

# Understanding the Relationship of Crypto currency Price Change and Media Influence: Bitcoin Case Analysis

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## Abstract

The purpose of this study is to understand the relationship between media and cryptocurrency price change. As an application example to prove this, bitcoin which is one of cryptocurrency is analyzed. On the analysis of Korea portal news from 2013 to 2017, it can be seen that there is a positive correlation between the number of Bitcoin times was mentioned in the news and the Bitcoin price change. This shows that the Bitcoin price change is closely affected to the information provided by the media. Also, during this period, the public perception of Bitcoin in Korea showed an improving trend of the Bitcoin as the number of positive reference to the affirmative increased, rather than negative. This study confirms the objective evidence that media and public perception provide a direct influence on cryptocurrency price change. The limitation of this study is that only the media information provided by the Naver (Korea portal) is used. And it is discussed only in terms of the effect of media and the change of public perception among various factors of cryptocurrency price fluctuation. Therefore, future research is needed to analyze various factors of cryptocurrency price fluctuation.

**Keywords:** Blockchain, Distributed Ledger, Bigdata, Bitcoin Price, Media influence.

## 1. INTRODUCTION

With the advent of the fourth industrial revolution, technological development is rapidly proceeding. The blockchain, one of the representative technologies is based on an innovative idea that reverses the concept of a centralized cloud system. The blockchain is based on the distributed ledger technology and has emerged as an alternative to solve the problems of the existing centralized way. The first cryptocurrency (virtual currency) that uses blockchain technology is Bitcoin. Today, Bitcoin is the subject of a lot of talk in the market, and there are many cryptocurrency exchanges where Bitcoin can be traded, so we can sell and buy the Bitcoin at the exchange in a similar way to stock trading.

This study aims to discuss various social factors influencing the price of cryptocurrency and its influence and to provide objective evidence about it.

For example, the information in the media is an important factor in determining the stock price, etc. Thus, the price of the cryptocurrency also can be influenced by the information which is transmitted through the mass media.

In this study it is to discuss the theoretical background of the price fluctuation factors of cryptocurrency and to provide the objective evidence about the influence of media and public awareness about cryptocurrency using the collected data. Therefore, we examined the correlation between the price fluctuation of Bitcoin and its news information in the media.

### 1.1 Cryptocurrency

According to Andy Greenberg [2011] and Patrick, Schueffel [2017], a cryptocurrency (or crypto currency) is a digital asset designed to work as a

medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets. McDonnell [2015] explained that cryptocurrencies are a kind of digital currency, virtual currency or alternative currency. Allison [2015] also mentioned that cryptocurrencies use decentralized control as opposed to centralized electronic money and central banking systems. The decentralized control of each cryptocurrency works through distributed ledger technology, typically a blockchain that serves as a public financial transaction database.

Generally considered the first decentralized cryptocurrency, Bitcoin was first released as open-source software in 2009 by pseudonymous developer Satoshi Nakamoto. It used SHA-256, a cryptographic hash function, as its proof-of-work scheme. Since the release of Bitcoin, over 4,000 altcoins (alternative variants of Bitcoin, or other cryptocurrencies) have been created.

In April 2011, Namecoin was created as an attempt at forming a decentralized DNS, which would make internet censorship very difficult. Soon after, in October 2011, Litecoin was released. It was the first successful cryptocurrency to use script as its hash function instead of SHA-256. Another notable cryptocurrency, Peercoin was the first to use a proof-of-work/proof-of-stake hybrid.

## 1.2 Bitcoin

Bitcoin is designed to freely transfer money and other financial transactions among individuals in a P2P way without a central bank. Based on blockchain technology, the transaction book is distributed across multiple users' servers in a global scope and uses an SHA-256 based password hash function (C Decker, R Wattenhofer., 2013, S Nakamoto., 2013; Hussain et al., 2019). After Bitcoin, a variety of coins have appeared, including Ethereum, Ethereum Classic, Ripple, Light Coin, Ecoin, Dash, Monroe, Zcash and Quantum.

Bitcoin serves as a kind of key currency between several coins. Unlike the nominal currency of the system, the Bitcoin has the property of decentralized processing, so it cannot manipulate the information that appears in centralized banking system. Bitcoin's software is programmed to generate inflation on a

limited line, which is predictable and available to all parties in advance. Thus, the central system cannot control inflation to affect the redistribution of value to users. Transactions between nodes are not refundable because there is no financial entity in between. The Bitcoin user sends the transaction details to the nodes that propagate the payment transaction in the network. Transactions that are in error or out of order are rejected by honest users. Some transactions fee are free, but you can pay more commissions to other nodes that speed up operations for trading (Kyung Mi Lee, Eun Hee Ko, Zhu Xian [2016], R Grinberg [2012]).

Currently the total amount of Bitcoins that can be mined is 21 million, and the rate of newly minted Bitcoins added to the coin supply of growth decreases exponentially every four years. Half of the total was generated in 2013, and 1/4 was generated in 2017. When the supply reaches the specified target, there will be no more production so that the currency can experience price deflation (increase in value). A single Bitcoin can be split by 8 decimal places (all  $2.1 \times 1,015$  units), eliminating the limiting factors needed to lower prices in the deflationary situation. After all Bitcoins have been produced, miners will proceed to collect transaction-related commission rather than use mining equipment to generate blocks for trading.

Bitcoin, which was born in 2009, has risen 20,000 fold in four years and ten months. It was also called "Gold 2.0" with tremendously high returns. This led to two types of Bitcoin investment methods. The first method is to buy the Bitcoin cheaply at the exchange with the low rate and then move and sell to the exchange where the exchange rate is high because the exchange rate is different at each exchange arbitrage. Then, the currency is converted into the dollar or the desired currency and the foreign exchange profit will be generated. There can at time be a difference of up to 20% between the exchange rates for each exchange, so the foreign exchange profit is very big compared to the existing foreign exchange market.

Another way is to buy at a low price and hold the Bitcoin and then sell it to the same market when the price rises as done in a stock market

## 2. PROBLEM DESCRIPTION

### 2.1 Network Externalities (Effects)

Jung-soo Kang [2014] mentioned that network effects is to demand for a particular product is affected by the needs of others. It is a concept introduced by the American economist, Harvey Levenstein [2003]. He said that Network effect is a phenomenon that once a demand for a product is formed, it has a great influence on the selection of other goods. It is also called network Externalities in other terms.

The network market is a positive consumption externality, where consumption behavior leads to more consumption, which is called network externalities. The concept of network externality refers to the phenomenon that the more consumers(users) who use a product or service, the more value of use increases according to Carl Shapiro and Hal R. Varian [1988] research. In other words, as shown in the study of ML Katz, C Shapiro [1992] as more consumers use a particular product, the value of the product becomes even higher.

In economics, externality refers to the phenomenon in which the economic activity of an individual(consumer or producer) has a ripple effect on a third party which was researched by Jungmin Lee and Namho Jeong [2012] and Sung Yong Jang and Sang Ji Kim [2007].

For example, in a typical case of fax services, the increase in fax sales drove fax usage opportunities. The purchase of a facsimile machine represents a quantitative consumption externality that leads to the consumption of more facsimile machines, and more and more people in the fax network purchase the facsimile.

The nature of network externality is that as users increase, the number of users continues to increase. More important than the quality of a product or service is how many people are using it. That is, demand for a particular commodity has an impact on people's purchasing, and thus the number of people who choose the commodity increases. As the production scale increases due to the externality of the network, the production cost decreases. The more people use it, the lower cost of production due to

economies of scale. So the lower selling price, more the number of buyers increases, as shown by MA Schilling [2002].

Network externality is generally known to be proportional not only to the number of users of a product but is also characterized by an exponential increase rather than a linear increase. Once the market place reaches a critical inflection point, then Network effects begin to emerge, drawing an exponential growth trajectory that is not linear, as shown by Katz & Shapiro [1985].

Metcalfe's Law, which many people know, is a theory that explains this network externality. According to Bob Metcalfe, the founder of 3Com and the networking technology used for Ethernet used in LANs, the usability of the network is said to be proportional to the square of the number of users(n).

When the number of users increase ten times, the value of the network increases 100 times.

For example, if there are three people who currently have a fax, there are three ways to connect one to one. If one more person is added and there are four people, there are six and  $n(n-1)/2$  in the case of n. Metcalfe p suggests that this logic increases the value of the network in proportion to the square of the number of users. For example, if n is from 10 to 1000 and 10,000, the value of the network increases to  $49,995,000 / 499,500 = 100$  times

### 2.2 The Network Effects Application Example

In his column Bisade Asolo [2018], explained the price influencing factors of cryptocurrency as follows. In terms of participants who directly influence cryptocurrency trading, they can be divided into media and investors.

From the media point of view, media reporting on cryptocurrency can affect not only public perception of the cryptocurrency but also its price. The manipulation of information can be used as a means of manipulating prices by media business owners. Also, the reporting negative and positive aspects of cryptocurrency can cause price changes.

Interest in the economic value of cryptocurrency is an influential factor for sustained trade. In some news, they talked about the negative side of

cryptocurrency. On the other side, there was an increase in the introduction of cryptocurrency as an innovative growth and investment.

In terms of innovation, cryptocurrency including Bitcoins are being introduced into the news as a new way of investing. Investors can raise the price by positively promoting cryptocurrency after buying most of the cryptocurrency since investors have a lot of assets to invest in. It is possible to stimulate investment by providing investors with confidence and if many investors have a purchase demand for cryptocurrency, there is a possibility of price increase then when the price goes up, the original owners may choose to sell their coins. Therefore this may cause the result in a loss for small sized investors.

A typical example is institutional investors intervening in buying and selling cryptocurrency in accordance with this strategy. In fact, financial institutions are increasingly interested in digital assets as their markets grow, commercialization increases and some countries that have actually applied cryptocurrency into the market appear. Compared to the stock market and the expected performance as a currency, corporate financing began to flow into the cryptocurrency market with the formation of regulations.

In terms of social influences, there are influencing factors that are demand and supply, public perception of cryptocurrency, legal and government intervention. First, many products are mainly priced by demand and supply. Therefore, it is the most important economic factors affecting price change. For example, a Bitcoin has a total limit of 20 million according to the study of Ju Yong Jeon and Eung Jeong Yeo [2014].

The Bitcoin quantity is made according to the provision rule and it cannot be changed. Thus, people can consider a limited supply to be valuable. As the half amount of Bitcoin made in 2016, approaches to the period, the Bitcoin price gradually increases because the newly issued coin supply is reduced.

Second, public awaness of cryptocurrency is spreading. The positive public reaction to innovative products, the differentiation of competition from traditional methods, and the link between negative reaction and criminal organization can be the factor

that determines cryptocurrency value and its price. Hacking of major currency exchanges, such as the case of Mt Gox, could also negatively impact the price of the cryptocurrency. On the other hand, innovations such as multi-signature security schemes and simplified payment gateways can have a positive effect. That is, due to the increasing interest and rapid growth, the cryptocurrency is frequently encountered, which increases the participation in the cryptocurrency transaction.

Third, legal regulations and government intervention in the market can affect prices. Furthermore, how the government responds to cryptocurrency is very sensitive to its price change according to the study of Hyun-jung Lee [2015]. Positive legal measures such as formal recognition of cryptographic money can have a positive impact on prices, while encryption disputes can have a negative impact on price.

With the introduction of the government's legal treatment of Bitcoin, customers trust in cryptocurrency has increased and Bitcoin transaction participation has increased, which has affected the rise in Bitcoin price. On April 1, 2017, Japan recognized Bitcoin as a legal currency and established a system whereby administrative officials could monitor it. This aim was to make virtual currency transactions more active. As a result, the Japanese people have secured an environment where they can trust virtual money as a future money.

Also in Australia, similar bill was quickly drafted. Australia has eliminated the dual tax imposed on virtual currency transactions, and Australian citizens using Bitcoins have been provided clear legislation on intangible assets for stable transactions. The bill said a 10% of goods and services tax (GST) and 10% tax would be imposed when using intangible assets as a payment medium, which provided trust to the Bitcoin-related market. This has contributed to the general demand as well as the Bitcoin price change with the increase in participants.

### 2.3 Problem description

In order to understand the relationship of cryptocurrency price change and media influence, Bitcoin was selected as an example (Zeibote, Volkova and Todorov, 2019). In 2009, Bitcoin,

which uses blockchain technology, emerged and interest in cryptocurrency has exploded in the past few years. Accordingly, the value of cryptocurrency has increased as a result of increasing exchanges just like stock trading as well as the use of Bitcoin as a virtual money for trading purposes in the market.

The price fluctuation of Bitcoin is influenced by various factors of society. Also, price fluctuations are very high and frequency in a very short time, many people take part in the trade of Bitcoin at the coin exchange market. Therefore, this study aims to provide objective evidence on the influence of media ripple effect and public perception on the Bitcoin among the influential factors of its price.

This study measured the correlation between the frequency of the word Bitcoin in the news (Naver portal site) in Korea and the Bitcoin price changes formed in the market. Also, we investigated whether the public perception of Bitcoin is evaluated as the positive or negative aspect. Therefore, the research theme are as follows.

- Topic 1 : Correlation between Bitcoin word frequency in news and Bitcoin price change.
- Topic 2 : Influence of public perception of Bitcoin and its value between 2016 and 2017.

From a media standpoint, there is expected to have an impact that a Bitcoin article not only affects public perception of Bitcoin, but it can also affect Bitcoin prices. Therefore, in order to obtain objective evidence, we investigated the correlation between Bitcoin word frequency and Bitcoin price change which is the research topic 1 (Kheyfets and Chernova, 2019).

One of the factors affecting the price of Bitcoin is whether the public feels positive or negative feeling about Bitcoin. During the data collection period, from 2016 to 2017, the Bitcoin price fluctuation was very large and the market response to Bitcoin was

investigated during the same period. The following words, (1) trading, (2) investment, (3) investment opening, (4) price increase, and (5) innovation were selected as affirmative words associated with Bitcoin. Five words were selected as negative words: (1) speculation, (2) money laundering, (3) blizzard, (4) danger, hacking and crushing, and (5) crime.

Each selected positive and negative word was used when measuring the frequency of exposure in the news in order to examine the public perception of Bitcoin in the market. The data used in this study tracked the association based on news appearing in portals in Korea. It is meaningful to contribute to activities such as the establishment of the related policy of Korea domestic virtual currency by analyzing domestic market recognition.

### 3. RESEARCH DESIGN

#### 3.1 Data description

This study is based on media data collected through online portal news site, Naver from Korea. The data collection period is 2013.01.01 - 2017.12.31(5 years)

Table 1: Data description

Division	Contents
Source	News articles in Naver which is popular portal site in Korea
Collection period	2013.01.01 – 2017.12.31(5years)
Number of articles	1,470,008 articles

The collected data were classified into news, science, economy, society and politics. The total collected data is 1,470,008 articles, which is in the order of 2013(9%), 2014(9%), 2015(20%), 2016(30%), and 2017(32%). Also, all year combined the classification is as follows: science(12%), economy(28%), society(33%) and politics(39%) were surveyed.

Table 2: Collected data specifications

Yr.	Science	Economy	Society	Politics	Total(%)
2013	19,933	35,865	46,606	42,914	125,385(9%)
2014	21,985	38,177	49,540	41,553	129,270(9%)

2015	38,536	86,874	112,158	97,295	296,327(20%)
2016	49,348	123,765	130,845	187,624	442,234(3%)
2017	44,242	124,455	141,190	211,147	476,792(32%)
Total(%)	174,044(12%)	409,136(28%)	480,339(33%)	580,533(39%)	1,470,008(100%)

In order to utilize the text mining methodology based on Word2vec in analyzing the contents of the medium, the collected articles were extracted by morpheme analysis and the data was organized. We used the Bitcoin price provided by Bithumb, a cryptocurrency exchanger to investigate the

fluctuation of the Bitcoin price. It was chosen because it is the company that has the largest volume of transactions in Korea during the collection period. The following are the Bitcoin price data from 2013 to 2017. Bitcoin prices have risen sharply from September 2016 to 2017.

Table 3: Bitcoin price from 2013 to 2017, unit: \$, source: Bithumb

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.
2013	20.41	33.38	93.03	139.23	128.82	97.51
2014	800	565	452	448.27	635.6	640.01
2015	217.41	255.7	244.33	236.11	228.7	262.89
2016	365.5	439.16	416.02	446.6	530.69	674.74
2017	<b>966.19</b>	<b>1,189.10</b>	<b>1,081.70</b>	<b>1,435.20</b>	<b>2,191.83</b>	<b>2,420.70</b>
Year	July.	Aug.	Sep.	Oct.	Nov.	Dec.
2013	97.91	129.46	123.1	198.23	1112.35	727.71
2014	579.04	483.37	387.14	337	376.72	317
2015	284.45	231.35	236.49	316	376.88	429.02
2016	623.67	576.15	611.1	704.09	739	966.58
2017	<b>2,856.00</b>	<b>4,718.20</b>	<b>4,367.00</b>	<b>6,458.30</b>	<b>9,907.00</b>	<b>17,122.22</b>

### 3.2 Analysis approach

In this study, we used the Word2vec method to take out the word to apply in analyzing contents of the medium. Word2vec is well known to mean a group of related models that are used to produce word embedding. These models are shallow, two-layer neural networks that are trained to reconstruct linguistic contexts of words.

Word2vec was created by a team of researchers led by Tomas Mikolov at Google. The algorithm has been subsequently analyzed and explained by other researchers such as Goldber Yoav and Levy Omer [2014], and Řehůřek Radim [2015].

Word2vec can utilize either of two model architectures to produce a distributed representation of words: Continuous Bag-of-Words (CBOW) or continuous skip-gram. In the continuous bag-of-words architecture, the model predicts the current word from a window of surrounding context words. The order of context words does not influence prediction (bag-of-words assumption). In the continuous skip-gram architecture, the model uses the current word to predict the surrounding window of context words. The skip-gram architecture weighs nearby context words more heavily than more distant context words.

It is known that CBOW is faster while skip-gram is slower but does a better job for infrequent words.

Looking at Continuous Bag of Words model(CBOW), the concept of 'context' is used. If you consider {"the", "Bitcoin", "over", "the", "price"} as a context in the sentence. It is a model that extracts the center word "Bitcoin" from these. This is called the CBOW model. The following explanations will help you understand.

First, the known parameters are introduced. The input to learn the model is a one-hot vector |W| with words replaced by x(i), i = 1, 2, 3, ....

For example:

$$w^{hardwork} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}, w^{dt} = \begin{bmatrix} 0 \\ 1 \\ 0 \\ \vdots \\ 0 \end{bmatrix}, w^{dt} = \begin{bmatrix} 0 \\ 0 \\ 1 \\ \vdots \\ 0 \end{bmatrix}, \dots, w^{zebra} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ \vdots \\ 1 \end{bmatrix}$$

Figure 1: One-hot Vector

If the context is (x<sup>(c-m)</sup>, ..., x<sup>(c-1)</sup>, x<sup>(c+1)</sup>, ..., x<sup>(c+m)</sup> ∈ R<sup>|V|</sup>) and some central word of {"the", "Bitcoin", "over", "the", "price"} is (= {" Bitcoin "}). It is also expressed in One-hot Vector form, and let's say y

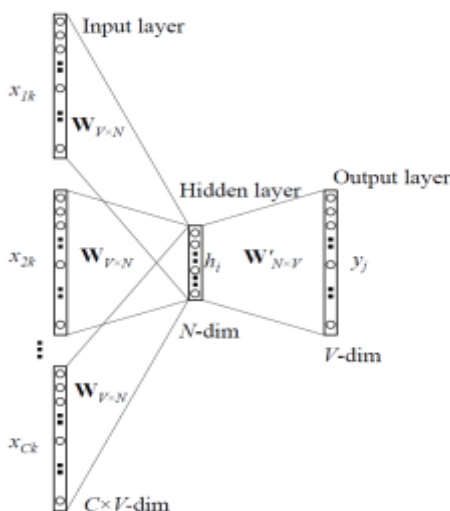


Figure 2: CBOW Architecture

Step 1. Repeating this step, if the center word is x<sup>(c)</sup>, prepare m words in the radius of the center word in one-hot vector form: (x<sup>(c-m)</sup>, ..., x<sup>(c-1)</sup>, x<sup>(c+1)</sup>, ..., x<sup>(c+m)</sup> ∈ R<sup>|V|</sup>). If (x<sup>(c-m)</sup>, ..., x<sup>(c-1)</sup>, x<sup>(c+1)</sup>,

..., x<sup>(c+m)</sup> ∈ R<sup>|V|</sup>) is context then, it learns that the center word is x<sup>(c)</sup>.

Step 2. Now embed this context in R<sup>n</sup> space for any n (n < m). This is also referred to as projection according to other data, since it can be seen that a large-length one-hot vector is projected into a small-dimensional space by multiplying matrix V.

$$(Vx^{(c-m)} = v_{(c-m)}, Vx^{(c-m+1)} = v_{(c-m+1)}, \dots, Vx^{(c+m)} = v_{(c+m)} \in R^n)$$

Matrix V becomes an embedded word vector of input words as well as an unknown parameter to be learned through repetition. The reason is that x<sup>i</sup> is a one-hot type

$$\begin{bmatrix} - & 2 & - & - \\ - & 7 & - & - \\ - & 1 & - & - \\ - & 4 & - & - \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 2 \\ 7 \\ 1 \\ 4 \end{bmatrix}$$

Figure 3 : Example of one-hot vector.

$$\hat{v} = \frac{v_{c-m} + v_{c-m+1} + \dots + v_{c+m}}{2m} \quad (1)$$

Step 4. Score vector is z = Ũ(v) ∈ R<sup>|V|</sup> z = Ũ(v) ∈ R<sup>|V|</sup>

Step 5. Finishing work. Converts score vector to probability.

$$\hat{y} = \text{softmax}(y) \in R^{|V|} \quad (2)$$

Ŷ<sub>i</sub> is the probability that the center word is x<sup>(i)</sup>.

We have to iterate so that ŷ becomes equal to y, the one-hot output vector mentioned above (=Ŷ<sub>c</sub> has a large value). When the jth row of U is denoted U<sub>(j)</sub>, the larger the vector z<sub>j</sub> = U<sub>(j)</sub> · v<sup>^</sup>. U<sub>(j)</sub> v<sup>^</sup><sup>(j)</sup> is adopted as a center word.

The larger the size of z<sub>j</sub> = U<sub>(j)</sub> · v<sup>^</sup><sup>(j)</sup> (i.e. the more similar vectors U<sub>(j)</sub> and v<sup>^</sup>), then the more the probability that x<sub>(j)</sub> is adopted as a center word increases. In this regard, the matrix is an unknown parameter to be learned through repetition and at the same time an embedded word vector of output words.

In this study, we extracted the words from data on Naver(the portal site in Korea) for a specified period(from 2013 to 2017) using word2vector and analyzed the effects of the media information about Bitcoin on changes in Bitcoin prices.

#### 4. ANALYSIS RESULTS AND ITS DISCUSSION

##### 4.1 Topic 1. Correlation between bitcoin word exposure in news and bitcoin price

For the period from 2013 to 2017, we analyzed the Bitcoin price fluctuation and the frequency of the word Bitcoin exposure in the news. The variation of each deviation was used for the analysis by using the mean and the standard deviation according to the difference between the values of each variable.

Table 4: Correlation between Bitcoin and each related field

Division	All	Science	Economy	Society	Politics
Correlation coefficient	0.89	0.30	0.94	0.50	0.33

The correlation between all news and Bitcoin mentions was very high at 0.89. Especially, Bitcoin correlated with Economics(0.94) and Society(0.50) news categories

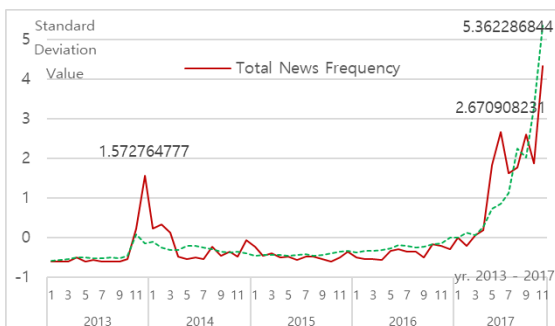


Figure 4: Correlation between Bitcoin mentions frequency in news and Bitcoin price fluctuation.

The more the word Bitcoin is mentioned in the news, the higher Bitcoin price has risen. Since 2013, the frequency of Bitcoin words appearances and changes in Bitcoin prices have been moving at the same direction. Between 2013 and 2014, the appearance of Bitcoin words increased, followed by Bitcoin prices. However,

since late 2017, the number of Bitcoin words has increased in the news after the Bitcoin price has risen.

This means that as the price of Bitcoin rises rapidly, it is mentioned more in the news, therefore it means that interest and investment have increased in the public with a virtuous cycle structure. Similarly, in the economic news, the number of Bitcoin exposures and Bitcoin price fluctuations show that the amount of Bitcoin exposures increased in the economic news in 2013, and the Bitcoin price subsequently increased with the time difference. And the same trend is observed in subsequent years through 2016.

In 2017, the number of Bitcoin word exposures in news increased after the change in Bitcoin price. In 2013, there was a time when people were preoccupied with the introduction of the Bitcoin and started to get interested in it as a new service. Between 2014 and 2016, interest in Bitcoins increased, which contributed to rise in Bitcoin prices as the media the number of people interested in investing in Bitcoins by providing various information at the same time. In addition, it was reported that there was the profit from Bitcoin investment since early 2017, and some countries have legally recognized Bitcoin, increased Bitcoin exchange in Korea, and the increase of workforce participation related to the positively influenced participation in the Bitcoin market. As a result, the number of Bitcoin investors has increased and the price of Bitcoin has risen due to the effect of network externality.

With regards to government, officials started to discuss the aspects of its activation and regulation, and various opinions of experts were provided in the news, and the public also contributed to the growing investment. In the case of the general public, the number of trading participants increased rapidly due to the increase in successful investment cases based on rapid Bitcoin price increase



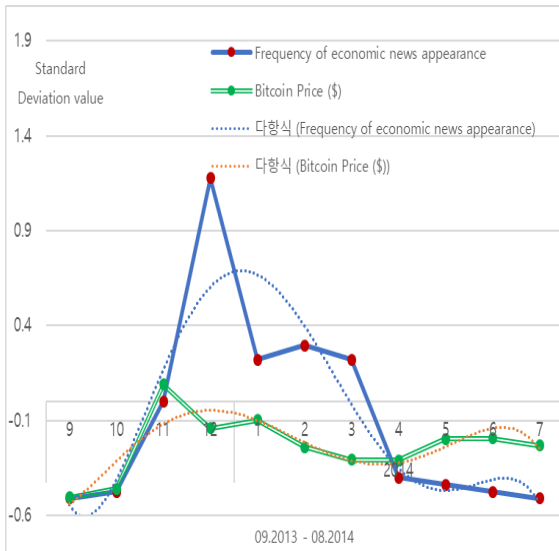


Figure 5: Correlation between the number of times of appearance of Bitcoin in the economic field and Bitcoin price fluctuation from 09.2013 to 08.2014.

Table 5: Number of positive and negative word exposures in Bitcoin articles

2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Positive	42	45	61	16	39	85	55	98	27	95	68	59
Negative	18	12	20	12	26	51	76	76	17	31	26	52
2017	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Positive	104	107	145	137	315	534	468	480	596	504	1,021	3,636
Negative	53	48	111	36	313	523	360	235	499	372	586	2,716

A survey of data from January 2016 to December 2017 showed that positive words were more frequently used than negative ones. This also referred to the negative aspects of Bitcoin in the market, but it was actually more positive for the general public. This showed that it contributed to build confidence in Bitcoin value in the market. It means that as the public gained confidence, it became a factor to increase participation in Bitcoin trading investment.

#### 4.2 Topic 2. Influence of perception of bitcoin and its value between 2016 and 2017

The frequency of exposure of each word in the news was measured by selecting positive and negative terms appearing in Bitcoin news as a measure of public perception related to Bitcoin. This study investigates how public awareness is perceived between the negative and positive aspect about Bitcoin. To assess the response to Bitcoin market, we selected positive words (transactions, investment, innovation, price increase, the opening of investment) and negative words (speculation, money laundering, bubble, danger, hacking, plunge and crime) related to Bitcoin

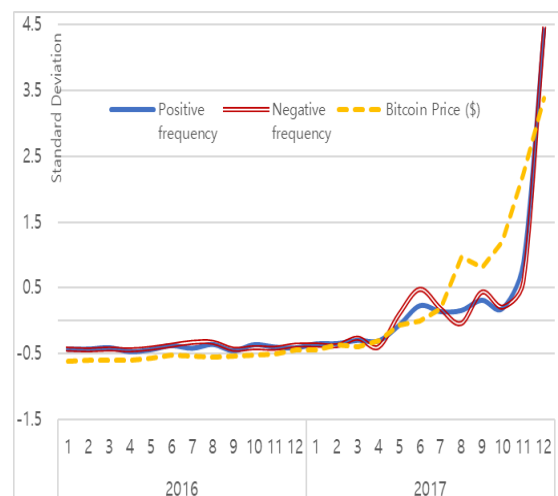


Figure 6: Public awareness of Bitcoin in 2017.

The standard deviation is a positive number, and a minus is inserted when the change of each value is decreased. According to media news

analysis, it is evaluated that it provided a positive view of people participating in the bitcoin investment.

Table 6: The standard derivation values of positive and negative word used in Bitcoin articles from 2016 to 2017

Year	Month	Jan	Feb	Mar	Apr	May	Jun
2016	Positive frequency	-0.43	-0.43	-0.41	-0.47	-0.44	-0.38
	Negative frequency	-0.44	-0.45	-0.44	-0.45	-0.42	-0.38
	Total Frequency	-0.44	-0.44	-0.42	-0.46	-0.43	-0.38
	Bitcoin Price (\$)	-0.62	-0.60	-0.60	-0.59	-0.57	-0.53
2017	Positive frequency	-0.35	-0.35	-0.30	-0.31	-0.07	0.23
	Negative frequency	-0.38	-0.38	-0.27	-0.41	0.09	0.47
	Total Frequency	-0.36	-0.36	-0.29	-0.35	0.00	0.33
	Bitcoin Price (\$)	-0.44	-0.37	-0.40	-0.30	-0.07	0.00

Year	Month	July	Aug	Sep	Oct	Nov	Dec
2016	Positive frequency	-0.42	-0.36	-0.45	-0.36	-0.40	-0.41
	Negative frequency	-0.33	-0.33	-0.44	-0.42	-0.42	-0.38
	Total Frequency	-0.38	-0.35	-0.45	-0.39	-0.41	-0.40
	Bitcoin Price (\$)	-0.54	-0.56	-0.55	-0.52	-0.51	-0.44
2017	Positive frequency	0.14	0.16	0.31	0.19	0.89	4.41
	Negative frequency	0.18	-0.05	0.43	0.20	0.59	4.43
	Total Frequency	0.16	0.07	0.36	0.19	0.76	4.43
	Bitcoin Price (\$)	0.18	0.96	0.82	1.20	2.23	3.39

### 4.3 Discussion

According to the results of this study, it can be confirmed through the empirical database that

new technologies are emerging due to technological development through Bitcoin and that they are directly or indirectly changing the

society changes connected with economic value. In the case of research topic 1, we found that there is the relationship between the numbers of times the word Bitcoin in the news and the Bitcoin price change. In the case of Bitcoin, the correlation with the news of Naver, the Korean portal site collected was very high at 0.89. Especially, Bitcoin is a service linked to economic value and correlation with the economy is very high as 0.94.

It is estimated that the newly emerging service has the confidence that this service would generate the profit. So the Bitcoin trader has increased in the market and the Bitcoin price has risen. In the case of research topic 2, we found that public awareness of Bitcoin, from January 2016 to December 2017 turns out that people have recognized the potential for a positive investment in Bitcoin, by showing that positive words were more frequently used than negative ones.

There were the negative aspects of the Bitcoin in the market, but it shows that the news contributed substantially more positive impacts to the public, contributing to building confidence in Bitcoin's value in the market. Therefore, it was analyzed that the news provided a positive influence on investment participation in Bitcoin.

## 5. CONCLUSION

Nowadays, the interest in cryptocurrency investment through exchanges is increasing, and this is emerging as a social issue. As a theoretical background for the price change of cryptocurrency, we discussed the network externality. Depending on network externality, the market leads to higher consumption and participant's activity, and the increase in cryptocurrency transaction is also connected to the network externality theory.

This study is provided objective evidence about media influence and public awareness of cryptocurrency price change influence. To do this, news data in Korea's popular portal site, Naver from 2013 to 2017 were collected and classified using a text-mining technique, and then the frequency of Bitcoin mentions and

Bitcoin price change were compared. In order to measure the public perception, positive and negative words related to Bitcoin were selected from the collected data and the frequency of appearances in news was tracked from 2016 to 2017 in Korea portal site.

In this study, the correlation between the number of Bitcoin mentions in the news and the price of Bitcoin is analyzed. From 2013 to 2017, Bitcoin exposures in the news and Bitcoin price rises were positively correlated with each other. Therefore, this research result provides the objective evidence that the Bitcoin price change is closely related to the information provided by the media. The Bitcoin trader has increased in the market and the Bitcoin price has risen. This phenomenon is explained by network externalities.

The public perception of Bitcoin was found to be more positive than negative in 2016 and 2017. The change in Bitcoin price is influenced by various factors, and we provide the objective evidence that media information and public perception provide the direct cause of cryptocurrency price change. Therefore, positive public perceptions have led to an increase in cryptocurrency prices.

This study is showed the objective evidence that cryptocurrency price change and media information are closely related.

The limitations of this study are the using only the information of the media articles provided news by the Korea's portal site, Naver and only measure the effects of the media and the change of public perception among the various factors of Bitcoin price fluctuation. Future research is also needed to track down other price fluctuation factors related to Bitcoin.

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