Is Bitcoin the ‘Paris Hilton' of the Currency World?
Or Are the Early Investors onto Something That Will Make Them Rich?

By

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Abstract.
The Bitcoin phenomenon, and the technological innovation that made it possible, is interesting - but for investors large and small, the more pertinent question is whether they should buy the virtual currency or avoid it. We analyze a Bitcoin investment from the standpoint of a U.S. investor with a diversified portfolio. Bitcoin investment shows high average return as well as volatility. Mean-variance Spanning tests show that Bitcoin investment offers significant diversification benefits. Well diversified portfolios with a small Bitcoin component (2%) shows small improvement in the risk-return trade-off.

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I. Introduction

Technological development and the increased use of the internet have led to the proliferation of virtual communities. Some of these communities have created and circulated their own currency for exchanging goods and services. Bitcoin is currently the most popular among these virtual or digital currencies and has been in news recently because of the wild fluctuations in its ‘value’.1 It has attracted enormous attention in recent months from venture capitalists, computer developers and merchants who see it as an alternative to traditional payments.2

The Bitcoin phenomenon, and the technological innovation that made it possible, is interesting—but for investors, the more pertinent question is whether they should buy the virtual currency or avoid it. In other words, should investors treat Bitcoin as an asset class?3

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1 Bitcoin is not the only virtual currency on the Web. There are others, such as Ripple, a new currency from a startup called OpenCoin.com

2 Cameron and Tyler Winklevoss, of Facebook fame, have filed with the Securities and Exchange Commission to launch an exchange-traded fund, called the Winklevoss Bitcoin Trust, that holds bitcoins. SecondMarket, a platform for investing in private assets, has already launched a private fund called the Bitcoin Investment Trust, which holds Bitcoins. Some merchants say they like Bitcoin because they don’t have to pay hefty credit-card transaction fees. Investors worried about inflation like the fact that the supply of Bitcoins can’t be manipulated by a central authority.

3 Investors are backing Bitcoin-related startups. And some firms are already trying to make it easier for investors to get involved. The German finance ministry has recognized it as a “unit of account” and senior U.S. government officials told a U.S. Senate committee on November 18th, 2013 that virtual currencies had legitimate uses. But there have also been many cases of Bitcoin theft. Exchanges that convert Bitcoin to other currencies have collapsed or closed. Silk Road, an online forum where illicit goods and services are traded for Bitcoin, was shut down by America’s Federal Bureau of Investigation in October 2013 but has since reopened.
Brière et al (2013) calculated that between July 2010 and July 2013, Bitcoin had an annualized return of more than 370% with 175% volatility. They found that its returns had a weak but significant correlation with gold and inflation-linked bonds, supporting the notion that some investors see Bitcoin as an inflation fighter. They concluded that a small allocation to Bitcoin—perhaps 3% of a well-diversified portfolio—could improve one’s risk-return trade-off.

This note will complement Brière et al (2013) study by using mean-variance Spanning test to see whether adding Bitcoin to a predetermined asset universe improves investment opportunities. In fact, this note improves upon Brière et al (2013) by extending the sample period to include the months of August through January 2014 which showed the highest level of volatility in Bitcoin price since its inception in 2009. A number of papers have studied the technical and computer-related aspects of Bitcoin. There is hardly any academic research to investigate the investment opportunities that Bitcoin presents. This paper tries to fill that gap in the literature and is one of the first studies in this area.

II. Bitcoin Network

Bitcoin is the world’s first completely decentralized peer-to-peer digital currency. A software developer pseudo-named Satoshi Nakamoto published the Bitcoin Protocol (Nakamoto, 2008) which outlined the theory of a decentralized currency. This was followed in January 2009 by the release of the open-source Bitcoin software, and the mining of the first Bitcoins. It rocketed to prominence in 2013, when the value of a Bitcoin soared more than 10-fold in a two-month period, from $22 in February to a record $266 in April. The price of a Bitcoin again rose to a record $1203 in December, 2013 before dropping to $954 on January 28, 2014. The nearly five-fold increase in the price since

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4 The Bitcoin price has fluctuated wildly, hitting $230 in April 2013, falling below $70 in July, and then exceeding $1200 in December 2013.

5 See, among others, Reid and Harrigan (2012) and Ron and Shamir (2013) and the references therein.

6 While the virtual-currency craze has sent Bitcoin prices to record highs, the development of new trading exchanges has made it confusing for enthusiasts to identify the current price. One Bitcoin exchange, Tokyo-based Mt. Gox, on January 28, 2014 showed a price of $954, up from less than $14 at the beginning of the year.
early November was fueled by rising expectations that the virtual currency will continue to gain traction as an alternative to traditional methods of payment.\(^7\)

Since its creation, Bitcoin has evolved from a mathematical proof of concept to a rapidly expanding economic network. It is now being used in business transactions around the world.\(^8\) Businesses big and small have shown interest in integrating the Bitcoin platform into their operations and providing new services within the Bitcoin economy. The momentum behind Bitcoin is coming from around the world, as amateur investors, venture capitalists and technology enthusiasts pump money into businesses that are trying to figure out how to use Bitcoin to buy and sell goods. A growing number of merchants accept Bitcoin, because the transaction costs associated with the currency are generally lower than those for using credit or debit cards.

Instead of being made on a printing press or by a central authority, Bitcoins are generated by solving complicated algorithmic searches by powerful computers, a process known as mining.\(^9\) Most Bitcoin users do not mine, but purchase or trade for their Bitcoin. Mining

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\(^7\) The prices are as of the writing of this draft on the Tokyo-based Mt. Gox exchange and on the Slovenia-based Bitstamp Exchange.

\(^8\) Commercial space venture Virgin Galactic which announced on November 22, 2013 that it would start accepting Bitcoins to reserve seat on future space trips – is just the latest of many businesses that have recently embraced the decentralized virtual payment system. Bitcoin is also accepted in diverse places like a Subway sandwich shop in Allentown, PA; Cheapair.com travel agency; Baidu (operator of a website in China); The University of Nicosia in Cyprus, etc. In January 2014, the Sacramento Kings NBA team became the first major professional sports franchise to accept Bitcoins. At today's prices, courtside seats for the March 1, 2014 match-up against the Minnesota Timberwolves would cost 0.28 Bitcoins. In dollars, those seats were listed for as much as $257.

\(^9\) Mining is the calculation of a hash of a block header, which includes, among other things, a reference to the previous block, a hash of a set of transactions and a nonce (a 32-bit/4-byte field whose value is set so that the hash of the block will contain a run of zeros). If the hash value is found to be less than the current target (which is inversely proportional to the difficulty), a new block is formed and the miner gets 50 newly generated Bitcoins. If the hash is not less than the current target, a new nonce is tried, and a new hash is calculated. This is done millions of times per second by each miner.
doesn't affect the average Bitcoin user much, but is still a very important part of the Bitcoin ecosystem.

All newly mined Bitcoin, along with every transaction, are publicly recorded. This record is known as the blockchain. While the blockchain records transaction details, it does not record any personal identifying information about the senders or recipients. The blockchain is a critical feature to maintain the transparency of the Bitcoin system, and make counterfeiting or double spending impossible.

There's a limit to the number of Bitcoins that can be mined. After the year 2040, no more Bitcoins will be created, and the total amount ever available is fixed at 21 million, more than half of which have already been mined.

III. Estimation Results

In this Section we perform a number of simple statistical tests to analyze the investment potential of Bitcoins. Following Briere et al (2013), we consider the case of a U.S. investor holding a diversified portfolio which includes both traditional assets (stocks, bonds, hard currencies) and alternative investments (commodities, real estate). We use the weekly BTC closing exchange rates against the U.S. dollar. The data is taken from Bitcoincharts website. Data for the dollar-denominated weekly returns of these indices are taken from Datastream. The sample period runs from August 1 2010 to January 24, 2014 for a total of 182 weeks.

The descriptive statistics are presented in Table 1. The average return for Bitcoin is very high at 476% annually while the volatility is 258%. Both the average return and volatility is much higher than those reported in Briere et al (2013). Adding data from four additional months to their sample period significantly changed the results. This reflects the sharp increase in both price and fluctuation during the last two months of our sample period. The kurtosis value of 16.10 for the Bitcoin reflects the extreme risk involved in holding this asset. The skewness of 2.30 is higher than the 2.02 reported in Briere et al paper. The high skewness value can only be reached by sophisticated strategies such as volatility investments meant to hedge financial portfolios against crises (Briere et al 2010). This may
indicate that Bitcoin could act as a partial hedge against crises. The high Sharp ratio of 2.94 indicates that Bitcoin is particularly attractive compared to other asset classes.

Next, we follow the procedure described in Ferson et al (1993) to conduct mean-variance spanning tests. This checks whether adding given assets to a predetermined universe improves investment opportunities. We add Bitcoin to portfolios made of (i) traditional assets such as currencies, bonds and stocks, (ii) alternative assets such as commodities and real estate, and (iii) all assets together. The results are given in Table 2. The portfolios which Bitcoin provide superior mean-variance trade-offs than do similar Bitcoin-free portfolios.

Next, we consider portfolio optimization and perform a refined analysis. Results show that Bitcoin has high diversification potential but is extremely volatile. As a result, it is not suitable for the lowest-risk portfolio. The average returns related to the same-risk efficient portfolio are given in Table 3. When a portfolio includes 2% Bitcoin, at the 5% volatility level the average annual return increases from 5% to 7%. At the 10% volatility level, the return increases from 8% to 10% when the portfolio contains 4% Bitcoin. Taken together, mean-variance Spanning tests show that Bitcoin investment offers diversification benefits. Well diversified portfolios with a small Bitcoin component (2%) shows improvement in the risk-return trade-off. However, the gains from holding Bitcoin in the portfolio is less than those given in Brière et al (2013). This may be due to the high volatility experienced by Bitcoin during our extended sample period.

IV. Concluding Remarks

Bitcoin's all-or-nothing nature probably means that investors shouldn't treat it as they would a normal asset class and instead think of it as they would a "tail-risk option"—one that pays off only if an extremely unlikely event occurs. That essentially means that Bitcoin is like a lottery ticket. Taking a tiny risk won't damage a portfolio if Bitcoin goes bust, but will have a sizable impact if it takes off.
What could that payoff be? And what’s the chance of success? Unfortunately, there’s no way to know either answer. If investors do tie Bitcoin’s price to that of gold, one Bitcoin could be worth $1 million. Even using a "conservative" estimate of, say, $200,000, the price of Bitcoin, at around $1,000, seems to factor in only a slight chance of the coins being equated to gold. Investors should think of Bitcoins as a long-term speculation rather than a short-term trade or a long-term investment. If investors decide to take the risk, they shouldn’t base their buying and selling on the gyrations of the market or invest more than the tiniest fraction of a portfolio that can be completely lost.
References


Table 1

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Bitcoin</th>
<th>Euro</th>
<th>Pound</th>
<th>Stocks</th>
<th>Bonds</th>
<th>Gold</th>
<th>Oil</th>
<th>Real Estate</th>
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<tbody>
<tr>
<td>Mean</td>
<td>10.04</td>
<td>0.02%</td>
<td>0.08%</td>
<td>0.11%</td>
<td>0.06%</td>
<td>0.11%</td>
<td>0.18%</td>
<td>0.20%</td>
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<tr>
<td>Annual Mean</td>
<td>476.32</td>
<td>0.44%</td>
<td>0.83%</td>
<td>15.22%</td>
<td>1.99%</td>
<td>4.33%</td>
<td>10.36%</td>
<td>10.37%</td>
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<td>Median</td>
<td>3.64%</td>
<td>0.08%</td>
<td>0.07%</td>
<td>0.66%</td>
<td>0.08%</td>
<td>0.20%</td>
<td>0.45%</td>
<td>0.30%</td>
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<td>Maximum</td>
<td>1060</td>
<td>4.43%</td>
<td>3.60%</td>
<td>9.30%</td>
<td>2.82%</td>
<td>8.00%</td>
<td>14.08%</td>
<td>6.30%</td>
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<tr>
<td>Minimum</td>
<td>-20.88%</td>
<td>-2.95%</td>
<td>-1.60%</td>
<td>-10.15%</td>
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<td>-8.16%</td>
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<td>St. Deviation</td>
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<td>1.60%</td>
<td>1.24%</td>
<td>2.80%</td>
<td>1.15%</td>
<td>2.18%</td>
<td>3.20%</td>
<td>1.80%</td>
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<tr>
<td>Volatility</td>
<td>258.15%</td>
<td>10.20%</td>
<td>8.76%</td>
<td>20.24%</td>
<td>8.26%</td>
<td>22.10%</td>
<td>31.28%</td>
<td>16.36%</td>
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<tr>
<td>Skewness</td>
<td>2.30</td>
<td>0.30</td>
<td>0.22</td>
<td>-0.58</td>
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<td>Kurtosis</td>
<td>16.10</td>
<td>3.90</td>
<td>3.14</td>
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<td>2.92</td>
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<tr>
<td>Sharp Ratio</td>
<td>2.94</td>
<td>0.08</td>
<td>0.16</td>
<td>1.14</td>
<td>0.36</td>
<td>0.30</td>
<td>0.42</td>
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<tr>
<td>Observations</td>
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### Table 2
Mean-Variance Spanning Test

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Ferson Spanning Test</th>
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<tbody>
<tr>
<td>Traditional Assets</td>
<td>4.74*</td>
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<tr>
<td>(currency, stocks, bonds)</td>
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</tr>
<tr>
<td>Alternative Assets</td>
<td>3.98*</td>
</tr>
<tr>
<td>(commodities, real estate)</td>
<td></td>
</tr>
<tr>
<td>All Assets</td>
<td>3.86*</td>
</tr>
<tr>
<td>(currency, stocks, bonds</td>
<td></td>
</tr>
<tr>
<td>Commodities, real estate)</td>
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</tr>
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</table>

### Table 3
Portfolio Performance

**Efficient Portfolio**

<table>
<thead>
<tr>
<th></th>
<th>5% Volatility</th>
<th>10% Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without Bitcoin</td>
<td>With Bitcoin</td>
</tr>
<tr>
<td><strong>Annual Mean</strong></td>
<td>5.21%</td>
<td>7.05%</td>
</tr>
<tr>
<td><strong>% Bitcoin</strong></td>
<td>0</td>
<td>2.0%</td>
</tr>
</tbody>
</table>