Disposed of Bitcoin? Using the Disposition Effect to Understand Financial News Sentiment and Bitcoin Returns

Emergent Research Forum (ERF)

Mengfan Cao
Wake Forest School of Business
mengfan.cao@outlook.com

Lauren Rhue
Wake Forest School of Business
rhuela@wfu.edu

Abstract
Since its inception, bitcoin has occupied a prominent role in the cryptocurrency market. As bitcoin received increased attention, researchers have examined popular sentiment as a predictor of bitcoin price fluctuation. However, the popular sentiment may differ from the sentiment of financial professionals. We ask whether the presence and news sentiment from prestigious business journals would affect the bitcoin return. We collected the daily bitcoin price data from 01/01/2017 to 03/31/2018 from the third-party cryptocurrency exchange website CoinMarketCap. The headlines of news mentioning bitcoin on Wall Street Journal and Financial Times are collected from LexisNexis Database. We calculated the sentiment embedded in the news headlines using a bag-of-words model and a dictionary-based approach. We estimate a regression of financial news sentiment on bitcoin daily return. Our main findings are that positive sentiment contributes significantly negatively to bitcoin return on the same day; negative sentiment day contributes positively, although not significantly. We interpret these findings through the disposition effect that, investors tend to sell high-performed assets and hold underperformed assets. The findings extend our understanding of disposition effect to the cryptocurrency market, and we plan to further examine if there is evidence of the disposition effect.

Keywords
Bitcoin, sentiment analysis, regression, cryptocurrencies

Introduction
The market for cryptocurrency expanded notably during 2017 although token prices and returns are marked by volatility (Saporic, 2017). The bursting of the “cryptocurrency market bubble” (Cornish and Murphy, 2018) has generated renewed interest in the factors driving cryptocurrency token returns. Bitcoin, as the leading token in cryptocurrency market, accounts for 48 percent of total market share in 2018 (Cambridge Judge Business School) and is the least volatile cryptocurrency (Saporic, 2017). Given the prominence of bitcoin, our study examines the factors driving that particular cryptocurrency. Prior research has demonstrated the predictive power of tweets and general news on bitcoin price fluctuation. General sentiment captures the popular sentiment, but that sentiment may differ from the attention and sentiment of financial experts. We ask whether the presence and news sentiment from prestigious financial news outlets would affect the bitcoin return. Our study focuses the Wall Street Journal (WSJ) and Financial Times (FT) to understand whether business articles affect the return in bitcoin market. We examine how the daily return interacts with the sentiment embedded in the headlines of the articles related to bitcoin. Our findings suggest that financial news does predict the bitcoin return.

Our study contributes to the literature on how popular sentiment influences cryptocurrency, specifically bitcoin. We examine the influence of sentiment and attention of finance news sources on bitcoin return. Many studies examine the influence of social media on bitcoin return using Twitter; however, Twitter captures the broad popular sentiment and not necessarily the sentiment of financial community. We consider whether the influence and/or perspective of the finance community shapes
the transaction volume and return of bitcoin. Second, our dataset includes the bitcoin bubble and subsequent burst. The exuberance for bitcoin in late 2017 may produce different results, so our research contributes to the body of literature by confirming that the relationship between social media and bitcoin is robust to changing market conditions.

Theory and Background

Bitcoin, a digital currency introduced in a 2008 white paper (Nakamoto 2008), was designed as a completely peer-to-peer protocol without the need for a financial intermediary. Since its inception in 2009, bitcoin has expanded in its reach with more than 17.5 million bitcoins in circulation as of February 2019. As a currency, it is subject to “deflationary pressures” when the demand for bitcoin outpaces the circulating supply (Sebastiao et al., 2017).

Given the expected relationship between demand for bitcoin and its expected return, it is important to know what demand-related factors increase the demand for bitcoin. Kristoufek (2013) identifies Google Trends (the popularity of the search terms) and the views on the bitcoin Wikipedia page as factors that influence the bitcoin return. Bouoiyour and Selmi (2015) also find that Google searches shape the bitcoin return.

Not all evidence of popularity indicates demand for bitcoin; the increase searches could indicate a demand away from bitcoin. To that end, Karalevicius (2018) uses sentiment analysis of English-language news articles to understand how it shapes the interday bitcoin prices. Polasik et al. (2015) use the sentiment of all English-language newspaper articles in the Lexis Nexus database and finds that positive sentiment increases the daily bitcoin return. Our study builds on this research by narrowing the focus to finance practitioners. We ask, does the financial news attention exert influence on bitcoin prices?

We expect that bitcoin returns will be subject to the disposition effect, i.e. investors tend to sell the stocks that are performed well and hold stocks that are “losers” to avoid the realization of loss (Weber and Camerer, 1998). The disposition effect is often explained using prospect theory (Barberis and Xiong, 2009), a theory of making decisions with risk. If finance professionals are risk-averse to their gains and risk-seeking in their losses, then positive sentiment about bitcoin could lead investors to sell their currency to realize their gains. Investors would hold bitcoin if sentiment were negative to avoid realizing their losses. The changing in the demand for bitcoin will influence the bitcoin price, leading to lower prices for high demand periods.

Data Collection

Bitcoin Price Data

We obtain the daily bitcoin price data from 01/01/2017 to 03/31/2018 from the third-party cryptocurrency exchange website CoinMarketCap. The CoinMarketCap data includes the daily open price, high price, low price and close price for bitcoin as well as the daily volume of trades and market capitalization. To examine profitability, we use the time series \( \text{Price}(t) \) of the bitcoin close price to calculate the daily return:

\[
\text{Return}(t) = \frac{\text{Price}(t) - \text{Price}(t - 1)}{\text{Price}(t - 1)}
\]

Financial News Coverage of Bitcoin

To obtain news about the coverage of bitcoin by financial media, we downloaded the news data from the LexisNexis Database. We searched the Wall Street Journal (WSJ) and the Financial Times (FT) for news articles containing the keyword “bitcoin” in the article. Our resulting data included 495 headlines from the Wall Street Journal and 1,000 headlines from the Financial Times. We calculated the sentiment for a headline instead of a complete article for two reasons. First, a large portion of investors may only look through the headline instead of a whole article. Second, sentiment in a headline and a corresponding article should be consistent.

We used a bag-of-words model and a dictionary-based approach to calculate the daily sentiment score. Each sentiment word in the headline is assigned a score using the AFINN lexicon (Nielsen,
The daily sentiment score is the aggregation of all the sentiment scores from the individual articles published on the same day. Positive sentiment words are assigned positive scores, and negative sentiment words are assigned negative scores. The higher the sentiment score is, the more positive the headline indicates and vice versa. The sentiment score is aggregated at the daily level.

We then transformed the daily sentiment score into binary variables. If the aggregated sentiment score of Wall Street Journal on that day is positive, we assigned WSJ – Positive unity, otherwise 0. Similarly, if the sentiment is negative (neutral), WSJ – Negative (WSJ – Neutral) is assigned 1, otherwise 0. If there is no sentiment score on WSJ on that day, the variable WSJ – Unknown is 1, otherwise 0. We did the same for the sentiment score of Financial Times.

**Summary Statistics**

After combining the daily bitcoin price data with sentiment data, we found that sentiment score from WSJ was unavailable for around 400 days, negative and positive sentiment accounts for around 25 days each, and neutral sentiment accounts for 3 days. Sentiment score from FT was unavailable for around 320 days, negative and positive sentiment accounts for around 60 days each, and neutral sentiment account for 10 days.

On a day where the sentiment score is available, the average number of WSJ articles mentioning bitcoin is 1.9 and the average number of FT bitcoin-mentioned articles is 4.1, indicated in the Table 1.

<table>
<thead>
<tr>
<th>Statistics</th>
<th>N</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close Price</td>
<td>455</td>
<td>5304.02</td>
<td>4602.22</td>
<td>777.76</td>
<td>19497.40</td>
<td>3637.52</td>
</tr>
<tr>
<td>Daily Return</td>
<td>454</td>
<td>0.57%</td>
<td>5.24%</td>
<td>-18.74%</td>
<td>25.25%</td>
<td>0.78%</td>
</tr>
<tr>
<td>No. of Financial Times articles</td>
<td>131</td>
<td>4.15</td>
<td>3.44</td>
<td>1</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Financial Times Sentiment</td>
<td>131</td>
<td>-0.32</td>
<td>4.61</td>
<td>-14</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>No. of Wall Street Journal articles</td>
<td>57</td>
<td>1.91</td>
<td>1.46</td>
<td>1</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Wall Street Journal Tone</td>
<td>57</td>
<td>-0.08</td>
<td>0.91</td>
<td>-1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Wall Street Journal Sentiment</td>
<td>57</td>
<td>-0.12</td>
<td>2.41</td>
<td>-7</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. Summary Statistics

The summary statistics indicate that the average tone and sentiment are negative on both journals, suggesting that financial news sources took a dim view of bitcoin.

**Results**

To examine how sentiment impacts bitcoin return, we built an Ordinary Least Squares (OLS) regression to capture the effects of sentiment on daily return. We matched the daily return times series with the sentiment time series, allowing us to see how does the sentiment on a day associate with the same day’s daily return. We regressed the daily return on the same day’s sentiment binary variables of both financial news. The model specification is shown below.

\[
\text{Return}_t = \alpha + \beta_1 \times \text{FT-Positive}_t + \beta_2 \times \text{FT-Negative}_t + \beta_3 \times \text{FT-Neutral}_t + \beta_4 \times \text{WSJ-Positive}_t + \beta_5 \times \text{WSJ-Negative}_t + \beta_6 \times \text{WSJ-Neutral}_t + \epsilon
\]

Table 2 describes our results. As shown in column (6), we find an association between the sentiment of the financial news stories and the daily return of bitcoin. Column (1) contains an indicator for whether there is a news articles in FT or WSJ, and we find no evidence that the presence of news in the FT or WSJ alone affects bitcoin return.

The Financial Times does not appear to influence bitcoin return. As shown in column (2), the coefficient estimate on FT – Any is not significant presence of news articles. In column (3), the coefficient estimates on the positive and negative sentiment of FT headlines are not significant. The coefficient estimates on both FT – Neutral and WSJ – Neutral are significantly negative, which indicates that news with a neutral tone headline are associated with lower bitcoin return. The sign of those is consistent with that of FT – Any and WSJ– Any in column (2).
There is evidence that the *Wall Street Journal* is associated with changes in bitcoin return. Column (4) shows that any article in the WSJ is associated with lower bitcoin returns. Interestingly, in terms of WSJ, a positive sentiment day contributes significantly negatively towards bitcoin return on that day, as shown by the coefficient estimates in columns (5) and (6). Although they are not significant, the coefficient estimates on WSJ – Negative is positive.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate (1)</th>
<th>Estimate (2)</th>
<th>Estimate (3)</th>
<th>Estimate (4)</th>
<th>Estimate (5)</th>
<th>Estimate (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any news</td>
<td>-0.0057</td>
<td>-0.0003</td>
<td>0.0006</td>
<td>0.005</td>
<td>-0.032</td>
<td>-0.039</td>
</tr>
<tr>
<td>FT – Any</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FT – Positive</td>
<td></td>
<td></td>
<td>0.0006</td>
<td>0.005</td>
<td>-0.027</td>
<td>-0.029</td>
</tr>
<tr>
<td>FT – Negative</td>
<td></td>
<td>-0.0003</td>
<td>0.0075</td>
<td>0.002</td>
<td>0.007</td>
<td>0.006</td>
</tr>
<tr>
<td>FT – Neutral</td>
<td>-0.039</td>
<td></td>
<td>-0.0178*</td>
<td>-0.017*</td>
<td>-0.094</td>
<td>-0.094</td>
</tr>
<tr>
<td>WSJ – Any</td>
<td>-0.0145*</td>
<td>-0.0146*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WSJ – Positive</td>
<td></td>
<td></td>
<td></td>
<td>-0.027</td>
<td>-0.029</td>
<td>-0.027</td>
</tr>
<tr>
<td>WSJ – Negative</td>
<td></td>
<td></td>
<td></td>
<td>0.0063</td>
<td>0.007</td>
<td>0.007</td>
</tr>
<tr>
<td>WSJ – Neutral</td>
<td></td>
<td></td>
<td>-0.101</td>
<td>-0.094</td>
<td>-0.094</td>
<td>-0.094</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0080</td>
<td>0.0076</td>
<td>0.0065</td>
<td>0.0075</td>
<td>0.0075</td>
<td>0.007</td>
</tr>
<tr>
<td>Observations</td>
<td>454</td>
<td>454</td>
<td>454</td>
<td>454</td>
<td>454</td>
<td>454</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.002</td>
<td>0.004</td>
<td>0.005</td>
<td>0.006</td>
<td>0.033</td>
<td>0.037</td>
</tr>
<tr>
<td>p-value</td>
<td>0.151</td>
<td>0.144</td>
<td>0.131</td>
<td>0.049</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Note:* *p* ≤ 0.05; **p** ≤ 0.01; ***p** ≤ 0.001

**Table 2. Coefficient Estimates of the Bitcoin Returns and Sentiment**

These results can be interpreted through the disposition effect. Investors who read WSJ news about bitcoin with a positive sentiment may sell their bitcoin holdings because they think bitcoin is performing well. As a result, the supply of bitcoin increases, the price would drop and thus would lead to a lower daily return. Similarly, investors who read news about bitcoin with a negative sentiment could hold their bitcoin holdings to avoid realizing the financial loss. At the same time, the demand for bitcoin may increase because investors who are optimistic about bitcoin in the long term may think it is a good time to enter the market. The increasing demand and limited supply could drive up the price of bitcoin and thus lead to a higher daily return. Future research will incorporate an analysis of the daily market volume of transactions.

Of course, the regression model does not show causality so we cannot be sure that the sentiment in business journals affects same-day daily bitcoin returns. It could be the other way around, i.e. business journals react towards the huge fluctuations in bitcoin return. As news articles typically cover past events, we believe that daily sentiment reflects past-short term events. However, we plan to incorporate a more robust identification strategy such as time-lagged independent variables.

**Discussion and Conclusion**

In summary, we find that the sentiment on a day interacts with bitcoin daily return differently for different business journals. A neutral tone in financial news headlines contributes negatively towards bitcoin return. Both positive and negative sentiment in *Financial Times* are positively associated with
returns compared to a day without sentiment score. In terms of Wall Street Journal, interestingly, positive sentiment is negatively associated with returns and negative sentiment is positively associated with returns. We interpret the result from a behavioral finance point of view that investors tend to sell high-performance assets and keep underperformed assets.

In our next steps, we plan to add more variables that are correlated with return and sentiment to the model, such as the market volume for the last 24 hours, in order to see in which way the coefficients of sentiment variables change. We also plan to use a more robust definition of sentiment using cloud-based sentiment analysis options such as IBM Watson. Additionally, we plan to extend the time window to include the periods with less volatility in 2018 and to examine the interday bitcoin price fluctuations (Karalevicius et al., 2018).

This paper contributes to our understanding of disposition effect and how it influences bitcoin. We find evidence that positive financial news is associated with lower bitcoin return, suggesting that the disposition effect may be present in cryptocurrencies. We plan to examine this question further with additional analysis of the post-bubble bitcoin prices and additional measures of sentiment. We also plan to examine bitcoin transaction volume to further investigate bitcoin and the disposition effect.

REFERENCES