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J.P. Morgan Perspectives

Decrypting Cryptocurrencies: Technology, Applications and Challenges

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See end pages for analyst certification and important disclosures, including investment banking relationships.
Charts are taken presentations from *Decrypting Cryptocurrencies: Technology, Applications and Challenges* published on February 9, 2018. Please see slide 27 for details on the analysts to contact.

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Introduction

- J.P. Morgan researchers from across a wide range of expertise analyze various aspects of Cryptocurrency (CC) to gain insight on this market and its potential evolution in this report. CCs' extremely rapid growth, and then fall, both in terms of number of CCs and prices and their challenge to the current financial infrastructure, are forcing all market participants to closely monitor and understand this new market.
- Cryptocurrencies are virtual currencies that are created, stored and governed electronically by an open, decentralized, cryptography system. CCs can be used to exchange money, to buy certain goods/services or as an investment. There are over 1,500 cryptocurrencies with a market cap of some $400bn as of February 8, 2018, with Bitcoin being the largest representing a third of the market according to CoinMarketCap.
- Launched in early 2009, Bitcoin (BTC) is the dominant cryptocurrency with a market cap of $140 billion (representing one-third of the CC market) and nearly 17 million BTC units in circulation (capped at 21 million). Bitcoin was the first major cryptocurrency and has spawned many competing CCs and technologies, many of which still fall back to Bitcoin as a support currency. Bitcoin itself has split into two cryptocurrencies, Bitcoin and Bitcoin Cash, to improve liquidity.

Technology

- Cryptocurrencies are the face of the innovative maelstrom around the Blockchain technology that is bringing both massive price volatility and a constant trial-and-error of new product try-outs and failures.
- CCs are unlikely to disappear completely and could easily survive in varying forms and shapes among players who desire greater decentralization, peer-to-peer networks and anonymity, even as the latter is under threat.
- The underlying technology for CCs could have the greatest application in areas where current payments systems are slow, such as across borders, as payment, reward tokens or funding systems for other Blockchain innovations and the Internet of Things, as well as parts of the underground economy.

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Applications

- There are over 1,500 CCs with a market cap of $400bn. Transactions in the three largest CCs average $550bn per month and come mostly from individuals. Ownership is highly concentrated. The opportunity set around direct CC trading appears relatively limited for banks, while the two Bitcoin futures recently launched are seeing only $140mn in daily trading.
- Blockchain saw its first expression through Bitcoin – the first CC – but is more likely to ultimately see its greatest application outside of CCs across other financial and non-financial transactions, even as Blockchain itself looks set to evolve fast as the market learns about what works best.
- There is the potential for increased usage of Blockchain in cross-border payments, settlement/clearing/collateral management as well as the broader world of TMT, Transportation and Healthcare but only where any cost efficiencies offset regulatory, technical and security hurdles.
- Hedge funds have been moving into this market making up most of the 175 CC funds but AUM remains only a few billion dollars. Asset managers are experiencing limited success in bringing products to market and have not been able to launch CC funds or ETFs without support from the SEC or major distributors.
- While about half of the early CC transactions happened in the underground economy, the share of this is declining, with investing and speculation now taking a much larger share.

Challenges

- It will be extremely hard for CCs to displace and compete with government-issued currencies, as dollars to euros and yuan are virtual natural monopolies in their regions and will not easily give up their seigniorage profits.
- CCs are experiencing heightened volatility and will face challenges from both technology (such as rising mining costs and hacking) and regulators who are concerned about anti-money laundering and investor protection, as CC payments are irreversible and there is no recourse.
- Security concerns have mounted in Bitcoin exchanges as hackers have infiltrated a number of CC exchanges generating large losses, while regulators are challenging anonymity.

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What is Blockchain?

Blockchain ≠ Bitcoin

In its simplistic form, Blockchain can be considered as a superior database where;

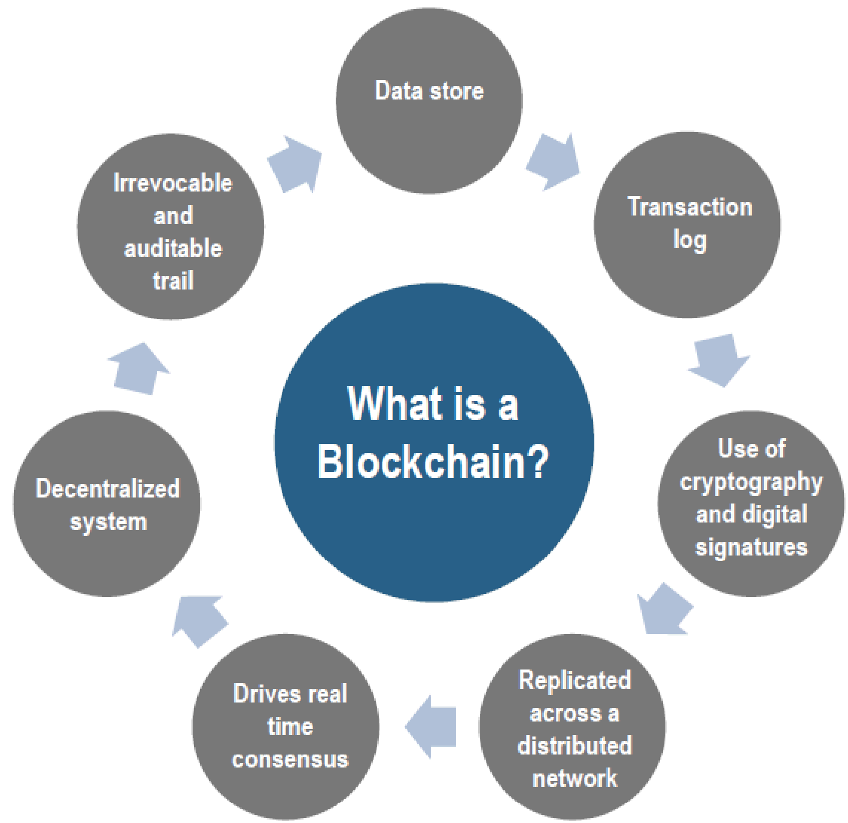
- i Data that is stored is encrypted
- ii Access to the data is encrypted
- iii The distributed nature of the Blockchain means that it has a built in redundancy and can survive the loss of one node because the master record is shared
- iv Transactions are immutable, in that it is impossible to alter historical records, thus creating a credible audit trail

Wikipedia definition of Blockchain

"*A block chain, or blockchain, is a distributed database that maintains a continuously-growing list of data records hardened against tampering and revision. It consists of data structure blocks—which hold exclusively data in initial blockchain implementations, and both data and programs in some (for example, Ethereum) of the more recent implementations—with each block holding batches of individual transactions and the results of any blockchain executables. Each block contains a timestamp and information linking it to a previous block.*"

Source: Wikipedia

The key components of Blockchain



Source: J.P. Morgan

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Benefits and obstacles of Blockchain adoption

Benefits of Blockchain adoption

Costs reduced

- Infrastructure costs reduced in data management, reconciliations, settlement, administration etc.

Efficiency improved

- Speeding up processes by permitting transactions without the need of a trusted third party.

Liquidity increased

- Scope to reduce settlement periods could promote lower capital requirements.

Security enhanced

- Cryptography ensures ledger is immutable and permissioned platform provides added security.

Regulation friendly

- Provides greater transparency with an auditable transaction log and mitigates counterparty risk.

Obstacles to Blockchain adoption

Cost: benefit analysis

- Managing a trade-off between short-term investment vs. long-term potential gains.

Free rider issue given collaboration necessary

- Sharing investment burden within and across industries may prove challenging.

Legal & Regulation

- Legal issues with use of smart contracts and need for regulatory approval for full adoption.

Technical hurdles

- Challenges relating to scalability, data privacy, technology standardization etc.

Security breaches

- Cyber threat could be disruptive and corrupt the blockchain network.

Source: J.P. Morgan

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Cryptocurrency 101

- **What is Cryptocurrency?**
  - Cryptocurrency is a virtual currency that is created, stored and governed electronically by an open, decentralized, cryptography system. There are over 1,500 cryptocurrencies with a market cap of ~$400 billion (as of February 8, 2018). Transactions are recorded on an open ledger called a Blockchain.
- **What are the major Cryptocurrencies?**
  - Bitcoin (BTC) is the dominant cryptocurrency with a market cap of ~$140 billion (representing over one-third of cryptocurrency market) and nearly 17 million BTC units in circulation (capped at 21 million).
- **Who are the key players in the Cryptocurrency ecosystem?**
  - In order for a cryptocurrency ecosystem to thrive, CCs must be created, stored, exchanged and processed. We divide these tasks into four sub-sectors.
    1. Miners that create CCs.
    2. Wallets that store CCs.
    3. Exchanges that serve to trade CCs for other CCs or national currencies.
    4. Processors that enable merchants to accept CCs as a payment tender.

Top 10 Cryptocurrencies By Market Capitalization

Rank	CC Name	Market Cap ($B)	% of Total Market Cap
1	Bitcoin	142.010	36%
2	Ethereum	80.511	20%
3	Ripple	30.224	8%
4	Bitcoin Cash	20.811	5%
5	Cardano	9.175	2%
6	NEO	8.109	2%
7	Stellar	7.309	2%
8	Litecoin	6.695	2%
9	EOS	5.477	1%
10	NEM	5.084	1%
	Total Market Cap	**396.980**	**100%**

Source: CoinMarketCap *Note: As of mid-day 2/8/2018

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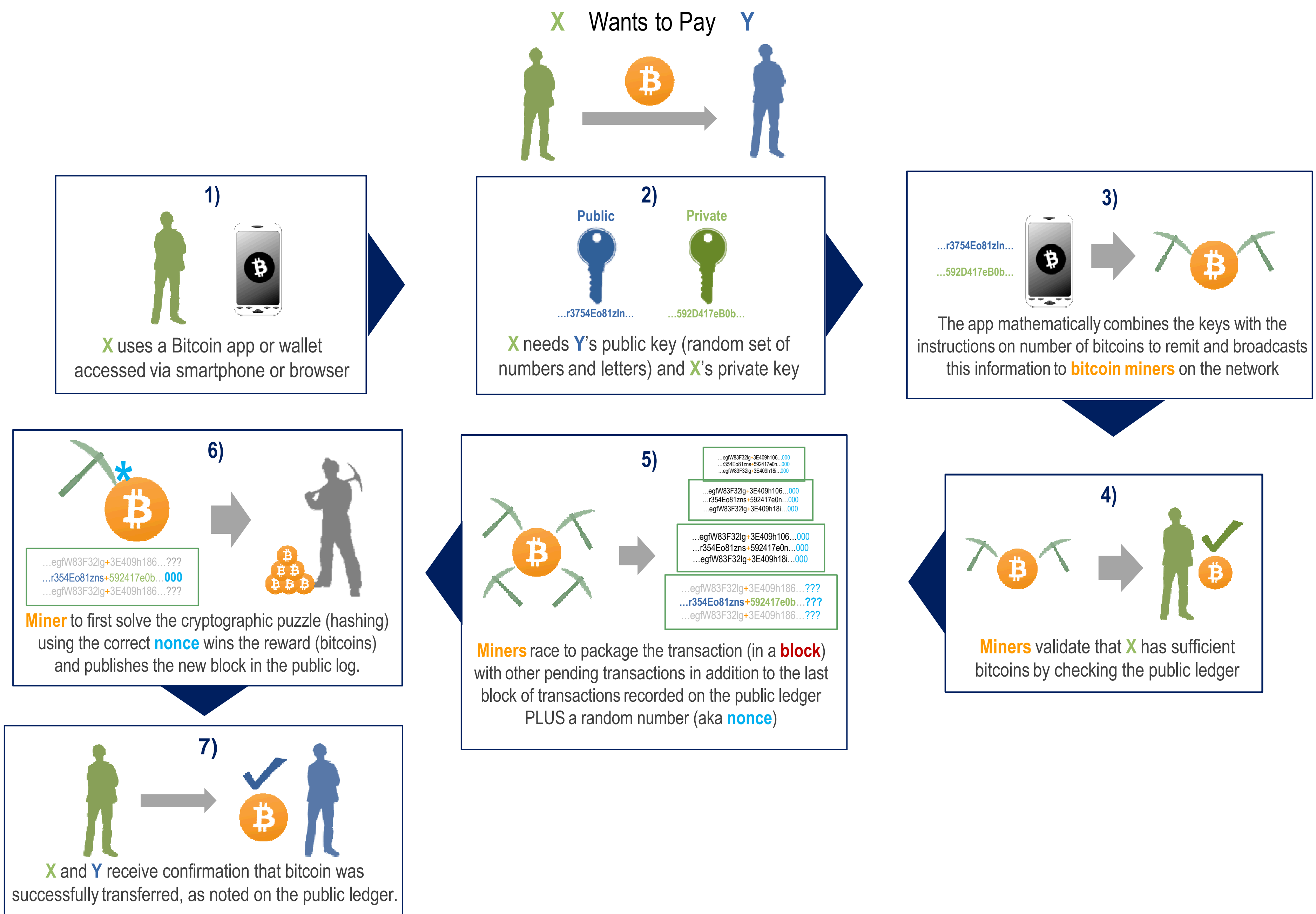
Cryptocurrency 101: Example Bitcoin transaction



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Cryptocurrencies as a currency

The accepted functional definition of money:

- Unit of account
- Medium of exchange
- Stable store of value

By these criteria, no existing cryptocurrency meets the definition of money.

- For the largest cryptocurrencies, the relatively stable supply of the cryptocurrency leads to massive price volatility (whether with respect to either traditional currencies or to a basket of goods and services). This price volatility defeats the usability of cryptocurrencies for monetary functions.
- Some cryptocurrencies promise to offer stable value (Tether, MakerDAO, Basecoin, etc.). It remains to be seen whether these will be successful.
- If a cryptocurrency can maintain a stable value, then it could more readily function as money. If this is achieved, then one can consider whether it could compete with traditional currencies.
- We don’t believe so—at least not in developed markets with functioning, stable currencies. It has long been observed that currencies are natural monopolies; once one is established it is very hard for a challenger to be needed or accepted.

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Cryptocurrencies and central banks

From competing to co-opting

Will we see central bank-issued cryptocurrency?

- Several central banks, including in Canada and Sweden, have explored the idea of issuing their own cryptocurrency
- The hope would be to marry the digital convenience of cryptocurrency with the stable value of traditional currency
- There are important and controversial design issues
  - First, if central bank cryptocurrency retained the anonymity of conventional cryptocurrency it could be at odds with many central banks' anti-money laundering goals
  - Second, central bank cryptocurrency could provide an outside option to commercial banks that could exaggerate banking panics or risk disintermediating the financial system
- On net, we do not expect to see major developed market central banks issue their own cryptocurrency anytime in the next few years
- On the other hand, many central banks have indicated an interest in employing distributed ledger technologies in their payment processing responsibilities

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Most of EM is troubled by the anonymity of cryptocurrencies; only a few facing cross-border sanctions are attracted by it

- EM authorities have generally welcomed digital currencies for use in settlement and payments system given large potential efficiency gains
- But CCs have already and will continue to run into regulatory headwind (China and India)
  - Much of this has to do with the inherent anonymity of CCs that makes tracking of transactions for security and taxation purposes difficult
- Ironically, some countries are hoping to exploit this anonymity to bypass cross-border sanctions (Venezuela)
- The success of such efforts is likely to be limited
  - Unlikely to expand beyond other sanctioned economies
  - With no discretionary adjustment to supply (unlike fiat money), price of CCs will be volatile
  - CCs do not provide any more policy credibility than other monetary arrangements with fiat money (e.g., pegged FX regimes, currency boards, dollarization)
  - Unlike fiat money, CC cannot provide emergency liquidity support during shortages as there is no space for a lender of last resort

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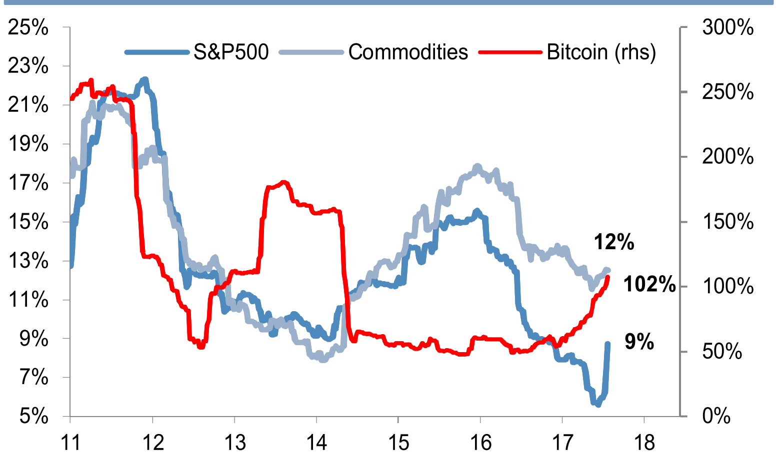
Cryptocurrencies can be 10 times more volatile than core markets, but for hedging purposes, what matters also are cryptocurrencies' correlations with other assets

Correlation of weekly returns over the past five years and past year

Past five years	S&P 500	USTs	US HG Credit	EM Local	TIPS	Commodities	Gold	Yen cash	Bitcoin
S&P 500	1	-0.28	-0.08	0.36	-0.05	0.32	-0.14	-0.34	0.04
USTs		1	0.91	0.29	0.84	-0.19	0.44	0.54	0.06
US HG Credit			1	0.43	0.87	-0.05	0.37	0.44	0.07
EM Local				1	0.46	0.36	0.32	0.19	-0.07
TIPS					1	0.04	0.38	0.40	0.07
Commodities						1	0.22	-0.01	-0.06
Gold							1	0.54	-0.03
Yen cash								1	-0.06
Bitcoin									1

Past year	S&P 500	USTs	US HG Credit	EM Local	TIPS	Commodities	Gold	Yen cash	Bitcoin
S&P 500	1	-0.10	0.04	0.22	-0.03	0.08	-0.01	-0.09	0.29
USTs		1	0.94	0.36	0.88	0.08	0.62	0.62	0.21
US HG Credit			1	0.36	0.83	0.15	0.54	0.54	0.23
EM Local				1	0.36	0.15	0.52	0.53	-0.10
TIPS					1	0.27	0.69	0.54	0.17
Commodities						1	0.46	0.19	-0.07
Gold							1	0.73	0.01
Yen cash								1	-0.04
Bitcoin									1

1Y realized volatility



Source for both chart and table: J.P. Morgan

Cryptocurrencies as portfolio diversification

Cryptocurrency detractors often cite these instruments' extreme volatility as a reason to avoid the most-watched market since dot-com stocks of the 1990s. But for those focused on diversification or portfolio insurance, what matters more is how these instruments' volatility plus their correlation with core markets impacts a portfolio's risk-return characteristics over the long term or during periods of extreme cyclical or political stress. Such extremes could include recessions, inflation surges, currency crises or collapse of the payments system.

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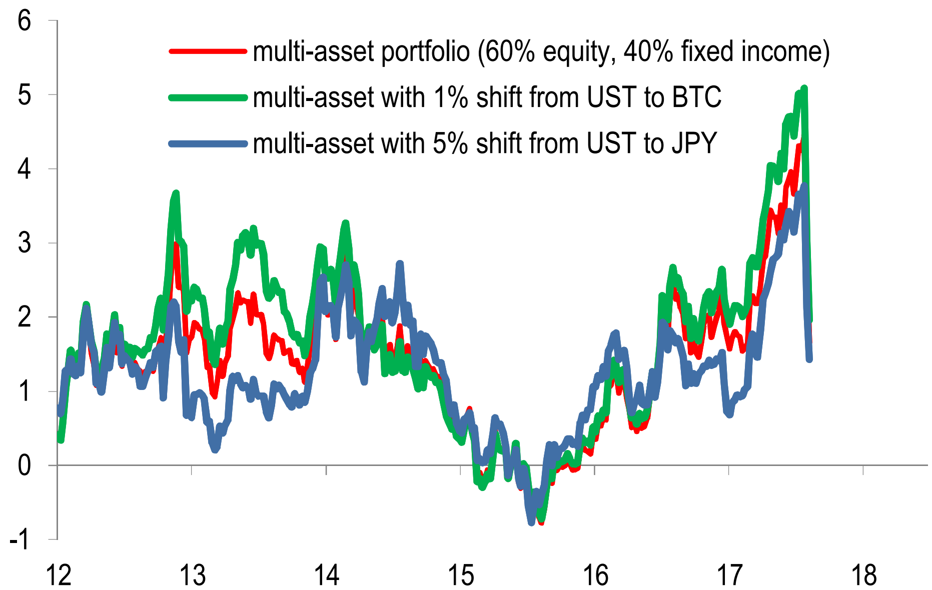
Caveats: Liquidity and stability of BTC risk/return characteristics

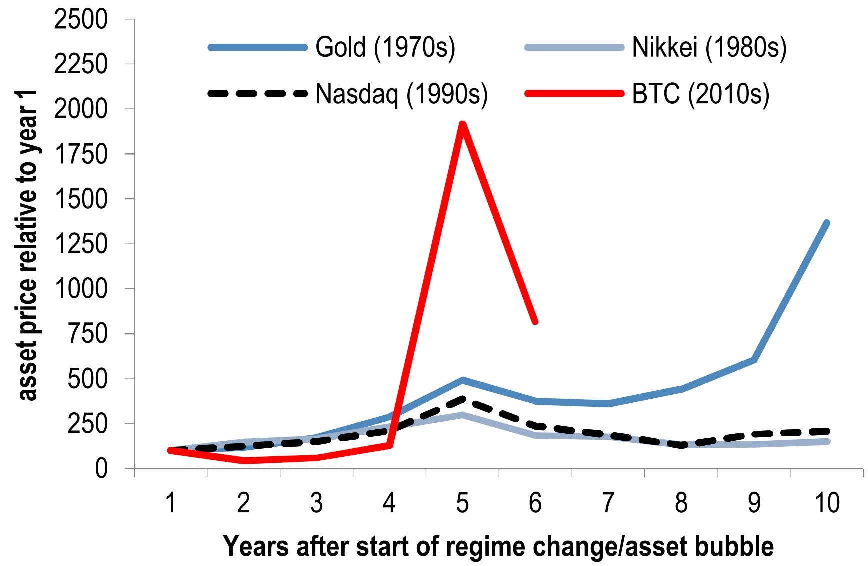
1% switch Treasuries to BTC improves portfolio efficiency more than other hedges, but didn't prevent drawdown in 2015

Rolling return-to-risk on portfolio of 60% US stocks, 20% USTs, 15% US HG credit & 5% EM local markets, vs portfolio that replaces 1% of USTs with BTC & 5% of USTs with yen



Bubble or the future of finance?

Asset values indexed to 100 in year one of regime change, subjectively chosen as 1971 for gold, 1986 for Nikkei, 1995 for Nasdaq and 2013 for Bitcoin.



Source for both charts: J.P. Morgan

Diversification value

Cryptocurrencies haven't existed for long enough to examine their contribution to portfolio efficiency over several business cycles, but their performance over the past few years suggests the following: some improvement in risk-adjusted returns over the medium term, but no ability to mitigate portfolio drawdown during periods of acute market stress like equity flash crashes of August 2015 and February 2018. Hedgers should hold two other reservations. One is cryptocurrencies' limited liquidity relative to traditional hedges like commodities, inflation-linked bonds or the yen, a feature endemic to any currency that is not legal tender. Another is unstable risk-return characteristics typical in the early phases of market development (similar to gold's behavior after the collapse of the Bretton Woods system), which cautions against extrapolation for risk-management purposes.

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CCs remain largely unregulated in the US; a number of agencies have taken action to protect investors. Other jurisdictions have gone as far as banning the trading of CCs

Summary of various regulatory actions and statements regarding cryptocurrencies

Agency	Date	Action
CFTC	9/17/15	CFTC issues settlement order against trading platforms listing Bitcoin options, clarifying the CEA's definition of "commodity"
SEC	7/25/17	SEC releases investigative report declaring that the tokens issued by the DAO are securities under the Securities Exchange Act
	9/11/17	SEC states that issuers of an ICO must demonstrate that the product is not a security or comply with applicable securities laws
FINRA	12/21/17	FINRA warns investors to be aware of stock scams when considering the purchase of shares of companies that tout high returns associated with cryptocurrencies
Federal Reserve	11/30/17	Quarles speaks on innovation in the payment system and acknowledges challenges around the treatment and definition of cryptocurrencies as well as the benefits from innovation for the future of the payment system
FinCEN	3/18/13	FinCEN issues guidance considering the use of virtual currencies from the perspective of categories within the definition of money service businesses, MSBs
NY State DFS	6/24/15	NY DFS issues final rules which require a license from the superintendent in order to engage in any virtual currency business activity
EP/ European Council	12/20/17	EP/EC release compromise text amending 4th AMLD to incorporate virtual currency exchanges and custodian wallet providers
ESMA	11/13/17	ESMA alerts investors of the risks of ICOs and alerts firms involved in ICOs to the need to meet regulatory requirements
BaFin	4/28/16	BaFin states virtual currencies qualify as financial instruments and thus, a commercial handling may trigger authorization requirements
	11/15/17	BaFin warns consumers of risks around ICOs and states that it decides on a case-by-case basis whether the offeror is required to obtain authorization under KWG
Swiss FINMA	9/29/17	FINMA issues Guidance 04/2017 that states, depending on how an ICO is structured, some parts may be covered by existing regulations; States it will investigate a number of ICO cases to determine whether provisions were breached
French AMF	11/19/17	AMF launches public consultation on ICOs; regulations expected following analysis of information gathered from consultation
UK FCA	4/1/17	The FCA issues a consultation on distributed ledger technology
	12/1/17	The FCA issues consumer warning about the risks of investing in cryptocurrencies
Canadian CSA	8/24/17	CSA issues statement that businesses should consider if prospectus, registration and/or marketplace requirements apply to their cryptocurrency offerings
Japan	8/25/16	Payment Services Act recognizes CC as a means of payment that is not a legal currency. Banking Act prohibits banks and securities companies from dealing in CC.
China PBOC	12/5/13	Private party transactions permitted, but financial institutions are prohibited from transacting
Taiwan	11/13/15	Financial Supervisory Commission indicates its stance on Bitcoin remains neutral
South Korea	9/29/17	Financial Services Commission bans ICOs
	1/23/18	The FSC says existing anonymous virtual accounts will be banned; cryptocurrency exchanges must provide customers' information
Singapore	10/2/17	MAS states that virtual currencies are not legal tender; MAS is working on a new payment services regulatory framework that will address money-laundering risks; states that ICOs must comply with existing securities laws
Indonesia	1/13/18	Bank Indonesia states cryptocurrencies are not a legitimate instrument of payment and prohibits payment system operators from making CC transactions

Source: CFTC, SEC, FINRA, Federal Reserve, FinCEN, NY State DFS, European Council, ESMA, BaFIN, FINMA, AMF, FCA, CSA, MAS, BI, Coindesk

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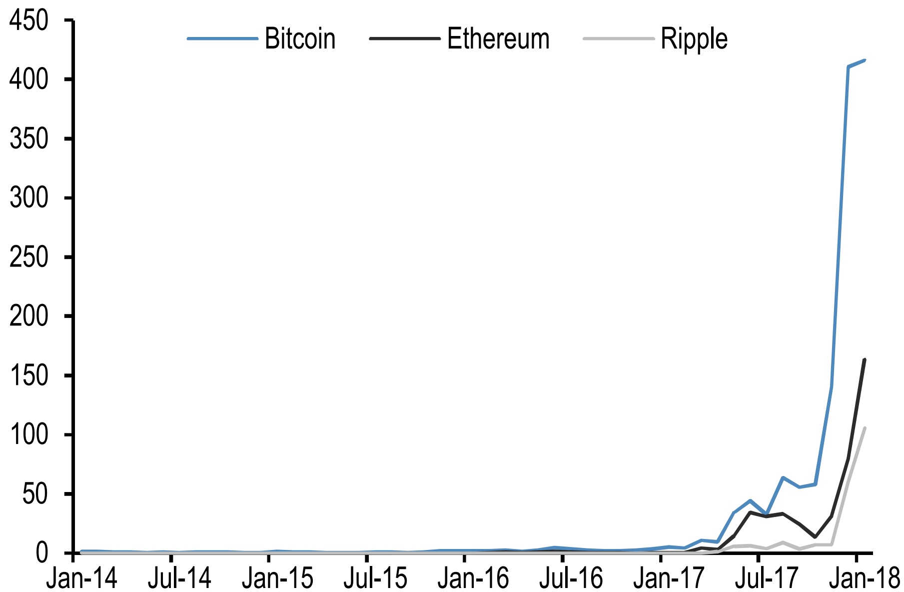
Participation in Cryptocurrency trading by financial institutions is low

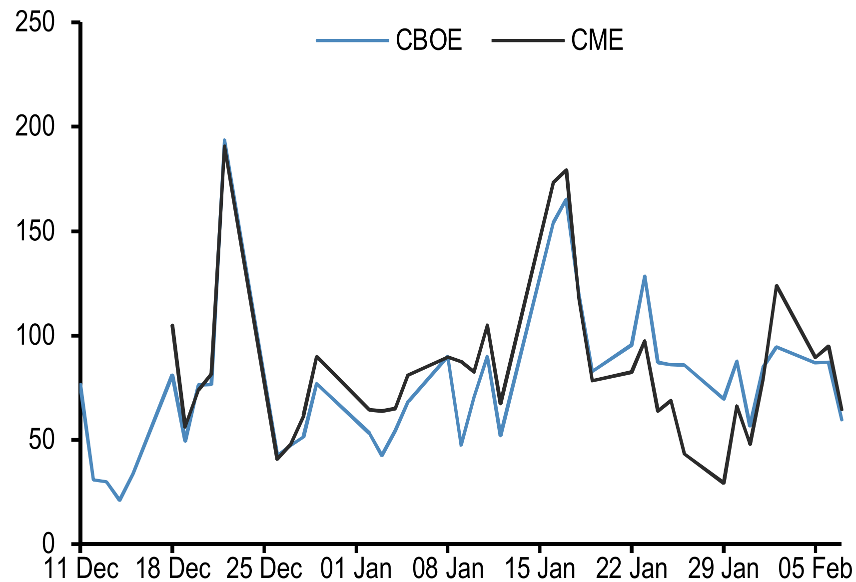
Monthly trading volumes; $bn



Source: Coinmarketcap

Monthly trading volumes in the three largest cryptocurrencies by market capitalization increased to $550bn in Dec17, around half of monthly trading volumes of gold futures, and around $680bn in Jan18

Daily aggregate trading volumes of bitcoin futures; $mn



Source: Bloomberg, J.P. Morgan

Volumes in the recently launched bitcoin futures, by contrast, have been slow to rise and remain a fraction of the average daily volumes of bitcoin of around $14bn since the contracts where launched

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Banking industry involvement in Cryptocurrencies and Blockchain technologies

Banking on the Blockchain

Banks have been active in pursuing initiatives around Blockchain but have limited direct involvement in Bitcoin or other Cryptocurrencies trading or settlement.

- We view the opportunity for Banks' involvement in cryptocurrency trading as relatively limited, not least due to regulatory concerns around AML and KYC regulation.
- However, we see Blockchain as an innovative technology that could bring transformational change to parts of the banking industry.
- Through Blockchain technologies, we see the potential for large cost efficiency gains for early-adopters in back and middle office functions. This could reflect in competitive asset pricing and eventually result in disruption or market share gains.

There is regulatory support for Blockchain in contrast to rising global pushback against cryptocurrencies like Bitcoin.
Mark Carney's (Chair of the Financial Stability Board and Governor of the Bank of England) comments around Blockchain:
"*New technologies could transform wholesale payments, clearing and settlement. In particular, distributed ledger technology could yield significant gains in the accuracy, efficiency and security of such processes, saving tens of billions of pounds of bank capital and significantly improving the resilience of the system."*

Ripple is an example of rising disruption from distributed ledger technology in the cross border payments space.
As a competitor to SWIFT, Ripple offers a cross-border payments platform using Blockchain technology that does not require the use of Ripple's cryptocurrency, XRP.

- **Benefits:** Relatively faster and cheaper form of making payments without the use of an intermediary. Payments can clear in seconds as opposed to 3-5 days within traditional systems that are being forced to respond.
- **Obstacles:** Despite a client base of 100+ financial institutions, the technology needs to gain traction before it can be widely accepted.

Ripple is already bringing change in the industry: SWIFT has responded with the creation of the Global Payments Innovation, a platform that allows for faster payments and tracking capabilities, partly a result of the disruptive force that new pioneers like Ripple have created in the industry.

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Banking on the Blockchain

Potential uses of Blockchain in the Banking Industry

Cross Border Payments

- Near real-time transfer of funds directly to parties involved
- Low cost fund transfers without intermediary fees and FX uncertainty
- Tamper-free Blockchain technologies allow for absolute transparency on time-frames and costs

Capital Markets

- Reduced trade life-cycles through near real-time trade settlement (T+0 potentially); reducing back office costs and allowing for less regulatory capital to be held for unsettled trades
- Potential for a centralized KYC/AML process and database across the industry; removing duplicative efforts from banks

Trade finance

- Transparency between multiple parties involved in the delivery process over specific details in the contract, costs and progress
- Smart contracts can allow for automated payments at specific checkpoints in the delivery route

Syndicated Lending

- Real-time distributed ledger updates allowing for transparency and reduced completion times; removing the need for paper communication, manual reconciliations and multiple contract reviews
- Smart contracts can allow for automated interest payments and reconciliations between trades and credit agreements

Data Monitoring and Reporting

- Uniform, consistent, golden source data available to multiple parties with a complete audit history

Examples of working platforms/PoCs

Business Area	Blockchain Platforms	Participating Banks' Initiatives
KYC	IBM and Hyperledger Fabric; Primechain Technologies patent pending technology	Credit Mutuel Arkea, IBM; MUFG, OCBC Bank, HSBC Singapore, Deutsche Bank, HSBC, MUFG, IBM;
DCM	Ethereum	Commonwealth Bank of Australia
Derivatives	Corda	Barclays
Fixed Income Trading	Chain, Eris Industries, Ethereum, IBM and Intel	R3
Payments	Ripple; IBM and Hyperledger Fabric; Utility Settlement Coin, Ethereum, Deloitte Technology,	Axis Bank, Rak Bank, Standard Chartered; MUFG; UBS, IBM, UBS, Clearmatics, Bank of New York Mellon, Deutsche Bank,
Oil Settlement	IBM and Hyperledger Fabric	Natixis, Trafigura, IBM
Securities	FundDLT	BNP Paribas, SmartAngels; Natixis
Syndicated Loans	Fusion LenderComm	R3, Finastra; R3, Synaps Loans,
Trade Finance	Skuchain Brackets platform; blockchain; IBM and Hyperledger Fabric; Infosys blockchain	Wells Fargo, Commonwealth Bank of Australia; Barclays, Wave; BBVA, Wave; UBS

Source: Company websites

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State of the asset management industry for Cryptocurrencies still nascent

1 **Existing AM Products:** Existing CC AM products lack the size and scale to constitute a major new asset class

Fund	Limitation
Grayscale's Bitcoin Investment Trust	Trades at >50% premium against the underlying spot market, setting possible sell-offs if premiums collapse.
Bitcoin Tracker One & Bitcoin Tracker	ETN products. Bitcoin Tracker One has ~$190mn of AUM, lacking in size
Tobam's Alternative Investment Fund	Not traded on an exchange and does not fall under the European mutual fund structure known as Ucits

2 **Bitcoin ETFs:** A number of asset managers have sought to launch Bitcoin ETFs, but have no success with SEC thus far

Fund	Status
Winklevoss Bitcoin Trust ETF	Denied, but Appealing
Bitcoin Investment Trust ETF	Withdrawn
Ether ETF	Awaiting Approval
VanEck Vectors Bitcoin Strategy ETF	Withdrawn
Rex Bitcoin Strategy ETF	Withdrawn
Rex Short Bitcoin Strategy ETF	Withdrawn
ProShares Bitcoin ETF	Withdrawn
ProShares Short Bitcoin ETF	Withdrawn
Evolve Bitcoin ETF (Canada)	Awaiting Approval
First Trust Bitcoin ETF	Withdrawn
Direxion Bitcoin ETF	Withdrawn
GraniteShares Bitcoin ETF	Awaiting Approval
GraniteShares Short Bitcoin ETF	Awaiting Approval
Direxion Daily Bitcoin 1.25x Bull ETF	Awaiting Approval
Direxion Daily Bitcoin 1.5x Bull ETF	Awaiting Approval
Direxion Daily Bitcoin 2x Bull ETF	Awaiting Approval
Direxion Daily Bitcoin 1x Bear ETF	Awaiting Approval
Direxion Daily Bitcoin 2x Bear ETF	Awaiting Approval

3 **Blockchain ETFs:** Blockchain ETFs are getting faster approval, but would not have the purity of exposure and returns as Bitcoin ETFs do

Fund	Underlying	Status
Amplify Transformational Data Sharing ETF	Equity Basket	Renamed from Amplify Blockchain Leaders ETF Launched on Jan 17th
Reality Shares Nasdaq NextGen Economy ETF	Equity Basket	Renamed from Reality Shares Nasdaq Blockchain ETF Launched on Jan 17th
Innovation Shares Blockchain Innovators ETF	Equity Basket	Awaiting Approval
First Trust index Blockchain ETF	Equity Basket	Awaiting Approval
Horizons Blockchain ETF	Equity Basket	Awaiting Approval

Source : Bloomberg and Company Filings; Data as of Jan 19th

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Migration to Bitcoin futures exchange trading still in early days

Migration to Futures Exchange Trading Could Help Drive Fund Approvals; But Development Still Early Days

1 Success in Gold ETF is Evidenced; Gold ETF Helped Gradually Transformed the Gold Market

- SPDR Gold Shares ETF provided investors with easy access to spot gold in equity form at low transaction costs
- Enhanced access to the physical market coincided with a meaningful increase in the price of Gold
- Is now one of the biggest funds in the market with >$35bn under management

2 Futures Exchanges Launch Bitcoin Futures Trading – Adding Security and Legitimacy

- CBOE and CME received CFTC approval and began listing and trading Bitcoin Futures on Dec. 10th and 18th
- Contracts are cleared through commission-regulated clearing houses and trading activities are closely monitored by CFTC

3 Bitcoin Futures Beginning to Get Traction, Though Activity Levels Early Days and Still Developing

- Bitcoin Futures volumes have been rather muted with an average of 6k contracts traded by CBOE per day and an average of 1k contracts by CME per day
- Pretty high volume for new contracts that started trading in December, but does not compare with activity on more established venues

4 Bitcoin Futures Add More Credibility and Legitimacy for Funds to Build Products

- Many funds have based investments off of futures for decades, as derivatives readily track underlying assets pretty well
- Futures exchanges are highly regulated, highly transparent, and are another source of liquidity and access for mutual funds and ETFs.

5 Shifting to Futures-Based Trading Is Not Readily Enough

- SEC still sees questions in: **1)** the legal questions raised by untested products traded on largely unregulated markets **2)** the security and surveillance of the spot market **3)** whether frequently traded ETFs can be accurately valued when cryptocurrencies are highly illiquid.

Source : J.P. Morgan, Bloomberg, SEC Filings and Company reports

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Cryptocurrency in retail payments

Although cryptocurrencies have certain advantages over incumbent payment forms (such as faster settlement times and lower fees), wide scale adoption seems unlikely in the medium-term given (1) a lack of trust in the currency by many merchants and consumers, and (2) a limited progression to-date in its demand-and-acceptance cycle.

- **Merchant Acceptance Considerations**
  - **Limited and niche consumer demand:** Given cryptocurrency's arguably niche consumer adoption, most merchants do not prioritize accepting it, which could limit widespread consumer adoption.
  - **Currency volatility risk:** Merchants who accept cryptocurrencies will likely intend to convert the funds into their domestic fiat and given the volatility in most cryptocurrencies this is likely a hurdle to acceptance.
  - **Complexity:** Integration and operational complexity may keep mainstream merchants on the sidelines as safe and interoperable platforms gain scale.
  - **Regulatory uncertainty**
  - **Lower cost of acceptance:** A key advantage to cryptocurrency usage is lower transaction costs for merchants. Cryptocurrency payment providers like Coinbase and Bitpay typically charge a lower cost than traditional ecommerce payment providers today.
  - **Faster settlement:** For many merchants today, transaction funds are settled over a period of days (typically two business days) and are processed in batches to reduce costs. Cryptocurrencies have the structural advantage of immediate settlement times once completed.

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Cryptocurrency in retail payments

- **Consumer Adoption Considerations**
  - **Limited merchant acceptance:** Until merchants begin committing to accepting cryptocurrencies as a payment type, widespread consumer adoption of currencies seem unlikely to us. That said, there are a handful of merchants testing the adoption of cryptocurrencies today:
    - **Tech merchants:** ***Microsoft*** *(digital purchases),* ***Tesla, Virgin Galactic*** *(orbital flights),* ***Newegg*** *(online electronics retailer),* ***Zynga*** *(mobile gaming),* ***Namecheap*** *(domain registrar), and formerly* ***Steam*** *(no longer accepts bitcoin; online videogame retailer).*
    - **Traditional merchants:** ***Overstock.com*** *(online retailer),* ***Expedia,*** *some* ***Subway*** *locations,* ***KYC Canada*** *and* ***Dish****.*
    - **SMB/Marketplaces:** ***WordPress*** *(blog builder),* ***Etsy****,* ***Intuit*** *(QuickBooks, Mint, etc.), and* ***Shopify*** *(eCommerce software).*
  - **Irregular sources of funds:** The vast majority of cryptocurrency funds are sourced by converting from a local fiat. This additional friction point in the consumer process will likely limit mass adoption, in our view, and may keep the currency as an ancillary payment option at most.
  - **Complexity:** When paying with cryptocurrencies, consumers are often required to complete an online order, and then typically have a short period of time (Newegg requires fifteen minutes) to transfer the funds through a separate platform.

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Cryptos in China: regulatory landscape, market overview and potential impact on online payment

Regulatory landscape

- **China has a clear stance on Cryptocurrency (CC):** In its announcement back in Dec 13, the PBOC makes two points clear in regards to its stance on CC (Bitcoin in particular, in our view):
  1) **Bitcoin is not a currency, and thus not a legal tender.** Instead, it is a form of virtual commodity transacted on internet platform.
  2) **Financial services related to CC are banned**: all financial institutions (FI) and payment providers are forbidden to provide services for or products denominated in Bitcoin, nor accepting Bitcoin as a means of payment & settlement. Any issuance of financial products with Bitcoin as underlying investments is strictly prohibited.
- **Limited involvement in CC from FI on the back of such a clear regulatory stance, in our view**
- **Intensifying regulatory tightening on CC since 2017**
- **PBOC is studying issuance of virtual currency**

Market Overview and potential impact on online payment

- **Bitcoin in China: leading in mining capability and forming a complete value chain**
- **Flaws in Bitcoin as a currency**
  1) from a regulatory perspective;
  2) from a technical perspective, Bitcoin's core Blockchain technology is still at an early stage and can't handle large transaction volume;
  3) from a currency value perspective, there's no benchmark to determine the value of Bitcoin, and its daily price volatility is too high to be used in daily transactions, and;
  4) from liquidity perspective, the total supply of Bitcoin is set to be 21m. The limitation of supply may cause deflation effect on Bitcoin and severely hurts liquidity if it's used as currency
- **Applications of Blockchain technology by major China online payment players**
- **Potential impact of Blockchain technology on China online payment market**

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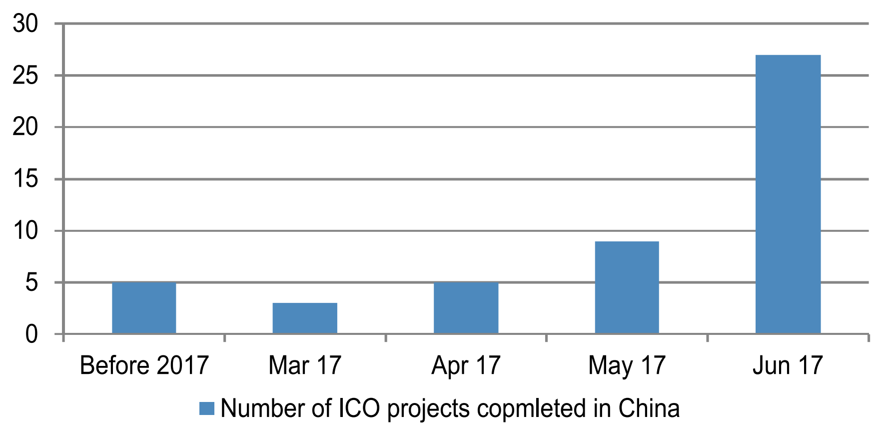
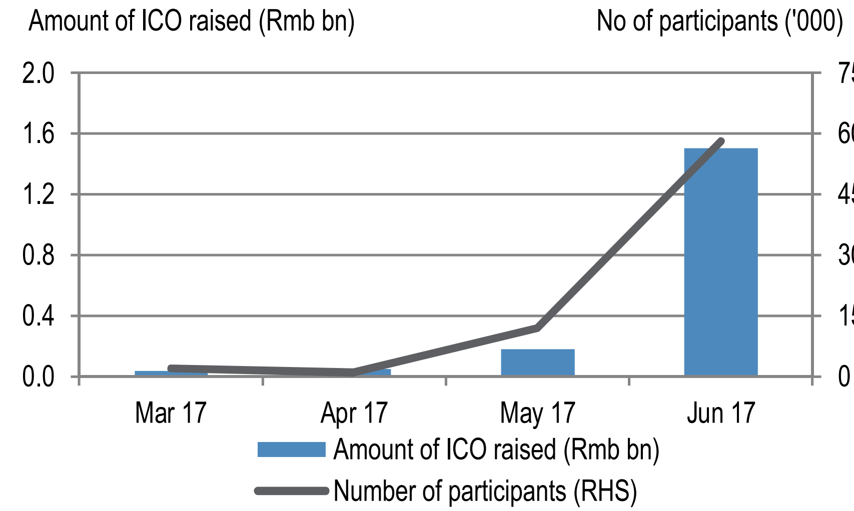
Cryptos in China: regulatory landscape, market overview and potential impact on online payment

Number of ICO projects completed in China



Source: Xinhua, J.P. Morgan estimates

Amount of ICO raised and number of participants (2017 Mar-Jun)



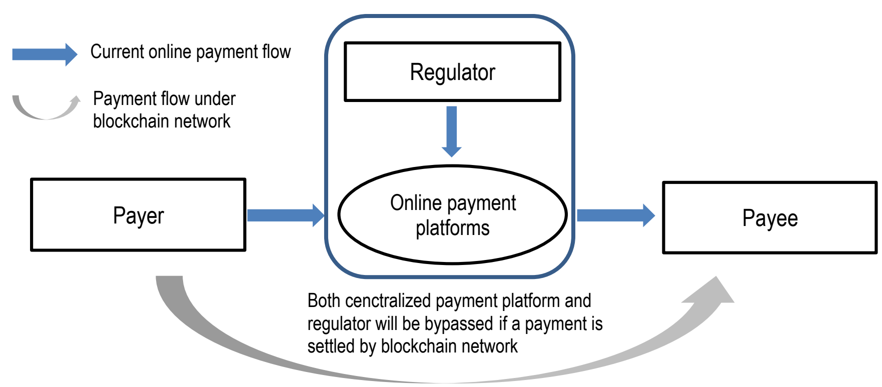
Source: Xinhua, J.P. Morgan estimates

Bitcoin value chain and representative companies in China

Mining	Trading	Storage	Media
• Bitmain • AntPool	• OKCoin • Huobi • BTCC	• Bither Wallet • Kuaiqianbao	• Cybtc.com • 8btc

Source: J.P. Morgan

A purely Blockchain-backed online payment system will bypass centralized clearance house and regulation body



Source: J.P. Morgan

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Examining Bitcoin's cost structure

- **Unlike Bitcoin's extrinsic value, which could be potentially linked to its usage and scarcity, Bitcoin's intrinsic value is tied to the cost to mine it.**
  - However, by design its supply is fixed and as such, the concept of marginal cost support does not apply. Rather the cost level of the lowest-cost producer will determine theoretical price support.
  - We believe the lowest cost producer currently is likely a Chinese miner with cheap access to power and overall mining costs around $3,200 per Bitcoin.
- **Chinese-owned companies have mined nearly 80%of the bitcoins in circulation globally.**
  - In a bear market, as competition for blocks overall decreases, the costs will also decline. In an extreme example, if China's low cost producers were to be the only group left mining, their costs will likely fall to below $1,750 per Bitcoin.
  - This mechanism of costs decreasing in $/BTC-rewarded terms as competition for blocks decreases, leaves us with little confidence in pegging a firm cost support floor over the long-term.

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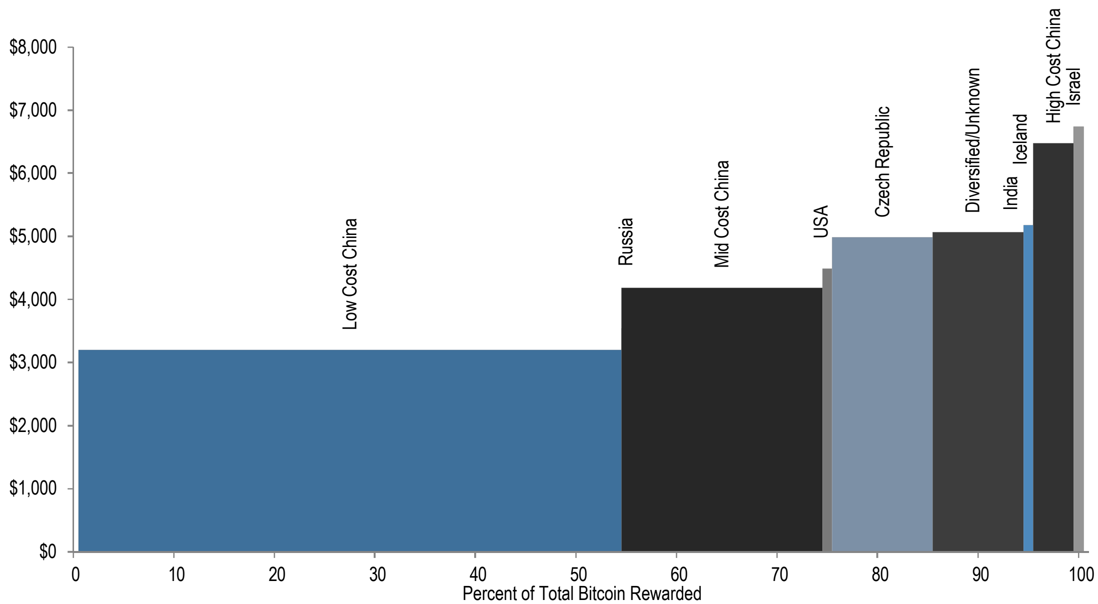
Examining Bitcoin's cost structure

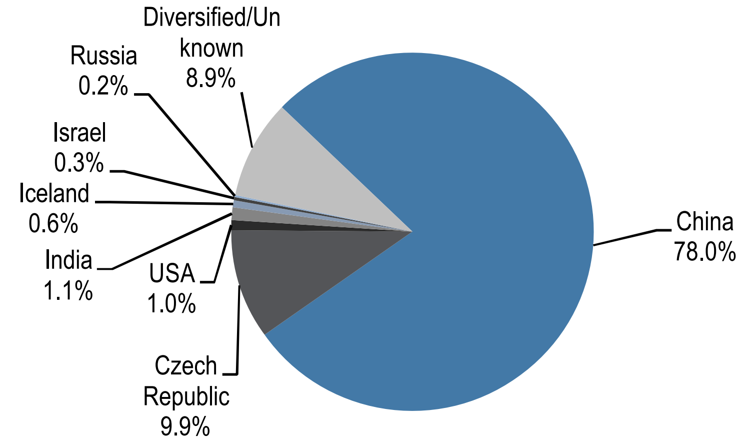
Regional Bitcoin mining cost curve, 2018 ytd

X-axis: Percent of total Bitcoin rewarded; Y-axis: cost in $/BTC



Source: Bloomberg New Energy Finance, Bitmain, Eurostat, EIA, Rosstat, News Reports, J.P. Morgan

Bitcoin hash rate distribution by country, Jan 13-16



Source: Bloomberg New Energy Finance. Country refers to country of ownership.

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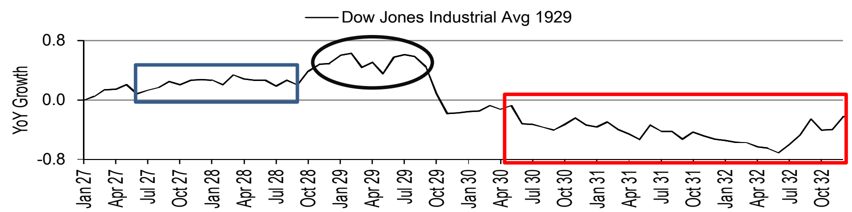
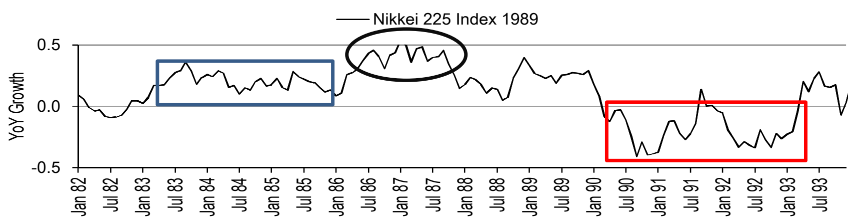
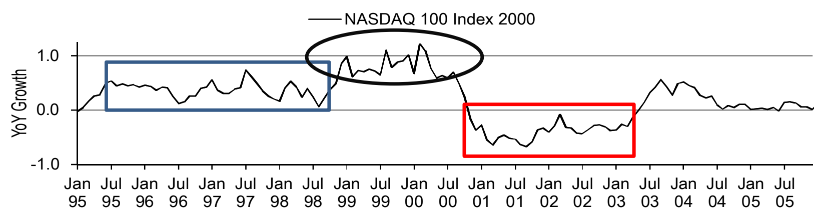
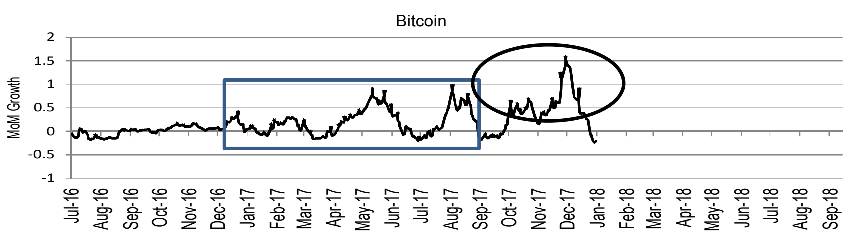
Utilizing a technical framework for Cryptocurrencies

Comparing boom-bust periods –The reversal in Bitcoin highlights the potential for a corrective phase; still, keep in mind it is a shorter timeframe and less mature asset class





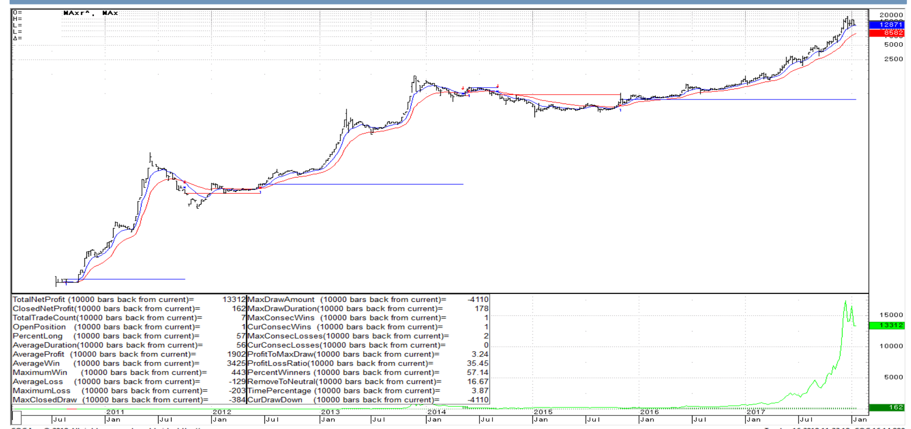




Source: J.P. Morgan, Bloomberg

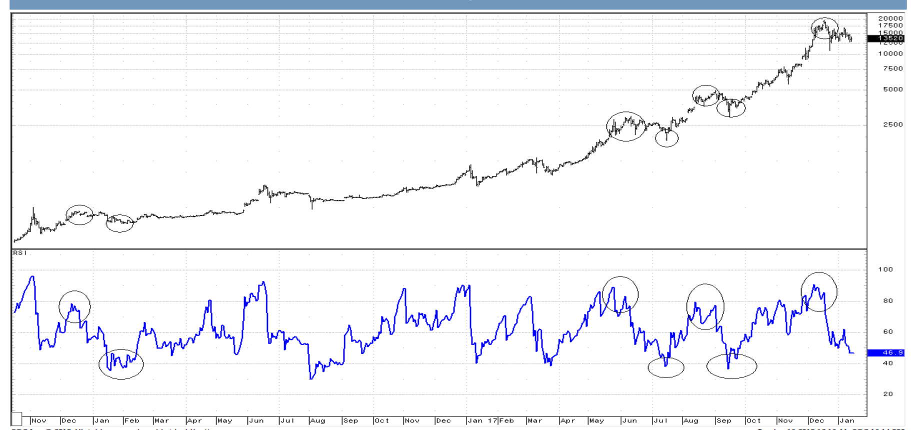
- A comparison of historical boom-bust periods in other markets provides a guideline to the risks in Bitcoin. However, it is important to note this market remains in a nascent stage.

Bitcoin – Using a moving average crossover system has been an effective strategy (10/30 exponential moving averages/log scale) with a 57% hit ratio since inception.



Source: CQG, Bloomberg

Bitcoin – Momentum divergences highlight specific timeframes when a bullish/bearish shift develops



Source: CQG, Bloomberg

- Technical factors such as simple moving average trading rules and bullish/bearish momentum divergences can provide a framework for potential buy and sell signals.

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Utilizing a technical framework for Cryptocurrencies

Bitcoin – Medium-term view: The decisive break below 9756 (50 %) suggests that we are dealing with a broader down-consolidation, which could retrace back to 4605 (76.4 %)

Bitcoin – Short-term view: The start window for a stronger countertrend rally appears to be open, but key-barriers would have to be cleared to support such a recovery

Source for both charts: Bloomberg

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Asset manager participation limited in cryptocurrency funds. Credibility an issue

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