

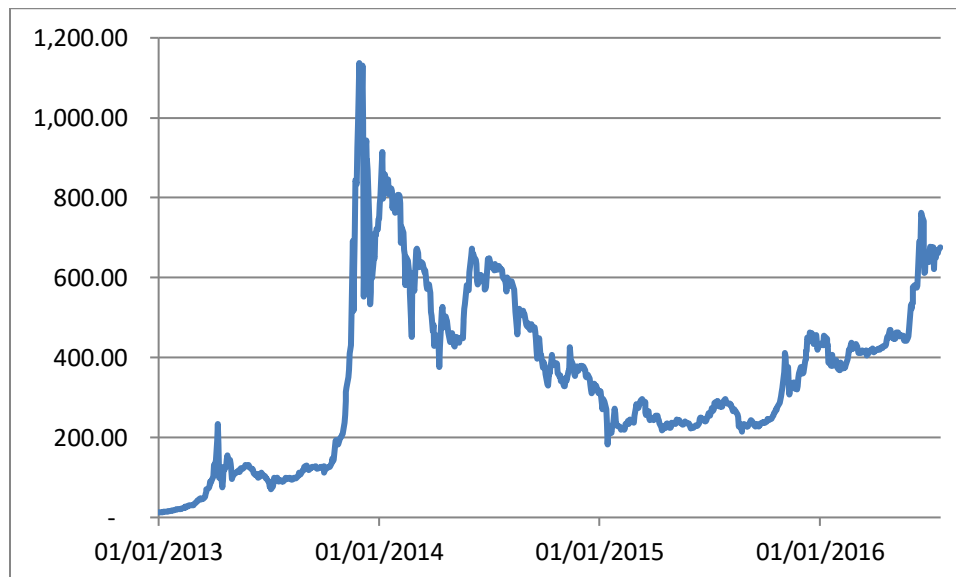
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Bitcoin: An Introduction

The digital asset has taken the world of payment systems by storm. Since its development in 2008, by an anonymous programmer, Bitcoin has promised to disrupt the existing global payments system. The decentralized virtual currency has the potential to provide low-to-no-cost transactions by taking advantage of its open source distributed ledger, referred to as the Blockchain.

Unfortunately, while the innovation has made strides in the industry by increasing the visibility and implementation of Blockchain technologies as applied to financial transactions, the persistent volatility of Bitcoin has made it difficult to be effectively used as a currency. This is primary due to the "store of value" characteristic attributed to successful currencies. That is, if the value of Bitcoin vis-à-vis the USD, for example, continues to fluctuate significantly then its success as a currency may be impaired. Figure 1 shows the value of Bitcoin versus the USD since 2013. It has ranged from \$13.36 USD/BTC to over \$1,000 USD/BTC. Recently, its value has fallen to approximately \$570 USD/BTC.

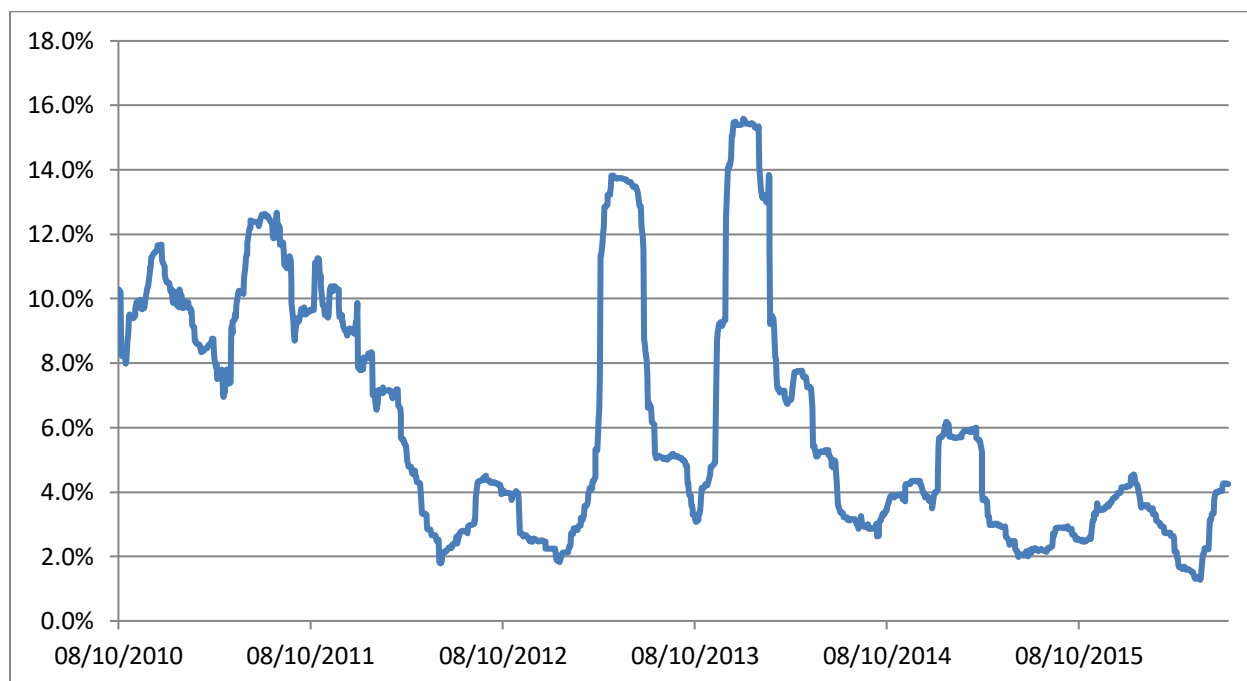
Figure 1: Dollars per Bitcoin 2013 -July 2016



Source: Bloomberg Data

This is a major impediment to the widespread adoption of Bitcoin. However, as the usage of the digital asset increases, volatility will start to normalize as noted in Figure 2 below.

Figure 2: Rolling 60 day volatility (not annualized)



Source: Bloomberg Data and VAAM Calculations

An interesting use of Bitcoin has been its inclusion into traditional portfolios. Investors have taken advantage of the asset's risk characteristics to diversify their holdings. Recent research by ARK Invest¹ demonstrates that over the past 5 years, Bitcoin has maintained a low to negative correlation with a wide range of traditional assets -- even with emerging market currencies. The Table below eloquently demonstrates this fact.

Table 1: Maximum "absolute value" one-year correlations since 2011

Asset	Bitcoin Correlation
S&P 500	0.36
US Bonds	-0.37
Bitcoin	1
Gold	-0.33
US Real Estate	-0.36
Oil	-0.36
Emerging Market Currencies	0.29

¹ <http://research.ark-invest.com/bitcoin-asset-class>

Source: Adapted from Table 4 Ark Invest Management LLC²

As shown above, the risk characteristics of Bitcoin suggest that it may be attractive to include in traditional portfolios as it has strong negative-to-low correlations with many assets. However, the

diversification benefit from holding assets is only one part of the story. In order to get a better picture of the benefits of including Bitcoin, we need to analyze its return characteristics. Table 2 shows the annualized geometric returns for Bitcoin since 2011 along with the total return for the S&P 500 for comparison.

Table 2: Annualized returns and volatility since 2011

	<u>BTC</u>	<u>S&P TR</u>	<u>BTC</u> <u>VOL</u>	<u>S&P</u> <u>VOL</u>	<u>BTC</u> <u>Ret/Risk</u>	<u>S&P Ret/Risk</u>
2011	1317%	2.11%	293%	16%	4.49	0.13
2012	218%	16.00%	53%	11%	4.11	1.49
2013	5428%	32.39%	272%	8%	19.99	3.82
2014	-58%	13.69%	70%	8%	(0.83)	1.65
2015	36%	1.38%	64%	14%	0.57	0.10
2016*	137%	7.82%	52%	13%	2.65	0.59

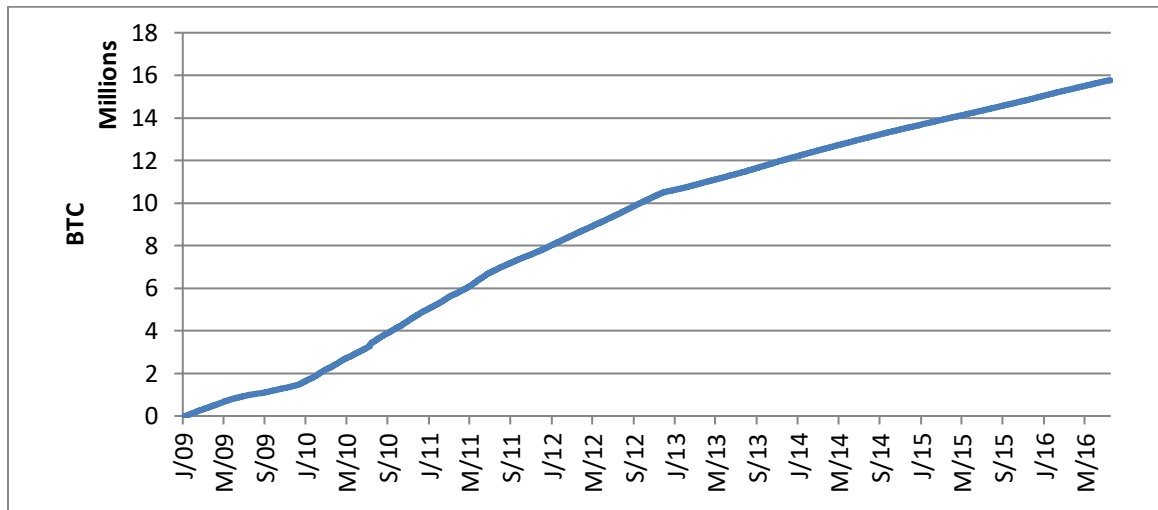
Source: Bloomberg Data (*YTD)

While the performance of Bitcoin over the past 6 years is impressive even on a relative basis, it is important to keep in mind that the reduction in volatility, as result of increased widespread transactional usage, will make it unlikely to achieve the magnitude of returns experienced previously. That is, while return/risk ratio of Bitcoin has made it historically attractive relative to the S&P, this metric has been declining in recent years.

Moreover, the design or underlying structure of Bitcoin is conducive towards supply constraints. In other words, the amount of Bitcoin outstanding has a limit. Currently, Bitcoin transactions rely on the facilitation of "miners". Miners are responsible for clearing transactions and publishing to the public ledger (the Blockchain). These participants are rewarded for their activities with newly created Bitcoins, hence the term "miners". This creates a potential problem for Bitcoin users, as the supply of Bitcoin reaches its limit "miners" would need to be compensated for their activities via alternate means. This is where transaction fees reenter the Bitcoin world. It is conceivable that, when the supply reaches its limit, transactions will be prioritized according to the associated fees. This will affect the attractiveness of Bitcoin as a medium of exchange and therefore impact its characteristics as an asset class. However, if the ubiquity of Bitcoin increases significantly it is possible that these fees will become trivial. Figures 3 and 4 below show the supply of Bitcoin and the Monetary Base of the US respectively.

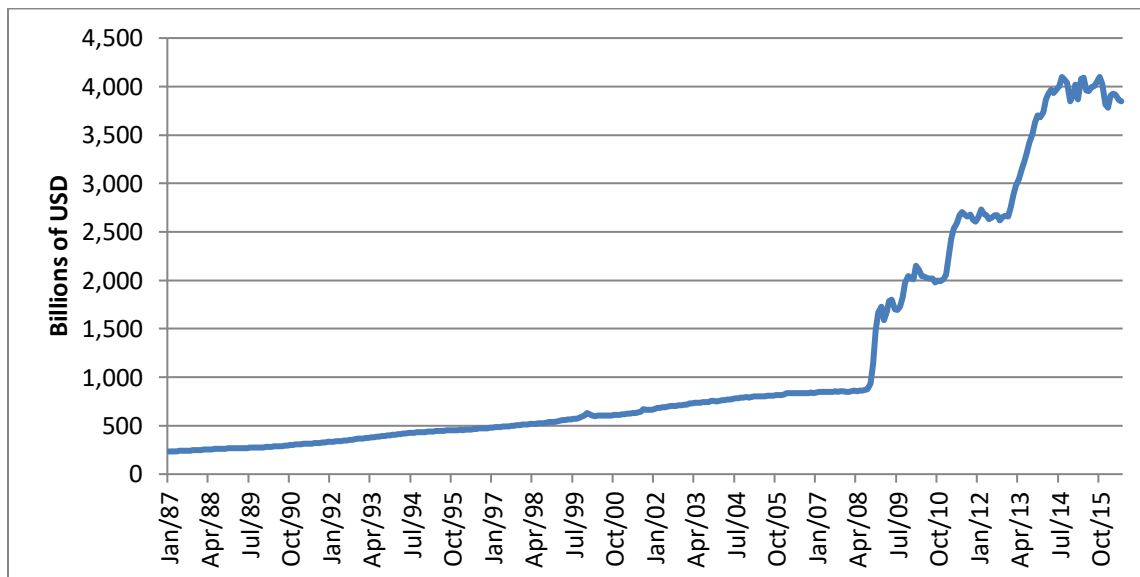
² <http://research.ark-invest.com/bitcoin-asset-class>

Figure 3: Total Bitcoin outstanding



Source: Blockchain data

Figure 4: US monetary base



Source: Federal Reserve Economic Data

As evidenced in the graph above, the growth in Bitcoin is starting to taper off. This is one of the features of a decentralized digital asset. In the case of Bitcoin, the total supply is capped at 21

million units. The supply of dollars, on the other hand, is controlled by the Federal Reserve. Therefore, the volume of dollars will generally follow the economy and the implementation of monetary policy.

While Bitcoin has yet to fully disrupt the financial industry, its underlying technology is attracting widespread attention. The Blockchain, which is a distributed database where the continuously growing transactions are maintained, has made its way into the lexicon of the largest financial firms. The chain serves as the public ledger for Bitcoin transactions. That is, it is where each existing and originating transaction is recorded. Since the ledger doesn't exist in a single place, it's decentralized and therefore deemed distributed. Whenever a new transaction is originated, the Blockchain is authenticated across the network, before the transaction can be included in chain.

The application of Blockchain technologies to finance has focused on precisely this aspect. That is, creating large distributed ledgers where transactions can be rapidly authenticated, cleared, and settled. In time, the Blockchain will expedite a range of banking and trading transactions. For this reason major financial institutions have formed the R3 Consortium, with the explicit intention of developing Blockchain solutions for the financial sector. Similarly, J.P. Morgan recently announced its own homegrown version named "Juno". While still in trial phase, the innovation promises to surpass existing solutions by providing the capacity to handle significantly more transactions per second. A number of firms have been formed around this idea, with Digital Asset Holding being at the forefront of the field. Given the enthusiasm of the industry in adapting this innovation, it is likely that regardless of whether Bitcoin succeeds as a currency or asset class, its impact will be strongly felt through the Blockchain.

To conclude, the benefits of adding Bitcoin to a traditional portfolio maybe biased by the lack of history of the asset. While the most-recent diversification features make it an attractive addition, it is difficult to ascertain whether these characteristics will persist as usage increases and the market matures. Nonetheless, several financial firms have sought to capitalize on the underlying technology of Bitcoin. The Blockchain, as described above, is distributed public ledger that records transactions. The potential for applying this technology to contracts, trading, and other financial transactions have attracted significant attention, as the Blockchain promises to increase the efficiency of these transactions.

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Emad is the Managing Partner and Chief Executive Officer of Vanderbilt Avenue Asset Management LLC. Vanderbilt's client base includes Multi-national Corporations, Public Funds, Foundations/Endowments, and Taft Hartley accounts.

Previously, Emad was Chairman of Institutional Business at Pioneer Investments. Pioneer investments has more than \$300 Billion in assets under management. The parent of Pioneer, UniCredit S.p.A., is the largest bank in Italy and the second largest bank in Europe. Pioneer had purchased Vanderbilt Capital Advisors, of which Emad was the founder and Chief Executive Officer.

Emad has had numerous articles published in professional and academic journals such as The Journal of Forecasting, The American Economist and The Journal of Fixed Income. He is a Board member of The National Investment Company. Emad was a member of the Board of Advisors of the Pacific Institute, The Advisory Committee of Fulcrum Global Partners, The Chief Executive Officers Club and formerly a board member of The Foreign Policy Association. He also served on the Board of Directors of the University of Albany Foundation, NextGen Healthcare Inc., The Park Avenue Bank, AA Bank and The New Providence Fund and Associates LP.

Emad is an FINRA Arbitrator. He is also a member of the National Association for Business Economists and The Economic Club of New York. Emad served as an adjunct professor at the University of Kansas and St. John's University.

Emad holds a Bachelor of Science from the University of Albany, and a M.A. and Ph.D. in Economics from the University of Kansas.