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18 December 2017

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Nine, Ten...Sixteen Thousand, but What is it? The Bitcoin Papers: A Hilliard Lyons Perspective

Bitcoin has grown this year into one of the most commonly discussed topics in the financial media; however, there are still discrepancies in the understanding of this nebulous term. Information and answers provided here will undoubtedly lead to follow-up questions, but in this piece, Hilliard Lyons will discuss some of the basic parameters that Wealth Advisors, and clients, need to know.

An Important Note: We believe that investors can meet long-term quantitative financial objectives and attain long-term qualitative financial goals without owning, trading or speculating in cryptocurrencies, tokens, or any related crypto-asset. We do not advocate trading/speculating in cryptocurrencies.

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Bitcoin and other cryptocurrencies along with related blockchain technology are relatively new concepts and their advancement has gained the attention of curiosity seekers, speculators, the tech savvy, and the general public. Readers should be aware this is a dynamic concept and industry, subject to changes and conditions that could occur quickly and dramatically.

Section I: Origin

Bitcoin (BTC) was created in 2009 by an anonymous user, ‘Satoshi Nakamoto’, on a cryptography mailing list. The initial purpose was to be an “electronic cash system” that required no trusted third party intermediary, thus facilitating peer-to-peer transactions. The entire system was based on a decentralization philosophy that allows the currency to transact without a central monetary authority (such as what the Federal Reserve is to the U.S dollar); to accomplish this disassociation from government-backed money and bank controlled payments, Satoshi Nakamoto created a **Blockchain** (explained in the next section, How It Works).

In the very early days, the currency was known to a narrow group of (mostly) computer programmers active in various online forums. The first online exchanges for Bitcoin were created in 2010, and quickly, Bitcoin became a preferred payment type for hackers, thieves, and black-market transactions due to its anonymity (one may recall the infamous “Silk Road” marketplace on the dark web). Accompanied by this negative reputation, the currency was largely written off by society and much of the mainstream financial system.

In late-2012 the Bitcoin Foundation was established to promote the currency worldwide and shed light on its potential benefits. While the foundation was not the only catalyst driving the shift in sentiment, it represented an initial step forward in Bitcoin gaining legitimacy. In 2013, Bitcoin was substantially introduced to the world as it garnered media attention due to its wild price volatility, perhaps most notably rising in price from ~\$100 to ~\$1,200 in only 30 days. During the same year, major governments began to make statements for the first time regarding the currency. China announced it would not allow its financial institutions to transact in Bitcoin; the US said it was open to the long-term prospects of Bitcoin’s underlying technology, but expressed and partially addressed concerns over its money laundering potential, including shutting down the aforementioned Silk Road.

2014 was a hallmark year in that several major retailers announced acceptance of Bitcoin including Dell, Microsoft (MSFT - \$86.85), and Overstock.com (OSTK - \$68.35). Enhanced legitimacy for Bitcoin led to other forms of cryptocurrencies, called **alt-coins**; the rise of some alternatives caused Bitcoin’s cryptocurrency market share to fall to 78% by the end of 2014. The following year was relatively uneventful for Bitcoin, as alternatives deemed ‘better’ usurped a measure of attention; characteristics of these alt-coins include faster transaction speeds and inherently better network scalability. Spurred in part by competitive forces, debate developed within the Bitcoin community as to whether or not updates should be applied to its Blockchain. From this time and through 2016, security proved to be a pressing issue as several exchanges succumbed to hacks, resulting in millions of dollars’ worth of lost coins. Nonetheless, the price of Bitcoin has remained the primary focal point of popular attention (particularly across 2017), with potential profits a leading driver of public interest, at the expense of more pragmatic usability and security concerns surrounding the currency.

Perhaps a simple way to tell the story of Bitcoin’s history is shown below, in viewing the peak prices from each year of existence. Note that prices up to 2013 are approximate; thereafter, prices are according to price data from the Coinbase exchange.

2009 – n/a, no exchanges established
2010 – \$0.29
2011 – \$29.58
2012 – \$13.31
(Bitcoin Foundation established in late-2012)
2013 – \$1,242
(Rise of alternative cryptocurrencies)
2014 – \$914 (falls as low as \$313)
2015 – \$457 (falls as low as \$200)
2016 – \$970
2017 – \$17,996 (to date)

Section II: How It Works

A Blockchain is effectively a **digital ledger** of transactions, connected via a network that is open to everyone. What makes a Blockchain unique is that it cannot be retroactively changed, revised or manipulated once a group of transactions have occurred, creating a 'block.' Once a block is established, it is added to all of the other transactions that have occurred on the network, creating a 'chain'. In this type of system it is not possible to issue returns or get your money back from an undesired transaction; once money is sent it is gone, thus presenting the double-edged sword of having no third party regulator or intermediary.

In order for transactions to be added to the chain they must be approved by a majority of 'nodes' on the network; the approval process is embodied by a universal computer protocol that is specific to Bitcoin (BTC). Each node that participates on this Blockchain network does so voluntarily; theoretically anyone can be (or could operate) a node. This entire approval process involves complex computer algorithms and is referred to as 'mining', but eventually only one node (the winner) will earn the right to confirm the transaction and ultimately add a block to the Blockchain.

An important point: in order to incentivize participation in the process of achieving consensus approval (or mining), this prior noted winner receives a fixed reward that comes in the form of new Bitcoin. This framework means that at the same time transactions are occurring on the Blockchain, new bitcoins are being created. The current reward stands at 12.5 BTC per block added; however, the system is set to halve that reward every time a certain number of blocks are created (210,000 blocks); for reference, the reward began at 50 BTC in 2009. As a result of this diminishing halving process, the total amount of Bitcoin that can ever be created is capped at about 21 million; at present there are roughly 16 million bitcoins in existence. While rewards for mining Bitcoin are decreasing over time, the process of mining blocks takes increasingly more computing power. Worth reiterating, all of these variables were predetermined by the algorithm put in place by Satoshi Nakamoto and, in true Blockchain fashion, cannot be altered.

Reverting to the theory that anyone can mine bitcoins, where we are on Bitcoin's timeline makes this impractical. Everyday desktop computers possessed enough power to realistically complete the approval process several years ago, but as popularity (and the value) of Bitcoin rose, hardware specifically designed for mining purposes was developed, and now stands as the only way to realistically generate a profit by mining when considering time value and energy costs.

Theoretically, regular desktops could still be utilized in mining applications, but winning a confirmation process would likely use more dollars of electricity than the bitcoin reward would be worth and, more importantly for a rational consumer, would take an extremely long time. Based on current mining difficulty, even the best desktop computer with top of the line processing capacity would take over 10,000 years to produce 1 BTC. As a result, the active community of entities that mine bitcoin has been consolidated to a few large players (businesses), due in part to the significant upfront cost of mining hardware. The chart on the next page is via Blocktrail.com and displays the distribution of blocks mined in the past year:

	24h	1W	1M	6M	1Y	Max
Pool	Blocks	%				
AntPool	9,839	17.64%				
DiscusFish / F2Pool	5,844	10.48%				
BTC.TOP	5,337	9.57%				
BTC.com	4,492	8.06%				
BTCC	4,041	7.25%				
ViaBTC	4,011	7.19%				
Bitfury	3,805	6.82%				
unknown	3,486	6.25%				
Slush	3,325	5.96%				
BW Pool	2,747	4.93%				
BitClub Network	1,910	3.43%				
GBMiners	1,490	2.67%				
1Hash	1,344	2.41%				
HaoBTC	1,118	2.01%				
Bitcoin.com	1,066	1.91%				
Kano CKPool	552	0.99%				
BATPOOL	442	0.79%				
Canoe Pool	321	0.58%				

Recently, there has been debate as to whether energy consumption for BTC purposes has gotten out of hand. While it is hard to quantify the exact magnitude of resources consumed by the BTC complex, there seems to be general consensus that it is significant. A source by the name of digiconomist.net has been tracking this issue since ~2014 via its relatively well-known Bitcoin Energy Consumption Index, which asserts that Bitcoin energy consumption is now greater than that of 159 countries based on kWh per year (recently surpassing Ireland). Most shocking in our view, based on its current growth rate, BTC could consume all of the world's current electricity production by February 2020. **An important point: These claims are all estimations, based on a range of assumptions that include:**

- **60% of mining revenue is spent on operations costs**
- **1kWh consumed = \$0.05 (the '60% pool')**

Nonetheless, this data serves the purpose of demonstrating a structural issue with the currency (energy consumption) that is allowed to balloon as the price of BTC surges. Below is more data from digiconomist.net (as of 12/7/17):

Key Network Statistics	
Description	Value
Bitcoin's current estimated annual electricity consumption* (TWh)	32.36
Annualized global mining revenues	\$ 11,322,523,149
Annualized estimated global mining costs	\$ 1,618,129,306
Country closest to Bitcoin in terms of electricity consumption	Serbia
Estimated electricity used over the previous day (KWh)	88,664,620
Implied Watts per GH/s	0.297
Total Network Hashrate in PH/s (1,000,000 GH/s)	12,551
Electricity consumed per transaction (KWh)	250.00
Number of U.S. households that could be powered by Bitcoin	2,996,536
Number of U.S. households powered for 1 day by the electricity consumed for a single transaction	8.45
Bitcoin's electricity consumption as a percentage of the world's electricity consumption	0.14%
(New) Annual carbon footprint (kt of CO2)	16,014
(New) Carbon footprint per transaction (kg of CO2)	123.73

Section III: How to (theoretically) Buy, Sell and/or Hold Bitcoin

Similar to most assets, bitcoins can be purchased from individuals or entities that own them; for retail purposes, this is most likely to occur on one of more than 50 active exchanges that are largely unregulated at this point. Without offering any view on the merits of buying/owing Bitcoin (BTC), we are comfortable suggesting a degree of caution when choosing an exchange, as all are slightly different and ascribe to varying security standards. Once an exchange is selected and a potential buyer creates an account, bank or credit/debit card information is provided; trading (buying and selling) may then take place in much the same fashion as other more-established markets. Hilliard Lyons does not permit Bitcoin purchases.

An important point: custodial standards and practices for ‘owned’ bitcoins are still under development. Remember, Blockchain transactions are irreversible, meaning stolen Bitcoin is essentially unrecoverable. At this juncture, it may be wise to take a step back briefly to talk about where bitcoins are held.

Bitcoins are ‘stored’ in a **Wallet**, although in a traditional sense, this is used lightly as bitcoins do not actually exist anywhere. Instead, what is actually stored are records of transactions. A record of a transaction involves 3 pieces of information; in a practical example, we say Clark would like to pay Barry:

1. (Originator) Clark originally received the bitcoin from Andrew, so he must include the address from which Andrew sent the bitcoin.
2. (Amount) How many bitcoins Clark wants to pay Barry.
3. (Forward) Clark must include Barry’s address to which the bitcoin will be sent.

Bitcoin addresses are not sensitive information and are public, similar to an email address. Here is an example of what one may look like:

3J98t1WpEZ73CNmQviecnyiWrnqRhWNLy

As a final wrinkle in the process, the only way for a transaction to occur from a wallet is with a secret **private key**. This key is the single most important aspect and must be kept secure, because anyone who has the key has access to any value contained within a wallet. Private keys are a bit longer than addresses:

E9873D79C6D87DC0FB6A5778633389F4453213303DA61F20BD67FC233AA33262

To summarize, there is no such thing as an account in regards to bitcoin in any tangible sense; one cannot look into a specific address to view a balance. Instead, the value associated with an address is found by looking back at all of the previous transactions and tabulating a running balance. A wallet aggregates this information for the owner and presents the balance in terms of BTC.

This may sound complex, and it seems esoteric by traditional standards; however, there may exist a silver lining and (pragmatically) a simplifying factor. Many exchanges offer wallets internally, and as a result, hold private keys for their clients. This is referred to as keeping your bitcoin ‘on the exchange.’ This procedure makes ownership as easy as entering an order; one can check back through the exchange interface to see an account value. Doing this, however, explicitly places an owner of Bitcoin at risk of the specific exchange being hacked, and its portfolio of private keys stolen. It is fair to assume that if a private key is compromised, any bitcoins held in the associated wallet would be quickly stolen, with no avenues for recourse. Exchanges obviously face an ongoing battle in terms of security, but as time progresses and the Bitcoin complex matures, it would seem reasonable that advancements will materialize (as custodial standards have developed for other markets) given the complexity involved with ownership options that are not ‘holding on the exchange’.

The primary alternative to housing a bitcoin ‘on’ an exchange is to hold a wallet on/in a separate location, including a phone, desktop, or even on an external hard drive disconnected from the internet all together. The mechanics involved in carrying out this task are not particularly important to the theory of Bitcoin, but it should

be well understood that holding Bitcoin ‘off’ an exchange adds another level of security, provided an owner remembers their private key! If lost, private keys are non-replaceable and are effectively non-replicable, as might be assumed by taking another look at the 64-character sample key provided in this report.

Practically, when using BTC to make a purchase at a retailer (i.e. overstock.com), the interface is essentially the exact same as if paying with a credit card and, in most cases, may require less information. If one wanted to make a \$15 purchase by selecting the BTC payment option, likely all that would be required is an email address and then, depending on the site, it may ask for a QR code, Bitcoin address, or a link to sign into Coinbase. The latter being the simplest, the customer simply logs in and authorizes the transaction. Retailers will usually use the spot exchange rate at the time of the transaction and then will take the corresponding BTC out of your wallet, in this case $\$15 = .00091324\text{BTC}$ (at present). If the buyer decided to send the item back and wanted the return in BTC as well, it is likely the retailer would use the exchange rate again at current time and not the rate of the initial transaction.

Section IV: Alternatives

A common misconception is that Bitcoin (BTC) is alone in the realm of cryptocurrency, when in reality there exist hundreds of other alternatives, as referenced earlier. Bitcoin was only the first and (still) most visible cryptocurrency. Despite the meteoric price rise of bitcoin, the ubiquitous first mover only represents about 55% of the total market value of all cryptocurrencies; while that is certainly still dominant, alternatives are worth noting given an equivalent market share stood at effectively 100% just ~5 years ago. Outlined below is a snapshot of the top 14 cryptocurrencies by market cap, according to coinmarketcap.com as 12/4/17:

#	Name	Market Cap	Price	Volume (24h)	Circulating Supply	Change (24h)	Price Graph (7d)
1	 Bitcoin	\$190,975,567,475	\$11,422.30	\$6,865,870,000	16,719,537 BTC	-2.96%	
2	 Ethereum	\$44,720,451,560	\$465.21	\$1,075,060,000	96,130,221 ETH	-3.10%	
3	 Bitcoin Cash	\$25,712,721,470	\$1,527.09	\$859,945,000	16,837,725 BCH	-5.44%	
4	 Ripple	\$9,679,625,160	\$0.250619	\$122,726,000	38,622,870,411 XRP *	-3.37%	
5	 IOTA	\$7,824,322,156	\$2.81	\$967,921,000	2,779,530,283 MIOTA *	47.40%	
6	 Dash	\$5,896,975,590	\$762.57	\$173,757,000	7,733,049 DASH	-3.49%	
7	 Bitcoin Gold	\$5,360,706,490	\$321.23	\$148,996,000	16,688,011 BTG	-4.13%	
8	 Litecoin	\$5,358,575,249	\$99.01	\$358,236,000	54,123,633 LTC	-4.63%	
9	 Cardano	\$3,417,032,334	\$0.131794	\$68,977,400	25,927,070,538 ADA *	-1.31%	
10	 Monero	\$3,049,615,304	\$197.60	\$70,501,100	15,433,120 XMR	-3.67%	
11	 Ethereum Classic	\$2,947,967,756	\$30.06	\$325,643,000	98,072,063 ETC	-4.11%	
12	 NEO	\$2,732,938,000	\$42.05	\$144,353,000	65,000,000 NEO *	12.03%	
13	 NEM	\$2,468,277,000	\$0.274253	\$18,877,600	8,999,999,999 XEM *	-1.82%	
14	 EOS	\$1,938,264,383	\$3.75	\$157,270,000	517,324,368 EOS *	-3.72%	

Acknowledging there are outliers, one will likely notice the majority of price graphs in the far right column look similar; simplistically, for the most part, the cryptocurrency asset class has shown correlation, seemingly keying off moves in Bitcoin.

A logical next question may be “*what is the difference then between BTC and any of the others on the list?*” In some instances, the answer is not much; however, some alternative currencies are on different Blockchains entirely. Blockchains themselves function with a standard set of properties, as described previously, but the inherent protocols that govern what transactions are accepted for inclusion on the Blockchains are different. In other words, different cryptocurrencies have unique governing algorithms; they have different rules.

Coins that are built upon the same underlying protocol as Bitcoin represent one subset of alt-coins. One may recall that Bitcoin was built open-source, or open to anyone. If a group of interested parties decides they want to create a new variant of the Bitcoin ‘rules’, they can **‘Fork’** (or split) their new version from the original Blockchain. A fork is necessary because transactions offered for approval based on new rules would not be compatible, and would otherwise be denied. One reason for a split might be to increase the size of blocks that are added to the chain, thus increasing transaction speeds. It is possible for a change to be made to current protocol without a split; however, this requires a vast majority approval from the mining community (~80%+).

Alt-coins can also be created with their own native Blockchains, meaning they could be significantly different than Bitcoin. These alt-coins may have been created with different goals or visions for their use, and their properties likely reflect this. **An important point: Bitcoin’s original purpose was to be a currency and nothing more.** Outside of Bitcoin and its derivatives however, most other alt-coins are not based upon the currency model, and instead have other underlying purposes to their Blockchain.

For example, take Ether (ETH), the #2 cryptocurrency in terms of market cap. ETH is built upon the native Ethereum Blockchain whose key feature revolves around smart contracts; this blockchain offers a decentralized way to have verification and enforcement of peer-to-peer contracts. Once terms for an agreement are made, they can be coded into the Ethereum Blockchain (remember this means they cannot be altered); then when those terms are met, the contract will be executed automatically. It may be helpful to think of a contract in loose terms, as in any set of if/then statements or set of progressive instructions. Ether, as a cryptocurrency, is simply the reflection of the market value ascribed to the execution of the preponderance of contracts held on the Ethereum Blockchain.

To conclude our discussion of alternative cryptocurrencies, it is important to be mindful of the idea that differing alt-coins carry varying levels of security, somewhat mirroring our assertions tied to different Bitcoin exchanges. Similarly, we believe interested parties should be aware that alt-coins have historically displayed Bitcoin-like volatility (if not more volatility). At the time of this writing, BTC was up ~1,065% for the calendar year 2017, while ETH was up ~5,503% over the same time frame.

Section V: Tokens

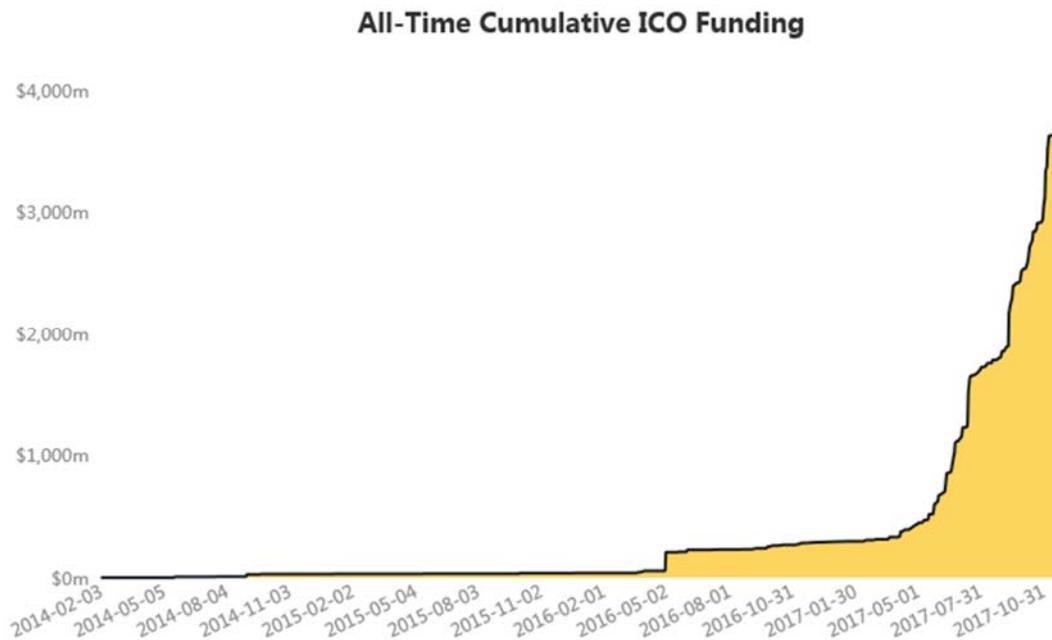
Rising in visibility in recent months, and creeping into the lexicon of mainstream media and a range of securities regulators, is the Initial Coin Offering, or simply ICO. As the name might imply, these events are similar to the traditional IPO that is well understood by most traditional market participants; ICOs are simply executed in the realm of crypto. An ICO is where a company (or other entity) raises funding by issuing what are called **‘Tokens’** that represent an interest in the underlying company, in much the same fashion as traditional equity shares might represent interest in a corporation. **An important point: The term ‘interest’ is used loosely, as described further momentarily.**

Tokens are issued on top of an existing Blockchain (primarily Ethereum to this point), which means they hold some of the same functional properties as a coin or alt-coin. These tokens though, theoretically represent value of the entity raising money through the ICO, as opposed to representing value of an underlying Blockchain (like ETH and the Ethereum Blockchain), or as opposed to being a standalone currency (like BTC).

ICOs are crowdsourced, effectively allowing anyone to participate provided an ‘investor’ has the cryptocurrencies needed to buy-in. ICO offering periods usually last for a brief period, maybe even a couple of days. Amongst the Bitcoin and cryptocurrency fervor in 2017, ICOs have exploded in popularity, bringing

offering entities an alternative way to raise funds versus traditional avenues (i.e. venture capital). ICOs are attractive to some for several reasons: participation is easy (potentially skirting accredited investor verifications), they are substantially unregulated (skirting compliance procedures produced by decades worth of securities legislation), and offering entities can raise *significant* amounts of capital without giving up ANY ownership interest in the company or venture. **Important note: Tokens only represent a ‘stake’ in a company, not a well-defined equity interest; what that ‘stake’ means is up to the discretion of the offering entity.**

To date, there has been no ICO-specific regulation. Little SEC enforcement action against ICO activities under existing regulatory statutes has taken place, although a Cyber arm of the Securities and Exchange Commission was established in September 2017. Perhaps intuitively, many ICO’s are accompanied by extremely few disclosures, leaving ample room for scams. We acknowledge some interest in the concept of ICO funding; however, under current frameworks, we find the growth of ICO funding in dollar terms in 2017 to be alarming. The following chart is as of November 26, 2017, from coindesk.com.



Total ICO funding has gone from ~\$300MM at the end of 2016 to \$3.775B, with still a month to go in 2017. The three ‘most successful’ funding rounds have raised \$185MM, \$232MM, and \$257MM, respectively.

December 1, 2017, was a landmark date in the ICO realm as the aforementioned SEC cyber unit filed its first charges, along the lines of prior guidance that suggested ICOs and their resulting coins could qualify as securities. The SEC has ordered a freeze of assets of those behind the company PlexCorps, which had recently raised \$15MM via an ICO of ‘PlexCoin’. Charges state that PlexCorps marketed and sold securities on the internet and falsely claimed the assets would yield a “1,354% profit in less than 29 days”. We expect the ensuing proceedings (and rulings) to have implications across the crypto-asset environment and provide insight into the direction of initial regulatory parameters.

Section VI: Practical Ramifications for Long-term Wealth Creation

Following education, comes action (even if it is inaction...spoiler alert), particularly in the world of investing and wealth advising. Before discussing a few granular concerns touching on several of the topics of this collection, we reiterate and re-emphasize a long-held view of the Hilliard Lyons Investment Strategies Group: **An Important Note: We believe investors can meet long-term quantitative financial objectives and attain qualitative long-term financial goals without owning, trading or speculating in cryptocurrencies, tokens, or any related crypto-asset. We do not advocate trading/speculating in cryptocurrencies.**

Although not necessarily our primary reason for offering this report, our discussion of Blockchain may offer our most constructive takeaway. Blockchain, remember—a digital ledger that cannot be changed or corrupted—is in our view, an exciting development in isolation from any current applications in the crypto world. Millions, if not billions, of transactions take place daily throughout the global economy, and even the slightest of process improvements, replicated trillions upon trillions of times, could yield very meaningful efficiency gains (not to mention enhanced data security). We hesitate to predict Blockchain will become as impactful as ‘e-communication’ or ‘automation’ or any number of other themes that shape our world; however, we are comfortable asserting that a range of widely-held blue chip companies across investor portfolios are working to capitalize on the technology, for the ultimate benefit of shareholders.

Somewhat more nuanced is our view on Bitcoin. We believe investors and advisors are best-suited by viewing the cryptocurrency as a speculative trading instrument, and then making a decision whether or not that type of instrument is worthy of further discussion. We specifically dissuade interested parties from starting their individual suitability analysis with a price chart of BTC’s meteoric price rise, and our analysis thus far has failed to yield sufficient evidence to support adding ‘crypto’ or BTC to our standard suggestion for asset allocation; we expect this will remain the case for the foreseeable future.

At our most lenient, we see the potential for BTC to develop into an established store of value; should this play out, Bitcoin would mirror some of the characteristics of gold (non-income producing, few practical uses, immune to political turmoil). Having offered that, we are compelled to point out that we see extremely low likelihood that BTC is ever able to establish itself as a ubiquitous worldwide currency, as it was originally intended. Capacity constraints inherent in the Bitcoin protocol become a concern at some point, as the current rate of 7 transactions per second is already woefully inadequate to handle the preponderance of financial transactions that occur today. Furthermore, success breeds copycats, and just as easily as Bitcoin was created, we suspect that other cryptocurrencies could emerge at some point (if necessary) that would structurally be better equipped to be a ubiquitous store of value/currency.

We also remind interested parties that ‘nodes’ are necessary to complete Bitcoin transactions, and that these nodes are BTC miners. Once BTC mining becomes impractical for even the best super computers (as bitcoins outstanding reaches its limit of ~21MM), we see two possible outcomes: A) a liquidity crisis, in which BTC become non-transferable (read: worthless), or more likely B) consensus revisions to the standing Bitcoin protocol that damage the rigid framework that backstops BTC’s current value (read: some sort of de-valuation? inflation?).

We more actively dissuade activity in the ICO market by retail participants. The environment is ripe for scams at this juncture, and even the legitimate offerings seem to be operating in a legal gray area. If ICO ‘tokens’ are attempting to replicate equity interests, we submit that well-established equity markets across the globe remain a fine place to gain these exposures.

Additional information is available upon request.

Stock priced as of market-close on Friday, December 15, 2017.

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