Needham

March 29, 2016

Bitcoin Investment Trust (GBTC)

Byte-ing Down Barriers with Bitcoin - Initiate at Buy with $62 PT

INVESTMENT HIGHLIGHTS: We believe that the price of Bitcoin stands to benefit substantially from rising demand for its two main use cases as a "digital gold" and as an alternative payments channel. We believe that this rising demand is the result of the relative advantages of using Bitcoin and is being driven by market trends and secular changes such as globalization, continued growth in ecommerce and by the ubiquity of enabling technology such as mobile phones. As a direct result, Bitcoin is disrupting trillion-dollar markets in payments and value-exchange.

- Bitcoin is a decentralized, borderless, peer-to-peer, electronic cash system that is disintermediating and removing friction in the exchange of value by enabling fast, low-cost, global, peer-to-peer payments.
- Similar to how the internet created a global, open network for the exchange of information, so too is Bitcoin and its underlying "blockchain" technology enabling an open and global network for the exchange of value. For reasons addressed within this report, we see Bitcoin and its underlying technology as among the most significant innovations in payments and money in decades, if not centuries.
- Bitcoin has a four-sided network effect that includes developers, transaction processors ("miners" securing the network), merchants, and consumers. All four of these major stakeholder segments are showing impressive growth but, most importantly, the strongest growth is in the stakeholder segments we see as most important to the first of two major growth stages.
- We deduce that the price of Bitcoin benefits from two main sources of demand: its value as a "digital gold" and its utility as a payments channel. While we estimate significant growth in both sources of demand, we believe that demand for Bitcoin as a payments channel will outpace growth in demand for Bitcoin as a "digital gold". We see the strongest adoption for Bitcoin as an alternative payments channel in emerging markets and for cross-border payments.
- For accredited and institutional investors, the advantage of gaining exposure to Bitcoin through the Bitcoin Investment Trust is the titled, auditable exposure provided and because the Trust addresses the unique challenges of properly acquiring and securely storing Bitcoin.
- Ultimately, we view shares of the Bitcoin Investment Trust (OTCQX: GBTC) as benefiting from the rise of value in their underlying security, Bitcoin. Based on our projected demand for Bitcoin as a "digital gold" and as a payments channel, we estimate a present value of $655 per Bitcoin which equates to a price of $62 per share of the Bitcoin Investment Trust.

INITIATING COVERAGE

Stock Rating	**BUY**
Price Target	**$62.00**

Internet/Financial Technology

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Stock Price Performance

Bitcoin Investment Trust 03/29/16

Market Data

Price (03/28/2016)	$54.40
52-Week Range	$94.86 - $21.22
Market Cap (MM)	-
Avg. Daily Volume	6,627.0
Total Debt/Cap.	-

Relevant disclosures begin on page 36 of this report.

Summary

Investment Thesis

The Bitcoin Investment Trust is a private open-ended Trust that invests exclusively in Bitcoin, and consequently the value of shares in the Trust is driven primarily by the price of Bitcoin. While investors can buy Bitcoin directly from an exchange, the advantage for accredited and institutional investors of gaining exposure through the Bitcoin Investment Trust is the titled auditable exposure provided and because the Trust addresses the unique challenges of properly acquiring and securely storing Bitcoin.

Bitcoin is a decentralized, borderless, peer-to-peer, electronic cash system that is disintermediating and removing friction in the exchange of value by enabling fast, low-cost, global, peer-to-peer payments.

Similar to how the internet created a global open network for the exchange of information, so too is Bitcoin and its underlying "blockchain" technology enabling an open and global network for the exchange of value. For reasons addressed in this report, we see Bitcoin and its underlying technology as among the most significant innovations in payments and money in decades, if not centuries.

Driven by market and secular changes such as the rise of ecommerce, globalization, and the ubiquity of enabling technology (mobile phones), Bitcoin is disrupting trillion-dollar markets in payments and value exchange. While other digitally-native payments networks have incrementally improved the experience of digital value exchange, these solutions ultimately rely on the same pre-existing and siloed infrastructure as the legacy financial system. So while these modern networks have made it easier to use that same aged financial infrastructure—particularly in a digital context—they have not created new infrastructure. Bitcoin, on the other hand, is a new infrastructure for digital value exchange.

We see value in Bitcoin as a "digital gold" and as a payment network that is enabling a global, open, permissionless financial system. Bitcoin has a four-sided network effect that includes developers, transaction processors ("miners" securing the network), merchants, and consumers. All four of these major stakeholder segments are showing impressive growth but, most importantly, the strongest growth is in the stakeholder segments we see as most important to the first of two major growth stages.

While Bitcoin has at times been associated with illicit activities and portrayed as anti-government or anti-establishment, we believe this narrative entirely misses the essential point: Bitcoin is pro-human empowerment—it enables people to be fully in control of their money and transaction activity and is used extensively for legitimate purposes. Far from being static, Bitcoin is constantly growing and improving thanks to a vibrant open-source community of developers that are constantly making improvements and helping to add new features and functionality to money and value exchange.

We deduce that the price of Bitcoin benefits from two main sources of demand: its value as a "digital gold" and its utility as a payments channel. We estimate that both sources of demand will grow significantly over the next five years and ultimately drive the price of Bitcoin significantly higher. While we see significant growth in both areas, we think that growth in demand for Bitcoin as an alternative payments channel will rise faster than the demand for Bitcoin as a "digital gold".

We see the fastest adoption rates for Bitcoin as a payments channel in emerging markets with lower financial inclusion, fewer and lower quality payments alternatives, and because emerging market countries tend to have less stable currencies, more onerous capital controls, and more frequent economic, monetary, or financial crises. We also estimate that adoption of Bitcoin as a payments channel will be greater for cross-border transactions (vs. domestic) because relative to alternatives the advantages of leveraging Bitcoin as a low-cost, fast, and borderless payments channel are greater for cross-border transactions than for domestic transactions.

Valuation

Ultimately, we view shares of the Bitcoin Investment Trust as benefitting from the rise of value in their underlying security, Bitcoin. Based on our projected demand for Bitcoin as a "digital gold" and as a payments channel, we estimate a present value of $655 per Bitcoin, which equates to a price of $62 per share of the Bitcoin Investment Trust (OTCQX: GBTC).

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Overview of the Trust

What is the Bitcoin Investment Trust? Why use the Trust to access Bitcoin?

The Bitcoin Investment Trust is a private open-ended trust that invests exclusively in Bitcoin. Each share of the Trust represents approximately 1/10th of a Bitcoin and consequently the price of each share of the Trust is driven primarily by the price of Bitcoin and, in the secondary market, also by demand for shares of the trust itself.

For investors—particularly institutional and accredited investors—the Bitcoin Investment Trust may be the best way to gain exposure to Bitcoin because as a relatively new investment asset, Bitcoin presents its own unique challenges, many of which are unfamiliar to traditional investors, such as: Where should I buy Bitcoin? What is a fair price based on current market conditions? How do I securely store Bitcoin? How do I ensure legal recognition of my investment interest? How do I treat this investment for tax purposes?

Grayscale addresses these challenges for investors with the Bitcoin Investment Trust by removing much of the complexity and potentially the risk of acquiring and storing Bitcoin while also providing a traditional titled and auditable investment wrapper.

What are the details of the Bitcoin Investment Trust? Who can invest in the Trust? Is there a minimum investment? What are the associated fees?

Grayscale's Bitcoin Investment Trust is available to accredited investors and requires a $25K minimum investment. The Trust charges 2% annually for administration and safekeeping. Subscriptions to the Trust can be made on business days and the Net Asset Value (NAV) of the Trust is published daily at 4:00pm EST. Investors are eligible to redeem their shares in the secondary market after a 1-year lock-up period.

Why do GBTC shares often trade at a premium or discount to their NAV? What does this mean for investors accessing shares in primary and secondary markets?

Shares of the Bitcoin Investment Trust are created as part of an ongoing private placement process to accredited investors. There is a 1-year lockup period for these unregistered shares. After the 1-year lock-up period the shares are eligible to be sold on OTCQX under the ticker GBTC. As such, the process for adding new shares to the secondary market is somewhat restricted and as a result the price of GBTC shares as quoted on OTCQX can trade away (to a premium or discount) from the trust's Net Asset Value (NAV). If the process for creating and redeeming shares became less restricted, the relative levels of premiums and discounts would likely dissipate significantly in response to arbitrage opportunities.

While the Bitcoin Investment Trust may be relevant to accredited, institutional and retail investors alike, it is likely best suited for accredited and institutional investors that can acquire shares at NAV via the ongoing private placement.

In contrast, retail investors must contend with a hefty premium for GBTC shares traded on OTCQX (currently a 30%+ premium) that is difficult to predict or depend on. As a result, retail investors that are knowledgeable about and comfortable with acquiring and storing Bitcoin may be better off acquiring Bitcoin directly from an exchange.

Who are the service providers of the Bitcoin Investment Trust?

Figure 1 GBTC Service Providers

Service	Provider
Sponsor	Grayscale Investments
Auditor	Friedman LLP
Legal Counsel to Sponsor	Sidley Austin, LLP
Custodian, Storage & Insurance	Xapo, Inc.
Delaware Statutory Trustee	Corporation Services Company
Transfer Agent	Continental Stock Transfer & Trust
Distribution and Marketing Agent	Genesis Global Trading
Authorized Participant	Genesis Global Trading

Source: Trust Documents, Needham & Company, LLC

What is Grayscale Investments?

The Bitcoin Investment Trust is sponsored by Grayscale Investments, which was founded in 2013 to create investment products that provide exposure to the emerging digital currency industry.

Grayscale Investments is a wholly-owned subsidiary of Digital Currency Group—a company that builds, incubates and invests in the blockchain and digital currency ecosystem.

Bitcoin

What is Bitcoin?

On the highest level, Bitcoin is a digital currency that utilizes its own underlying network to enable fast, low-cost, global value transfers 24/7.

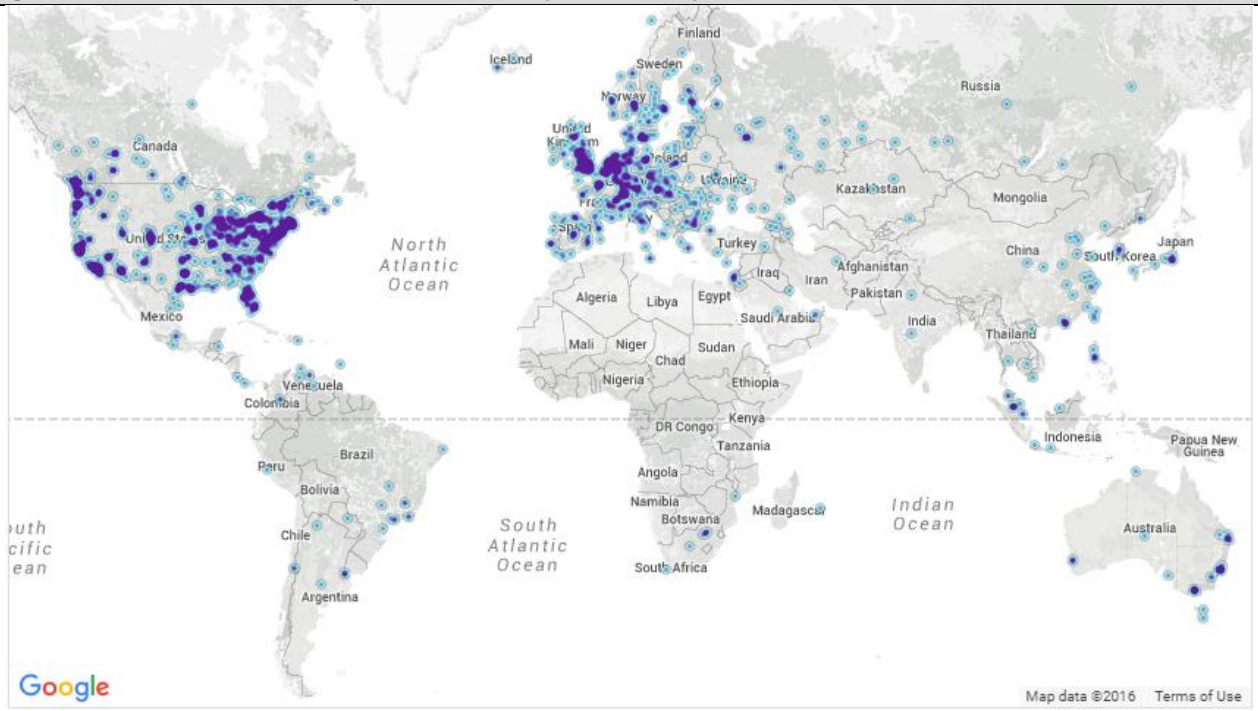
That said, Bitcoin is many different things to different people (currency, commodity, store of value, payment network, settlement system etc.). Indeed, even various branches, entities, and regulatory bodies of the United States Federal Government have defined Bitcoin differently. The IRS declared that virtual currencies such as Bitcoin should be treated as property for tax purposes. Meanwhile, in a prosecution of a defunct Bitcoin company, the SEC treated Bitcoin as a security and FinCEN considers Bitcoin closer to currency. The point is that Bitcoin is different things to different people, so rather than focusing on the labels applied, we believe it would be prudent for potential users and investors to consider the underlying characteristics of Bitcoin.

In this respect, we believe the most important underlying characteristics and functionality of Bitcoin are that it is a decentralized, peer-to-peer, open-source, and permissionless network that facilitates the transfer of a scarce native asset (Bitcoins). The term Bitcoin can refer to the digital currency, the underlying network, or both. Some industry participants differentiate between the two by using “bitcoin” (lower case) in

reference to the digital currency and "Bitcoin" (upper case) to refer to the network, protocol and broader ecosystem—we're less dogmatic about upper- versus lower-case usage of Bitcoin and instead rely on context to distinguish the currency from the broader protocol, network, and ecosystem.

Considering that much of the appeal of Bitcoin is the absence of any central points of control and its resulting value as a peer-to-peer currency and payment network, decentralization is a particularly important aspect of Bitcoin. The extent of Bitcoin's decentralization is highlighted in the figure below, which shows the global distribution of roughly 7,000 Bitcoin nodes. In effect, to "shut down" Bitcoin would require shutting down the thousands of globally distributed computing nodes that run the Bitcoin protocol. This is a significant aspect of Bitcoin's appeal as a highly resilient digital currency and payment network.

Figure 2 Global Distribution of Bitcoin Nodes (March 2016)



Source: 21.co, Google

We note ample educational resources on Bitcoin, how it functions, and how it is secured—we do not intend to recreate these resources here. Instead, we focus on why we think Bitcoin is appealing from an investment perspective. For more general information on Bitcoin we recommend the following resources:

- The original Bitcoin Whitepaper: Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System" (2008)
- www.Bitcoin.org. This site has many educational resources
- Video: The Khan Academy has an informative video series covering the basics and some of the deeper details of Bitcoin. The video series can be found at KhanAcademy.org or on YouTube.com.

Why should anyone care about Bitcoin? Why is it significant to payments, money, and finance?

We believe the importance of Bitcoin is that it is a disintermediating technology that is removing friction in the exchange of value and empowering people with unprecedented control over their money and transactions.

For thousands of years, value exchange has largely been a peer-to-peer phenomenon. Whether people were exchanging cowry shells, arrowheads, gold or cash, the exchange of value or money has almost always been a peer-to-peer phenomenon. However, as we moved toward non-cash transactions (credit cards, debit cards, checks, etc.) intermediaries became necessary and valuable. Intermediaries were necessary to connect disparate financial infrastructures and protect against fraud. However, while providing these services, intermediaries also inherently introduced friction into value exchange, and that friction manifests in the form of costs, risks, and delays.

Bitcoin, on the other hand, replaces intermediaries with a computer protocol, which in our view is also significantly more reliable. Now, thanks to Bitcoin, non-cash transactions are also a peer-to-peer arrangement.

Figure 3 "Payments are now Packets"

Source: CoinDesk, Balaji Srinivasan, Andreessen Horowitz, Khosla Ventures

Aside from being an order of magnitude more efficient, replacing intermediaries with computer code is also important because it enables *more* value exchange by improving access to digital payments for the financially underserved and for small value transactions that are prohibitively expensive to transmit via legacy payment channels. That is, without requiring a bank account (which half of the world population doesn't have) Bitcoin enables people to confidently transact without knowing or even trusting one another. Instead, only a mobile phone or internet connected computer is necessary, and we note that an increasingly large percentage

of the world has access to a mobile phone—most of which are projected to be smart phones within the next five years.[1]

What's more is that the low marginal cost of transactions afforded by Bitcoin is also helping to enable new innovations such as micro-transactions and machine-to-machine payments in the Internet of Things. Aside from the low marginal costs of transacting via Bitcoin, the fact that Bitcoin has reduced payments to code is also enabling "programmable value" and allowing consumers to do things with money that weren't previously possible (without a high cost and billable attorney hours). Examples include multi-signature functionality and time-locks (both of which we discuss later in this report).

While Bitcoin has at times been portrayed as anti-government, anti-corporate, or just anti-establishment, we believe this all misses the essential point: Bitcoin is pro-human empowerment. Bitcoin enables people to be fully in control of their money and transactions such that their money cannot be confiscated (even by government—as recently happened in Cyprus) and their transactions cannot be blocked by any single third party.

Lastly, as a cornerstone of the rapidly emerging blockchain industry, we think Bitcoin will also likely be an important part of an emerging, open, global financial network.

What's the difference between Bitcoin the token ("cryptocurrency") and Bitcoin the network?

The actual units that can be sent and spent over the network are sometimes referred to as bitcoins (lower case) while the broader protocol and underlying decentralized, peer-to-peer, permissionless network are often referred to as Bitcoin (upper case)—we rely primarily on context to distinguish the two. The other keyword around bitcoin is "blockchain" which, as it relates to Bitcoin, refers to the record of transactions that enables the transmittance of Bitcoins.

A Bitcoin is a unit of account that can be transmitted peer-to-peer over a decentralized network that is secured and maintained by transaction processors ("miners"). Total supply of Bitcoin is capped at 21 million which, by current estimates, will all be released by the year 2140. Importantly, the Bitcoin network and protocol is open-source, meaning that anyone can review, modify, and distribute the code freely. Bitcoin is also permissionless in that anyone can use the network, be a node on the network, or be a transaction processor on the network. Similarly, anyone can innovate or build a business utilizing the Bitcoin network without requiring permission or licensing from a Bitcoin governing body, in much the same way that anyone can participate in the Internet or build a business off the Internet.

What can one do with Bitcoin?

In short, Bitcoin users can spend, send, or store their Bitcoin.

Bitcoin can be spent for goods and services, sent to other users, or held as a speculative investment or store of value. There are currently over 100,000 merchants accepting Bitcoin through two of the most popular Bitcoin merchant service providers (bitpay and Coinbase), including well-known companies such as Expedia, Dell, Intuit, Overstock.com, Dish Network, Gyft, Zynga, Shopify, Newegg, TigerDirect, and Rakuten. Companies such as Xapo and Coinbase also offer debit cards that allow users to spend Bitcoin anywhere that Visa is accepted. While users are technically spending Bitcoin, the merchant actually

[1] Fred Wilson, "The Second Smartphone Revolution" (2016), http://avc.com/2016/03/the-second-smartphone-revolution/

receives their local currency (the providers of such debit card services convert Bitcoin to local currency when the payment is initiated).

Users can also send Bitcoin to anyone in the world at any time regardless of jurisdiction or geographic location, which is ultimately enabling a new level of peer-to-peer connectedness—one in which value is exchanged as easily between peers as information is today via the Internet.

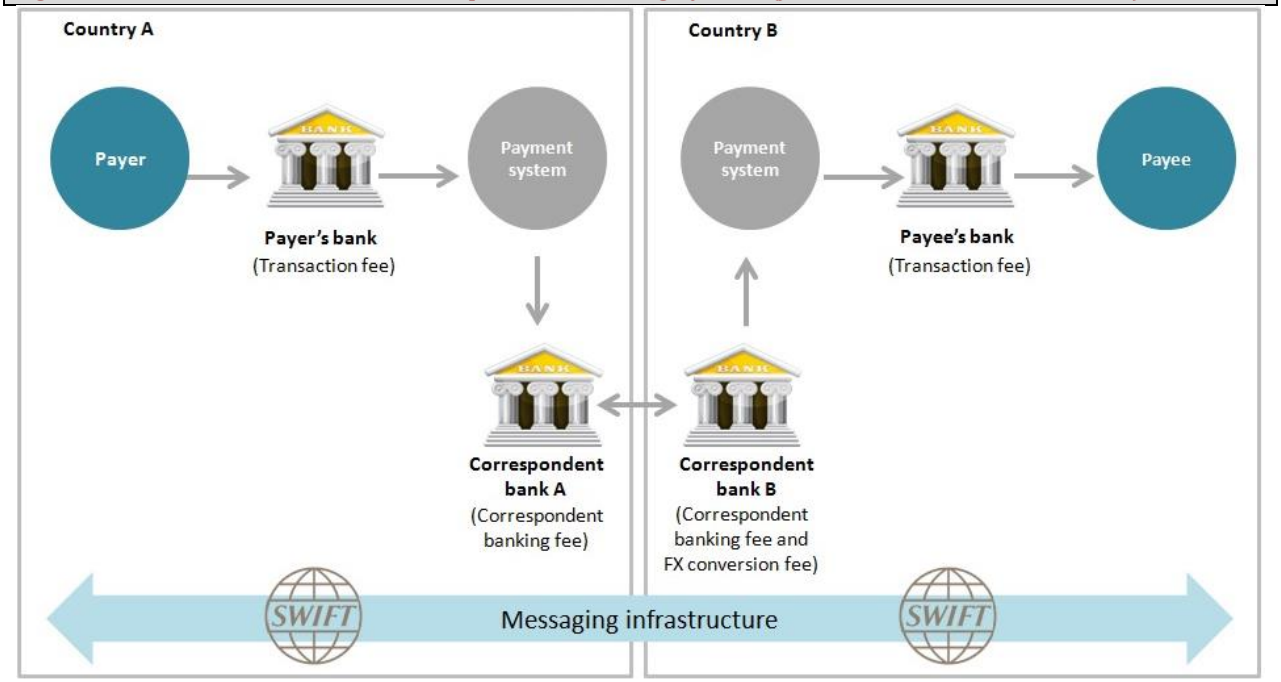
Lastly, users can hold/store their Bitcoin as a speculative investment or as a store of value. Bitcoin is unique in that users can hold and store their Bitcoin in a manner that, by design, allows the user (and only the user) to access their funds.

What are the problems with money and value transfer today and how might Bitcoin be a solution?

Problem: intermediating friction—To engage in value transfer today, consumers, governments, and businesses all depend upon intermediaries (or a *series* of intermediaries) to carry out transactions on their behalf. Most but not all of these intermediaries are trustworthy and the system is built this way because, historically, we've needed intermediaries to conduct transactions and protect against fraud. The problem, however, is that intermediaries introduce friction into value exchange and that friction manifests in the form of otherwise avoidable cost, risks, and delays.

> **Bitcoin:** Today, through advances in cryptography, decentralization, and distributed consensus that are embodied in Bitcoin, we now have the technology to securely, reliably, and quickly transact value peer-to-peer (C2C, B2C, B2B) without relying on intermediaries. This ability to transact peer-to-peer is significantly reducing friction in the exchange of value.

Figure 4 Intermediaries in the Correspondent Banking System (for Cross-Border Remittances)



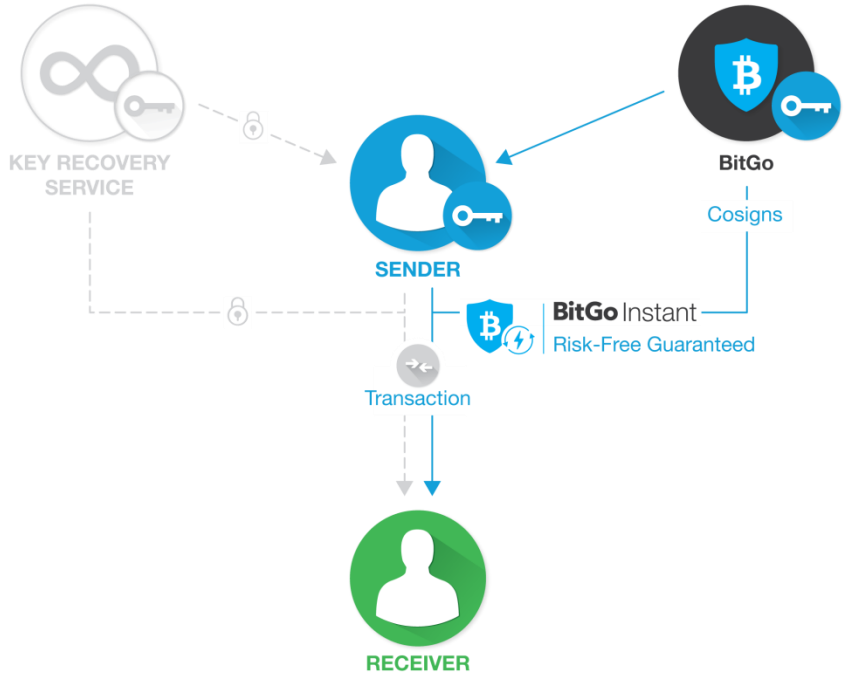
Source: Aite Group

Problem: delays—Even domestic bank transfers in the United States typically take 1-2 days to actually settle and be available to the receiver, and the problem is worse for cross-border payments, which often take 3-5 days.[2] A significant portion of this delay is the result of intermediaries mitigating the risk of a "double-spend"—a situation where a user attempts to fraudulently spend the same money twice with two different counterparties (only one of which will ultimately be able to receive the funds). Delays in settlement finality are even worse on the merchant side where transactions are typically subject to chargebacks for up to 6 months—a particularly onerous burden and substantial risk for retail merchants.

> **Bitcoin:** Bitcoin transfers are relatively instantaneous in comparison. Depending on the level of desired assurance, Bitcoin payments range from nearly instantaneous (a couple seconds) to roughly 60 minutes to be fully confirmed and secure. So whereas mitigating the risk of a "double-spend" in traditional payment channels necessitates days of delay, the Bitcoin network only takes seconds, minutes, or an hour to mitigate the same risk. In general, larger transactions are at greater risk of a "double-spend" and, consequently, recipients of larger transactions typically desire or require longer confirmation times at the upper end of the range. Smaller transactions are generally lower-risk and confirmation times might be only seconds long. Companies such as BitGo and Bitnet (in partnership with BlockCypher) reduce this delay further by offering services that allow merchants to accept transactions instantly.[3,4] BitGo uses a multi-signature strategy to ensure that funds are not double-spent while BlockCypher uses transaction and network analytics to help companies such as Bitnet calculate the probability of a double-spend attempt (based on speed of propagation, transaction fees, and other factors).

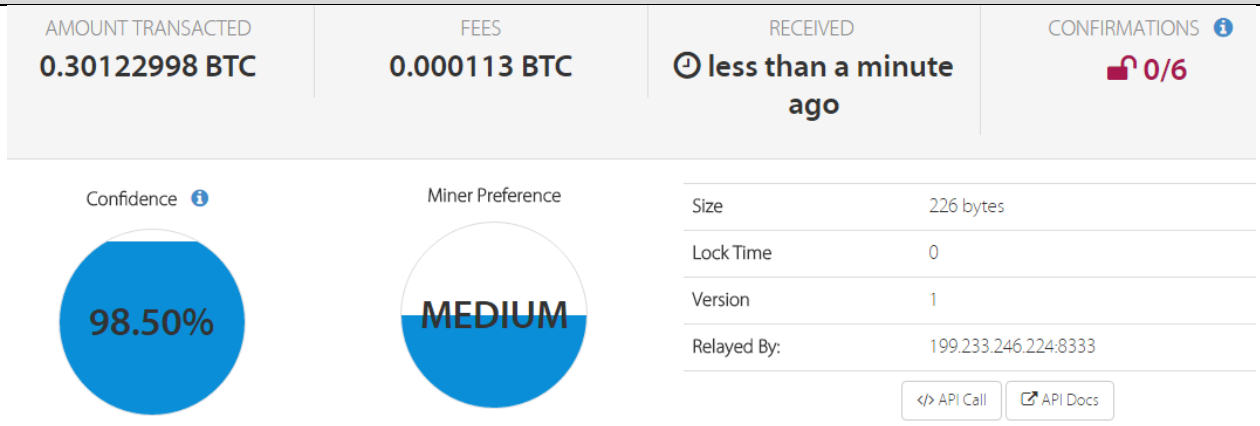
[2] "Global Payments 2015: A Healthy Industry Confronts Disruption" (2015), McKinsey
[3] https://www.bitgo.com/instant
[4] http://www.coindesk.com/bitnet-launches-instant-approval-tool-for-Bitcoin-merchants/

Figure 5 BitGo Instant



Source: BitGo

Figure 6 BlockCypher Live Block Explorer with Confidence Interval



Source: BlockCypher

Problem: cost—The series of intermediaries that we depend upon to conduct transactions today incur costs in their role which, in addition to a profit margin, is baked into the cost of traditional value transactions (e.g., payments) resulting in more expensive transaction costs for all consumers and businesses.

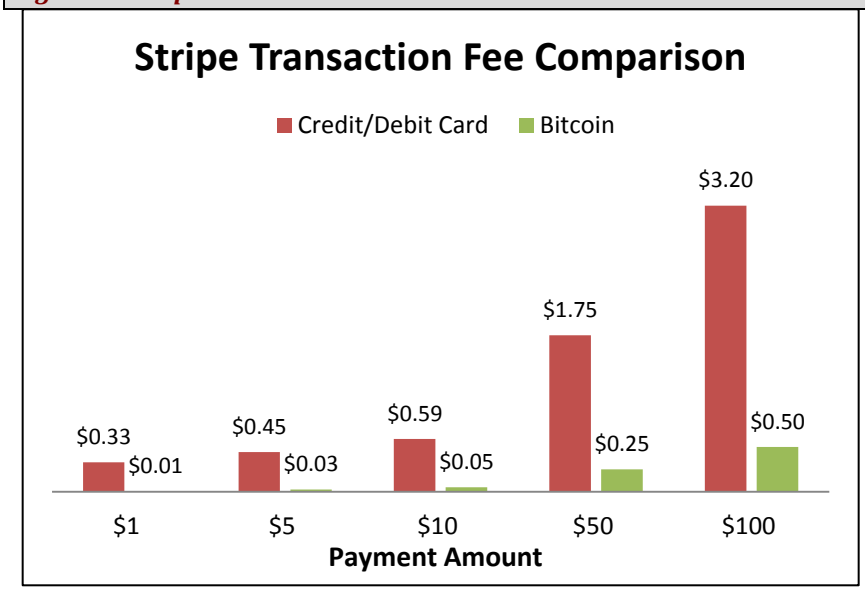
Bitcoin: In comparison and largely because consumers aren't beholden to an intermediary (or series of intermediaries) to conduct transactions with Bitcoin, the costs of transacting are significantly reduced.

Figure 7 Transfer Cost: Approximate Cost of Remitting $200

Remittance Corridor	Money Transfer Operators	Banks	Bitcoin
Australia–Papua New Guinea	15%	18%	0.02%
Germany-Serbia	7%	21%	0.02%
Japan-Brazil	10%	18%	0.02%
Malaysia-Indonesia	2%	7%	0.02%
New Zealand–Tonga	9%	18%	0.02%
Russia-Ukraine	2%		0.02%
South Africa–Mozambique	12%	22%	0.02%
South Africa–Zimbabwe	16%	19%	0.02%
Saudi Arabia–Pakistan	3%	3%	0.02%
United Arab Emirates–India	3%	13%	0.02%
United Kingdom–India	2%	5%	0.02%
United Kingdom–Philippines	6%	5%	0.02%
United States–Colombia	6%	18%	0.02%
United States–Mexico	7%	4%	0.02%
United States–Philippines	7%	10%	0.02%

Source: IMF[5], Needham & Company Estimates

Figure 8 Stripe Transaction Fees



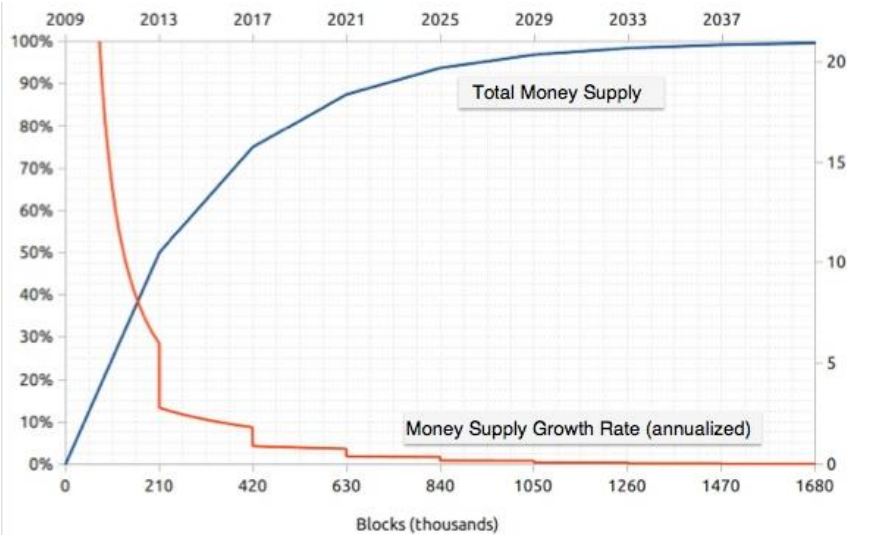
Source: Stripe, Needham & Company, LLC

[5] Dilip Ratha, "Remittances: Funds for the Folks Back Home" (2012), International Monetary Fund, Finance & Development

Problem: fiat debasement—Over time fiat currencies have not performed well as a store of value: Over the past 20 years alone the United States dollar has lost 53% of its value, the British Pound has lost 47%, the Euro has lost 40%, and the Australian dollar has lost 64%. The declining value of these currencies is likely attributable to their expanding monetary bases—all of which have seen drastic expansion over the same period.

Bitcoin: In contrast, the Bitcoin community has capped the total supply of Bitcoin at 21 million with a pre-defined, known distribution schedule. With continued demand this limited supply should lend itself to Bitcoin being a better store of value over time.

Figure 9 Bitcoin Supply and Growth Rate



Source: Satoshi Nakamoto Institute

Problem: traditional money is static—Simply put, traditional moneys such as fiat currency and gold are not programmable, and this limits the extent to which advanced functionality can be built directly into these forms of money.

Bitcoin: In comparison, Bitcoin has made money programmable such that nearly everything we can do with data and computer code, we can now do with money. In short, Bitcoin is enabling new functionality for money. We're only in the early days of permissionless innovation for this open-source programmable money, but there has already been tremendous innovation including, for example, multi-signature functionality, which for the first time allows multiple parties to truly own the same money—something that could have significant implications for areas such as corporate governance. Another example of the innovation around the programmable function of Bitcoin is CLTV (check-lock-time-verify) which allows anyone to lock money in time only to be accessible by themselves or another party at a pre-specified future point in time. We think these innovations are only the first of many to emerge from the powerful combination of an avid development community improving the open-source protocol and building on top of it.

Problem: opacity—Many types of payments, especially cross-border payments, are surprisingly opaque. The best way to illustrate this is to compare payments to

modern package delivery. We can send a package to the other side of the world, know exactly how much it will cost, see exactly where it is in transit, know when it will arrive, and have assurance that it will arrive in proper condition. In contrast, when sending a cross-border payment the complete cost is often unknown, the payment is hard or impossible to track, the arrival date is often uncertain, and the amount received may be less than intended (due to additional fees).

Bitcoin: transparency—By its very nature, the complete ledger of Bitcoin transactions ("The Blockchain") is public and available for anyone to review. At any point in time you can see exactly what is happening to a transaction: whether it is being propagated through the network and when it has been included in a block that is appended to the blockchain. Other companies are building off the Bitcoin payment rail to deliver a superior customer experience: For example, Align Commerce uses Bitcoin behind the scenes to power low-cost, transparent B2B payments without actually exposing clients to the volatility or intricacies of Bitcoin.

Figure 10 Cross-Border Payments: A Poor User-Experience

"...high cost does not translate in to high speed: these [cross-border] payments typically take three to five working days to complete. Often, there Is also a significant lack of transparency in pricing, timing, and tracking...Customer experience in making cross-border transaction and documentary business is poorly aligned with today's expectations. This mismatch provides an open door for attackers."
-McKinsey & Company

Source: McKinsey & Company[6]

Figure 11 Align Commerce vs. Bank Fees

	Bank Wire Fees	Align Fees
Wire Initiation Fees	$30	$0
Beneficiary Intermediary Fee	* $35	$0
Local Bank Receiving Fee	* $15 - $30	$0
International Exchange Rate	* 3% - 6%	1.9%

* Hidden or occasionally hidden banking fees

Source: Needham & Company, LLC

[6] "Global Payments 2015: A Healthy Industry Confronts Disruption" (2015), McKinsey

What are the secular and market trends (changes in demographics, technology trends, laws, regulations) that are driving the need for a new solution?

E-commerce & Globalization
On the highest level, in a world where we increasingly transact with parties across the world, we believe there is a strong case to be made for a borderless, low cost, fully digital payment network, and we believe Bitcoin fills this need as it reduces payments to bits and bytes that can be moved cheaply, anytime, to anywhere in the world.

Ubiquity of Mobile Phones
Mobile phones have rapidly become pervasive in developed and emerging economies alike and mobile phones are now the most common way for people to access the internet.[7] And this trend seems far from abating, as it is projected that by 2020 roughly 65% of the world's population will have a smartphone (with Internet access).[8] Further, "the ubiquity of mobile phones is changing the way consumers access financial services"[9] in that the mobile phone is increasingly the medium through which users consume financial services. Historically, financial services required heavy infrastructure investments including expensive brick-and-mortar retail centers. Now, the rise of mobile phones is changing the banking experience and could help drive adoption of a natively digital payment network such as Bitcoin that can be accessed from a mobile phone.

Dysfunctional money
Similarly, Bitcoin holds an appeal in countries where money has been particularly dysfunctional: For example, over the past 4 decades Argentina has seen at least eight currency crises, four banking crises, and two sovereign defaults. Some Argentine people have seen their life savings nearly wiped out multiple times in a relatively short time frame—lending further credibility to the search for a viable alternative.

Argentina is only one of many countries that have struggled with reliable money. From 1920 to 2008 (~ 1 generation) there have been over 50 examples globally where *monthly* inflation exceeded 50% across at least 35 countries. Ultimately a lack of reliable money is a global problem that has affected hundreds of millions of people—This is currently driving and should continue to drive a search for better payment channels and a more reliable money.

Strict capital controls appear to be another driver of interest in Bitcoin, where it is seen as a solution to restrictions on the flow of money that may be necessary for economic trade.

Latin American countries such as Venezuela, Argentina, and Brazil that have implemented draconian capital controls and experienced rapid inflation and economic contractions have seen some of the most rapid Bitcoin adoption recently[10]. In 2015, Bitcoin payment processing company bitpay saw record-breaking growth in payment processing volume in Latin America, with merchant transactions rising over 1,700%

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[7] Roxanne Bauer, "Media (R)evolutions: Convergence around mobile phones in sub-Saharan Africa" (2016), The World Bank
[8] Benedict Evans, "How Mobile is Enabling Tech to Outgrow the Tech Industry" (2014), Andreessen Horowitz
[9] "Consumer and Mobile Financial Services" (2015), Board of Governors of the Federal Reserve System
[10] Sonny Singh, Alberto Vega, "Why Latin American Economies are Turning to Bitcoin" (2016), TechCrunch

from the beginning of the year[11]. Trading volumes in Brazil and Mexico rose over 200% and 600%, respectively[12][13].

Figure 12 Inflation in Latin America

Annual Inflation Rate		
	2015	2014
Venezuela	275%	63%
Argentina	28%	36%
Brazil	11%	6%

Source: Financial Times and CIA Factbook

How does Bitcoin compare to fiat currencies and gold as a form of money?

Aside from the specific problems noted above, it can also be instructive to take into account how Bitcoin, gold, and fiat currencies stack up against one another in regard to the degree that they exhibit some of the favorable traits of "good money".

Figure 13 Comparing Favorable Traits of Money

	Fiat Currency	Gold	Bitcoin
General Accepted	●	○	◔
Portable	◕	◕	●
Durable	◑	◕	●
Fungible	●	●	●
Divisible	◕	◑	●
Secure (difficult to counterfeit)	◑	◕	●
Store of Value	◔	◕	◔
Scarce (Predictable Supply)	◔	◕	●
Stable (low volatility)	●	◑	◔

Source: Needham & Company, LLC

[11] "Understanding Bitcoin's Growth in 2015" (2016), bitpay
[12] "Mercado Brasileiro de Bitcoins" (2015), bitValor
[13] "Asi Crecio el Bitcoin en Mexico durante el 2015" (2016), Bitso

While there are several areas where we believe Bitcoin is superior to other forms of currency, we do note that we also find it lacking in a couple of the most important areas, including general acceptance as a form of payment, volatility, and store of value to name a few. We think that Bitcoin's deficiencies in these areas are emblematic of its early stage of development, and that these drawbacks could diminish over time with greater adoption.

In what ways is Bitcoin potentially inferior to other modern payment networks?

The current state of the Bitcoin network presents select limitations relative to other modern payment networks.

At times one of the most evident limitations of the current state of the Bitcoin network is its throughput capacity. While modern payment networks like PayPal and Visa are capable of processing several thousand transactions per second, the Bitcoin network is technically limited to about 7 transactions per second but at times hits capacity at less than 3 transactions per second. For the time being this limitation only presents itself occasionally (when there is an abnormally large amount of activity on the network), but it has become a more frequent problem over time as Bitcoin has grown in popularity and usage. There are several competing solutions being developed to help scale the Bitcoin network and increase throughput capacity.

Another attribute of Bitcoin payments that can be considered both a useful feature and a limitation is the irreversibility of transactions. That is, unlike the Visa network, for example, where transactions can be reversed for as long as 6 months, transactions on the Bitcoin network cannot be reversed within any time frame. For merchants the irreversibility of transactions on the payment network reduces counterparty risk and, consequently, is a favorable feature. For users, however, this means that consumer-friendly features such as zero-liability fraud protection do not currently exist on the Bitcoin network.

Another aspect of the Bitcoin network that can also be considered either a plus or a minus is the public nature of Bitcoin's transaction ledger, the blockchain. On the one hand it's a large part of what makes Bitcoin work but, on the other hand, users don't necessarily want their transactions displayed publicly (albeit pseudonymously)—this is particularly true for transactions conducted by large financial institutions.

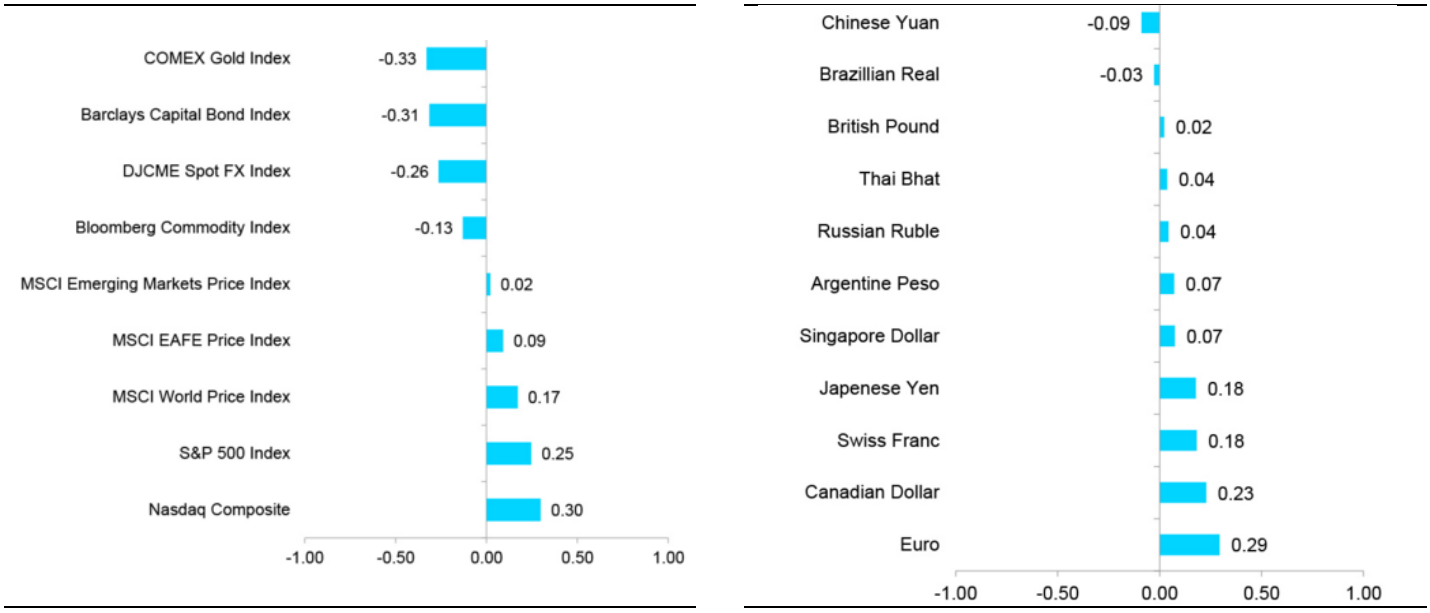
Significant extensions and upgrades that could help bring increased throughput, scaling, and privacy to Bitcoin such as "sidechains", the "lightning network", and confidential transactions are currently being developed and tested. If some or all of these prove successful they could be significant catalysts for Bitcoin.

How correlated is Bitcoin to other asset classes?

Bitcoin tends to be relatively uncorrelated to other asset classes. The exact results vary depending on the Bitcoin price index, the date window, and other inputs used but most of these analyses are similar in their conclusion that Bitcoin is relatively uncorrelated to other major markets.

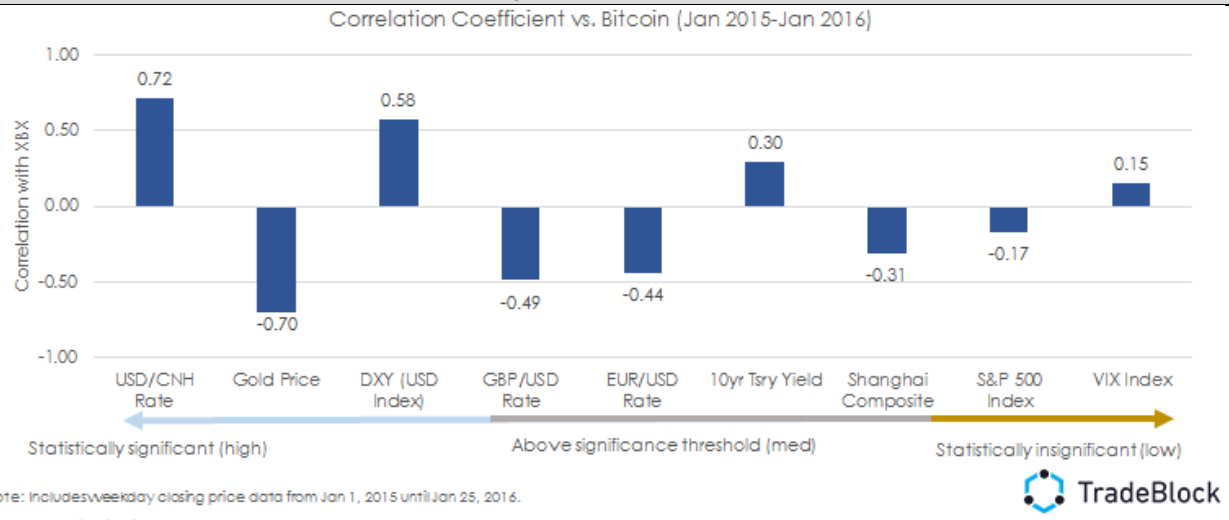
Interestingly, despite being similar to gold in some respects—scarcity in particular—both analyses included below show an inverse price correlation between gold and Bitcoin. Also interesting is that while one analysis concludes that the strongest positive correlation is between Bitcoin and the Chinese Yuan, the other analysis shows a slight inverse correlation.

Figure 14 Grayscale Investments Bitcoin Correlation Analysis



Correlation coefficient of major assets classes and currencies versus Bloomberg's Bitcoin Index. Based on 12 months of 10-day rolling price returns, 1/29/15-1/29/2016
Source: Grayscale Investments, Bloomberg

Figure 15 TradeBlock Bitcoin Correlation Analysis



Source: TradeBlock

Ultimately much of the varying correlation is likely attributable to the fact that, as the market is in its nascent stages, the price of Bitcoin is largely driven by internal factors within the Bitcoin economy rather than as a result of external price movements. As Bitcoin establishes a longer track record, more consistent correlation results will likely emerge.

What are Bitcoin's key growth metrics and how are they trending?

Bitcoin has a four-sided network effect that includes developers, transaction processors ("miners" securing the network), merchants, and consumers. To examine Bitcoin's traction and growth we examine changes and growth among these four stakeholder segments.

While all four groups will eventually need to grow substantially to achieve greater mainstream adoption, we don't expect them all to grow parallel with one another. Instead, we expect a two-stage growth and adoption process—the first stage should include growth in transaction processing power (important for security) and growth in developer activity while the second stage should include accelerated adoption among merchants and consumers.

In the first stage, we expect to see relatively parallel growth in developer activity and transaction processing (security) because of the naturally symbiotic relationship between the incentive to secure the network and the incentive to build on the network. Said differently, we don't expect to see growth in developer activity without growth in network security and, similarly, we don't expect to see growth in network security without indications of future usage and demand (for which developer activity is a promising leading indicator).

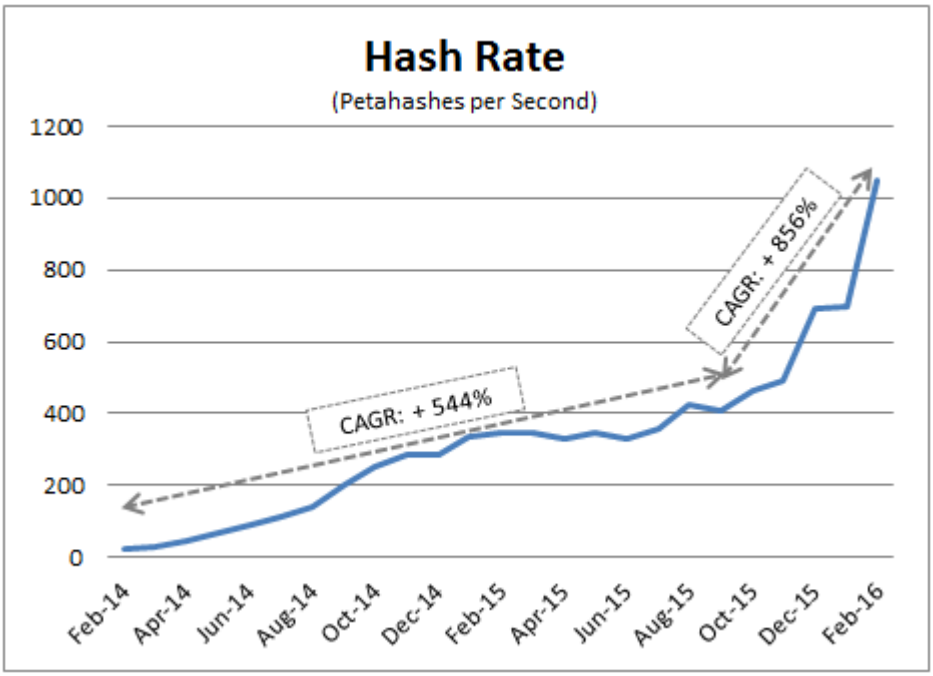
Only once the network is secure (it is considered highly secure today) and developers have built useful applications and services for the network do we expect to see wider mainstream adoption of Bitcoin among consumers and merchants. Importantly, while our analysis shows impressive growth across all four major groups, growth is strongest in developer activity and transaction processing—the areas that are most important to the first of the two growth stages.

Transaction processors ("miners"): Transaction processors are important to the Bitcoin network not just because they process transactions but, perhaps even more importantly, because they also secure the network with their computing power. The total amount of computing power on the Bitcoin network is immense: As of mid-2015 the total computing power on the Bitcoin network was 6,000x the computing power of the world's top-500 super computers combined[14] or 100x larger than all of Google's estimated computing power[15]—and the total computing power on the Bitcoin network has grown over 200% since those figures were estimated.

[14] "The Old Cloud is Dead, Welcome to the New Blockchain Cloud" (2015), William Mouyagar

[15] Pete Rizzo, "21 Chairman Hints at Stealth Startup's Larger Mission" (2015), CoinDesk

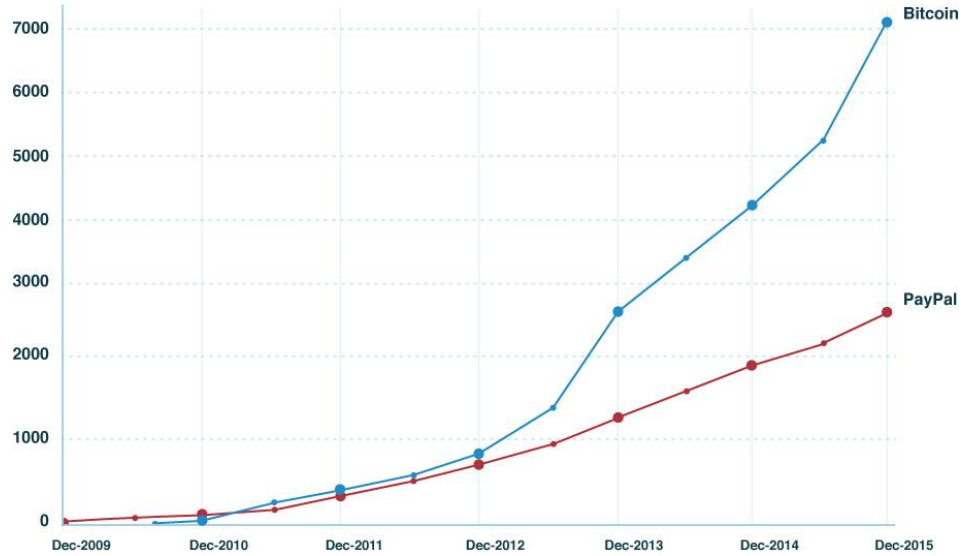
Figure 16 Growth in Computing Power on the Bitcoin Network



Source: Blockchain.info, Needham & Company, LLC

Developer Activity: There is no perfect way to measure and compare total developer activity around Bitcoin vs. other payment networks. However, one good proxy that helps provide context is an evaluation of the number of GitHub repositories that reference Bitcoin. The results show a "hockey stick" in developer activity over the past two years, which we believe will ultimately help produce the applications and services that will drive greater mainstream Bitcoin adoption among merchants and consumers.

Figure 17 Number of GitHub Repositories Mentioning Payment Methods

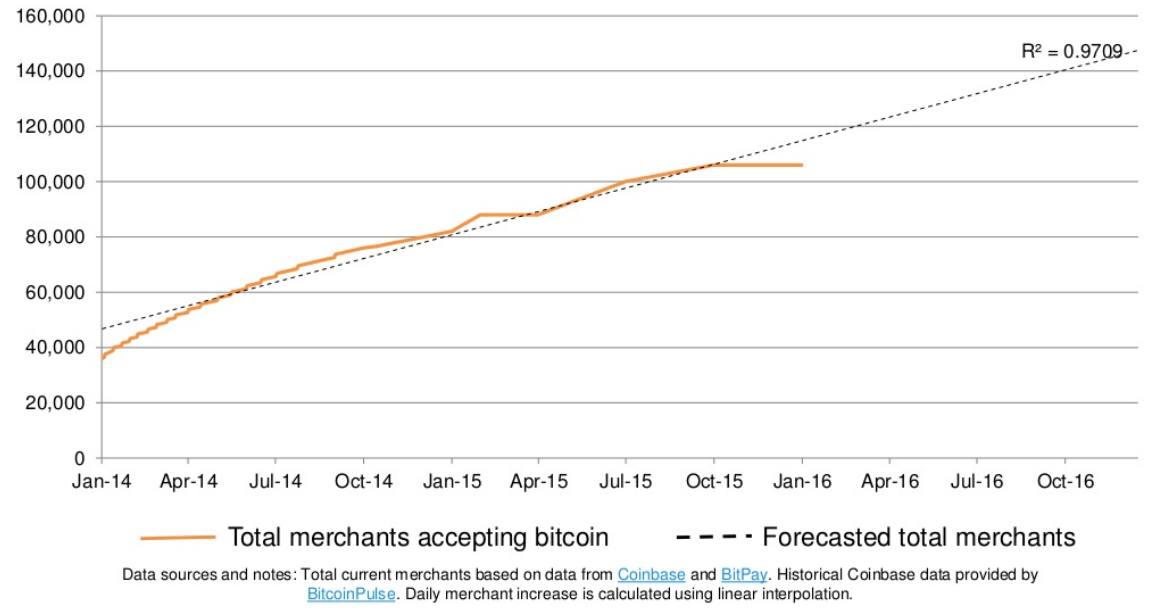


Source: Coinbase[16]

Merchants: The rate of merchant adoption has been growing significantly. Exact numbers are hard to come by so we use figures from the two biggest merchant processors (Coinbase and bitpay) as a proxy for merchant adoption. Their numbers, as reported in CoinDesk's State of Bitcoin and Blockchain report, show a 60%+ CAGR from January 2014 (<40K merchants) to January 2016 (>100K merchants). Among the 100K+ merchants accepting Bitcoin are many large name-brand corporations such as Expedia, Microsoft, Dell, Newegg, Gyft, and Zynga along with many others. While the growth in merchant adoption has been impressive and significant, it's not yet at the "hockey-stick" stage that we expect will happen with greater mainstream adoption.

[16] "2015 Bitcoin Year in Review" (2015), Coinbase

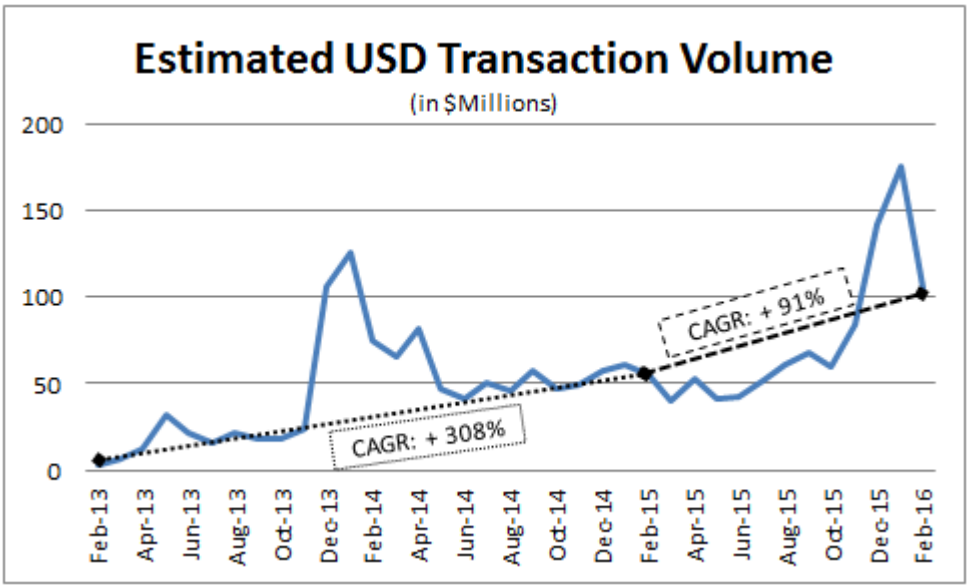
Figure 18



Source: CoinDesk Needham & Company, LLC

Consumers: The last segment of Bitcoin's four-sided network effect, and the one that we believe will ultimately be the most important, is consumer adoption. Here again, there is no perfect metric to measure consumer adoption. Our preferred metric, albeit with its own deficiencies, is to look at estimated daily USD transaction volume. Again, growth here resembles merchant adoption—which is in line with our two-stage growth thesis—in that while growth has been impressive, it's not the drastic growth we expect to see in the second major growth phase. Still, it took roughly two years (Feb 2013-Feb 2015) to add $50 million in estimated daily USD transaction volume and only one year (Feb 2015-Feb 2016) to add the next $50 million.

Figure 19 Growth in Daily Transaction Volume



Source: Blockchain.info, Needham & Company, LLC

Ultimately, while we see strong growth across all four major stakeholder groups in the Bitcoin ecosystem, more significantly we see the strongest growth in the areas that we think are most important at this stage: transaction processors (network security) and developers. We think that following the robust funding in the broader ecosystem (over $1 billion) and the flurry of product development over recent years that we are in the mid- to late stages of the first in the two major stages of growth and adoption. We expect to see significant products, applications and services built on and around Bitcoin that should solve consumer pain points and drive significantly greater adoption.

What are potential catalysts for the price of Bitcoin?

Mainstream payment adoption: The most obvious longer-term positive catalyst for the price of Bitcoin is greater mainstream payment adoption. As shown in our estimates of potential adoption into major payment markets, even a very small slice of the global retail payments pie moving onto Bitcoin rails would be a significant positive catalyst for demand (and price). While we don't think that consumer adoption is about to turn exponential, we do expect to see rapid acceleration in the use cases and geographies where we believe Bitcoin is most useful, including cross-border payments and in many emerging market countries.

Scaling solution: While we view the current scaling debate as less of a problem and more of a product (and a strength) of an open-source development process for money, we also believe that major payments volumes that could move into Bitcoin are holding back until a solution is implemented and the outlook is clear. If a scaling solution is implemented without major turbulence we think it will be a positive catalyst not just because it would enable greater volumes but also because it would serve as an important historical precedent for Bitcoin's ability to tackle tough scaling challenges while simultaneously addressing leadership concerns.

Technical advancements: We think that technologies such as sidechains and the lightning network that are currently being developed could be positive catalysts for demand and price if they prove successful. Sidechains and the lightning network

promise to help alleviate some of the biggest concerns with Bitcoin today, including privacy, speed and throughput. Similarly, these technologies (and others) could bring other use cases and increased demand to the Bitcoin blockchain (such as smart contracts as being developed by Rootstock).

Monetary crises: Throughout history, monetary, financial, and economic crises tend to occur at fairly regular intervals. These crises could be isolated to one country, one region, or even be global but, regardless, when traditional money and finance doesn't work well, people tend to seek alternatives and for many, the next crisis will be the first time that Bitcoin is an available alternative.

Improvements in access: While the on-ramps to Bitcoin have improved significantly over recent years, they still typically require a specialized Bitcoin provider. If Bitcoin and Bitcoin services were available through major financial institutions such as banks and FX brokers, we think this could significantly improve access and ultimately be a positive catalyst for price. Similarly if investors were able to gain exposure to Bitcoin through an exchange-traded fund (ETF) listed on a major stock exchange such as the NYSE or Nasdaq directly through their regular brokerage account, it could have a significant positive impact on price.

What are the biggest hurdles to adoption?

Perception: Bitcoin is still often associated with illegal activity, hacking, and bankruptcies, and this perception likely inhibits adoption. Much like how the Internet is an open communications system that can be used by anyone for good or for bad, Bitcoin is an open financial system that can be used by anyone—including both good and bad actors. Open systems such as the Internet and Bitcoin tend to find initial adoption among the most underserved populations—which often includes those engaged in illegal or shunned activities. As with the internet in its early days, the task is to avoid throwing Bitcoin out with the bathwater and to avoid letting bad actors ruin what could ultimately be a boon to millions of people around the world.

Volatility: While the volatility of Bitcoin is part of what makes it attractive as an investment, it also inhibits adoption for its bigger use case: as a payments mechanism and store of value. That said, there are many companies in recent years that have created solutions that make Bitcoin's volatility a non-issue: Merchants that accept Bitcoin via bitpay or Coinbase, for example, needn't incur any currency risk from Bitcoin; instead, these vendors accept Bitcoin on the merchant's behalf, immediately convert it to local currency, and deposit it directly to the merchant's account (at the price they expected to receive for the sale). Furthermore, as Bitcoin adoption increases and its market capitalization grows, fluctuations in demand will be relatively less impactful to price and consequently volatility would diminish over time.

Awareness & know-how: Another barrier to adoption is that much of Bitcoin's potential user base is still relatively unfamiliar with Bitcoin including where to buy it, how it works, and how to store it. This is common to any new technology but likely remains an adoption hurdle for Bitcoin at least in the short term.

User experience & utility: In Bitcoin's earliest days, the only way to acquire Bitcoin was to mine it and there was very little that a user could do with it. The Bitcoin industry has come a long way since then in that there are now many places to easily buy Bitcoin (including numerous mobile phone apps) and there are thousands of merchants accepting Bitcoin. However, the user experience can be further improved and Bitcoin could be applied to other use cases—both of which would drastically improve the utility of Bitcoin for users and consequently further Bitcoin adoption.

After a spate of funding in recent years, there are many competent and well-funded companies working on solving these problems and improving the experience and utility of using Bitcoin.

Regulatory uncertainty: Overall, regulators have shown an interest in letting the nascent Bitcoin industry innovate without strict regulation. However, there is still significant regulatory uncertainty in many jurisdictions, and without explicit endorsement or regulation some businesses and users may be hesitant to adopt Bitcoin. New York was the first U.S. state to create specific licensing requirements unique to Bitcoin companies (termed the "BitLicense") and other states such as California are currently working on Bitcoin-specific regulatory clarity—either or both of which could become a basis for regulation in other jurisdictions around the world. While the regulatory burden could be costly for some Bitcoin companies, there's also an indirect cost to the regulatory uncertainty that is apparent in the challenge that many Bitcoin companies have in establishing banking and certain other partnerships.

How can we contextualize the magnitude of the opportunity for Bitcoin? How do we value Bitcoin? What are our assumptions about future adoption and how might that impact the price of Bitcoin?

To contextualize the magnitude of the market opportunity for Bitcoin, we divide the market into two major sources of demand: Bitcoin's value as a "digital gold" and its utility as an alternative payments channel.

"Digital Gold"

Based on evaluations of the movement of individual Bitcoin[17,18] we estimate that roughly 75% of all Bitcoin is currently dormant or held as an investment in Bitcoin as a "digital gold". Bitcoin's appeal in this segment is largely attributable to its known finite supply and its value as a liquid speculative investment in a nascent technology. Given a current total Bitcoin market capitalization of $6.4 billion, we estimate that the portion of Bitcoin's total market capitalization associated with its value as a "digital gold" is roughly $4.8 billion.

In comparing this market capitalization to the gold market, we differentiate the overall total gold market (which includes those owning and holding physical gold) from the portion of the gold market that is held in exchange-traded funds (ETFs). In actuality, owning and holding Bitcoin is probably closer to owning physical gold in that the owner is (or can be) completely and solely in control of the asset without any potentially competing claims. However, this overall physical gold market includes many segments that may not find appeal in Bitcoin in the short to medium term. For example, we think it is highly unlikely that segments of this market where gold has cultural value (i.e., in India, where gold may be passed down for generations) will be likely to adopt Bitcoin as a supplement or alternative.

Instead, we believe that the better comparable is the portion of the gold market held in ETFs—that is, we think that people who gain exposure to gold via ETFs are significantly more likely to add Bitcoin to their investment portfolio than the segment of the gold market that buys physical gold. We estimate there is $74 billion worth of gold held in ETFs around the world. In comparison, the portion of Bitcoin's total market capitalization that we attribute to its value as a "digital gold" is $4.8 billion—roughly 6% of the size of the gold ETF market. We estimate that demand could push this figure to 25% of the gold ETF market by the end of 2020. The size of the gold ETF

[17] Nermin Hajdarbegovic, "Analysis: Around 70% of Bitcoins Unspent for Six Months or More" (2014), CoinDesk
[18] Dan Goodin, "78 percent of Bitcoin currency stashed under digital mattress, study finds" (2012), Ars Technica

market fluctuates up and down with demand, so we assume a constant-sized gold ETF market for which 25% would represent $18.5 billion in demand for Bitcoin as a "digital gold". While this $18.5 billion is significant relative to the gold ETF market, it would represent less than 0.3% of the broader $7 trillion gold market.

We think that our estimate of 25% of the gold ETF market could ultimately prove conservative given that, in at least one respect, Bitcoin has an access advantage (it can be acquired without a bank or brokerage account) and because holding gold ETFs and Bitcoin are not mutually exclusive (we think that gold ETF investors would find value in Bitcoin for its diversification[19] and upside potential). Further, the investment appeal in Bitcoin as a "digital gold" extends beyond its finite supply and also includes the portion of the market that owns it as a rare opportunity to hold a liquid speculative investment in a nascent technology (blockchain). There could also be significant upside to our estimate if mainstream financial institutions were to further integrate Bitcoin into offered services—for example, if a Bitcoin ETF were approved to trade on one of the world's major stock exchanges or if major banks or FX brokers began offering Bitcoin services (purchase, storage, payments, etc.)—but this is not currently priced into our estimates and assumptions.

Payments Utility

The global payments market is immense: According to Boston Consulting Group's "Global Payments 2015" report[20] and corresponding interactive edition[21], the total value of global non-cash transactions topped $430 trillion in 2014 and is forecasted to top $619 trillion in 2020.

The total $619 trillion forecast can be divided into retail payments (those initiated by consumers) and wholesale payments (those initiated by businesses and governments). Of the two, the total value of wholesale payments is significantly larger than the total value of retail payments (2020 forecast of $552 trillion vs. $68 trillion). While it's certainly possible that Bitcoin finds traction in the wholesale payments market (for example, Align Commerce targets underserved SMB businesses and uses the Bitcoin payment rail), for conservatism we're currently limiting our adoption projections to the retail market given some reluctance among financial institutions and governments in particular to consider public blockchains like Bitcoin. While recently there have been significant shifts among some financial institutions toward Bitcoin (namely, a Bitcoin integration at USAA via Coinbase), we think it's too early to price this scenario into our assumptions. For these reasons and because the pain point is stronger in the retail market where fees (especially as a percentage of transaction value) are significantly greater, we limit our adoption projections to the retail market for now.

Figure 20 High Cost of Retail Payments

"Although retail payments accounted for a small fraction of transaction values in 2014 (11 percent), they generated 78 percent of total payments revenues"

Source: Boston Consulting Group report "Global Payments 2015"

[19] "Bitcoin Correlations to Macro Environment: Gold and Yuan Standouts" (2016), TradeBlock

[20] Stefan Dab, Mohammed Badi, Laurent Desmangles, Gero Freudenstein, Alenka Grealish, Federico Muxi, Pedro Rapallo, Olivier Sampieri, Yann Senant, Kuba Zielinski, "Global Payments 2015: Listening to the Customer's Voice" (2015), Boston Consulting Group and SWIFT

[21] "Global Payments 2015: The Interactive Edition" (2015), Boston Consulting Group

We further subdivide the retail payments market to arrive at Bitcoin's addressable market opportunity as a payments channel. The first distinction we make within the retail payments market is between emerging markets and developed markets. We believe that adoption will be significantly greater in emerging markets (albeit still a small portion overall) than in developed markets given that financial inclusion is significantly lower in emerging markets, the viable alternatives are fewer (and of lower quality), and that emerging market countries tend to have less stable currencies, more onerous capital controls, and more frequent economic, monetary, or financial crises.

We also subdivide both the developed retail payments market and the emerging retail payments market into the portion of transactions that are domestic versus cross-border. We assume greater adoption for cross-border transactions given that, relative to alternatives, the advantages of leveraging Bitcoin as a low-cost, fast, and borderless payments channel are greater for cross-border transactions than for domestic transactions.

Taken together, we assume the greatest rate of adoption for cross-border transactions initiated in emerging markets (2% of $2 trillion market), followed by cross-border transactions initiated in developed markets (1% of $1 trillion market), followed by domestic emerging market transactions (0.40% of $24 trillion market) followed by domestic developed market transactions (0.10% of $40 trillion market).

Figure 21 Estimated Bitcoin Retail Payments Market Share

The Market

2020 Estimated Retail Payments Values ($billion)		
	Developed Markets	Emerging Markets
Cross-Border	$813	$2,137
Domestic	$40,224	$24,363

Bitcoin % Share

Estimated 2020 Bitcoin Retail Payments Market Share		
	Developed Markets	Emerging Markets
Cross-Border	1.00%	2.00%
Domestic	0.10%	0.40%

Bitcoin $ Share

2020 Estimated Retail Payments Values ($billion)		
	Developed Markets	Emerging Markets
Cross-Border	$8	$43
Domestic	$40	$97

Source: Boston Consulting Group, Needham & Company, LLC

In total, we estimate roughly $189 billion of payments value transacted via Bitcoin in 2020 which, assuming payments velocity of 12, would require a monetary base of $16 billion.

Aggregating the Demand

Aggregating our two sources of demand for Bitcoin (as a "digital gold" and as a payments channel) we estimate a 2020 required monetary base of $34 billion. Given a 2020 estimated average Bitcoin supply of 18 million, we estimate the required price of Bitcoin in 2020 to support demand to be $1,896. We apply a discount rate of 25% to arrive at a present value for Bitcoin of $655 which equates to a price target of $62 per share of the Bitcoin Investment Trust (each share represents ~0.095 Bitcoin as of 2/29/16)

See our model below and the infographic in the appendix of this report for a visualization of our estimates.

Figure 22 Bitcoin Model

Demand Source 1: Payments Utility

2020 Retail Payments Value (Domestic)			
Region	**Value ($billion)**	**Market share**	**Share Value (billion)**
APAC (EM)	12,502	0.40%	$50.0
LatAm	5,537	0.40%	$22.1
MENA	1,920	0.40%	$7.7
Rest of World	1,683	0.40%	$6.7
Eastern Europe	2,720	0.40%	$10.9
APAC (DM)	4,346	0.10%	$4.3
North America	24,830	0.10%	$24.8
Western Europe	11,048	0.10%	$11.0
Domestic Retail Total	**64,587**	**0.213%**	**$137.7**

2020 Retail Payments Value (X-border)			
Region	**Value ($billion)**	**Market share**	**Share Value ($billion)**
APAC (EM)	1,851	2.00%	$37.0
LatAm	63	2.00%	$1.3
MENA	58	2.00%	$1.2
Rest of World	77	2.00%	$1.5
Eastern Europe	88	2.00%	$1.8
APAC (DM)	266	1.00%	$2.7
North America	196	1.00%	$2.0
Western Europe	350	1.00%	$3.5
X-border Retail Total	**2,950**	**1.725%**	**$50.9**

2020 Retail Payments Value (Domestic & Cross Border)			
Region	**Value ($billion)**	**Market share**	**Share Value (billions)**
APAC (EM)	14,353	0.61%	$87.0
LatAm	5,601	0.42%	$23.4
MENA	1,979	0.45%	$8.8
Rest of World	1,760	0.47%	$8.3
Eastern Europe	2,808	0.45%	$12.6
APAC (DM)	4,612	0.15%	$7.0
North America	25,026	0.11%	$26.8
Western Europe	11,399	0.13%	$14.6
Retail Total	**67,537**	**0.279%**	**$188.5**
Assumed Velocity			12
2020E Bitcoin Payments Monetary Base (billions)			**$15.7**

Demand Source 2: "Digital Gold"

Bitcoin as "Digital Gold"	
Bitcoin Price (1 Month Average)	$415
Bitcoin Supply (millions)	15.35
Bitcoin Market Cap (billions)	$6.38
"Digital Gold" % of Total BTC Cap (Estimate)	75%
BTC Digital Gold Market Cap (billions)	$4.78

Gold ETF Market	
Top 10 Gold ETF AUM (Tonnes of Gold)	1,604
Estimated Total Gold ETF AUM (Tonnes) (+5%)	1,684
Estimated Total Gold ETF AUM (Ounces)	59,415,878
$/Ozgold (1 Month Average)	$1,246
Gold ETF Market Cap (billions)	$74

Total Gold Market	
Est. Total Above Ground Gold (Tonnes)	165,000
$/OZgold	$1,246
Total Gold Market Cap (billions)	$7,249

Bitcoin "Digital Gold" vs. Gold ETF Market & Total Gold	
Bitcoin Digital Gold as % of Gold ETF Market	6.5%
Bitcoin Digital Gold as % of Total Gold Market	0.1%
Target % of Gold ETF MC	25.0%
2020E Bitcoin Digital Gold Monetary Base (billions)	**$18.5**

Total

Aggregated Demand	
Total 2020E Bitcoin Monetary Base (billions)	$34.2
Total 2020E Average Bitcoin Supply	18,046,875
2020E Price Based on Supply/Demand	$1,896
Discount Rate	25%
Estimated Bitcoin Present Value	**$655**

Sources: Boston Consulting Group for Payments Market Forecasts; Needham & Company, LLC Estimates

Spencer Bogart

Source: Needham & Company, LLC

Longer term, how might Bitcoin gain greater mainstream adoption?

We think that Bitcoin has many advantages that could help drive adoption; however, in evaluating the potential for greater mainstream adoption, we instead focus on Bitcoin's biggest drawbacks and how they might be diminished or resolved over time—we think this is a necessary precondition to much broader adoption.

We see numerous catalysts that could drive greater mainstream adoption such as endorsements from major enterprises, financial institutions, financial technology companies and regulators or the development of "killer apps" that leverage Bitcoin (others discussed on page 24). However, even without any of those binary catalysts, we see another scenario where Bitcoin wins in the long-run: We think that time is on Bitcoin's side and that it could gain greater mainstream adoption by simply being the best alternative in an otherwise poor option-set.

We start from the premise that Bitcoin's two biggest drawbacks are its volatility and the fact that it is not a ubiquitously accepted payment method. Given these drawbacks, we think that adoption will first occur in places and situations where these drawbacks are simply still better than the alternatives.

The situations where Bitcoin becomes relatively more appealing include monetary, financial, and economic crises—which tend to occur at fairly regular intervals throughout the world. For example and as noted previously, in the short period from the mid-1970s to 2002, Argentina had eight currency crises, four banking crises, and two sovereign defaults.[22] Simply put, money has not worked well in Argentina. It's no surprise that Garrick Hileman, an economic historian at the London School of Economics, ranks Argentina #1 in his Bitcoin Market Potential Index (BMPI).

In short, the up and down volatility of Bitcoin seems almost unbearable until you're stuck in a local currency such as the Venezuelan bolivar, the Argentine peso, or the Brazilian real, for which inflation rates are projected to hit 275%, 38%, and 11%, respectively, in 2016. In these situations where a significant loss in purchasing power is imminent, the up and down volatility of Bitcoin is less concerning. Aside from instances of rampant inflation, Bitcoin is also relatively more attractive in economies with onerous capital controls, significant financial repression and/or unstable currencies.

We think that in these situations the probability of Bitcoin adoption is greater. As adoption grows, Bitcoin's market capitalization expands and in turn makes the price of Bitcoin more stable and less responsive to smaller shifts in demand. This serves to reduce volatility while also increasing the appeal for merchants to accept Bitcoin (because there are more consumers using it). We see this as a virtuous feedback loop for Bitcoin adoption in that as volatility falls and more merchants accept Bitcoin, it becomes more attractive to other consumers. We think that even without any other major catalysts this feedback loop could ultimately drive Bitcoin to greater mainstream adoption.

How have regulators approached Bitcoin and what is the regulatory outlook?

Globally, the regulatory approach to Bitcoin has been a mixed bag. On one end of the spectrum, some countries have banned the use of digital assets such as Bitcoin (Ecuador and Bolivia), others have taken a cautious regulatory approach (the United States, for example), while others have remained completely hands off (Estonia).

[22] Graciela Kaminsky, Amine Mati, Nadi Choueiri, "Thirty Years of Currency Crises in Argentina: External Shocks or Domestic Fragility?" (2009), George Washington University, NBER, and International Monetary Fund

Ultimately, regulatory risk will likely persist for years to come as existing regulations were not tailored to address Bitcoin as a new form of money or payment channel and, consequently, new rules will likely be written (such as the BitLicense in New York).

Overall, regulators in the US appear keen to avoid leveling very restrictive regulations in this innovative area and have taken a relatively cautious approach as a result. One good resource for Bitcoin users and investors based in the United States is Coin Center (www.coincenter.org) which is a "non-profit research and advocacy center focused on the public policy issues facing cryptocurrency technologies such as Bitcoin."

Among the most-often cited concerns in mainstream media regarding Bitcoin is its use for illegal money laundering and potentially as a channel for terrorist or narcotics financing. While there could be potential for such activities, it is estimated to be relatively low risk: For example, the UK Treasury and Home Office noted in its "UK national risk assessment of money laundering and terrorist financing" that digital currencies are low-risk for these types of activities. In fact, digital currencies received the lowest risk score for money laundering among 12 channels whereas the highest-risk channels/mediums were banks, accountancy service providers, cash and legal service providers. Despite the apparent facts on the ground, if the public or government regulators become concerned that Bitcoin is being used extensively for these purposes, it could introduce significant regulatory risk.

Figure 23 Risk of Digital Currencies as Tools for Money Laundering

National risk assessment on money laundering						
Thematic area	Total vulnerabilities score	Total likelihood score	Structural risk	Structural risk level	Risk with mitigation grading	Overall risk level
Banks	34	6	211	High	158	High
Accountancy service providers	14	9	120	High	90	High
Legal service providers	17	7	112	High	84	High
Money service businesses	18	7	119	High	71	Medium
Trust or company service providers	11	6	64	Medium	64	Medium
Estate agents	11	7	77	Medium	58	Medium
High value dealers	10	6	56	Low	42	Low
Retail betting (unregulated gambling)	10	5	48	Low	36	Low
Casinos (regulated gambling)	10	3	32	Low	24	Low
Cash	21	7	147	High	88	High
New payment methods (e-money)	10	6	60	Medium	45	Medium
Digital currencies	5	3	15	Low	11	Low

Source: UK HM Treasury and Home Office[23]

Still, the regulatory environment is a moving target that could prove favorable or detrimental to Bitcoin and, consequently, users and investors would be prudent to stay apprised of current regulatory developments in their country or state.

Risks

Hard fork: If there were a significant number of users and transaction processors ("miners") on the network that elected to choose an alternative version of the Bitcoin software the Bitcoin network could fork and potentially result in two different blockchains. This could have a significant adverse effect on the price, perception, and usage of Bitcoin.

"Cyber Attacks": There are numerous ways that users or attackers could try to manipulate, diminish or otherwise attack the Bitcoin network including but not limited to "51% attack", "selfish mining", Sybil attack, and Denial of Service (DoS) attacks. While the risk of these attacks and others is real, the Bitcoin network has overall been able to sustain and avert substantial attacks over its 7+ year history, and thousands of upgrades have made it better able to withstand potential attacks.

[23] "UK national risk assessment of money laundering and terrorist financing " (2015)

Alternative Blockchains / Alternative Digital Currencies: As Bitcoin has gained popularity over recent years there have been hundreds of "alt-coins" created that have attempted to serve a different use case or to improve upon Bitcoin's real or perceived deficiencies. However, blockchains and especially digital currencies tend to have a strong network effect and no other blockchain or digital currency has come close to matching Bitcoin in terms of total market capitalization.

Regulation: While regulatory agencies, particularly in the United States, have taken a relatively cautious approach to Bitcoin regulation, governments and regulators certainly have the ability to ban, outlaw or otherwise make it excessively onerous to access Bitcoin.

Bitcoin Investment Trust Liquidity: A decrease in liquidity for shares of the Bitcoin Investment Trust, specifically GBTC shares traded on OTCQX, could adversely affect the premium or discount of shares relative to their Net Asset Value (NAV). Currently GBTC shares on OTCQX trade at a substantial premium to their Net Asset Value and because this premium could rise or fall independent of demand for Bitcoin, non-accredited retail investors may better off buying Bitcoin from an exchange than gaining exposure through a titled, auditable investment product such as the Bitcoin Investment Trust which may better suited for the mandates of institutional and accredited investors.

Estimated 2020 BITCOIN DEMAND & PRICE TARGET

Demand Source: Payments

$619 Trillion
Estimated Total Global **2020** Payments Value

FOR NOW, WE EXCLUDE WHOLESALE PAYMENTS FROM **THE MARKET OPPORTUNITY**

RETAIL **$68 Trillion**

WHOLESALE **$552 Trillion**

We assume greater adoption in emerging markets;

$41 Trillion DEVELOPED MARKETS

$27 Trillion EMERGING MARKETS

And greater adoption for cross-border transactions

DOMESTIC	CROSS-BORDER	CROSS-BRODER	DOMESTIC
$40 Trillion	$1 Trillion	$2 Trillion	$24 Trillion
0.10%	1.00%	2.00%	0.40%
$40	$8	$43	$97

Bitcoin Payments Share: (%)
2020E
Bitcoin Payments Value: ($billion)

ESTIMATED TOTAL 2020 PAYMENTS VALUE VIA BITCOIN:
$189 BILLION

REQUIRED BITCOIN MONETARY BASE TO SUPPORT ESTIMATE:
$16 BILLION

ASSUMED VELOCITY
12

Demand Source: "Digital Gold"

The gold market is very large...
$7 TRILLION Estimated Total Value of All Above-Ground Gold → ...of which ETFs are a relatively small portion... → **$74 BILLION** Estimated Total AUM in Gold Exchange-Traded Funds (ETFs)

75% of Total Bitcoin Market Cap

We estimate...
$4.8 BILLION of Bitcoin's Current Market Cap is Attributable to Value as "Digital Gold" → ...which is roughly 6% of the size of the gold ETF market... → **6%**

We estimate demand could push this to 25% by 2020

25%

WE ESTIMATE THAT BY 2020 THE PORTION OF BITCOIN'S MARKET CAPITALIZATION ASSOCIATED WITH ITS VALUE AS A "DIGITAL GOLD" COULD GROW TO 25% OF THE SIZE OF THE GOLD ETF MARKET, OR ROUGHLY...

$19 BILLION

ESTIMATED 2020 BITCOIN DEMAND

$19 BILLION	$16 BILLION	$34 BILLION	18.05 MILLION
From Value as a Digital Gold :	From Utility as a Payments Mechanism:	Total Estimated 2020 Bitcoin Demand	Estimated 2020 Avg Bitcoin Supply

$655	25%	$1,896
Estimated Bitcoin Present Value	Discount Rate	2020 Price Based on Estimated Supply and Demand

This infographic should be read in conjunction with associated report containing relevant disclosures.

Payment market forecasts from Boston Consulting Group "Global Payments 2015" Report. All other estimates and forecasts from Needham & Company, LLC.

Needham
Investment Banking & Asset Management

Demand Source 1: Payments Utility

2020 Retail Payments Value (Domestic)			
Region	**Value ($billion)**	**Market share**	**Share Value (billion)**
APAC (EM)	12,502	0.40%	$50.0
LatAm	5,537	0.40%	$22.1
MENA	1,920	0.40%	$7.7
Rest of World	1,683	0.40%	$6.7
Eastern Europe	2,720	0.40%	$10.9
APAC (DM)	4,346	0.10%	$4.3
North America	24,830	0.10%	$24.8
Western Europe	11,048	0.10%	$11.0
Domestic Retail Total	**64,587**	**0.213%**	**$137.7**

2020 Retail Payments Value (X-border)			
Region	**Value ($billion)**	**Market share**	**Share Value ($billion)**
APAC (EM)	1,851	2.00%	$37.0
LatAm	63	2.00%	$1.3
MENA	58	2.00%	$1.2
Rest of World	77	2.00%	$1.5
Eastern Europe	88	2.00%	$1.8
APAC (DM)	266	1.00%	$2.7
North America	196	1.00%	$2.0
Western Europe	350	1.00%	$3.5
X-border Retail Total	**2,950**	**1.725%**	**$50.9**

2020 Retail Payments Value (Domestic & Cross Border)			
Region	**Value ($billion)**	**Market share**	**Share Value (billions)**
APAC (EM)	14,353	0.61%	$87.0
LatAm	5,601	0.42%	$23.4
MENA	1,979	0.45%	$8.8
Rest of World	1,760	0.47%	$8.3
Eastern Europe	2,808	0.45%	$12.6
APAC (DM)	4,612	0.15%	$7.0
North America	25,026	0.11%	$26.8
Western Europe	11,399	0.13%	$14.6
Retail Total	**67,537**	**0.279%**	**$188.5**
Assumed Velocity			12
2020E Bitcoin Payments Monetary Base (billions)			**$15.7**

Demand Source 2: "Digital Gold"

Bitcoin as "Digital Gold"	
Bitcoin Price (1 Month Average)	$415
Bitcoin Supply (millions)	15.35
Bitcoin Market Cap (billions)	$6.38
"Digital Gold" % of Total BTC Cap (Estimate)	75%
BTC Digital Gold Market Cap (billions)	$4.78

Gold ETF Market	
Top 10 Gold ETF AUM (Tonnes of Gold)	1,604
Estimated Total Gold ETF AUM (Tonnes) (+5%)	1,684
Estimated Total Gold ETF AUM (Ounces)	59,415,878
$/Ozgold (1 Month Average)	$1,246
Gold ETF Market Cap (billions)	$74

Total Gold Market	
Est. Total Above Ground Gold (Tonnes)	165,000
$/OZgold	$1,246
Total Gold Market Cap (billions)	$7,249

Bitcoin "Digital Gold" vs. Gold ETF Market & Total Gold	
Bitcoin Digital Gold as % of Gold ETF Market	6.5%
Bitcoin Digital Gold as % of Total Gold Market	0.1%
Target % of Gold ETF MC	25.0%
2020E Bitcoin Digital Gold Monetary Base (billions)	**$18.5**

Total

Aggregated Demand	
Total 2020E Bitcoin Monetary Base (billions)	$34.2
Total 2020E Average Bitcoin Supply	18,046,875
2020E Price Based on Supply/Demand	$1,896
Discount Rate	25%
Estimated Bitcoin Present Value	**$655**

Sources: Boston Consulting Group for Payments Market Forecasts; Needham & Company, LLC Estimates

Spencer Bogart

Source: Needham & Company, LLC

Valuation (Price Target: $62.00)

- We view shares of the Bitcoin Investment Trust (OTCQX: GBTC) as benefiting from the rise of value in their underlying security, Bitcoin. Based on our projected demand for Bitcoin as a "digital gold" and as a payments channel, we estimate a present value of $655 per Bitcoin which equates to a price target of $62 per share of the Bitcoin Investment Trust.

Potential Upside Drivers

Mainstream payment adoption: The most obvious longer-term positive catalyst for the price of Bitcoin is greater mainstream payment adoption. As shown in our estimates of potential adoption into major payment markets, even a very small slice of the global retail payments pie moving onto Bitcoin rails would be a significant positive catalyst for demand (and price). While we don't think that consumer adoption is about to turn exponential, we do expect to see rapid acceleration in the use cases and geographies where we believe Bitcoin is most useful, including cross-border payments and in many emerging market countries.

Scaling solution: While we view the current scaling debate as less of a problem and more of a product (and a strength) of an open-source development process for money, we also believe that major payments volumes that could move into Bitcoin are holding back until a solution is implemented and the outlook is clear. If a scaling solution is implemented without major turbulence we think it will be a positive catalyst not just because it would enable greater volumes but also because it would serve as an important historical precedent for Bitcoin's ability to tackle tough scaling challenges while simultaneously addressing leadership concerns.

Technical advancements: We think that technologies such as sidechains and the lightning network that are currently being developed could be positive catalysts for demand and price if they prove successful. Sidechains and the lightning network promise to help alleviate some of the biggest concerns with Bitcoin today, including privacy, speed and throughput. Similarly, these technologies (and others) could bring other use cases and increased demand to the Bitcoin blockchain (such as smart contracts as being developed by Rootstock).

Monetary crises: Throughout history, monetary, financial, and economic crises tend to occur at fairly regular intervals. These crises could be isolated to one country, one region, or even be global but, regardless, when traditional money and finance doesn't work well, people tend to seek alternatives and for many, the next crisis will be the first time that Bitcoin is an available alternative.

Improvements in access: While the on-ramps to Bitcoin have improved significantly over recent years, they still typically require a specialized Bitcoin provider. If Bitcoin and Bitcoin services were available through major financial institutions such as banks and FX brokers, we think this could significantly improve access and ultimately be a positive catalyst for price. Similarly if investors were able to gain exposure to Bitcoin through an exchange-traded fund (ETF) listed on a major stock exchange such as the NYSE or Nasdaq directly through their regular brokerage account, it could have a significant positive impact on price.

Risks to Target

Hard fork: If there were a significant number of users and transaction processors ("miners") on the network that elected to choose an alternative version of the Bitcoin software the Bitcoin network could fork and potentially result in two different blockchains. This could have a significant adverse effect on the price, perception, and usage of Bitcoin.

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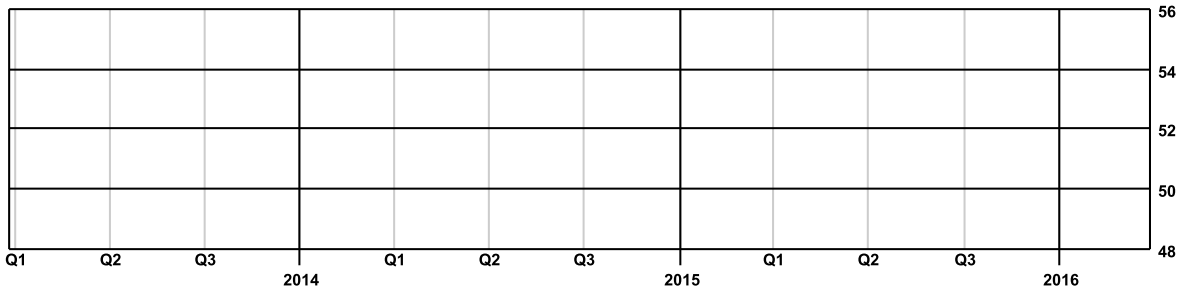
Rating and Price Target History for: Bitcoin Investment Trust (GBTC) as of 03-28-2016



The research analyst and/or research associate (or household member) has a financial interest in Bitcoin digital currency.

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Strong Buy	4	17
Buy	64	16
Hold	30	3
Underperform	< 1	0
Rating Suspended	< 1	0
Restricted	< 1	0

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