# MODELLING CRYPTOCURRENCY ACTIVITIES' REPORTAGE USING CORRELATED TOPIC MODEL

# T. O Maku<sup>1\*</sup>; M. O. Adenomon, and M. U. Adehi

1. Department of Statistics, Faculty of Science, Federal University, Otuoke, Nigeria.

2, 3. Department of Statistics, Faculty of Science, Nasarawa State University, Kefi, Nigeria

## \*Corresponding Author: makuto@fuotuoke.edu.ng; +2347060988998

## Abstract

This study aimed at unveiling the connections amidst cryptocurrency activities by users and how traders read these activities online to aid their trading capabilities. Therefore, it examined the daily actions of Bitcoin traders who may have learned about the market from news items. The study employed the latent Dirichlet Allocation (LDA) model and its version, and the Correlated Topic Model (CTM) to examine news stories that were scraped from the market section website of CNBC. Using this machine learning process, topics with their terminology and words that were hidden in the documents and articles were found. The Document-Termmatrix was used to create coherence and perplexity graphs, which were then used to determine the number of Topics (K) to prevent the CTM from being overfitted or underfitted. The topics were determined by estimating the proportions for each document, and the CTM was used to perform correlation tests between the themes that were found. Similarly, document-word proportions and topic-word proportions were also measured. The posterior covariance matrix produced by the CTM was used to create a dense topic graph, which was then fed straight into a network analysis model to show positive, negative, and no relationships between the topics. Additionally, papers were searched using the "Hellinger distance" approach to determine the relationship between two or more documents/articles. The outcome demonstrates that there were more positive correlations between the topics that were found and between the different documents and topics that might have included the collective knowledge underlying the cryptocurrency traders' actions.

**Keywords:** Topic modeling, Latent Dirichlet Allocation, Correlated Topic Model, Consumer News and Business Channel's market section website

## 1. INTRODUCTION

As early as 2200 BC, payments were made using several kinds of money before the invention of cryptocurrency. But since its inception, money has undergone constant transformation, taking on new forms while still performing the same essential functions. When money initially started to circulate, it was usually in the form of commodities, or goods with intrinsic value that were exchanged between people, such as produce or seeds. Some academics claim that the earliest money was made of cowry shells (Sehra *et al*, 2018).

As civilization developed, various forms of money, such as gold and silver, were produced and eventually took the role of barter as a medium of exchange.

Our perception of money started to change with the introduction of the World Wide Web, which eventually led to the development of credit cards, smartphones that could access bank

accounts, and other financial advancements. Simultaneously, technological improvements were also impacting other facets of our existence.

Because of the cryptocurrencies' recent development and increase in market capitalization, more people are opting to invest in platforms like Litecoin, Ethereum, Ripple, and Bitcoin. The price and policy uncertainty in the cryptocurrency market have an impact on the daily return pattern of the market (Sehra *et al*, 2018). One should be aware of the considerable danger that the decentralized nature of cryptocurrencies brings before making an investment or dealing with them. The uncertainty indices for investors and many users estimate the degree of unpredictability for the future direction of the financial market, spanning from numerous themes, the market factors (internal & external), and the trade friction among all the digital currencies.

We have decided to focus our analysis on Bitcoin out of all the various cryptocurrencies. According to a website (coindesk.com), the current price of one bitcoin is more than 42,978.125 US dollars or 30,480,937.80 million naira.

The legalization of Bitcoin in countries like Australia and Japan has significantly increased demand for the cryptocurrency and positively impacted the market. More countries throughout the world are gradually accepting Bitcoin. As per "The Africa Report," an online publication, the use of cryptocurrencies in Africa surged by 120% between July 2000 and June 2021. The behavior of individuals who possess a significant quantity of Bitcoins, together with societal opinions, political beliefs, and emotional states, all influence the price of Bitcoin.

News articles are a good source of knowledge on the previously stated components because they often provide the public with first-hand information. Through several mobile applications, people who are interested in Bitcoin transactions can access the most recent news, price movements, and their causes at any time and from any location. They could utilize this knowledge to help them decide whether to buy or sell. In this study, we investigated the influence of daily news on the price of bitcoin. The investigation shows that crowd wisdom is a powerful predictor of key events affecting cryptocurrency that investors and users use and can connect to data from news articles.

By evaluating and assigning a numerical value to these resources (textual data), we attempt to make use of the result of the investigation carried out. The most useful type of information is probably the textual information seen in news items, which is the views of traders and investors. It plays several significant roles. Text (in natural language form) is the most natural way to store and encode human information. Text is the most expressive form of information since it can explain other media kinds like images and videos. For example, to identify images that

match a user's textual input keyword query, the Google image search engine often matches a set of text of photos. (Zhai and Massung, 2016).

A substantial portion of the public gets at least some information via websites, applications, or social networking sites, according to several surveys. The web channel is currently the second most important source of information behind television among those who prefer reading news articles over watching or listening to the news. (Kaya and Karsligil, 2010). Given the exponential growth of digital text data, there is a great demand for methods and tools for handling and leveraging big text data in this environment. Text data is largely created by humans for communication, and as such, it is usually rich in semantic content and contains significant knowledge, opinions, and preferences. These factors all contribute to the demand for text data. However, most machine learning algorithms cannot deal with raw texts directly. News articles in plain text are converted into numerical features that can be processed by machine learning systems. The field of natural language processing (NLP) has made some text analysis algorithms and techniques easily accessible. Among the numerous text representation methods are distributional semantics, N-grams, Bag of Words, One-Hot Encoding, Vector Semantics (tf-idf), etc. The recommended approach made use of the Latent Dirichlet Allocation (LDA) and its version correlated Topic Model (CTM) which are part of the Topic model family.

Topic models that learn a limited range of topics, such as Latent Dirichlet Allocation (LDA), are said to be able to capture the co-occurrence of terms in discrete count data. (Blei and Jordan, 2003). Given themes, any article can be represented as a distribution over topics, and any downstream supervised job can then use the weights of this distribution as input. Topic models reduce the complexity of the data, which improves the interpretability of forecasts, particularly when the topics are interpretable. This renders topic models valuable in domains like criminal justice (Da et al, 2017) and health care (Michael et al, 2017) where interpretability is a need for downstream validation. Since it makes it simpler to evaluate this massive volume of textual data to learn about various information and preferences, including how much news affects the Bitcoin market, text/opinion mining has become quite popular (Zhai and Massung, 2016). Sources of textual data include both independently developed and corporately produced materials. Sources generated by the company, such as quarterly and annual reports, can provide a rich language structure that, when carefully examined, can forecast the company's future performance (Kloptchenko et al, 2004). Topic models are generative models with a probabilistic basis that are utilized in natural language processing and machine learning (Liu et al, 2016). "Topics" describes the undefined, hazy connections between words in a vocabulary and how they are used in writing. A document is conceptualized as an assortment of topics.

Topic models unearth the hidden themes in the collection and annotate the papers according to those themes. It is believed that each word comes from one of those topics. Lastly, a distribution of document coverage of topics is generated, providing a new way to analyze the topics' viewpoints data.

Blei and Jordan (2003) introduced the LDA, which is an even more extensive probabilistic generative model (unsupervised machine learning) that builds upon Probability latent semantic allocation (PLSA). Since the introduction of LDA (Blei and Jordan, 2003), the methodology has served as a foundation for several topic models. Although the LDA might be most appropriate for learning static or fixed set themes in a corpus, it can also be customized in some ways to learn dynamic topics. For example, to determine the links between topics in a corpus, Bollen et al, (2010) developed the Correlated Topic Model (CTM), which is based on LDA. The more adaptable Logistic Normal distribution was adopted by the CTM in place of the Dirichlet distribution for the latent variable that represents the percentage of each topic in a document. This allows for an examination of the covariance/correlation structure of the model's component elements. These provide a model where the existence of one latent topic may be related to another, and they more faithfully capture the latent topical structure of the data. The primary computational hurdle for Topic modeling using the LDA and its variants is approximating posterior distribution, and many of these problems are unsolvable. Numerous approximation strategies have been proposed, primarily categorized into two approaches: Variational Inference and Markov Chain Monte Carlo (MCMC). The MCMC approximation approach (Griffiths et al, 2004) uses collapse Gibbs sampling, while the variational inference approximation (Blei and Lafferty, 2006) uses mean field variational inference (Griffiths et al, 2004) collapse variational inference (Teh et al, 2006), and expectation propagation.

Stenqvist and L"onn"o, (2017), collected 2.27 million messages regarding Bitcoin from Twitter and utilized the dataset to infer the short-term price change. At intervals of four minutes to four hours, aggregated sentiment changes were performed, and values were advanced one to four times to correspond to corresponding price changes. The testing results show that their ideal parameters yield a 79% accuracy. Because their research is based on data from a single month, it is not representative.

400 distinct kinds of chain-lets were extracted from the Bitcoin blockchain by Akcora *et al*, (2018), who then used cosine similarity to cluster them. A random forest model was employed to predict the price of Bitcoin, and Granger Causality was utilized to show the dataset's predictive power. Certain forms of chain lets were shown to have the largest predictive

influence on both investment risk and the price of Bitcoin when they examined the Granger predictive causality of chain lets.

McNally *et al*, (2018) predicted the price of Bitcoin using mining difficulty, hash rate, and historical pricing data using a machine learning algorithm. They achieved the best classification accuracy of 52% and RMSE of 8% for price data, mining difficulty, and hash rate with the use of machine learning. Their RMSE of 8% and classification accuracy score of 52% were the best.

The research by Yao *et al*, (2019) is closely related to ours; in this study, the researchers investigated if news stories have an impact on the price of bitcoin by applying machine learning and the Senti-Graph. Sentiment analysis is used by Senti-Graph to turn a news article into a graph. In comparison to previous feature extraction strategies, their trial findings indicate that the strategy had a good forecast accuracy, which also illustrates the impact of news items on the price of bitcoin.

Bollen *et al*, (2010), attempted to predict the stock market. From daily tweets, Opinion Finder and GPOMS gathered seven features. Before training self-organizing fuzzy neural networks, these traits were investigated via Granger causality. They only use news articles in their scenarios, which are different from instant communications. The news contains more thorough information and is relatively longer. The length of the tweets utilized in their research was limited to 140 characters, whereas the news does not have this restriction.

Nagar and Hahsler, (2012), searched the news and eliminated articles of specific stock categories. Articles, sentences, paragraphs, and titles are a few examples. The number of variances between positive and negative words indicates the polarity of an event. The percentage of positive polarity incidences in a corpus determines its score. They found a strong relationship between the corpora scores and the firm price.

Mueller and Rauh, (2016), provided an innovative method for topic-modelling newspaper text summaries (LDA). They predicted the beginning of the bloody fight one or two years in advance. When making their prediction, they distinguished between the possibility of violence between nations and the occurrence of conflict within each nation at a given time. Their analysis shows that the within-country variation, or their generated news data, has a comparative advantage in wartime prediction. They proposed that this is a particularly useful addition since it incorporates textual data into the most often used conflict predictors in the study.

Geletta *et al*, (2020), used natural language processing (NLP) and machine learning (ML) techniques to identify recurring patterns in narrative research materials to distinguish between successful and failed studies. Their goal was to identify the factors that led to unsuccessful research endeavours.

Colianni *et al*, (2015), looked into whether supervised machine learning algorithms may be used to develop profitable bitcoin trading techniques utilizing cryptocurrency-related Twitter data. They provided an overview of many machine-learning techniques for identifying changes in the Bitcoin market. The well-known alternative currency that is examined in this study is called Bitcoin (BTC). To ensure that exact inputs were used across the entire model, a thorough error analysis was conducted. Their analysis produced an accuracy gain of 25% on average.

Blei and Lafferty, (2006), developed the correlated topic model (CTM), which displays the correlation between topic proportions using the logistic normal distribution. They created an approximation posterior inference method based on mean-field variational inference for this model. Their analysis revealed that CTM yields a better match than LDA when applied to a batch of OCRed articles from the journal Science. They also showed how the CTM may be used to intuitively view and analyze this and other unstructured data sets.

Utilizing an interpolated multi-model approach, Wolk, (2020), examined the impact of social media on cryptocurrency prices. They illustrated how the extremely speculative valuations of cryptocurrencies were substantially impacted by the mental and behavioral attitudes of the general public.

Parekh *et al*, (2022), proposed DL-Gues, a robust and hybrid framework that considered both market sentiment and the interdependence of each coin for predicting cryptocurrency prices. They considered the Dash price projection, which was calculated for various validation loss functions based on price history and tweets from Dash, Litecoin, and Bitcoin. To evaluate the applicability of DL-Gues on other cryptocurrencies, they also analyzed the price history and tweets of Bitcoin-Cash, Litecoin, and Bitcoin to deduce findings for price prediction of Bitcoin-Cash.

Card *et al*, (2017), provided a broad neural framework based on topic models and built upon recent advancements in variational inference techniques to enable the flexible and rapid insertion of metadata and the study of alternative models. Their approach yielded good results with a fair trade-off between ambiguity, coherence, and sparsity. Finally, to demonstrate the potential of their method, they looked at a corpus of papers about immigration to the US.

Valencia *et al*, (2019), proposed predicting fluctuations in the price of Litecoin, Ethereum, Bitcoin, and Ripple cryptocurrency marketplaces by utilizing publicly accessible social media data and conventional machine learning techniques. They compared the use of neural networks (NN), support vector machines (SVM), and random forests (RF) using components from Twitter and market data as input features. The results showed that NN outperformed the other models, that machine learning and sentiment analysis may be used to predict cryptocurrency prices, and that some cryptocurrencies may be extrapolated just from Twitter data.

Previous studies like Yao *et al*, (2019) and Wolk, (2020), have shown that the impact of investor opinion on Bitcoin returns can be measured using unstructured language, such as sentiments on Twitter, which may or may not include meaningful and sufficient information. Our study will use structured textual data to examine how the sentiment of Bitcoin users affects Bitcoin returns. The goal of our suggested text-feature extraction of unsupervised Latent Dirichlet Allocation, or the CTM, is to raise traders' awareness when they rely on news items for trade expertise.

## 2 MATERIALS AND METHOD

The study population focused on news stories about cryptocurrency-related activity published in foreign media between 2016 and 2022. The Consumer News and Business Channel (CNBC) is the source of these news pieces, and Appendix IV has hyperlinks to each document. Because of the widespread use of Bitcoin among other cryptocurrencies, it is used in this study.

Every one of the more than 6,000 news pieces published between 2016 and 2022 was written in English. With a custom Python script called "beautiful Soap" created with the Jupyter Notebook, the text data was quickly scraped from the source mentioned above together with the accompanying meta-data. The query 'Daily Bitcoin reports was used. The pages were stored in a comma-separated (CSV) format with the following meta-data:

- i. Article Headline
- ii. Article section
- iii. Article link
- iv. Article date
- v. Article summary
- vi. Article body
- vii. Opening Price
- viii. Closing Price

#### 2.1 Specifications and Estimation of the CTM

To overcome a limitation, the Correlated Topic Model (CTM) introduces a more flexible distribution that permits investigating the covariance structure across components (Blei and Lafferty, 2006). This was accomplished by replacing the Dirichlet distribution with the Logistic Normal distribution (Aitchison and Shen, 2019), which is conjugated to the topic assignments and so more computationally convenient. The CTM yields a more accurate and realistic fit of the latent topical structure by using the logistic normal distribution in its hierarchical model to describe the hidden composition of topics linked with each document (Aitchison, 2019, Blei and Lafferty, 2006).



Figure 2.1: The CTM model

CTM assumes the following generative process and produces N-word documents.

- 1. For each topic  $k \in \{1, \dots, K\}$ 
  - a. Draw a distribution over words  $\beta_k \sim Dir(\emptyset)$
- 2. For each document  $d \in \{1, \dots, D\}$ ,
  - a. Draw  $\eta_d | (\mu, \Sigma) \sim \mathbb{N} (\mu, \Sigma)$
  - b. Obtain a topic distribution  $\theta_d = (\theta_{d1}, \dots, \theta_{dK})$  as  $\theta_{dk} = f(\eta_d)$
  - c. Let  $\eta_d$  be the word in document d,  $\forall n \in \{1, ..., N_d\}$ 
    - i. Draw topic assignment  $z_{d,n}|\eta \sim Mult(f(\eta d))$
    - ii. Draw word  $w_{d,n}|(z_{d,n}, \beta_{1:K})$  Mult $(\beta_{z_{d,n}})$

where  $f(\eta_d)$  is a function that maps the real vector natural parameter,  $\eta$  to the simplex

$$\theta = f(\eta) = \frac{\exp(\eta_i)}{\Sigma_j \exp(\eta_i)}$$

The full joint distribution is as follows:

 $p(w, z, \beta, \eta | \emptyset, \mu, \Sigma) = p(\beta | \emptyset) p(\eta | \mu, \Sigma) p(z | \eta) p(w | \beta, z)$ 

$$=\prod_{k} \frac{\Gamma(\Sigma_{\nu} \phi_{\nu})}{\prod_{\nu} \Gamma(\phi_{\nu})} \beta_{k\nu}^{\phi_{w}-1} \cdot \prod_{d} \frac{1}{2\pi^{\frac{k}{2}} |\Sigma|^{\frac{1}{2}}} \exp\left\{-\frac{1}{2} (\eta_{d}-\mu)^{T} \Sigma^{-1} (\eta_{d}-\mu)\right\} \cdot \prod_{d} \prod_{n} \frac{\exp\left(\eta_{dz_{dj}}\right)}{\Sigma_{k} \exp(\eta_{dk})} \beta_{z_{dn} w_{dn}}$$
(1)

Given a collection of topics and distribution over topic proportions  $\{\beta_{1:K}, \mu, \Sigma\}$ , for a document w<sub>d</sub>, the posterior distribution of the latent variables conditioned on the words of a document is;

$$p(\eta, \mathbf{z} | \mathbf{w}, \boldsymbol{\beta}_{1:K}, \boldsymbol{\mu}, \boldsymbol{\Sigma}) = \frac{p(\eta | \boldsymbol{\mu}, \boldsymbol{\Sigma}) \prod_{n=1}^{N} p(Z_n | \boldsymbol{\eta}) p(W_n | Z_n, \boldsymbol{\beta}_{1:K})}{\int p(\eta | \boldsymbol{\mu}, \boldsymbol{\Sigma}) \prod_{n=1}^{N} \boldsymbol{\Sigma}_{z_n}^k p(Z_n | \boldsymbol{\eta}) p(W_n | Z_n, \boldsymbol{\beta}_{1:K}) d\eta}$$
(2)

We estimated the CTM parameters using variational expectation maximization and given a collection of documents by attempting to maximize the likelihood of the corpus as a function of the topic  $\beta_{1:K}$  and the multivariate Gaussian ( $\mu$ ,  $\Sigma$ ).

In the E-step, we will use variational inference to maximize the (coordinate ascent) objective function constrained concerning the variational parameters for each document.

$$L(\mu, \Sigma, \beta_{1:\mathrm{K}} | \mathbf{w}_{1:\mathrm{D}}) \ge \sum_{d=1}^{D} \mathbb{E}_{q}[\ln p(\eta_{d} z_{d} w_{d} | \mu, \Sigma, \beta_{1:\mathrm{K}})] + \mathrm{H}(q_{d})$$
(3)

We maximized the bound concerning the model parameters in the M-step. This included a maximum likelihood estimate of the themes and multivariate Gaussian using assumed adequate statistics, with the expectation being taken about the variational distributions derived in the E-step.

$$\hat{\beta}_i \, \alpha \, \sum_d \tau_{d,i} n_d \tag{4}$$

$$\widehat{\mu} = \frac{1}{D} \sum_{d} \lambda_{d} \tag{5}$$

$$\widehat{\Sigma} = \frac{1}{D} \sum I v_d^2 + (\lambda_d - \widehat{\mu}) (\lambda_d - \widehat{\mu})^{\tau}$$
(6)

where  $n_d$  is the vector of word counts for document *d*.

## 2.2 Fitting the Model

The variational expectation-maximization (VEM) approach is employed to fit the models. Parameters like the "Document-Term matrix," "K" (the number of topics), and "control" (the correlated Topic Model (CTM)-VEM) were used to fit the correlated Topic Model. The algorithm's rate of convergence was modified by varying the settings of the "control" (CTM-VEM). The convergence tolerance for the variance and E-M algorithms was established using the parameters. Additionally, one of the settings for the conjugate gradient algorithm which alternates between the E-step and M-step to optimize the likelihood of the corpus sets the maximum number of iterations that may be performed.

In the M-step, the technique determines the maximum bound for the model parameters (the topics and the multivariate normal parameters), and in the E-step, it determines the maximum bound for the latent variables (the topic proportions and the topic assignments Z). Variational inference was applied until the relative change in the probability was less than 10<sup>-6</sup>, and variational EM was applied until the relative change in the likelihood bound was less than

10<sup>-4</sup>. The iterations on a 2.7GHz core i7 HP laptop with 8 GB RAM reached convergence in precisely 6 hours and 45 minutes.



## **3 RESULTS AND DISCUSSION**

Figure 3.1: Bar plot of documents from various sections on the CNBC website.

Figure 3.1 shows that most of the documents out of the 5819 documents, came from the technology section. This simply means that cryptocurrency activities are driven by technology.



Figure 3.2: Bar plot of the top 40 words in the corpus

The top 40 words according to Figure 3.2 above show words like "bitcoin", "year", "company", and "market", e.t.c has a high frequency of occurrence in the corpus.



Figure 3.3: Wordcloud of the first 400 words in the corpus

Regarding Figure 3.3, the word cloud is a broader view of word occurrence frequencies when compared with the barplot in Figure 3.2 above. The bigger the word, the higher the frequencies.

# Table 3.1: Tabular Summary of the corpus

Number of	Total word count	Total number of
documents		unique words
5,819	1,119,023	17,616

Table 3.1 shows a summary of the entire corpus, given that we analyzed 5,819 articles with a total word count of 1,119,023 and unique terms totaling 17,616.



Figure 3.2: Graph of coherence scores for the corpus

We used the elbow approach to examine the graph in Figure 3.2 and determine which number of topics is the most correct. When taking the coherence score into account, the elbow with the highest frequency (k = 13) has the optimal number of topics. We chose the second elbow with the highest frequency, k = 35, to prevent the model from being under-fitted. This seems to be a good way to represent the corpus without going overboard.

# Table 3.2: Table showing the first Seven (7) Topics with Ten (10) words/terms from the CTM output

Topic 1	Topic 2	Topic 3	Topic 4	<b>Topic 5</b>	Topic 6	<b>Topic 7</b>
tokenize	playing	first	developer	staid	polling	buildup
honig	netherlands	tripled	fond	mediumsized	interfax	affirmed
imply	feel	thankful	tape	firstout	piloted	superrich
maxim	marked	regret	doug	costing	crow	iaccino
Aaound	sloan	stifel	chip	oncepopular	accrued	nonaccredited
Cryptic	bashed	supervision	perjury	sample	distributor	premature
incorporates	faceless	export	takeover	wikipedia	becky	mood
safety	supplychain	celebrate	screenshot	overexuberance	bancorp	faint
supplydemand	permissioned	vaynerchuk	natixis	iaccino	private	mile
cybercrime	devastating	gear	chosen	silver	buzzy	threat

From the above table, Topic 1 talks about the News articles' safety measures, when considering adding bitcoin and other cryptocurrencies to one's retirement savings. Topic 2 exposes the News article's concern about the losses made in the bitcoin market, the sharp tumbling of bitcoin price, and its recovery trend. Awareness of scammers' activities in the Bitcoin and cryptocurrency market, education on safety guilds against falling victim, and the proportion of Bitcoin investors adopting artificial intelligence while trading were all captured in Topic 3. Topic 4 captures how Investors fled risk assets after the Federal Reserve of the US affirmed its commitment to an aggressive tightening path. Also, a measure of the activity of bitcoin miners' possibilities of giving investors a clue as to where the digital currency is headed next is captured in this Topic. Topic 5 encapsulates how Bitcoin could be having a "watershed" moment, as the cryptocurrency continued to rally off of lows. Sports trading card activities, fetching record prices in the millions, and collectors lining up online to buy virtual basketball "moments" that use blockchain were also captured in Topic 5. Activities as to how the crypto market was hit by several factors, ranging from the collapse of stable-coin terra-USD to questions of solvency at crypto lender Celsius are explained by Topic 6.

The activities of Draper, an early backer of Bitcoin and its underlying blockchain technology, participating in a so-called "initial coin offering" of Tezos was revealed by Topic 7. The Abu

Dhabi Financial Services Regulatory Authority's declaration on bitcoin having the same status as "commodities", is also captured in this same topic. The dollar falling to two-week lows on choppy trading, led by losses against the yen and euro, was recorded to be at risk sentiment improved in the afternoon session amid stock market gains and as U.S. Treasury yields rose. However, this led bitcoin price surging overnight, which is captured in Topic 8.

There are other 22 topics uncovered by the CTM, which can be seen in Appendix (i).

## Table 3.4 shows the CTM Per Topic-word proportion output.

		accordin		aggressiv	algorithmi		
		g	affirmed	e	c	alltime	analyst
						3.78E-	
	1	5.34E-05	5.37E-05	9.16E-05	9.83E-05	05	5.79E-05
						6.71E-	
	2	8.25E-05	1.87E-05	8.29E-05	3.18E-05	05	9.18E-05
						9.66E-	
TOPICS	3	3.45E-05	3.68E-05	0.00011	9.49E-05	05	4.39E-05
						6.52E-	
	4	2.24E-05	6.25E-05	7.63E-05	4.18E-06	05	9.3E-05
						8.86E-	0.00010
	5	3.97E-05	2.97E-05	6.81E-05	3.14E-05	05	1
			0.00010			6.82E-	
	6	9.11E-05	2	1.15E-05	6.1E-05	05	7.19E-05
						4.96E-	
	7	1.63E-05	0.000112	5.11E-05	9.27E-05	05	5.38E-05
						7.13E-	
	8	9.5E-05	6.33E-05	6.01E-05	9.87E-05	05	2.7E-05
						6.14E-	
	9	9.83E-05	2.99E-05	0.000105	2.02E-05	05	7.46E-05
	1					8.64E-	
	0	8.85E-05	7.42E-05	5.7E-05	2.11E-05	05	2.94E-05

## **TERMS/WORDS**

Table 3.4 above, shows the proportions or percentages of terms/words in each of the 35 Topics unveiled by the CTM. Ten (10) Topics and Six (6) words/terms were randomly selected and displayed in the table above while the full information can be seen in the appendix. The result reveals that 0.00534% of Topic 1 is formed by the word/term "according", 0.00825% of Topic 2 is formed by the word/term "according", 0.00345% of Topic 3 is formed by the word/term "according" and Same theory applies to other Topics and words/terms.

	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6	Topic 7
document	0.01442	0.01160	0.01758	0.59197	0.01207	0.01205	0.01194
0	6	9	1	8	9	1	1
document		0.00789	0.00803	0.31319	0.01219	0.22933	0.00728
1	0.0066	7	6	7	8	8	5
document	0.01188	0.01088	0.03087	0.01510	0.01257	0.22074	0.00918
2	3	8	9	7	7	2	5
document	0.00942	0.01392	0.01135	0.36103	0.01097	0.01306	0.00889
3	4	5	3	9	9	2	7
document	0.00652	0.00721	0.00785	0.00946	0.00721	0.00766	0.00642
4	4	3	6	1	2	1	3
document	0.01046	0.01994		0.01773	0.01537	0.01109	0.01019
5	8	3	0.01357	4	5	4	7
document	0.01304	0.01775		0.02226	0.01844	0.01667	0.01571
6	4	4	0.01755	8	8	9	4
document	0.01549	0.02177		0.04205	0.02436	0.02256	0.01506
7	3	8	0.02131	1	8	4	6
document	0.01099	0.01172		0.30184	0.01220	0.00994	0.01122
8	5	1	0.01078	9	2	7	7

#### Table 3.5 shows the CTM Per Document-Topic proportion output.

According to Table 3.5 above, there is a 5819(row) by 35(column) matrix which shows that the proportions of terms/words in the documents/articles, came from the CTM Topics. However, because of the volume of this result and for clarity's sake, just the eight (8) documents/articles were selected and displayed in the table above why the full information can be seen in the appendix. The result reveals that 1.4% of the words in Document 0 are from Topic 1, 0.66% of the words in Document 1 are from Topic 1, 1.18% of the words in Document 2 are from Topic 1 and this goes on till the 35th topic and 5819th documents are exhausted.



Figure 3.3: Topic Correlation graph

Visualizing the clear correlative relationship between the identified Topics using the Network analysis. [10], which relied on the edges (relationships) and the centrality of the Nodes (Topics) to determine the correlative measure of the Network Analysis graph. It is evident from Figure 3.3 above that the connecting lines, or edges, vary in thickness, distance, and color. The stronger the correlation, the more ticker the edges are; the blue and red colors indicate positive and negative correlations, respectively, between the Topics. The graph's density allows it to be successful in capturing the intricate correlation between the Topics. The hierarchy of Topic relevance is indicated by the nodes' (Topics') centrality.

Topic 35 occupies a central position in the graph, with thicker edges indicating a few Topics that are highly and positively connected with it. This only indicates that Topic 35, Topic 1, Topic 12, and Topic 21 have strong centrality and are hence highly predictive of traders.



Figure 3.4: Topics' strength centrality correlation

Figure 3.4 provides further information on the graph in Figure 3.3, which illustrates the relationship between the subjects. The subjects are arranged in ascending order based on their significance and strength; correlations are shown by the black squares, whereas none are shown by the grey squares. Upon closely examining the subjects presented in Table 3.2, Subject 1 is related to subjects 21, 28, 8, 12, 34, 1, and 20. The topics 31, 32, 29, 10, 2, 33, 16, 22, 14, 17, 24, and 18 are linked to topic 2. There is a relationship between subjects 11,9,27,5,4,23,3,13,19,30,15,6,31 and topic 3. Topics 11, 9,27,5,25,4,23,3,13,19,30,15,6,31,32,29, and 10 are linked to subject 4. Correlates with subjects 27, 25, 23, 3. 13, 11, 9, 4, and 19 are topic 5. For the sake of concision, the degree of correlation between the correlated topics is displayed

in Figure 3.3's dense sparse graph. Topic 1 is one instance of this, as it has favorable relationships with subjects 21, 28, 8, 12, 34, 1, and 20. The sparse graphs, however, indicate that it has a strong correlation with subject 12 initially, followed by topic 21 and then topic 20.



Figure 3.5: Similarity of a queried document and closest documents

One randomly chosen document was queried using the Hellinger distance approach to determine which two documents were closest to the requested document. The graphs below illustrate how the approach calculates the distances between the two nearest documents and the document being queried, accordingly. The graphs in Figure 3.5 above show that, among the two nearest documents and the questioned document, Topics 4 and 6 have the largest proportions. Every topic follows a similar pattern of appearance.

## 4. CONCLUSION

The significance and application of LDA and its version, the CTM, in textual data mining and analysis have been investigated to uncover latent themes, inferred topics, and topics' associations among documents. Relationships between the Hidden Topics in our textual data were also disclosed. Similarly, the relationships between the papers, Topic, and Word/terms were also disclosed. linkages between things like "safe investment plans by traders," "retirement saving incentives," "security of investors brokerage," "cryptocurrency theft," "enthusiasm among investors and traders," "excitement and interest of traders," "crypto mining and the US health care system," etc. are examples of these linkages. Lastly, the relationship between the documents was revealed thanks in large part to the "Hellinger distance."

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# APPENDICES

# **(I)**

# Table showing the thirty-five (35) Topics with Ten (10) words/terms from the CTM output

Topic 1	tokenize	honig	imply	maxim	abound	cryptic	incorporat	safety	supplyder	cybercrim
Topic 2	playing	netherlan	feel	marked	sloan	bashed	faceless	supplycha	permissio	devastatir
Topic 3	first	tripled	thankful	regret	stifel	supervisic	export	celebrate	vaynerchu	gear
Topic 4	develope	fond	tape	doug	chip	perjury	takeover	screensho	natixis	chosen
Topic 5	staid	mediumsi	firstout	costing	oncepopu	sample	wikipedia	overexub	iaccino	silver
Topic 6	polling	interfax	piloted	crow	accrued	distributo	becky	bancorp	private	buzzy
Topic 7	buildup	affirmed	superrich	iaccino	nonaccrec	premature	mood	faint	mile	threat
Topic 8	koomey	utah	ascendanc	cryptofun	rwyo	nvidias	yeah	digitize	salesforce	cochief
Topic 9	course	baseball	tattoo	monetized	moscow	summons	farreachin	stave	assign	somewhat
Topic 10	underesti	belshe	rieder	stopgap	divorced	suspicious	iphone	banker	citizen	dialing
Topic 11	temptatio	instead	scramblin	realized	chess	global	bentsen	reining	urge	wasted
Topic 12	bloodclott	seller	processed	softened	diversifica	system	spec	runoff	tallied	exited
Topic 13	bread	bolder	soccer	switzerlar	highlyanti	centraliza	parity	chicago	mahaney	richer
Topic 14	loginov	quicken	jefferies	everyone	misrepres	plummeti	emin	barclays	bitpanda	worked
Topic 15	ballooned	ethereal	bitcoincha	soybean	oversight	arising	caixin	microsoft	monitor	knowyour
Topic 16	disparate	observe	analytics	versa	hoped	materially	squarespa	rigid	scrutinizir	download
Topic 17	kaleido	unlike	monaco	zscaler	gearing	regional	diamondb	ottersec	obie	netscape
Topic 18	parcel	favoring	jackie	breyer	blowback	lang	nlnk	module	tendency	calling
Topic 19	chappelle	opecled	benefittin	microlend	resulting	facebookt	yhoo	saudi	redesign	arose
Topic 20	memorab	neighborh	commissio	morningst	elder	patino	encourage	niche	whistleblo	raced
Topic 21	wayfair	moderate	fyre	johnson	counterof	designing	offensive	considere	quits	happier
Topic 22	oneal	bead	document	gigabyte	shortsight	distressec	warmed	consists	talking	tradeoff
Topic 23	victory	kenyan	spate	cyberint	expiring	pandemic	asus	ebrokers	tianjin	draft
Topic 24	hileman	keurig	garland	reply	gamers	esma	nakamoto	pivoted	till	assisting
Topic 25	likelihood	opioids	tailspin	fixing	trump	talented	misunders	singapore	line	physic
Topic 26	explosion	easymone	inverse	attributio	disclosure	fired	castle	vcbacked	alleviated	everest
Topic 27	tested	buzzy	reside	unsealed	standoff	reader	specialty	twoshot	assign	trailed
Topic 28	amend	content	gamble	explainer	streeters	shelled	surfside	mitsubish	namesake	pedal
Topic 29	ziop	sledgehar	virgin	religion	soccer	based	contact	amending	corn	uptake
Topic 30	russia	panteras	witnessin	winkler	financebit	buyback	imperfect	harleydav	spun	tucked
Topic 31	hopefully	patch	commerci	copeland	solves	forfeited	guggenhe	stratosphe	roubini	sarah
Topic 32	vehicle	rainy	overheate	clearly	poland	contends	warns	zavery	transactio	piloted
Topic 33	grmn	tragedy	assume	argues	nice	hayek	body	sort	cornell	specially
Topic 34	clothes	twohour	anecdotal	radically	garlinghou	respective	ingenuity	housing	јеер	nbas
Topic 35	button	supporter	slim	springing	subset	unnecessa	ritholtz	sopori	helsinki	mobius

# (II)

# Tables showing the CTM Per Topic-word proportion output (not all).

							WORDS/TE	RMS							
	according	affirmed	aggressive	algorithm	alltime	analyst	apiece	arrow	asset	average	bank	bankrupto	bitcoin	blink	briefly
11	5.34E-05	5.37E-05	9.16E-05	9.83E-05	3.78E-05	5.79E-05	1.25E-05	9.20E-05	3.85E-05	8.41E-05	3.45E-05	9.05E-05	6.67E-05	3.60E-06	7.48E-05
T2 T3	3.45E-05	3.68E-05	0.00011	9.49E-05	9.66E-05	4.39E-05	6.81E-05	3.05E-05	7.87E-05	6.61E-06	3.27E-05	7.78E-05	6.65E-06	3.50E-05	6.28E-05
T4	2.24E-05	6.25E-05	7.63E-05	4.18E-06	6.52E-05	9.30E-05	3.36E-05	7.80E-06	2.38E-05	5.99E-05	0.000111	2.79E-05	8.62E-05	8.42E-05	0.000109
Т5	3.97E-05	2.97E-05	6.81E-05	3.14E-05	8.86E-05	0.000101	2.32E-05	7.08E-05	7.20E-05	8.48E-05	4.28E-05	2.87E-05	0.000102	2.92E-05	8.53E-05
T6	9.11E-05	0.000102	1.15E-05	6.10E-05	6.82E-05	7.19E-05	5.06E-06	4.33E-05	8.95E-05	8.00E-05	1.18E-05	6.06E-05	5.58E-05	0.000102	3.35E-05
T7 T0	1.63E-05	0.000112	5.11E-05	9.27E-05	4.96E-05	5.38E-05	5.26E-05	9.08E-05	6.44E-05	1.52E-05	2.73E-06	9.72E-05	4.92E-05	1.03E-05	1.88E-05
18 TQ	9.50E-05	2 99F-05	0.001E-05	9.87E-05	7.13E-05 6.14E-05	2.70E-05	3.40E-05 8.27E-05	4.02E-05	3.19E-05	3.48E-05	5.88E-05	8.84E-05	9.59E-05	4.70E-05	1.78E-06 9.13E-05
T10	8.85E-05	7.42E-05	5.70E-05	2.02L-05	8.64E-05	2.94E-05	5.26E-05	5.97E-05	1.14E-05	1.51E-05	8.90E-05	9.40E-05	7.08E-05	4.06E-05	9.12E-05
T11	4.51E-05	1.33E-05	7.75E-05	9.47E-05	2.67E-05	0.000106	1.53E-05	8.65E-05	4.19E-05	1.23E-05	9.29E-05	5.37E-05	0.000108	5.04E-05	6.15E-05
T12	6.59E-05	7.74E-05	4.67E-05	9.49E-05	7.53E-05	1.28E-06	9.27E-05	2.43E-05	3.84E-05	4.29E-05	4.37E-05	1.04E-05	1.90E-05	2.91E-05	2.57E-05
T13	6.12E-05	0.000105	4.97E-05	6.02E-05	4.63E-05	0.0001	3.24E-05	8.34E-06	9.54E-05	3.23E-05	0.000104	7.40E-05	0.000102	7.86E-05	4.20E-05
T14	2.08E-05	6.29E-05	0.000105	8.05E-05	3.05E-05	2.17E-05	2.27E-05	5.36E-05	8.14E-05	3.21E-05	6.78E-05	9.33E-05	2.35E-05	7.72E-05	4.19E-05
T15	9.13E-05	1.81E-05	6.62E-05	1.76E-05	2.08E-05	8.74E-05	7.70E-05	0.000107	2.86E-05	0.000104	2.73E-05	9.37E-05	8.35E-05	0.0001	2.75E-05
T17	5.00F-05	9.61F-05	1.05E-05	2.99E-05	7.49F-05	4.38F-05	0.000108	3.02F-05	4.63E-05	1.15E-05	2.18F-05	9.26F-05	8.87F-05	4.99E-05	7.10F-05
T18	1.51E-05	6.86E-05	8.00E-06	2.06E-05	8.97E-05	4.03E-05	6.14E-05	5.04E-05	7.05E-06	3.41E-06	4.36E-05	1.58E-05	9.68E-05	3.03E-05	7.31E-05
T19	4.74E-05	3.99E-05	9.67E-05	1.60E-06	6.69E-05	0.000108	1.69E-05	4.52E-06	5.60E-05	1.12E-05	4.95E-05	5.27E-05	8.32E-05	4.00E-05	4.25E-05
T20	8.26E-05	2.61E-05	8.41E-05	6.42E-05	3.46E-05	2.63E-05	7.40E-06	3.07E-05	3.29E-05	5.69E-05	8.26E-05	5.53E-05	1.31E-05	3.15E-05	2.81E-06
T21	5.93E-05	1.75E-05	3.18E-05	0.000103	7.00E-05	2.73E-05	1.01E-05	0.000111	9.04E-05	2.22E-06	0.000108	6.04E-05	2.52E-05	3.21E-05	4.49E-05
T22 T22	6.32E-05	9.13E-05	7.94E-05	4.22E-05	3.48E-05	0.000107	5.70E-05	1.60E-06	1.81E-05	0.000103	0.000111	3.90E-05	3.83E-05	7.64E-06	1.60E-05
T24	9.12E-06	3.92E-05	7.65E-06	6 28E-05	3.23E-05	7.04E-05 9.72E-06	5.03E-05	7.81E-05	8.16E-05	3.64E-05	9.24E-05	7.64E-05	4.11E-05 3.84E-05	2.93E-05	3.21E-06
T25	9.95E-05	1.20E-05	1.92E-06	9.30E-05	6.37E-05	1.43E-05	8.30E-05	5.28E-05	4.49E-05	9.54E-05	6.18E-06	5.86E-05	7.58E-05	4.95E-05	3.03E-05
T26	0.000112	9.68E-06	3.13E-05	2.65E-06	0.000109	2.19E-05	0.000107	2.94E-05	4.58E-05	2.93E-05	9.20E-05	9.22E-05	2.27E-05	5.61E-05	4.77E-05
T27	9.82E-06	5.40E-05	3.39E-05	7.58E-05	1.75E-05	4.18E-05	8.03E-05	3.92E-05	5.56E-05	6.76E-05	8.32E-05	0.000102	9.73E-05	6.04E-05	5.89E-05
T28	8.51E-05	4.57E-05	7.73E-05	2.97E-05	3.81E-05	9.60E-05	0.000107	8.82E-05	2.88E-05	2.11E-05	8.96E-05	1.99E-05	0.000112	5.31E-05	6.06E-05
T29	8.54E-05	4.06E-05	0.000113	5.16E-05	7.70E-06	3.31E-05	5.67E-05	2.44E-05	2.79E-05	1.77E-05	9.11E-05	9.39E-05	8.73E-05	3.17E-05	9.03E-06
130	2.25E-05	8.98E-05	8.19E-05	7.82E-05	1.46E-05	6.93E-05	5.65E-05	9.92E-05	4.805.05	7.65E-05	3.00E-05	7.22E-05	2.06E-05	4.93E-05	9.37E-05
T32	0.000103	2.39E-05	0.000109	2.10F-06	8.61F-05	0.000101	3.59F-05	7.87F-05	4.80E-05	1.69F-05	2.18F-05	0.000101	9.42F-05	5.17E-05	8.06F-05
T33	1.36E-06	0.000106	3.90E-05	2.42E-06	5.59E-05	7.62E-05	1.55E-05	5.29E-05	0.000112	5.45E-05	5.63E-05	3.35E-06	4.70E-05	7.20E-05	5.64E-05
T34	8.89E-05	3.13E-05	5.99E-05	4.01E-05	2.80E-05	2.45E-05	5.45E-06	6.84E-05	0.00011	9.80E-05	6.62E-05	9.51E-05	7.65E-05	7.18E-05	4.71E-05
T35	7.05E-05	7.65E-05	7.93E-05	2.77E-05	6.13E-05	9.52E-05	5.46E-05	2.91E-05	4.85E-05	6.58E-05	8.94E-05	7.38E-05	6.89E-05	8.60E-05	1.34E-05
							WORDS/TE	RMS							
	bring	capital	cause	celsius	central	chain	chair	chairman	close	coin	coincided	collapse	commitm	continue	crypto
T1	7.88E-05	7.09E-05	3.76E-05	6.86E-05	2.98E-05	6.22E-05	3.57E-05	7.97E-05	3.07E-05	4.16E-06	8.86E-05	9.18E-05	6.71E-05	2.11E-05	4.41E-05
T2	2.65E-05	3.52E-05	4.50E-05	9.36E-05	4.61E-05	5.85E-05	5.75E-05	8.92E-05	5.24E-05	9.61E-05	8.86E-05	1.25E-05	2.79E-05	0.000109	7.26E-05
Т3	0.000103	3.05E-06	1.16E-05	5.45E-05	8.93E-05	0.000107	2.38E-05	9.69E-05	7.22E-05	9.38E-05	8.73E-05	9.10E-05	8.09E-05	4.88E-05	8.21E-05
T4	6.64E-05	0.000111	8.19E-05	2.34E-05	8.71E-05	9.99E-05	7.76E-05	3.07E-05	3.06E-05	6.14E-05	9.45E-05	6.69E-05	5.14E-05	4.29E-05	0.000101
T5	3.81E-05	6.31E-06	7.15E-05	5.99E-05	6.47E-05	7.67E-05	4.89E-05	2.50E-05	2.62E-05	4.40E-05	9.00E-06	4.72E-06	7.33E-05	6.77E-05	8.13E-05
Т6	7.92E-05	6.32E-05	3.19E-05	3.69E-06	0.000103	5.67E-05	5.55E-05	1.66E-05	4.76E-05	0.000108	4.26E-06	4.89E-05	6.18E-05	8.37E-05	0.000111
T7	5.35E-05	0.000107	8.82E-06	4.69E-05	2.88E-05	4.52E-05	9.16E-05	6.45E-05	7.11E-05	0.000107	9.66E-06	0.00011	5.79E-06	0.0001	4.04E-05
т8	4.96E-05	4.30E-05	8.60E-05	4.04E-05	9.92E-05	0.000111	5.70E-05	1.60E-05	3.47E-05	1.41E-05	5.17E-05	8.88E-05	5.82E-06	3.99E-05	4.98E-05
T9	9 14F-05	5 50E-05	9 30F-05	0.00011	7 22F-05	4 16F-06	4 60F-05	8 04F-05	7 06F-05	8 91F-05	2 46F-05	5 71F-05	8 60F-05	6 50F-05	5 20E-05
T10	4 79E-05	9 84F-06	6.49E-05	6 71E-05	0.000106	3 36E-05	6 66E-05	8 11E-05	9 56E-05	0.000108	1.09E-05	6 08E-05	2 56E-05	4 19E-05	2 56E-05
T11	6 505 05	4 595 05	7 605 05	2 60E 05	2 125 05	4 20E 05	5 11E 05	1 405 05	1 59E 05	0.000100	9 425 05	7 905 05	4 00E 05	2 21E 05	2.04E 05
T12	0.092-05	4.596-05	7.00E-05	0.00E-05	2.12E-05	4.29E-05	5.11E-05	1.40E-05	4.305-05	1.000102	0.422-05	7.69E-05	4.99E-05	2.210-05	2.94E-05
112	0.000107	2.4/E-05	5.90E-05	2.45E-05	3.30E-05	0.49E-05	0.000103	9.46E-05	4.70E-05	1.04E-00	9.50E-05	6.79E-05	3.05E-05	4.95E-05	4.30E-06
113	4.02E-05	1.10E-05	5.42E-05	7.40E-05	0.000104	0.000104	8.86E-05	7.21E-05	0.000104	4.23E-05	5.77E-05	1.42E-05	7.63E-05	2.6/E-05	8.79E-05
T14	9.47E-06	6.29E-05	6.88E-05	0.000109	1.32E-05	4.00E-05	5.05E-05	1.40E-05	0.000101	9.54E-05	8.35E-05	2.17E-05	5.44E-05	7.30E-05	4.51E-05
T15	6.85E-05	9.99E-05	2.90E-05	1.78E-05	1.18E-05	9.57E-05	4.78E-05	3.53E-05	4.86E-05	1.11E-05	5.30E-05	0.00011	6.77E-05	0.000106	2.87E-05
T16	7.51E-05	6.28E-05	7.22E-05	8.97E-05	7.60E-05	6.96E-05	5.20E-05	1.36E-05	1.64E-05	7.48E-05	7.44E-05	5.62E-05	1.04E-05	1.86E-06	3.67E-05
T17	8.47E-05	0.000102	6.00E-05	7.00E-05	3.64E-05	8.93E-05	2.81E-06	5.15E-05	4.89E-05	3.46E-05	7.86E-05	1.23E-05	5.44E-05	0.0001	6.21E-05
T18	0.000109	9.94E-05	0.000111	8.15E-05	1.68E-05	7.03E-05	6.96E-05	9.99E-06	7.45E-05	5.02E-05	9.45E-05	9.34E-05	5.75E-05	3.25E-05	1.42E-05
T19	8.23E-05	2.64E-05	3.62E-05	2.48E-05	5.86E-06	6.28E-05	9.63E-05	1.70E-05	0.000106	9.76E-05	8.46E-05	2.58E-05	3.51E-05	3.70E-06	9.97E-05
T20	1.17E-05	4.02E-05	8.11E-05	4.06E-05	0.000102	0.000112	9.09E-05	4.32E-05	2.51E-05	4.74E-05	6.14E-05	5.67E-05	2.41E-05	7.24E-05	2.48E-05
T21	4.11E-05	0.000104	3.43E-06	8.89E-05	2.40E-06	4.33E-05	0.000105	3.82E-05	0.000108	5.62E-05	6.51E-05	7.32E-05	1.78E-05	5.52E-05	7.41E-05
T22	4.48E-05	7.14E-05	7.98E-05	0.000101	4.34E-05	8.65E-05	3.54E-05	1.20E-05	2.03E-05	9.13E-06	6.64E-05	0.00011	4.50E-05	0.000111	3.61E-06
T23	1.16E-05	5.76E-05	2.96E-05	0.000103	6.36E-06	4.65E-05	6.07E-05	3.00E-05	4.36E-05	3.93E-06	7.81E-06	9.89E-05	0.000108	7.60E-05	0.000102
T24	7 34E-05	9 56E-05	2 80E-05	9 99E-05	1 69E-05	8 23E-05	9 79E-05	1 14E-05	3 36E-05	0.000105	0.000105	9 30E-05	6 57E-05	5.06E-05	3 39F-05
T25	5 00E 05	2 055 05	5 1/E 05	2.465.05	2 065 05	0.61E.05	5.505.05	2 11E 05	0.91E.05	0.000105 0.25E 05	0.505105	4 525 06	0.000102	1 61E 05	5 515 05
125	1.425.06	7.935-05	1 EOE OE	2.401-05	2.90L-05	2.445.05	9.30E-05	0.265.05	2.025.05	2 565 05	3.38L-03	4.321-00	0.000103	E 21E 0E	5.511-05
120	1.43E-Ub	1.02E-U5	1.50E-05	0.33E-05	0.00E-U5	5.44E-05	0.3UE-U5	9.30E-U5	5.U3E-U5	2.30E-05	4.94E-05	0.0001	0.000101	5.21E-U5	3.04E-05
127	3.92E-05	4.75E-05	9.50E-Ub	9.79E-05	0.23E-U5	0.000105	3.99E-05	0.000106	5.59E-05	5.08E-U5	0.000109	0.000106	0.000102	0.000103	2.05E-05
128	7.39E-05	0.000106	2.56E-05	6.03E-05	5.03E-05	1.02E-05	3.79E-05	8.49E-05	7.12E-05	0.000112	8.84E-05	1.20E-05	5.37E-05	6.09E-05	2.08E-06
129			C OOF OF	1 01E OE	6 515 05	5 24F-06	8.18E-05	8.44E-05	7.83E-05	0.000103	0.00011	4.28E-05	3.70E-06	8.73E-06	5.18E-05
	9.37E-05	1.46E-05	6.80E-05	4.61E-05	0.511-05	512 12 00									
130	9.37E-05 1.11E-05	1.46E-05 7.66E-05	6.80E-05 8.34E-05	4.81E-05 7.67E-05	7.79E-05	0.000107	2.74E-05	6.53E-05	6.91E-05	6.36E-05	8.66E-05	2.44E-05	3.49E-05	9.98E-05	8.06E-05
T30 T31	9.37E-05 1.11E-05 6.46E-05	1.46E-05 7.66E-05 5.32E-05	6.80E-05 8.34E-05 4.78E-05	4.81E-05 7.67E-05 4.14E-05	7.79E-05 6.34E-05	0.000107 6.50E-05	2.74E-05 9.69E-05	6.53E-05 1.11E-05	6.91E-05 5.39E-06	6.36E-05 9.99E-05	8.66E-05 0.000108	2.44E-05 9.27E-05	3.49E-05 3.12E-05	9.98E-05 5.17E-06	8.06E-05 6.79E-06
T30 T31 T32	9.37E-05 1.11E-05 6.46E-05 8.76E-05	1.46E-05 7.66E-05 5.32E-05 9.64E-05	6.80E-05 8.34E-05 4.78E-05 1.49E-05	4.81E-05 7.67E-05 4.14E-05 5.73E-05	0.31E-03 7.79E-05 6.34E-05 2.97E-06	0.000107 6.50E-05 0.000102	2.74E-05 9.69E-05 9.07E-06	6.53E-05 1.11E-05 7.69E-05	6.91E-05 5.39E-06 8.97E-05	6.36E-05 9.99E-05 1.57E-05	8.66E-05 0.000108 7.55E-05	2.44E-05 9.27E-05 1.30E-05	3.49E-05 3.12E-05 0.000103	9.98E-05 5.17E-06 4.59E-05	8.06E-05 6.79E-06 6.50E-05
T30 T31 T32 T33	9.37E-05 1.11E-05 6.46E-05 8.76E-05 1.88E-05	1.46E-05 7.66E-05 5.32E-05 9.64E-05 2.53E-05	6.80E-05 8.34E-05 4.78E-05 1.49E-05 0.000108	4.81E-05 7.67E-05 4.14E-05 5.73E-05 8.10E-06	7.79E-05 6.34E-05 2.97E-06 7.81E-05	0.000107 6.50E-05 0.000102 8.98E-05	2.74E-05 9.69E-05 9.07E-06 3.42E-05	6.53E-05 1.11E-05 7.69E-05 8.09E-05	6.91E-05 5.39E-06 8.97E-05 5.16E-06	6.36E-05 9.99E-05 1.57E-05 6.33E-05	8.66E-05 0.000108 7.55E-05 8.41E-05	2.44E-05 9.27E-05 1.30E-05 8.71E-05	3.49E-05 3.12E-05 0.000103 3.97E-05	9.98E-05 5.17E-06 4.59E-05 0.000107	8.06E-05 6.79E-06 6.50E-05 5.97E-05
T30 T31 T32 T33 T34	9.37E-05 1.11E-05 6.46E-05 8.76E-05 1.88E-05 2.47E-05	1.46E-05 7.66E-05 5.32E-05 9.64E-05 2.53E-05 0.000106	6.80E-05 8.34E-05 4.78E-05 1.49E-05 0.000108 1.00E-05	4.31E-05 7.67E-05 4.14E-05 5.73E-05 8.10E-06 3.89E-05	0.31E-03 7.79E-05 6.34E-05 2.97E-06 7.81E-05 0.000104	0.000107 6.50E-05 0.000102 8.98E-05 4.72E-05	2.74E-05 9.69E-05 9.07E-06 3.42E-05 6.66E-06	6.53E-05 1.11E-05 7.69E-05 8.09E-05 3.68E-05	6.91E-05 5.39E-06 8.97E-05 5.16E-06 6.00E-05	6.36E-05 9.99E-05 1.57E-05 6.33E-05 0.000109	8.66E-05 0.000108 7.55E-05 8.41E-05 8.51E-05	2.44E-05 9.27E-05 1.30E-05 8.71E-05 0.00011	3.49E-05 3.12E-05 0.000103 3.97E-05 9.68E-05	9.98E-05 5.17E-06 4.59E-05 0.000107 3.35E-05	8.06E-05 6.79E-06 6.50E-05 5.97E-05 5.82E-05
T30 T31 T32 T33 T34 T35	9.37E-05 1.11E-05 6.46E-05 8.76E-05 1.88E-05 2.47E-05 0.000104	1.46E-05 7.66E-05 5.32E-05 9.64E-05 2.53E-05 0.000106 8.43E-06	6.80E-05 8.34E-05 4.78E-05 1.49E-05 0.000108 1.00E-05 5.90E-05	4.81E-05 7.67E-05 4.14E-05 5.73E-05 8.10E-06 3.89E-05 4.85E-05	7.79E-05 6.34E-05 2.97E-06 7.81E-05 0.000104 3.31E-06	0.000107 6.50E-05 0.000102 8.98E-05 4.72E-05 9.33E-06	2.74E-05 9.69E-05 9.07E-06 3.42E-05 6.66E-06 3.27E-05	6.53E-05 1.11E-05 7.69E-05 8.09E-05 3.68E-05 9.50E-05	6.91E-05 5.39E-06 8.97E-05 5.16E-06 6.00E-05 7.29E-05	6.36E-05 9.99E-05 1.57E-05 6.33E-05 0.000109 4.25E-05	8.66E-05 0.000108 7.55E-05 8.41E-05 8.51E-05 5.84E-05	2.44E-05 9.27E-05 1.30E-05 8.71E-05 0.00011 6.51E-05	3.49E-05 3.12E-05 0.000103 3.97E-05 9.68E-05 2.69E-05	9.98E-05 5.17E-06 4.59E-05 0.000107 3.35E-05 6.96E-05	8.06E-05 6.79E-06 6.50E-05 5.97E-05 5.82E-05 6.09E-05

## (III)

Table showing the CTM Per Document-Topic proportion output, For 34 documents outof 5819 documents.

													iopi cs																						
	T1	T2	T3	T4	TS -	r6	17	T8	T9	T10	T11	T12	13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	T31	T32	T33 *	134	T35
DO	0.014426	0.011609	0.017581	0.591978	0.012079	0.012051	0.011941	0.010844	0.011921	0.011775	0.011955	0.010909	0.01294	0.011647	0.01224	0.011401	0.011412	0.011754	0.010875	0.009426	0.013631	0.010306	0.010854	0.011841	0.011791	0.010874	0.012877	0.013224	0.010571	0.012052	0.012199	0.013004	0.010642	0.011802	0.013571
D1	0.0066	0.007897	0.008036	0.313197	0.012198	0.229338	0.007285	0.008155	0.009893	0.010316	0.008557	0.006585	0.008475	0.007242	0.007969	0.0117	0.007603	0.006458	0.00802	0.00557	0.008067	0.008716	0.00691	0.007938	0.007965	0.009612	0.185744	0.007126	0.009786	0.006223	0.011605	0.010983	0.009138	0.007498	0.011598
D2	0.011883	0.010888	0.030879	0.015107	0.012577	0.220742	0.009185	0.01331	0.01294	0.010929	0.158323	0.008359	0.014689	0.010858	0.00967	0.012998	0.011656	0.012899	0.025598	0.009183	0.00967	0.008364	0.015354	0.010021	0.012208	0.008815	0.029646	0.009232	0.013274	0.010896	0.011995	0.200159	0.009599	0.012098	0.015985
D3	0.009424	0.013925	0.011353	0.361039	0.010979	0.013062	0.008897	0.010858	0.01283	0.011175	0.009725	0.011655	0.01118	0.010122	0.011248	0.014468	0.011397	0.01001	0.267056	0.009019	0.010257	0.010508	0.01236	0.009569	0.013289	0.011063	0.010629	0.011911	0.011002	0.013029	0.011205	0.011196	0.010272	0.010464	0.013822
D4	0.006524	0.007213	0.007856	0.009461	0.007212	0.007661	0.006423	0.006366	0.008119	0.229791	0.006817	0.007256	0.008422	0.006582	0.00775	0.008252	0.007849	0.006822	0.00816	0.006823	0.006766	0.007528	0.007411	0.006107	0.525616	0.006675	0.009056	0.006789	0.00692	0.006669	0.007432	0.006891	0.007671	0.007747	0.009363
D5	0.010468	0.019943	0.01357	0.017734	0.015375	0.011094	0.010197	0.022538	0.016784	0.016658	0.016343	0.012326	0.010829	0.011543	0.013483	0.012472	0.016057	0.012753	0.015103	0.019525	0.013254	0.012423	0.010956	0.013403	0.017967	0.012511	0.014004	0.516575	0.012551	0.011001	0.012413	0.013131	0.011199	0.018117	0.0157
D6	0.013044	0.017754	0.01755	0.022268	0.018448	0.016679	0.015714	0.016179	0.021199	0.017863	0.014497	0.013659	0.016473	0.014612	0.014435	0.41025	0.019799	0.018076	0.022077	0.012922	0.015375	0.013426	0.014891	0.01312	0.018361	0.016281	0.025001	0.017948	0.023148	0.01727	0.018536	0.020726	0.013962	0.019339	0.01912
D7	0.015493	0.021778	0.02131	0.042051	0.024368	0.022564	0.015066	0.017768	0.020464	0.019895	0.018457	0.019712	0.023004	0.017375	0.022513	0.023756	0.035048	0.018543	0.023077	0.012977	0.030901	0.015431	0.016715	0.017005	0.030283	0.264651	0.027701	0.02233	0.019556	0.022803	0.018951	0.016876	0.015667	0.021963	0.022946
D8	0.010995	0.011721	0.01078	0.301849	0.012202	0.009947	0.011227	0.009967	0.309665	0.009918	0.013529	0.010143	0.015606	0.01153	0.011587	0.0112	0.012612	0.012138	0.011087	0.009767	0.010743	0.009942	0.014295	0.011102	0.011617	0.010531	0.012634	0.009885	0.016345	0.011761	0.011835	0.013087	0.011939	0.012405	0.014407
D9	0.01111	0.013435	0.012233	0.175937	0.012978	0.410769	0.011789	0.013136	0.012069	0.013392	0.013366	0.011086	0.012182	0.010927	0.011703	0.012478	0.014615	0.011883	0.011964	0.00919	0.013291	0.01167	0.011523	0.013168	0.012782	0.012167	0.014639	0.013793	0.011152	0.011341	0.014199	0.016343	0.011107	0.011627	0.014957
D10	0.012285	0.009884	0.011742	0.584555	0.014194	0.015081	0.009813	0.011305	0.01466	0.011911	0.013898	0.009053	0.010605	0.012671	0.012714	0.008864	0.009656	0.011923	0.010649	0.008129	0.013332	0.01064	0.017786	0.012881	0.012688	0.009629	0.016765	0.012568	0.012777	0.01026	0.014861	0.013296	0.013627	0.011573	0.013727
D11	0.0111	0.015212	0.011174	0.296243	0.011677	0.014243	0.011186	0.012245	0.010511	0.012038	0.015678	0.010692	0.012185	0.01023	0.01332	0.011889	0.010883	0.011246	0.014087	0.009791	0.013047	0.01133	0.011324	0.01347	0.012141	0.011542	0.29965	0.014013	0.011712	0.010731	0.014466	0.012773	0.011087	0.012158	0.014925
D12	0.008203	0.008612	0.015964	0.012516	0.010826	0.009369	0.009487	0.009694	0.008937	0.010855	0.010803	0.008298	0.239525	0.011537	0.010534	0.011704	0.009305	0.009552	0.011797	0.008499	0.010678	0.010224	0.008868	0.011067	0.012569	0.011335	0.011589	0.011546	0.012668	0.008608	0.406695	0.011625	0.011716	0.011593	0.013203
D13	0.008889	0.012218	0.009621	0.011129	0.008728	0.434711	0.009266	0.007671	0.010185	0.008482	0.008112	0.007928	0.008361	0.009116	0.008367	0.009665	0.008038	0.008115	0.011198	0.008768	0.010332	0.008907	0.009499	0.009363	0.008377	0.009346	0.264204	0.008509	0.007696	0.008053	0.008826	0.008967	0.008405	0.009593	0.011353
D14	0.015125	0.015171	0.012925	0.422563	0.015164	0.021909	0.011313	0.015797	0.01924	0.014271	0.012229	0.012427	0.016704	0.012462	0.013003	0.024063	0.012691	0.011112	0.020485	0.010004	0.04908	0.0127	0.020255	0.011594	0.01381	0.0125	0.028257	0.016394	0.015095	0.036773	0.015108	0.015241	0.011532	0.015235	0.017769
D15	0.011348	0.176856	0.027894	0.040083	0.034551	0.050812	0.015543	0.014403	0.053334	0.017924	0.017649	0.009381	0.019	0.01344	0.025721	0.01118	0.030623	0.011813	0.028564	0.011424	0.017849	0.013407	0.03297	0.013581	0.020597	0.013547	0.022457	0.014827	0.034352	0.04083	0.033203	0.029495	0.02893	0.038917	0.023495
Documen D16	0.014152	0.021826	0.014201	0.016661	0.013013	0.012161	0.01531	0.015439	0.470764	0.011322	0.019724	0.010855	0.018758	0.014631	0.014032	0.013809	0.01845	0.016331	0.023408	0.011352	0.015114	0.016698	0.019141	0.013204	0.016251	0.017449	0.016011	0.01447	0.013555	0.013603	0.014871	0.018235	0.016578	0.01147	0.017152
D17	0.007953	0.012951	0.010558	0.381183	0.007827	0.275037	0.007893	0.009653	0.009789	0.009447	0.008953	0.006703	0.011104	0.008873	0.008403	0.011436	0.00744	0.007354	0.008939	0.005428	0.010157	0.007801	0.008711	0.00816	0.008644	0.008234	0.059634	0.008832	0.008183	0.00794	0.00855	0.009217	0.007261	0.008889	0.01185
D18	0.012441	0.014863	0.463946	0.018572	0.017926	0.01718	0.013244	0.016531	0.014102	0.014919	0.014926	0.017863	0.016773	0.014075	0.014415	0.020753	0.01452	0.016267	0.01606	0.01455	0.015621	0.014657	0.017163	0.01593	0.015194	0.016143	0.017262	0.014103	0.014138	0.012972	0.017188	0.020196	0.013467	0.014534	0.017507
D19	0.013656	0.015951	0.056377	0.01524	0.026747	0.007644	0.011438	0.033021	0.01645	0.01229	0.140549	0.00805	0.014666	0.009282	0.008934	0.009233	0.012676	0.009278	0.143729	0.006936	0.009776	0.010085	0.011699	0.009731	0.067091	0.01144	0.10732	0.014591	0.097741	0.011331	0.012233	0.023411	0.012112	0.010593	0.018699
D20	0.013268	0.081586	0.015958	0.022809	0.051274	0.011448	0.010313	0.017594	0.044494	0.013101	0.018992	0.012348	0.131357	0.01505	0.012044	0.015308	0.139576	0.015024	0.016344	0.012502	0.015499	0.012202	0.012612	0.015397	0.010757	0.011561	0.080456	0.008537	0.012618	0.013355	0.022158	0.030586	0.047399	0.015829	0.020647
D21	0.017883	0.021228	0.020263	0.018284	0.021925	0.02052	0.012078	0.013608	0.017269	0.256589	0.015664	0.014695	0.015885	0.016963	0.019077	0.014826	0.015465	0.011563	0.203226	0.012211	0.017006	0.010952	0.016814	0.014573	0.015728	0.016399	0.018093	0.015296	0.013896	0.017253	0.015838	0.01964	0.01507	0.015059	0.019163
D22	0.005692	0.008643	0.006946	0.405417	0.007311	0.00884	0.006455	0.007398	0.00789	0.006362	0.007717	0.005975	0.007873	0.007526	0.006436	0.00772	0.006387	0.006168	0.007913	0.006062	0.00782	0.006785	0.008145	0.00645	0.007425	0.006972	0.007102	0.006392	0.006836	0.358017	0.006733	0.008013	0.006223	0.007167	0.009189
D23	0.009859	0.013027	0.184706	0.228561	0.010632	0.016629	0.011704	0.009212	0.015931	0.009238	0.011327	0.009986	0.0102	0.013166	0.011604	0.014514	0.010918	0.009354	0.012778	0.008177	0.069562	0.01048	0.156559	0.009753	0.010124	0.009929	0.013479	0.010133	0.012056	0.014598	0.010627	0.014743	0.009904	0.010816	0.015712
D24	0.010228	0.017966	0.014104	0.233547	0.015658	0.021165	0.012058	0.013369	0.089055	0.014668	0.022224	0.010861	0.01242	0.015998	0.013638	0.014948	0.012456	0.011957	0.013843	0.011309	0.033434	0.015311	0.186819	0.014481	0.014008	0.013218	0.01712	0.013965	0.014113	0.012598	0.01518	0.018066	0.014354	0.017334	0.018529
D25	0.009778	0.011393	0.012972	0.302668	0.012986	0.016834	0.012495	0.010466	0.015591	0.010953	0.286146	0.010885	0.011026	0.012105	0.011434	0.012319	0.011792	0.009966	0.01108	0.010487	0.01501	0.012283	0.01631	0.012643	0.011602	0.012005	0.016221	0.012897	0.012127	0.011687	0.014179	0.011528	0.011654	0.011376	0.015101
D26	0.010919	0.013551	0.017345	0.018431	0.012661	0.014688	0.011614	0.012068	0.019225	0.018679	0.016161	0.012807	0.013418	0.020563	0.016359	0.01204	0.013757	0.013348	0.469677	0.01332	0.019438	0.010476	0.013631	0.012697	0.01861	0.013833	0.033839	0.013285	0.014218	0.011368	0.016938	0.017454	0.018572	0.018012	0.016998
D27	0.010463	0.012925	0.013629	0.298203	0.013476	0.011923	0.012342	0.013114	0.01391	0.014544	0.013567	0.00997	0.011575	0.011418	0.01206	0.013095	0.012255	0.012375	0.011917	0.010872	0.012852	0.01348	0.010888	0.011422	0.012751	0.011198	0.012874	0.29456	0.012552	0.011485	0.012949	0.010875	0.010811	0.012682	0.014985
D28	0.007895	0.252432	0.009909	0.014608	0.011037	0.397897	0.012487	0.009874	0.010078	0.009762	0.01164	0.009212	0.008877	0.010063	0.009684	0.013998	0.009365	0.009392	0.011435	0.008653	0.010786	0.009645	0.010546	0.009679	0.010432	0.009632	0.013518	0.011845	0.009313	0.010901	0.010665	0.01258	0.009357	0.009787	0.013016
D29	0.013121	0.034817	0.027869	0.092102	0.014063	0.208586	0.018067	0.01278	0.025113	0.046611	0.018216	0.013269	0.018272	0.02325	0.01967	0.034485	0.02312	0.014202	0.019288	0.011996	0.015602	0.013831	0.020848	0.015663	0.016302	0.015093	0.058581	0.021266	0.016937	0.015376	0.016933	0.028147	0.016596	0.017483	0.022444
D30	0.009048	0.013463	0.022972	0.283008	0.016773	0.016543	0.009575	0.011258	0.01292	0.011474	0.013402	0.009938	0.14026	0.011108	0.010578	0.034939	0.009884	0.009898	0.012399	0.009349	0.01207	0.009817	0.066168	0.012904	0.086127	0.012904	0.014948	0.010834	0.015379	0.013013	0.011978	0.019036	0.015751	0.012547	0.01774
D31	0.015021	0.015264	0.020208	0.03289	0.018042	0.014004	0.01955	0.014077	0.228295	0.014167	0.095349	0.012647	0.019561	0.014643	0.018145	0.098063	0.013249	0.010233	0.015219	0.012618	0.01883	0.013886	0.016847	0.014497	0.039084	0.012747	0.019477	0.013927	0.017052	0.017055	0.029362	0.025631	0.024606	0.014735	0.021019
D32	0.013651	0.014527	0.016853	0.084588	0.013884	0.014554	0.01638	0.012939	0.016142	0.013768	0.01711	0.011209	0.014267	0.014086	0.016762	0.01432	0.01505	0.010584	0.427493	0.012259	0.014979	0.012482	0.015792	0.016551	0.016383	0.012671	0.017531	0.014282	0.013817	0.016135	0.012876	0.021102	0.014003	0.013626	0.017344
D33	0.022755	0.033737	0.049615	0.028998	0.029646	0.028621	0.016823	0.018553	0.040961	0.040395	0.062535	0.014963	0.019792	0.038063	0.023671	0.044469	0.024683	0.011809	0.02251	0.014036	0.036731	0.026521	0.026522	0.024055	0.038811	0.026933	0.052016	0.018759	0.024763	0.019509	0.022648	0.019758	0.022917	0.026044	0.027374
D34	0.008446	0.008266	0.022329	0.009749	0.012005	0.012095	0.013609	0.011726	0.141753	0.008048	0.010265	0.008421	0.12899	0.010344	0.022313	0.009682	0.011301	0.009048	0.010663	0.008658	0.00899	0.01631	0.007575	0.022572	0.008897	0.012847	0.103213	0.012542	0.064692	0.01077	0.201944	0.013505	0.01155	0.009991	0.016889

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Table showing Preprocessed data randomly attached from Document 0 to Document5818.

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2018-01-2         1/018-01-1         1/1/20           Joc 5797         Self-made Money   M https://wi 2018-01-2         1/1/20         1/2/20           Joc 5797         Self made Money   M https://wi 2017-12.3         2017-12.4         These weiblicion or i 1/2/30/20           Joc 5797         GPL and Money   M https://wi 2017-12.3         2017-12.4         These weiblicion or i 1/2/30/20           Joc 5797         GPL and Money   M https://wi 2017-12.2         2017-12.4         These weiblicion or i 1/2/30/20           Joc 5801         Marc Kub Money   M https://wi 2017-12.2         2017-12.4         These arei heart 3/2/30/20 <t< td=""><td>18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         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52         doc 50           53         doc 51           54         doc 52           55         doc 53           56         doc 54           57         doc 55           58         doc 56           59         doc 57           60         doc 54           61         doc 58           62         doc 61           64         doc 62           65         doc 64           67         doc 66           68         doc 66           70         doc 68           70         doc 67           70         doc 68           70         doc 67           70         doc 67           70         doc 68           70         doc 67           70 <td>Bitcoin w/ Next Gen https://w 2022-07-0/2 Bitcoin prTechnolog https://w 2022-06-1/2 Bitcoin bil Technolog https://w 2022-06-1/2 Coinbase Markets https://w 2022-06-2/2 Bitcoin b0 Wehttps://w 2022-06-2/2 Bitcoin b0 Warkets https://w 2022-06-2/2 Bitcoin b0 Warkets https://w 2022-06-1/2 Bitcoin b0 Warkets https://w 2022-06-1/2 Bitcoin b0 Warkets https://w 2022-06-1/2 Bitcoin b0 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2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           6/21/2022         2080           5/2/2022         2080           5/2/2022         2080           5/2/2022         2080           5/2/2022         2080           5/2/2022         2080           5/2/2022         2080           6/2/2022         2080</td> <td>52.57         2           32.57         2           577.6         2           577.6         2           577.6         2           52.89         3           52.89         4           52.89         4</td> <td>1647.17 5792 ( 0452.62 5793 ( 0739.48 5794 ( 0739.48 5795 ( 0739.48 5795 ( 0339.48 5795 ( 0339.48 5795 ( 0339.48 5796 ( 0360.48 5799 ( 0452.62 5800 ( 0363.87 5803 ( 037.87 5805 ( 03</td> 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2/2/20           Joc 5797         Self made Money   M https://wi 2017-12-2         Jol 2/2-12         You wait support   Jol 2/2/20         Jol 2/2/20           Joc 5801         Mark Cubi Money   M https://wi 2017-12-2         Jou 1/2-2         Jou 1/2/2/20         Jou 1/2/2/20           Joc 5803         Jan Woney   M https://wi 2017-12-2         Jou 1/2/20         Jou 1/2/2/20         Jou 1/2/2/20         Jou 1/2/2/20<!--</td--><td>18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           17         34062.           18  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5797         Meet the Si Money   M https://wi 2018-01-2         Jol 1/2-12         Jol 1/2-12         Jol 1/2-12           Joc 5797         Self made Money   M https://wi 2018-01-2         Jol 1/2-12         Hom wait support   Jol 2/2/20         Jol 2/2/20           Joc 5797         Self made Money   M https://wi 2017-12-2         Jol 2/2-12         You wait support   Jol 2/2/20         Jol 2/2/20           Joc 5801         Mark Cubi Money   M https://wi 2017-12-2         Jou 1/2-2         Jou 1/2/2/20         Jou 1/2/2/20           Joc 5803         Jan Woney   M https://wi 2017-12-2         Jou 1/2/20         Jou 1/2/2/20         Jou 1/2/2/20         Jou 1/2/2/20 </td <td>18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           18         34062.           17         34062.           17         34062.           17         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52         doc 50           53         doc 51           54         doc 52           55         doc 53           56         doc 54           57         doc 55           50         doc 55           50         doc 56           50         doc 56           50         doc 56           60         doc 66           61         doc 58           61         doc 58           62         doc 60           64         doc 62           65         doc 66           60         doc 66           60         doc 66           70         doc 68           71         doc 69           72         doc 71           73         doc 71	Bitcoin w/ Next Gen https://w 2022-07-0/2 Bitcoin pr Technolog https://w 2022-06-1/2 Bitcoin bil Technolog https://w 2022-06-1/2 Coinbase Markets https://w 2022-06-2/2 New York Crypto Wchttps://w 2022-06-2/2 Bitcoin bo Markets https://w 2022-06-1/2 Bitcoin bo Market Wchttps://w 2022-06-1/2 Bitcoin bo Market Wchttps://w 2022-06-1/2 Grayscale Finance https://w 2022-06-1/2 Crypto ext Technolog 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S2         doc 50           S3         doc 51           S4         doc 52           S5         doc 53           S6         doc 54           S7         doc 55           S8         doc 56           S9         doc 57           60         doc 58           61         doc 58           65         doc 64           64         doc 62           65         doc 63           66         doc 64           67         doc 65           68         doc 67           70         doc 68           71         doc 70           73         doc 71           73         doc 71           73         doc 77           73         doc 77           73         doc 70           73         doc 71           74         doc 72           75         doc 73	Bitcoin w/ Next Gen https://w 2022-07-0/2 Bitcoin pi Technolog https://w 2022-08-2/2 Goinbase Markets https://w 2022-08-2/2 Coinbase Markets https://w 2022-08-2/2 Bitcoin bull Technolog https://w 2022-08-2/2 Bitcoin bol Markets https://w 2022-08-1/2 Bitcoin to Daves WE https://w 2022-08-1/2 Bitcoin to Daves WE https://w 2022-08-1/2 Jack Dorse Bitcoin to https://w 2022-08-1/2 Bitcoin to Oaves WE https://w 2022-08-1/2 Bitcoin to Chrone We https://w 2022-08-1/2 Bitcoin to Chrone Ve https://w 2022-08-1/2 Bitcoin to Chrone Ve https://w 2022-08-1/2 Grayscale Finance https://w 2022-08-1/2 Grayscale Finance https://w 2022-08-1/2 Bitcoin to Crybo Withtps://w 2022-08-1/2 Bitcoin to Crybo Withtps://w 2022-08-1/2 Bitcoin dr Crybo Withtp	222-07-0; 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2	0 Bitcoin b Ma	arkets	https://www.cnbc.com/2022/08/29/bitcoin-drops-below-20000-to-lowest-level-since-mid-july-as-investors-dump-risk-assets.html	2022-08-	2 2022-08-2	Investors	bitcoin b	ri 8/28/2022
3	1 A closely- Cry	yptocur	https://www.cnbc.com/2022/08/26/bitcoin-btc-price-key-metric-flashes-bottom-for-the-crypto.html	2022-08-	2 2022-08-2	A measu	ebitcoin p	oc 8/24/2022
4	2 Bitcoin ha Cry	yptocur	https://www.cnbc.com/2022/08/26/crypto-winter-is-coming-but-it-will-be-a-warm-winter-says-vc-firm.html	2022-08-	2022-08-2	Bitcoin m	acrypto wi	ir 8/25/2022
5	3 Sudden cr Cry	ypto Wo	https://www.cnbc.com/2022/08/19/sudden-crypto-market-drop-sends-bitcoin-below-22000.html	2022-08-	1 2022-08-2	Bitcoin hi	it bitcoin fr	i 8/18/2022
6	4 Ether is up Teo	chnolog	https://www.cnbc.com/2022/08/19/ether-eth-price-outpaces-bitcoin-btc-as-ethereum-merge-nears.html	2022-08-	1 2022-08-1	Since find	d since find	d 8/18/2022
7	5 Skybridge Cry	ypto	https://www.cnbc.com/2022/08/15/skybridges-scaramucci-on-two-things-that-will-prop-up-bitcoin-demand.html	2022-08-	1:2022-08-1	Bitcoin fu	u bitcoin fu	a 8/14/2022
8	6 Bitcoin to Cry	yptocur	https://www.cnbc.com/2022/08/15/bitcoin-tops-25000-for-the-first-time-since-june-before-slipping.html	2022-08-	1. 2022-08-1	Bitcoin b	ri bitcoin b	ri 8/14/2022
9	7 BlackRock Ma	arkets	https://www.cnbc.com/2022/08/11/blackrock-launches-a-private-trust-to-give-clients-exposure-to-spot-bitcoin.html	2022-08-	1 2022-08-1	The large	s blackrock	< 8/10/2022
10	8 MicroStrat Cry	ypto Wo	https://www.cnbc.com/2022/08/02/microstrategy-ceo-saylor-moves-to-chairman-role-focusing-on-strategy-and-bitcoin.html	2022-08-	0:2022-08-0	MicroStra	al microstra	at 8/1/2022
11	9 Bitcoin bri Cry	yptocur	https://www.cnbc.com/2022/07/29/bitcoin-btc-price-rises-following-stocks-higher-in-a-post-fed-rallyhtml	2022-07-	2 2022-07-2	Bitcoin's	r bitcoin to	o 7/28/2022
12	10 Tesla has (Teo	chnolog	https://www.cnbc.com/2022/07/20/tesla-converted-75percent-of-bitcoin-purchases-to-fiat-currency-in-q2-2022.html	2022-07-	2 2022-07-2	Tesla CEC	early yea	ai 7/19/2022
13	11 Bitcoin jur Ma	arkets	https://www.cnbc.com/2022/07/28/bitcoin-jumps-above-23000-after-federal-reserve-interest-rate-hike.html	2022-07-	2 2022-07-2	Bitcoin ro	bitcoin ro	3: 7/27/2022
14	12 Crypto mi Cry	ypto Wo	https://www.cnbc.com/2022/07/18/crypto-miners-moved-over-300-million-of-bitcoin-in-one-day.html	2022-07-	L 2022-07-1	New data	a data bloc	:k 7/17/2022
15	13 Bitcoin to Cry	yptocur	https://www.cnbc.com/2022/07/18/bitcoin-btc-tops-22000-ethereum-jumps-as-crypto-market-rallies.html	2022-07-	1 2022-07-1	Bitcoin b	o bitcoin b	o 7/17/2022
16	14 Bitcoin to Tee	chnolog	https://www.cnbc.com/2022/07/20/crypto-prices-bitcoin-btc-climbs-above-23000.html	2022-07-	2 2022-07-2	Bitcoin to	bitcoin b	r 7/19/2022
17	15 Bitcoin Fa Cry	ypto Wo	https://www.cnbc.com/2022/07/02/bitcoin-family-say-they-lost-1-million-in-value-this-year.html	2022-07-	2022-07-0	The "Bitc	c bitcoin fa	ar 7/1/2022
18	16 Worldå,-å ETF	F Edge	https://www.cnbc.com/2022/07/07/worlds-largest-bitcoin-fund-sues-sec-over-crypto-etf-rejection.html	2022-07-	2022-07-0	Grayscale	e digital cu	r 7/6/2022
19	17 For bitcoir Tee	chnolog	https://www.cnbc.com/2022/07/15/bitcoin-btc-price-bottom-heres-what-the-market-wants-to-see.html	2022-07-	L 2022-07-1	Industry	p improver	rr 7/13/2022
20	18 Coinbase Tee	chnolog	https://www.cnbc.com/2022/07/18/coinbase-stock-pops-17percent-as-cryptocurrencies-bitcoin-and-ether-rally.html	2022-07-	1 2022-07-1	Coinbase	share coi	n 7/17/2022
21	19 El Salvado Cry	ypto Wo	https://www.cnbc.com/2022/06/25/el-salvador-bitcoin-experiment-not-saving-countrys-finances.html	2022-06-	2 2022-06-2	The gove	r salvador	€ 6/24/2022
22	20 Billions in Cry	ypto Wo	https://www.cnbc.com/2022/07/06/tax-writeoff-possible-for-bitcoin-lost-to-lending-sites-like-celsius.html	2022-07-	2022-07-1	The bad o	d crypto le	n 7/5/2022
23	21 Bitcoin he Ma	arkets	https://www.cnbc.com/2022/07/08/bitcoin-heads-toward-best-week-since-october-as-crypto-collapse-stabilizes.html	2022-07-	2022-07-0	Bitcoin is	price bito	x 7/7/2022
24	22 Bitcoin Ju: Cry	ypto Wo	https://www.cnbc.com/2022/06/30/bitcoin-just-had-its-worst-month-in-more-than-a-year.html	2022-06-	3 2022-06-3	Bitcoin Ju	bitcoin fi	n 6/29/2022
25	23 Five reasc Tee	chnolog	https://www.cnbc.com/2022/07/01/bitcoin-btc-posts-worst-quarter-in-more-than-a-decade-5-reasons-why.html	2022-07-	2022-07-0	Bitcoin lo	bitcoin w	rc 6/30/2022
26	24 Bitcoin po Cry	yptocur	https://www.cnbc.com/2022/06/30/bitcoin-btc-on-track-for-its-worst-quarter-in-more-than-a-decade.html	2022-06-	3 2022-06-3	Bitcoin h	a bitcoin th	1 6/29/2022
27	25 Bitcoin fal Cry	yptocur	https://www.cnbc.com/2022/06/30/bitcoin-falls-below-19000-again-as-pressure-mounts-on-crypto-firms.html	2022-06-	3 2022-06-3	Cypto he	d bitcoin th	1 6/29/2022
28	26 Charts sug Ma	ad Mone	$https://www.cnbc.com/2022/06/22/charts-suggest-bitcoin-could-rally-over-the-next-few-months-but-likely-wont-reach-old-highs-jim-cramer-says.html \label{eq:conduct} and eq:con$	2022-06-	2 2022-06-2	Bitcoin d	conbes era	n 6/22/2022
29	27 ProShares Ma	arkets	https://www.cnbc.com/2022/06/20/proshares-is-launching-a-short-bitcoin-etf-this-week.html	2022-06-	2022-06-2	Eight mo	n eight mo	n 6/19/2022
30	28 Bitcoin bri Cry	ypto Wo	https://www.cnbc.com/2022/06/29/bitcoin-btc-briefly-drops-below-20000-as-pressure-mounts-on-crypto.html	2022-06-	2 2022-06-2	Bitcoin fe	el bitcoin b	ri 6/28/2022
31	29 Bitcoin bo Cry	votocur	https://www.cnbc.com/2022/06/20/bitcoin-btc-rebounds-but-struggles-to-hold-above-20000html	2022-06-	2 2022-06-2	The crypt	t bitcoin ju	JI 6/19/2022