserves, and gold
Hacking	No recourse if you are hacked	Can be insured by bank or credit card company

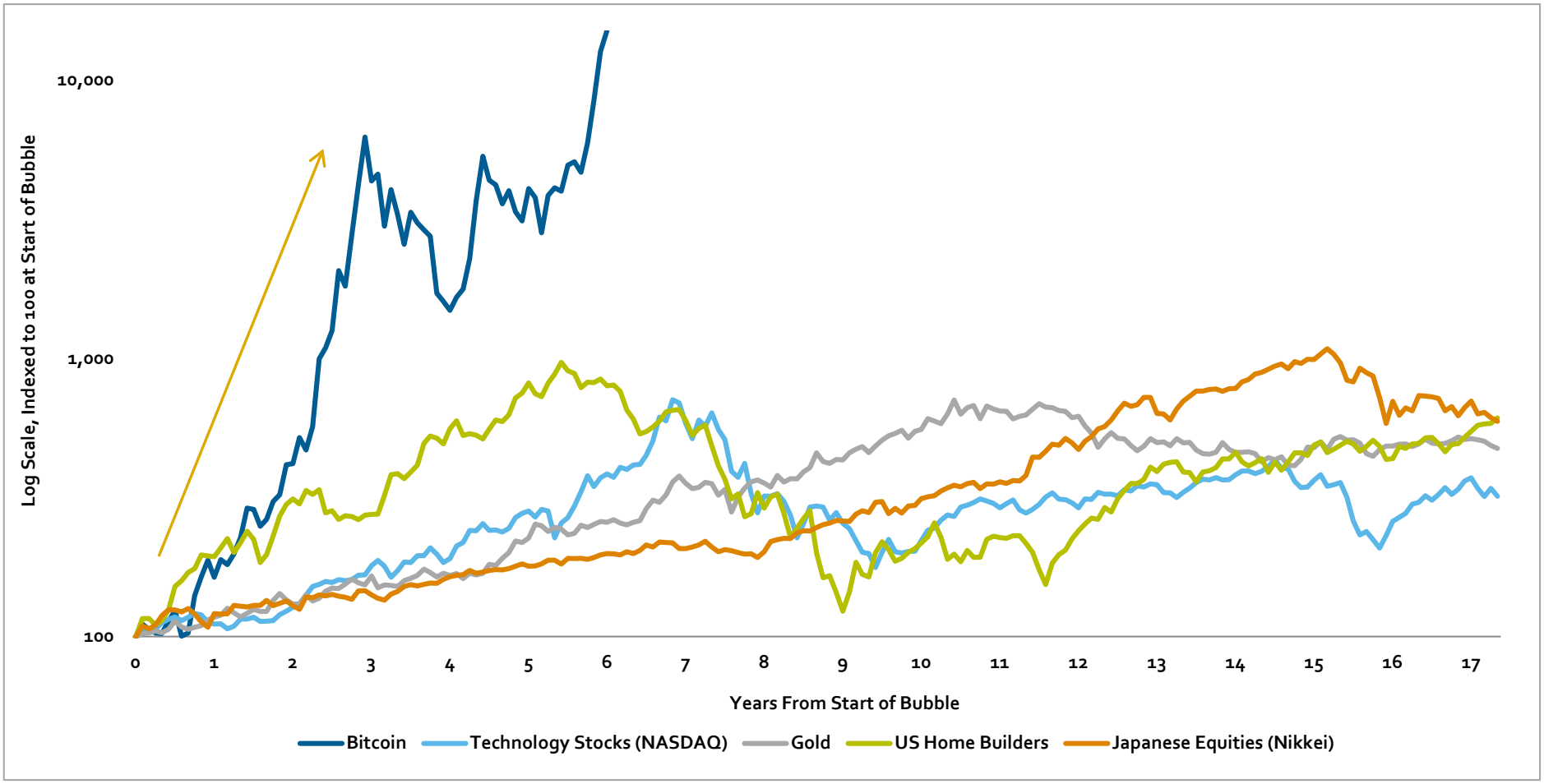
Yes Partial No

Please see important disclosures immediately following the cover page and also on page 28 for additional drawbacks and risk considerations.
Source: Federal Reserve Bank of St. Louis, Bitcoin.org, Morgan Stanley Wealth Management Global Investment Office

Bitcoin's Strong Price Appreciation Has Little Precedent

Bitcoin vs. Other Asset Bubbles

As of January 29, 2021

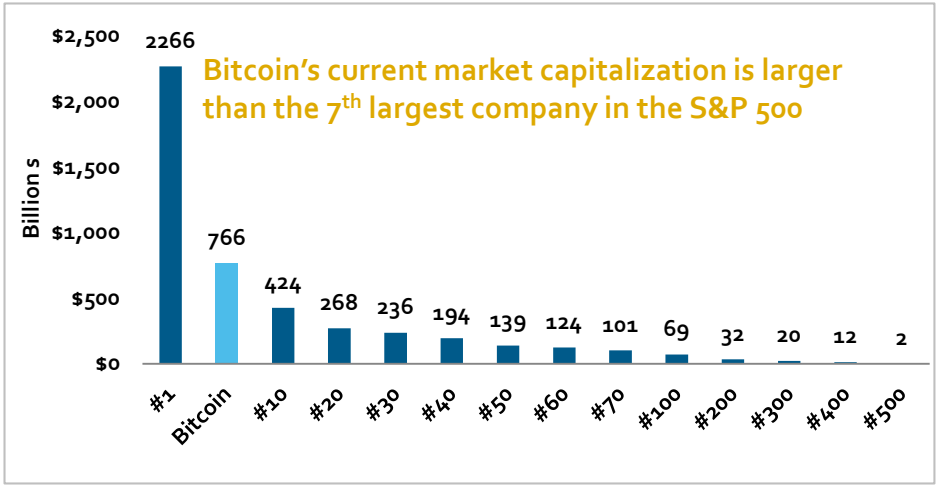


Source: Bloomberg, Morgan Stanley Wealth Management Global Investment Office. Note: Log scale, all series indexed to 100 at beginning of bubble. Bitcoin begins on 1/30/2015, NASDAQ on 4/30/1993, Gold on 3/30/2001, and US Home Builders (represented by the Dow Jones U.S. Select Home Construction Total Return Index) on 2/29/2000. The Dow Jones U.S. Select Home Construction Index measures constructors of residential homes, including manufacturers of mobile and prefabricated homes intended for use in one place.

Putting Bitcoin's Valuation in Context

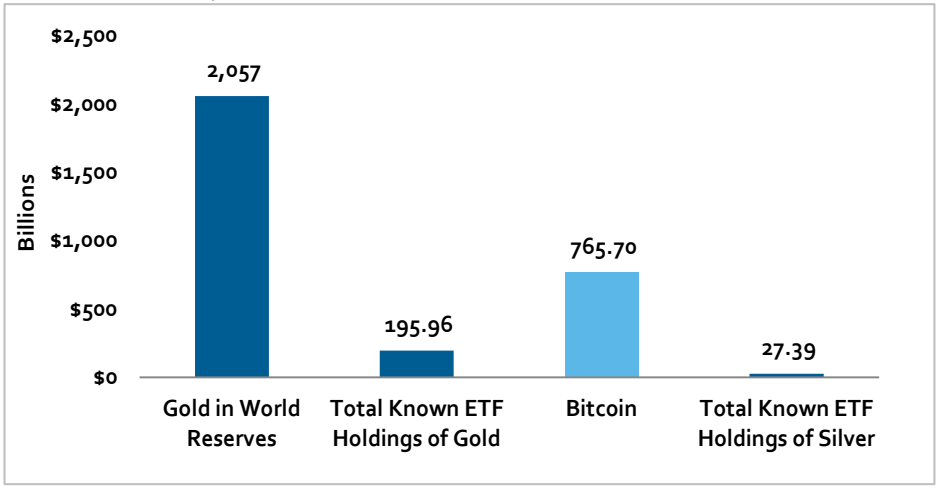
Bitcoin Market Cap vs. Market Cap of Select S&P 500 Equities

As of February 2, 2021



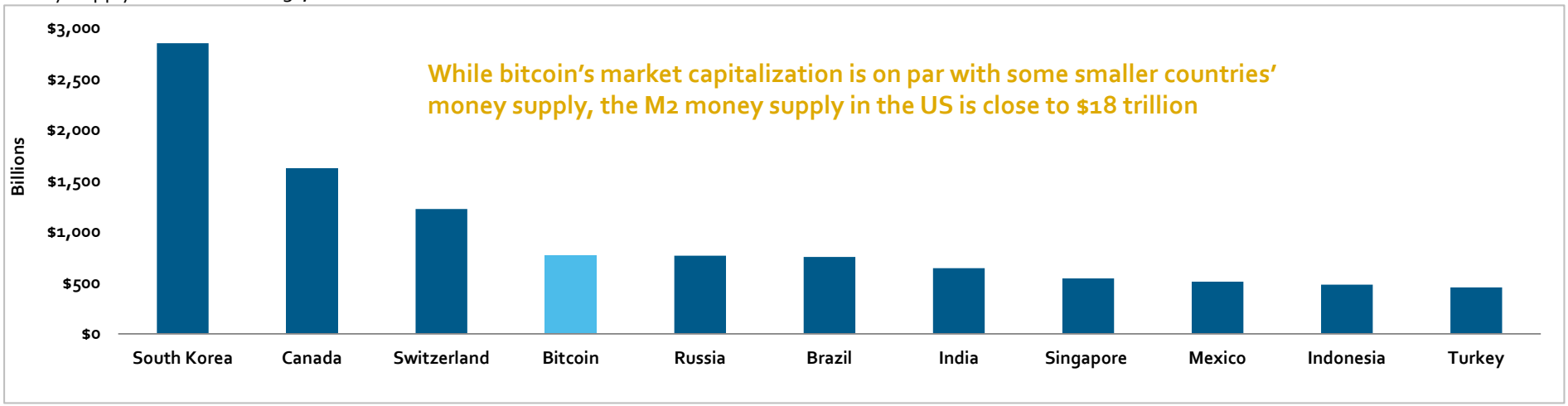
Bitcoin Market Capitalization vs. Gold and Silver

Data as of February 2, 2021



Bitcoin Market Capitalization vs. Select Country's Money Supply (M2)

Money Supply as of December 31, 2020



Source: Bloomberg, Haver Analytics, IMF, Coinmarketcap.com, Morgan Stanley Wealth Management Global Investment Office. M2 is a measure of the money supply that includes all elements of M1 as well as "near money." M1 includes cash and checking deposits, while near money refers to savings deposits, money market securities, mutual funds and other time deposits.

What Do the Skeptics Say About Bitcoin?

Skeptics Are Saying…

- **The price has gone up too fast.** Bitcoin might have some value, but speculation and fear of missing out is likely driving recent movement.
- **Another coin might displace bitcoin.** Often the first entrant to a new technology is not the winner.
- **Technology could break.** Bitcoin technology is relatively untested. How can we be sure that it cannot be hacked or broken?
- **World governments might all make bitcoin illegal to curb criminal activity.** People engaging in illicit activities constitute many of the users.
- **Transactions are too slow, too hard, and not widely accepted.** It is faster and easier to use a credit card or cash than bitcoin to make a purchase.
- **Not backed by anything.** When you own bitcoin you have no right to anything physical; it's purely electronic.
- **Supply is not really constrained.** Even if bitcoin supply is limited to 21 million coins, many other coins are created every day meaning true supply of cryptocurrencies is not limited.
- **Too energy intensive.** Running the Bitcoin network uses a lot of electricity that could be used for a more productive purpose.

"Central bankers say the success of bitcoin and other cryptocurrencies is just a bubble." – Reuters[1]

"The bitcoin feeds on itself. There are no fundamental reasons for its price to reach such levels." – Nouriel Roubini (Economist)[2]

"Bitcoin is an attempt to replace fiat currency and evade regulation and government intervention. I don't think that's going to be a success." – Ben Bernanke (Former Fed Chair)[3]

"Nobel-winning economist Shiller calls bitcoin a fad." – CNBC[4]

"Bitcoin's Wild Ride Shows The Truth: It Is Probably Worth Zero." – The Wall Street Journal[5]

Source: Bloomberg, Haver Analytics, IMF, Coinmarketcap.com, Morgan Stanley Wealth Management Global Investment Office. Note: 1: "Bubble or breakthrough? Bitcoin keeps central bankers on edge," Reuters, 11/27/2017. 2: "Economist Nouriel Roubini says Bitcoin is a 'gigantic speculative bubble' — here's how he thinks the crypto-craze will finally end," Business Insider, 11/8/2017. 3: "Bernanke Thinks Bitcoin Will Fail (But He Likes Blockchain)," Fortune, 10/16/2017. 4: "Nobel-winning economist Shiller calls bitcoin a fad," CNBC, 10/16/2017. 5: "Bitcoin's Wild Ride Shows The Truth: It Is Probably Worth Zero," The Wall Street Journal, 9/18/2017.

Appendix

What Is the "Halfing"?

As of February 2, 2021

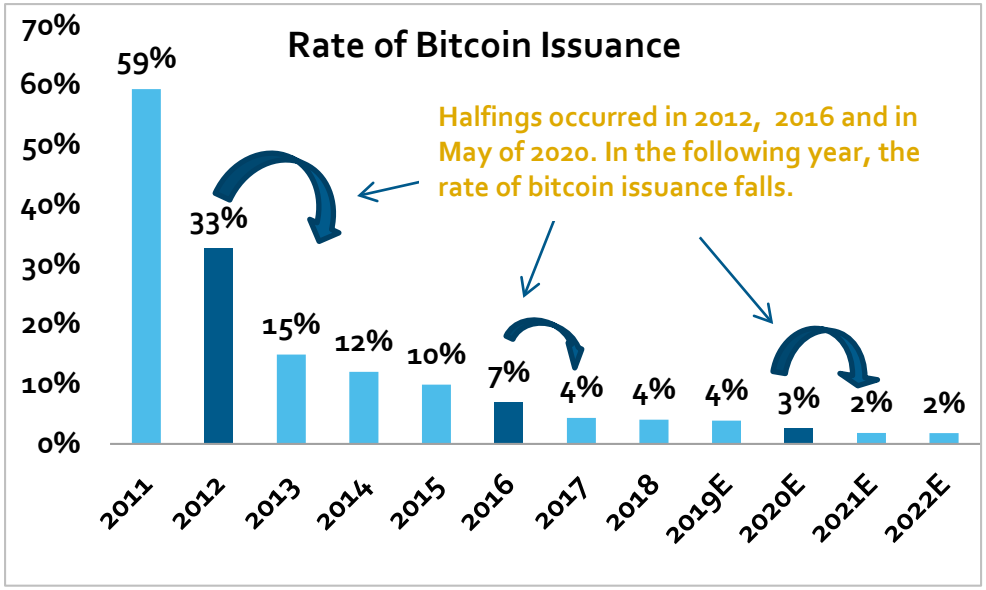
What is the Halfing? The rate of growth in Bitcoin supply or "Bitcoin's issuance" is cut in half every four years in an event called "the halfing," or sometimes "the halvening." This reduction in supply growth was written into the software from the very beginning. Satoshi Nakamoto described it in his email including the original code. The new coins were meant to be a subsidy to miners to encourage adoption. As the network grew, the subsidy could be replaced with transaction fees, leaving the total supply constant.

How does the halfing work? The number of bitcoins outstanding increases every time "a block" is produced. This occurs every 10 minutes on average. The miner is rewarded freshly minted bitcoins. Every 210,000 blocks (which is about four years) the software automatically cuts the mining reward in half. Originally, 50 bitcoins were minted every 10 minutes. In 2012, the reward dropped from 50 to 25 bitcoins every 10 minutes and in 2016 the reward dropped from 25 to 12.5 bitcoins. In 2020, the reward has dropped again from 12.5 bitcoins to 6.25 bitcoins.

The May 2020 halfing was the third bitcoin halfing. After the halfing, the annual rate of bitcoin issuance will decrease from around 4% in 2019 to about 2% in 2021.

Rate of Bitcoin Issuance

As of December 24, 2019



Source: Coinmarketcap.com, Morgan Stanley Wealth Management Global Investment Office. This is not a recommendation or endorsement of Bitcoin or any other cryptocurrency.

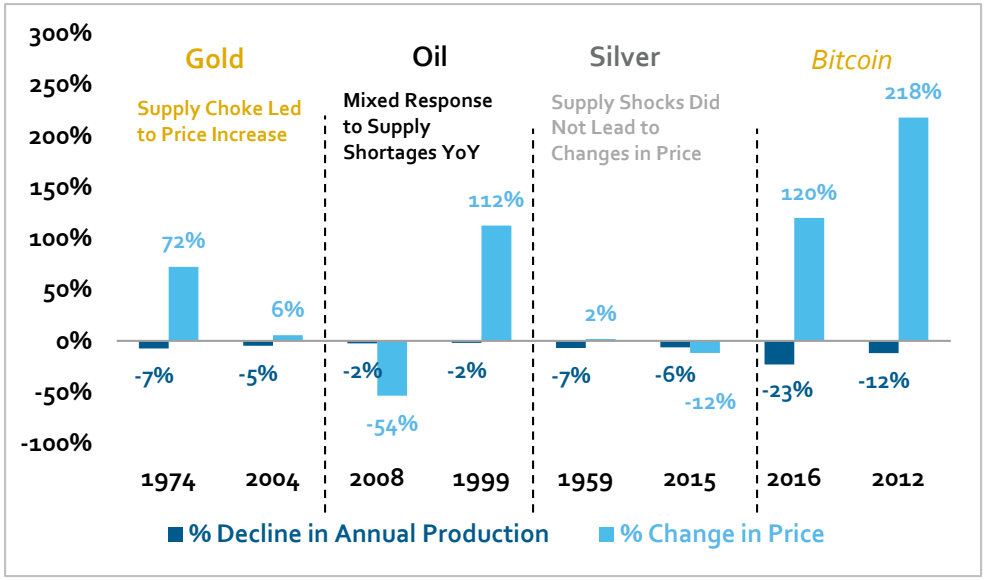
Why Is the Halfing Important?

As of February 2, 2021

The May 2020 halfing was the third bitcoin halfing. Similar to supply shocks in commodity markets such as oil or gold, a decline in annual production of bitcoin could impact price. However, unlike commodity supply shocks, which are typically not known in advance and therefore cannot be priced in, the bitcoin supply shock is set to be larger than shocks associated with commodities and it will not be a surprise, so some believe it may be priced in before it happened. **Some bitcoin followers believe that the 94% return in 2019 was explained by bulls pricing in the next halfing.** Other bitcoin advocates believe the 2020 halfing will lead to another strong year in 2021. The last two "halfing" years preceded the two years with the largest annual gains for bitcoin, though bitcoin was very small, very illiquid, and was not widely known in either year. This debate, "supply shock" or "priced in," could continue all year.

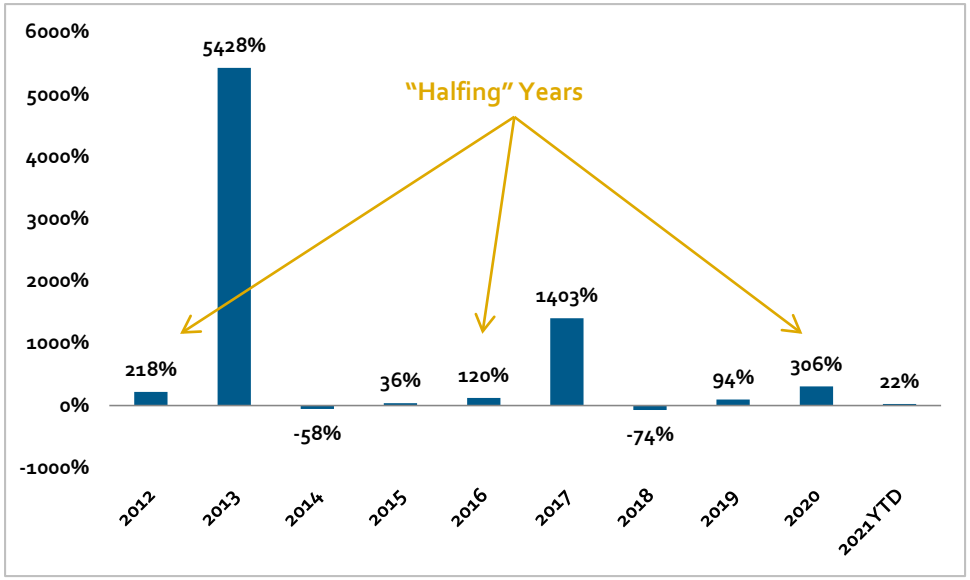
Performance of Commodities During and After Largest Supply Shocks

As of August 3, 2020



Bitcoin Returns by Year

As of February 2, 2021

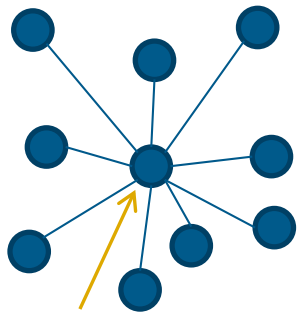


.Source: Coinmarketcap.com, Bloomberg, Morgan Stanley Wealth Management Global Investment Office. This is not a recommendation or endorsement of Bitcoin or any other cryptocurrency.

What Is a Blockchain?

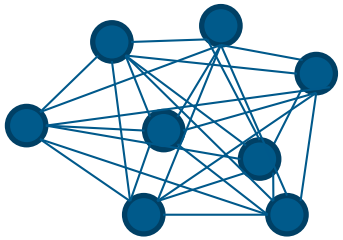
- **A blockchain is a chronological chain of records that are linked together and encrypted by cryptography**. This data is then shared with everyone involved in the process, also known as open distributed ledger, so that each party is viewing the same set of records—essentially a public spreadsheet. The decentralized nature of a blockchain may help make it more resistant to an attack; the electronic nature of a blockchain gives it speed, flexibility and potential for automation. Benefits of this technology include:
  - **Security**: Cryptography and encryption may help address risks of record tampering and data vulnerability
  - **Visibility**: Transaction processing can be streamlined, errors detected, and all parties can monitor in real time
  - **Dispute resolution**: Due to the step-by-step nature of blockchain, all parties have a digital record of past events
- Risks include:
  - **Technology fails**: Blockchain is a new technology; there is a risk that the technology could fail and data is hacked or altered
  - **Additional costs**: Requires redundant processing power and there is a cost of switching to and scaling a new technology
- **Cryptocurrencies are only one application of the blockchain technology**. While blockchain technology remains in its early stages, potential applications include: payment verification, securities clearing and settlement, supply chain management, and storing sensitive personal and financial information.

Centralized Ledger Traditionally Used for Record Keeping Has a Single Point of Failure



Theoretically, records held in a central location provide a single target as the opportunity for hackers and corruption

Decentralized Record Keeping Can Be More Resistant to an Attack



The decentralized nature of a blockchain may help make it more resistant to an attack because data would need to be altered in multiple locations

Source: BlockChain.Info, CoinDesk, Morgan Stanley & Co. Research, Morgan Stanley Wealth Management Global Investment Office

Blockchain Can Have Other Real-World Applications

Example: Using Blockchain to Monitor Supply Chain for Food Safety

Why use blockchain?	• **It is currently very difficult to monitor a food delivery supply chain** and catch virus outbreaks before they hit food stores • This can cause massive recalls and detrimental food safety consequences
How would it work?	• **Implement a blockchain service to digitally monitor and record the step-by-step process** that food delivery takes: who is the supplier, how and where it was grown, who inspected it, where it was shipped to, and how did it move between these steps, etc.
What are the benefits?	• **Avoiding massive recalls** could reduce food retailer losses due to food disposal, restocking, distribution logistics, and legal fees • Should an issue be discovered, this technology could allow the user to **narrow down the search to one shipment or geographic area** rather than removing every potentially exposed product • Finding the point of infection allows for appropriate **risk mitigation throughout the supply chain**
What are the risks?	• New technology could fail or be hacked • Costs associated with replacing existing technology, infrastructure, processes, and training personnel

Source: Morgan Stanley & Co. Research, Morgan Stanley Wealth Management Global Investment Office

Additional Reading

- Original Bitcoin Whitepaper – by Satoshi Nakamoto
  - https://bitcoin.org/bitcoin.pdf
- IBM Blockchain – business and industry use cases
  - https://www.ibm.com/blockchain/
- Blockchain Research – McKinsey Global Institute
  - http://www.mckinsey.com/search?q=blockchain
- *The Truth About Blockchain* – Harvard Business Review
  - https://hbr.org/2017/01/the-truth-about-blockchain
- What You Should Know About Bitcoin
  - http://www.finra.org/investors/highlights/what-you-should-know-about-bitcoin
- Bitcoin Basics – 9 Things You Should Know About the Digital Currency
  - http://www.finra.org/investors/bitcoin-basics-9-things-you-should-know-about-digital-currency
- AlphaCurrents: Blockchain Belief
  - https://mssbcie.ms.com/ri/#lookup=3124A496-50DC-417B-8056-682010ED1121;page=reportdetails;previousState=filter~%40~ContentType_Alias%3AInvestment%20Resources%7C*%7Clookup~%40~blockchain%7C*%7CpageIndex~%40~1%7C*%7Cpage~%40~search%7C*%7Csort~%40~relevanc
- Cryptocurrency Trading Platforms: Do Your Homework
  - http://www.finra.org/investors/highlights/cryptocurrency-trading-platforms-do-your-homework

Source: Morgan Stanley Wealth Management Global Investment Office

Risk Considerations

Buying, selling and using **Bitcoin or other virtual currency products** is highly speculative and may result in substantial losses in a short period of time. Risks include:

- Digital currency such as Bitcoin or other virtual currency products is not legal tender. No law requires companies or individuals to accept the currency as a form of payment. Instead, Bitcoin or other virtual currency-products use is limited to businesses and individuals that are willing to accept them. If no one were to accept digital currencies, Bitcoin and other virtual currency products would very likely become worthless.
- The exchange rate of Bitcoin or other virtual currency products versus the USD historically has been very volatile and the exchange rate could drastically decline. For example, the exchange rate of Bitcoin versus the USD has dropped more than 50% in a single day. Bitcoin may be affected by such volatility as well.
- Platforms that buy and sell Bitcoin or other virtual currency products can be hacked, and some have failed. In addition, like the platforms themselves, digital wallets can be hacked. As a result, consumers can—and have—lost some or all of their holdings of digital currency.
- Bitcoin or other virtual currency product transactions can be subject to fraud and theft. For example, a fraudster could pose as a Bitcoin exchange, Bitcoin intermediary or trader in an effort to lure you to send it digital currency, which is then stolen.
- Unlike US banks and credit unions that provide certain guarantees of safety to depositors, there are no such safeguards provided to digital wallets by their providers or regulators.
- Payments in Bitcoin or other virtual currency products are irreversible. Once you complete a transaction, it cannot be reversed. Purchases can be refunded, but that depends solely on the willingness of the vendor-recipient to do so.
- In part because of the anonymity Bitcoin and other virtual currency products offer, it has been used in illegal activity, including drug dealing, money laundering and other forms of illegal commerce. Abuses could impact legitimate consumers and speculators; for instance, law enforcement agencies could shut down or restrict the use of platforms and exchanges, limiting or shutting off entirely the ability to use or trade Bitcoin or other virtual currency-products.
- As a recent invention, Bitcoin and other virtual currencies do not have an established track record of credibility and trust. Bitcoin and other virtual currencies are evolving.
- Bitcoin is a speculative investment, and like any speculative investment, investors can lose money. With digital currency, profits or losses are virtually impossible to predict.
- Bitcoin prices have fluctuated widely, and wildly, almost from the currency's inception. Bitcoin prices plummeted following the closure of a Tokyo-based bitcoin exchange—and earlier when the Chinese central bank banned banks from accepting bitcoins. Other factors that affect digital currency prices include supply and demand, rumors and even where bitcoins are traded (since prices are far from uniform from one bitcoin exchange to the next). In short, bitcoin speculation is extremely risky. Never speculate with money you cannot afford to lose.

Futures contracts are volatile, leveraged and involve inherent risks. Futures transactions are not appropriate for every investor and clients should refrain from investing (or hedging) in futures unless they are knowledgeable, experienced and fully understand the terms and risks, including but not limited to:

1. Liquidity risks – even if a cash market position is properly hedged, the client might have to post additional "variation" payment for losses incurred on the futures contracts;
2. Basis risk- the futures positions might not effectively track the underlying cash commodity resulting in a hedged position that doesn't perform as expected;
3. Options – clients should be fully aware of the standardized terms, special vocabulary (delta, vega etc.) and the potential high risk characteristics of option transactions;
4. Potential of loss – because of the effect of leverage, a relatively small market movement will have a proportionately large impact on the funds you have deposited. This loss can be equal to, or some instances greater than the full amount of your initial investment.

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For more information on the ranking models, please see *Adverse Active AlphaSM 2.0: Scoring Active Managers According to Potential Alpha* and *Value Score: Scoring Fee Efficiency by Comparing Managers' "Fair Value" and Actual Expense Ratios.* The whitepapers are available from your Financial Advisor or Private Wealth Advisor. ADVERSE ACTIVE ALPHA is a registered service mark of Morgan Stanley and/or its affiliates. U.S. Pat. No. 8,756,098 applies to the Adverse Active Alpha system and/or methodology.

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Electronic payments arrive to the payee within 1-2 business days, check payments arrive to the payee within 5 business days. Same-day and overnight payments are available for an additional fee within the available payment timeframes.

KEY ASSET CLASS CONSIDERATIONS AND OTHER RISKS

Investing in the markets entails the risk of market volatility. The value of all types of investments, including stocks, mutual funds, exchange-traded funds ("ETFs"), closed-end funds, and unit investment trusts, may increase or decrease over varying time periods. To the extent the investments depicted herein represent **international securities**, you should be aware that there may be additional risks associated with international investing, including foreign economic, political, monetary and/or legal factors, changing currency exchange rates, foreign taxes, and differences in financial and accounting standards. These risks may be magnified in **emerging markets and frontier markets**. **Small- and mid-capitalization companies** may lack the financial resources, product diversification and competitive strengths of larger companies. In addition, the securities of small- and mid-capitalization companies may not trade as readily as, and be subject to higher volatility than, those of larger, more established companies. The value of **fixed income securities** will fluctuate and, upon a sale, may be worth more or less than their original cost or maturity value. Bonds are subject to interest rate risk, call risk, reinvestment risk, liquidity risk, and credit risk of the issuer. **High yield bonds** are subject to additional risks such as increased risk of default and greater volatility because of the lower credit quality of the issues. In the case of **municipal bonds**, income is generally exempt from federal income taxes. Some income may be subject to state and local taxes and to the federal alternative minimum tax. Capital gains, if any, are subject to tax. **Treasury Inflation Protection Securities' (TIPS)** coupon payments and underlying principal are automatically increased to compensate for inflation by tracking the consumer price index (CPI). While the real rate of return is guaranteed, TIPS tend to offer a low return. Because the return of TIPS is linked to inflation, TIPS may significantly underperform versus conventional U.S. Treasuries in times of low inflation. There is no guarantee that investors will receive par if TIPS are sold prior to maturity. The returns on a portfolio consisting primarily of **environmental, social, and governance-aware investments ("ESG")** may be lower or higher than a portfolio that is more diversified or where decisions are based solely on investment considerations. Because ESG criteria exclude some investments, investors may not be able to take advantage of the same opportunities or market trends as investors that do not use such criteria. The companies identified and investment examples are for illustrative purposes only and should not be deemed a recommendation to purchase, hold or sell any securities or investment products. They are intended to demonstrate the approaches taken by managers who focus on ESG criteria in their investment strategy. There can be no guarantee that a client's account will be managed as described herein. **Options** and margin trading involve substantial risk and are not appropriate for all investors. Besides the general investment risk of holding securities that may decline in value and the possible loss of principal invested, **closed-end funds** may have additional risks related to declining market prices relative to net asset values (NAVs), active manager underperformance and potential leverage. Closed-end funds, unlike open-end funds, are not continuously offered. There is a one-time public offering and once issued, shares of closed-end funds are sold in the open market through a stock exchange. Shares of closed-end funds frequently trade at a discount from their NAV which may increase investors' risk of loss. The risk of loss due to this discount may be greater for investors expecting to sell their shares in a relatively short period after completion of the public offering. This characteristic is a risk separate and distinct from the risk that a closed-end fund's net asset value may decrease as a result of investment activities. NAV is total assets less total liabilities divided by the number of shares outstanding. At the time an investor purchases shares of a closed-end fund, shares may have a market price that is above or below NAV. Portfolios that invest a large percentage of assets in only one industry **sector** (or in only a few sectors) are more vulnerable to price fluctuation than those that diversify among a broad range of sectors.

Alternative investments often are speculative and include a high degree of risk. Investors could lose all or a substantial amount of their investment. Alternative investments are appropriate only for eligible, long-term investors who are willing to forgo liquidity and put capital at risk for an indefinite period of time. They may be highly illiquid and can engage in leverage and other speculative practices that may increase the volatility and risk of loss. Alternative Investments typically have higher fees than traditional investments. Investors should carefully review and consider potential risks before investing. Certain of these risks may include but are not limited to: Loss of all or a substantial portion of the investment due to leveraging, short-selling, or other speculative practices; Lack of liquidity in that there may be no secondary market for a fund; Volatility of returns; Restrictions on transferring interests in a fund; Potential lack of diversification and resulting higher risk due to concentration of trading authority when a single advisor is utilized; Absence of information regarding valuations and pricing; Complex tax structures and delays in tax reporting; Less regulation and higher fees than mutual funds; Risks associated with the operations, personnel, and processes of the manager; and Risks associated with cybersecurity. As a diversified global financial services firm,

Morgan Stanley Wealth Management engages in a broad spectrum of activities including financial advisory services, investment management activities, sponsoring and managing private investment funds, engaging in broker-dealer transactions and principal securities, commodities and foreign exchange transactions, research publication, and other activities. In the ordinary course of its business, Morgan Stanley Wealth Management therefore engages in activities where Morgan Stanley Wealth Management's interests may conflict with the interests of its clients , including the private investment funds it manages. Morgan Stanley Wealth Management can give no assurance that conflicts of interest will be resolved in favor of its clients or any such fund. All expressions of opinion are subject to change without notice and are not intended to be a forecast of future events or results. 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These limitations include survivorship bias (the returns of the indices may not be representative of all the hedge funds in the universe because of the tendency of lower performing funds to leave the index); heterogeneity (not all hedge funds are alike or comparable to one another, and the index may not accurately reflect the performance of a described style); and limited data (many hedge funds do not report to indices, and the index may omit funds, the inclusion of which might significantly affect the performance shown. The HFRI indices are based on information self-reported by hedge fund managers that decide on their own, at any time, whether or not they want to provide, or continue to provide, information to HFR Asset Management, L.L.C. Results for funds that go out of business are included in the index until the date that they cease operations. Therefore, these indices may not be complete or accurate representations of the hedge fund universe, and may be biased in several ways. Composite index results are shown for illustrative purposes and do not represent the performance of a specific investment. Individual funds have specific tax risks related to their investment programs that will vary from fund to fund. Clients should consult their own tax and legal advisors as Morgan Stanley Wealth Management does not provide tax or legal advice. Interests in alternative investment products are offered pursuant to the terms of the applicable offering memorandum , are distributed by Morgan Stanley Wealth Management and certain of its affiliates, and (1) are not FDIC-insured, (2) are not deposits or other obligations of Morgan Stanley Wealth Management or any of its affiliates, (3) are not guaranteed by Morgan Stanley Wealth Management and its affiliates, and (4) involve investment risks, including possible loss of principal. Morgan Stanley Wealth Management is a registered broker-dealer, not a bank. 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Investment products in this category may employ various investment strategies and techniques for both hedging and more speculative purposes such as short -selling, leverage, derivatives and options, which can increase volatility and the risk of investment loss. Alternative investments are not appropriate for all investors. As a diversified global financial services firm, Morgan Stanley Wealth Management engages in a broad spectrum of activities including financial advisory services, investment management activities, sponsoring and managing private investment funds, engaging in broker-dealer transactions and principal securities, commodities and foreign exchange transactions, research publication, and other activities. In the ordinary course of its business, Morgan Stanley Wealth Management therefore engages in activities where Morgan Stanley Wealth Management's interests may conflict with the interests of its clients , including the private investment funds it manages. Morgan Stanley Wealth Management can give no assurance that conflicts of interest will be resolved in favor of its clients or any such fund. Alternative investments involve complex tax structures, tax inefficient investing, and delays in distributing important tax information. Individual funds have specific risks related to their investment programs that will vary from fund to fund. Clients should consult their own tax and legal advisors as Morgan Stanley Wealth Management does not provide tax or legal advice.

A majority of Alternative Investment managers reviewed and selected by GIMA pay or cause to be paid an ongoing fee for distribution from their management fees to Morgan Stanley Wealth Management in connection with Morgan Stanley Wealth Management clients that purchase an interest in an Alternative Investment and in some instances pay these fees on the investments held by advisory clients. Morgan Stanley Wealth Management rebates such fees that are received and attributable to an investment held by an advisory client and retains the fees paid in connection with investments held by brokerage clients. Morgan Stanley Wealth Management has a conflict of interest in offering alternative investments because Morgan Stanley Wealth Management or our affiliates, in most instances, earn more money in your account from your investments in alternative investments than from other investment options.

It should be noted that the majority of hedge fund indexes are comprised of hedge fund manager returns. This is in contrast to traditional indexes, which are comprised of individual securities in the various market segments they represent and offer complete transparency as to membership and construction methodology. As such, some believe that hedge fund index returns have certain biases that are not present in traditional indexes. Some of these biases inflate index performance, while others may skew performance negatively. However, many studies indicate that overall hedge fund index performance has been biased to the upside. Some studies suggest performance has been inflated by up to 260 basis points or more annually depending on the types of biases included and the time period studied. Although there are numerous potential biases that could affect hedge fund returns, we identify some of the more common ones throughout this paper.

Self-selection bias results when certain manager returns are not included in the index returns and may result in performance being skewed up or down. Because hedge funds are private placements,

hedge fund managers are able to decide which fund returns they want to report and are able to opt out of reporting to the various databases. Certain hedge fund managers may choose only to report returns for funds with strong returns and opt out of reporting returns for weak performers. Other hedge funds that close may decide to stop reporting in order to retain secrecy, which may cause a downward bias in returns.
Survivorship bias results when certain constituents are removed from an index. This often results from the closure of funds due to poor performance, "blow ups," or other such events. As such, this bias typically results in performance being skewed higher. As noted, hedge fund index performance biases can result in positive or negative skew. However, it would appear that the skew is more often positive. While it is difficult to quantify the effects precisely, investors should be aware that idiosyncratic factors may be giving hedge fund index returns an artificial "lift" or upwards bias.

Hedge Funds of Funds and many funds of funds are private investment vehicles restricted to certain qualified private and institutional investors. They are often speculative and include a high degree of risk. Investors can lose all or a substantial amount of their investment. They may be highly illiquid, can engage in leverage and other speculative practices that may increase volatility and the risk of loss, and may be subject to large investment minimums and initial lockups. They involve complex tax structures, tax-inefficient investing and delays in distributing important tax information. Categorically, hedge funds and funds of funds have higher fees and expenses than traditional investments, and such fees and expenses can lower the returns achieved by investors. Funds of funds have an additional layer of fees over and above hedge fund fees that will offset returns. An investment in an **exchange-traded fund** involves risks similar to those of investing in a broadly based portfolio of equity securities traded on an exchange in the relevant securities market, such as market fluctuations caused by such factors as economic and political developments, changes in interest rates and perceived trends in stock and bond prices. An investment in a **target date portfolio** is subject to the risks attendant to the underlying funds in which it invests, in these portfolios the funds are the Consulting Group Capital Market funds. A target date portfolio is geared to investors who will retire and/or require income at an approximate year. The portfolio is managed to meet the investor's goals by the pre-established year or "target date." A target date portfolio will transition its invested assets from a more aggressive portfolio to a more conservative portfolio as the target date draws closer. An investment in the target date portfolio is not guaranteed at any time, including, before or after the target date is reached. **Managed futures** investments are speculative, involve a high degree of risk, use significant leverage, are generally illiquid, have substantial charges, subject investors to conflicts of interest, and are appropriate only for the risk capital portion of an investor's portfolio. Managed futures investments do not replace equities or bonds but rather may act as a complement in a well diversified portfolio. Managed Futures are complex and not appropriate for all investors. **Rebalancing** does not protect against a loss in declining financial markets. There may be a potential tax implication with a rebalancing strategy.

Asset allocation and diversification do not assure a profit or protect against loss in declining financial markets. Past performance is no guarantee of future results. Actual results may vary.

Tax laws are complex and subject to change. Morgan Stanley Smith Barney LLC ("Morgan Stanley"), its affiliates and Morgan Stanley Financial Advisors and Private Wealth Advisors do not provide tax or legal advice and are not "fiduciaries" (under ERISA, the Internal Revenue Code or otherwise) with respect to the services or activities described herein except as otherwise provided in writing by Morgan Stanley and/or as described at www.morganstanley.com/disclosures/dol. Individuals are encouraged to consult their tax and legal advisors (a) before establishing a retirement plan or account, and (b) regarding any potential tax, ERISA and related consequences of any investments made under such plan or account.

Annuities and insurance products are offered in conjunction with Morgan Stanley Smith Barney LLC's licensed insurance agency affiliates.

Indices are unmanaged and investors cannot directly invest in them. They are not subject to expenses or fees and are often comprised of securities and other investment instruments the liquidity of which is not restricted. A particular investment product may consist of securities significantly different than those in any index referred to herein. Composite index results are shown for illustrative purposes only, generally do not represent the performance of a specific investment, may not, for a variety of reasons, be an appropriate comparison or benchmark for a particular investment and may not necessarily reflect the actual investment strategy or objective of a particular investment. Consequently, comparing an investment to a particular index may be of limited use.

This material is not a financial plan and does not create an investment advisory relationship between you and your Morgan Stanley Financial Advisor. We are not your fiduciary either under the Employee Retirement Income Security Act of 1974 (ERISA) or the Internal Revenue Code of 1986, and any information in this report is not intended to form the primary basis for any investment decision by you, or an investment advice or recommendation for either ERISA or Internal Revenue Code purposes. Morgan Stanley Private Wealth Management will only prepare a financial plan at your specific request using Private Wealth Management approved financial planning signature.

We may act in the capacity of a broker or that of an advisor. As your broker, we are not your fiduciary and our interests may not always be identical to yours. Please consult with your Private Wealth Advisor to discuss our obligations to disclose to you any conflicts we may from time to time have and our duty to act in your best interest. We may be paid both by you and by others who compensate us based on what you buy. Our compensation, including that of your Private Wealth Advisor, may vary by product and over time.

Investment and services offered through Morgan Stanley Private Wealth Management, a division of Morgan Stanley Smith Barney LLC, Member SIPC.

For index, indicator and survey definitions referenced in this report please visit the following: https://www.morganstanley.com/wealth-investmentsolutions/wmir-definitions

GLOBAL INVESTMENT COMMITTEE (GIC) ASSET ALLOCATION MODELS: The Asset Allocation Models are created by Morgan Stanley Wealth Management's GIC.

HYPOTHETICAL MODEL PERFORMANCE (GROSS): Hypothetical model performance results do not reflect the investment or performance of an actual portfolio following a GIC Strategy, but simply reflect actual historical performance of selected indices on a real-time basis over the specified period of time representing the GIC's strategic and tactical allocations as of the date of this report. The past performance shown here is simulated performance based on benchmark indices, not investment results from an actual portfolio or actual trading. There can be large differences between hypothetical and actual performance results achieved by a particular asset allocation or trading strategy. Hypothetical performance results do not represent actual trading and are generally designed with the benefit of hindsight. Actual performance results of accounts vary due to, for example, market factors (such as liquidity) and client-specific factors (such as investment vehicle selection, timing of contributions and withdrawals, restrictions and rebalancing schedules). Clients would not necessarily have obtained the performance results shown here if they had invested in accordance with any GIC Asset Allocation Model for the periods indicated. Despite the limitations of hypothetical performance, these hypothetical performance results allow clients and Financial Advisors to obtain a sense of the risk/return trade-off of different asset allocation constructs. The hypothetical performance results in this report are calculated using the returns of benchmark indices for the asset classes, and not the returns of securities, fund or other investment products. Models may contain allocations to Hedge Funds, Private Equity and Private Real Estate. The benchmark indices for these asset classes are not issued on a daily basis. When calculating model performance on a day for which no benchmark index data is issued, we have assumed straight line growth between the index levels issued before and after that date.

FEES REDUCE THE PERFORMANCE OF ACTUAL ACCOUNTS: None of the fees or other expenses (e.g. commissions, mark-ups, mark-downs, fees) associated with actual trading or accounts are reflected in the GIC Asset Allocation Models. The GIC Asset Allocation Models and any model performance included in this presentation are intended as educational materials. Were a client to use these models in connection with investing, any investment decisions made would be subject to transaction and other costs which, when compounded over a period of years, would decrease returns. Information regarding Morgan Stanley's standard advisory fees is available in the Form ADV Part 2, which is available at www.morganstanley.com/adv. The following hypothetical illustrates the compound effect fees have on investment returns: For example, if a portfolio's annual rate of return is 15% for 5 years and the account pays 50 basis points in fees per annum, the gross cumulative five-year return would be 101.1% and the five-year return net of fees would be 96.8%. Fees and/or expenses would apply to clients who invest in investments in an account based on these asset allocations, and would reduce clients' returns. The impact of fees and/or expenses can be material.

Variable annuities are long-term investments designed for retirement purposes and may be subject to market fluctuations, investment risk, and possible loss of principal. All guarantees, including optional benefits, are based on the financial strength and claims-paying ability of the issuing insurance company and do not apply to the underlying investment options. Optional riders may not be able to be purchased in combination and are available at an additional cost. Some optional riders must be elected at time of purchase. Optional riders may be subject to specific limitations, restrictions, holding periods, costs, and expenses as specified by the insurance company in the annuity contract. If you are investing in a **variable annuity** through a tax-advantaged retirement plan such as an IRA, you will get no additional tax advantage from the variable annuity. Under these circumstances, you should only consider buying a variable annuity because of its other features, such as lifetime income payments and death benefits protection. Taxable distributions (and certain deemed distributions) are subject to ordinary income tax and, if taken prior to age 59½, may be subject to a 10% federal income tax penalty. Early withdrawals will reduce the death benefit and cash surrender value.

Equity securities may fluctuate in response to news on companies, industries, market conditions and general economic environment. **Ultrashort-term fixed income** asset class is comprised of fixed income securities with high quality, very short maturities. They are therefore subject to the risks associated with debt securities such as credit and interest rate risk.

Master Limited Partnerships (MLPs) are limited partnerships or limited liability companies that are taxed as partnerships and whose interests (limited partnership units or limited liability company units) are traded on securities exchanges like shares of common stock. Currently, most MLPs operate in the energy, natural resources or real estate sectors. Investments in MLP interests are subject to the risks generally applicable to companies in the energy and natural resources sectors, including commodity pricing risk, supply and demand risk, depletion risk and exploration risk. Individual MLPs are publicly traded partnerships that have unique risks related to their structure. These include, but are not limited to, their reliance on the capital markets to fund growth, adverse ruling on the current tax treatment of distributions (typically mostly tax deferred), and commodity volume risk. The potential tax benefits from investing in MLPs depend on their being treated as partnerships for federal income tax purposes and, if the MLP is deemed to be a corporation, then its income would be subject to federal taxation at the entity level, reducing the amount of cash available for distribution to the fund which could result in a reduction of the fund's value. MLPs carry interest rate risk and may underperform in a rising interest rate environment. MLP funds accrue deferred income taxes for future tax liabilities associated with the portion of MLP distributions considered to be a tax-deferred return of capital and for any net operating gains as well as capital appreciation of its investments; this deferred tax liability is reflected in the daily NAV, and, as a result, the MLP fund's after-tax performance could differ significantly from the underlying assets even if the pre-tax performance is closely

tracked.

Investing in commodities entails significant risks. Commodity prices may be affected by a variety of factors at any time, including but not limited to, (i) changes in supply and demand relationships, (ii) governmental programs and policies, (iii) national and international political and economic events, war and terrorist events, (iv) changes in interest and exchange rates, (v) trading activities in commodities and related contracts, (vi) pestilence, technological change and weather, and (vii) the price volatility of a commodity. In addition, the commodities markets are subject to temporary distortions or other disruptions due to various factors, including lack of liquidity, participation of speculators and government intervention. **Physical precious metals** are non-regulated products. Precious metals are speculative investments, which may experience short-term and long term price volatility. The value of precious metals investments may fluctuate and may appreciate or decline, depending on market conditions. Unlike bonds and stocks, precious metals do not make interest or dividend payments. Therefore, precious metals may not be appropriate for investors who require current income. Precious metals are commodities that should be safely stored, which may impose additional costs on the investor.

REITs investing risks are similar to those associated with direct investments in real estate: property value fluctuations, lack of liquidity, limited diversification and sensitivity to economic factors such as interest rate changes and market recessions. Risks of **private real estate** include: illiquidity; a long-term investment horizon with a limited or nonexistent secondary market; lack of transparency; volatility (risk of loss); and leverage. Principal is returned on a monthly basis over the life of a **mortgage-backed security.** Principal prepayment can significantly affect the monthly income stream and the maturity of any type of MBS, including standard MBS, CMOs and Lottery Bonds. **Asset-backed securities** generally decrease in value as a result of interest rate increases, but may benefit less than other fixed-income securities from declining interest rates, principally because of prepayments.
Yields are subject to change with economic conditions. Yield is only one factor that should be considered when making an investment decision. **Credit ratings** are subject to change. **Duration**, the most commonly used measure of bond risk, quantifies the effect of changes in interest rates on the price of a bond or bond portfolio. The longer the duration, the more sensitive the bond or portfolio would be to changes in interest rates. The majority of $25 and $1000 par **preferred securities** are "callable" meaning that the issuer may retire the securities at specific prices and dates prior to maturity. Interest/dividend payments on certain preferred issues may be deferred by the issuer for periods of up to 5 to 10 years, depending on the particular issue. The investor would still have income tax liability even though payments would not have been received. Price quoted is per $25 or $1,000 share, unless otherwise specified. Current yield is calculated by multiplying the coupon by par value divided by the market price. The initial interest rate on a **floating-rate security** may be lower than that of a fixed-rate security of the same maturity because investors expect to receive additional income due to future increases in the floating security's underlying reference rate. The reference rate could be an index or an interest rate. However, there can be no assurance that the reference rate will increase. Some floating-rate securities may be subject to call risk. The market value of **convertible bonds** and the underlying common stock(s) will fluctuate and after purchase may be worth more or less than original cost. If sold prior to maturity, investors may receive more or less than their original purchase price or maturity value, depending on market conditions. Callable bonds may be redeemed by the issuer prior to maturity. Additional call features may exist that could affect yield. Some $25 or $1000 **par preferred securities** are QDI (Qualified Dividend Income) eligible. Information on QDI eligibility is obtained from third party sources. The dividend income on QDI eligible preferreds qualifies for a reduced tax rate. Many traditional 'dividend paying' perpetual preferred securities (traditional preferreds with no maturity date) are QDI eligible. In order to qualify for the preferential tax treatment all qualifying preferred securities must be held by investors for a minimum period – 91 days during a 180 day window period, beginning 90 days before the ex-dividend date.
Companies paying **dividends** can reduce or cut payouts at any time.

Nondiversification: For a portfolio that holds a concentrated or limited number of securities, a decline in the value of these investments would cause the portfolio's overall value to decline to a greater degree than a less concentrated portfolio. The **indices selected by Morgan Stanley Wealth Management** to measure performance are representative of broad asset classes. Morgan Stanley Wealth Management retains the right to change representative indices at any time. Because of their narrow focus, **sector investments** tend to be more volatile than investments that diversify across many sectors and companies.

Growth investing does not guarantee a profit or eliminate risk. The stocks of these companies can have relatively high valuations. Because of these high valuations, an investment in a growth stock can be more risky than an investment in a company with more modest growth expectations. **Value investing** does not guarantee a profit or eliminate risk. Not all companies whose stocks are considered to be value stocks are able to turn their business around or successfully employ corrective strategies which would result in stock prices that do not rise as initially expected .
Any type of **continuous or periodic investment plan** does not assure a profit and does not protect against loss in declining markets. Since such a plan involves continuous investment in securities regardless of fluctuating price levels of such securities, the investor should consider his financial ability to continue his purchases through periods of low price levels.
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