K1 - An Empirical Evaluation Into The Adoption of Cryptocurrencies by Public Companies Within The United States

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Contents

1. Executive Summary

Cryptocurrencies were invented in 2009 by the pseudonymous developer Satoshi Nakamoto (Wikipedia). Over the years the number of cryptocurrencies and the value of the cryptocurrencies have grown significantly with the total market capitalization reaching almost three trillion dollars in 2021 (CoinMarketCap). The growth of this market has caught the attention of many private and public investors. Now companies are being created where their whole business strategy revolves around cryptocurrencies, such as Cryptocurrency miners and Cryptocurrency exchanges. Even companies whose businesses focus on other areas are adopting this new form of currency, for example Tesla is an automotive manufacturer and is now accepting bitcoin as a form of payment (Tesla).

The novelty of cryptocurrencies has meant that public companies have had a significant amount of freedom when it comes to disclosing these assets in their public statements. However given the volatility of these crypto-assets the U.S. Securities and Exchange Commission (SEC) are tightening the regulations on the disclosure of cryptocurrencies and are enforcing public companies to clearly disclose the nature and amount of these assets (Asmakov). This is likely to become a problem for many public companies holding cryptocurrencies as they have never before been required to disclose these assets to this level of scrutiny. This will leave many public companies vulnerable to fines and investigations by the SEC. In order to avoid these fines and ensure that these companies comply with the SEC many of these companies will need compliance consulting.

K1 tasked this project with investigating the adoption of cryptocurrencies by industry. This will allow K1 to identify industries which need help disclosing the presence of crypto assets and identify players in industries which should be looking into cryptocurrencies to enhance their business plan.

In order to investigate the adoption of cryptocurrencies by public companies, an automated tool was created which extracts the relevant SEC forms and counts the presence of a defined list of keywords. The algorithm also looks at the location of these keywords and evaluates whether they are in a financial table or not. This gives the user an understanding of whether the company has already disclosed that keyword in a table compared to just mentioning the keyword in a body of text. The algorithm then outputs a dataframe with the count of the keywords and the count of the keywords within a table for each company. This list of keywords can be changed by the user to incorporate any new keywords which may be of interest. Initially a list of commonly used keywords associated with cryptocurrencies was used. This list contained: 'digital asset','cryptocurrency', 'cryptocurrencies', 'digital holdings','bitcoin','ethereum'.

With these results a statistical evaluation was created to evaluate the penetration of cryptocurrencies by industry. The tool created during this project returned 5764 companies. Out of the 5746 companies 7.13% of the companies mentioned a crypto-related keyword in their 10-K, and 1.46% of the companies mentioned a keyword in a financial table within their 10-K. It found that the services-computer processing & data preparations sub-industry was the most prevalent industry when it comes to crypto-adoption, with 30.1% and 18.1% of the companies within that sub-industry having a keyword present in their 10-K and 10-K financial tables respectively.

2. Business Problem

K1 is a consulting services company, focused on providing proprietary data, technology and insights to support their clients stay ahead of complex demands related to risk, governance and growth. They are a global company with a diverse group of clients that varies from industry to industry. The client has identified that the surge in adoption of cryptocurrencies by public companies is of interest to them.

Companies tend to adopt cryptocurrencies in three different scenarios: (1) invest in cryptocurrencies, (2) accept cryptocurrencies as a payment method, (3) crypto mining, and (4) crypto trading platform. The novelty of cryptocurrencies has meant that public companies have had a significant amount of freedom when it comes to disclosing these assets in their public filings. However recently the SEC has announced that they will tighten regulations on the disclosure of cryptocurrency holdings by public companies. This will leave many public companies vulnerable to litigation for incorrect disclosures.

The scope of this project is to analyze the adoption rate of cryptocurrencies by public companies for each industry. This will allow K1 to, firstly identify which industries and specific companies may need assistance to comply with these new regulations, and secondly identify which companies could benefit from the introduction of cryptocurrencies into their business model.

3. Methodology - Web Scraping

In order to address the scope of the project the Electronic Data Gathering, Analysis and Retrieval system (EDGAR) database was selected as the main source of information. This database performs automated collection, validation, indexing, acceptance, and forwarding of submission by companies and others who are required by law to file forms with the U.S. Securities and Exchange Commision (SEC). The EDGAR database is probably the most rich, standardized, and updated source of information for public companies around the world, to get an overview of company performances, actions and operations.

A database of this length requires a strategy. Given the novelty of the cryptocurrency industry, up till recently the SEC has not explicitly said how companies should disclose cryptocurrency assets. Fortunately, all public companies are required to make this information

public to investors in one way or another. This allowed for an unbiased approach to this problem as the same information would be available from every public company.

As part of our strategy was to narrow down and correctly select the fillings we would be retrieving information from. Given the interest in having consistency in our information we decided to focus on the fillings categorized as mandatory in order to comply with the SEC regulations. This will allow us to approach this problem in an unbiased way as we will be receiving the same amount of information from every public company. These forms are:

a. 10-K: The annual report on Form 10-K provides a comprehensive overview of the company's business and financial condition and includes audited financial statements in interest of investor knowledge and awareness.
b. 10-Q: The Form 10-Q includes unaudited financial statements and provides a continuing view of the company's financial position during the year, in interest of investor knowledge and awareness. These reports must be filed for each of the first three fiscal quarters of the company's fiscal year.
c. 8-K: The form 8-K is a report of unscheduled material events or corporate changes at a company that could be of importance to the shareholders or the Securities and Exchange Commission (SEC). Companies generally have four business days to file this report for an event that triggers the filing requirements.

The examination of known cryptocurrency-adopters' SEC forms brought about how cryptocurrencies were being disclosed by public companies. This gave rise to two observations; Firstly, all known-adopters indeed had dedicated a portion of their reports to describe their intentions of adopting cryptocurrencies. Secondly, there is no consistency in the way companies financially report assets related to cryptocurrencies out of those that choose to report them at all. In order to overcome the lack of uniformity of these disclosures two approaches were considered.

The first was a Supervised Binary Text Classifier Machine Learning Model. This technique assigns a set of predefined categories to open-ended text. Text classifiers can be used to organize, structure, and categorize any kind of text. It takes a text, analyzes its content, and then automatically assigns relevant tags. To do this we would manually label companies as crypto-adopters and non-crypto-adopters. Then by imputing the relevant SEC forms into the Supervised Text Classifier Model it would identify the attributes that are indicative of a company holding cryptocurrencies. This classifier would then be run on the remaining companies forms and it would return the probability of that company being a crypto adopter. However two problems with this method arose:

1. Firstly the reports were lengthy and the sample size of the positively labeled companies was small. This meant that the supervised text classifier was bound to find random similarities among the reports of companies which had been positively identified as crypto holders, that have nothing to do with cryptocurrency adoption. Leading to inaccuracy of the classification.
2. Secondly, even if this model did not do this, it will essentially be searching for the crypto keywords, because there is no way the model can identify the presence of crypto without looking at a keyword.

To avoid these complications a more simplistic but robust method was used; an Automated Keyword Scraping Tool. The logic behind generating this automated mechanism is to deliver consistent results based on minimal user input. The tool was developed in accordance with the different features available in the EDGAR database website; therefore it aims to filter based on date range, filling type and keywords. The inputs should be selected in accordance with the judgment and interest of the user.

In order to create an input that would consistently identify companies that have adopted cryptocurrencies, a dictionary of keywords was created. It contained the most consistently occurring cryptocurrency-related keywords found either in text or financial tables.

These keywords selected were:

1. 'digital asset'
2. 'cryptocurrency'
3. 'cryptocurrencies'
4. 'digital holdings'
5. 'bitcoin'
6. 'ethereum'

In order to confirm the robustness of these keywords a number of 10-Ks with the keyword present were analyzed by hand in order to ensure that the algorithm was picking up the keywords in the right context. Initially ‘crypto’ was included into this list. However this returned many false positives because crypto is used in many other words such as cryptosecurity and cryptography. Therefore this keyword was removed and replaced with cryptocurrency and cryptocurrencies.

For this analysis the algorithm will count the presence of the plural of regular nouns assuming the plural is the same as the original with an ‘s’ added onto the end. Therefore it is not necessary to for example add bitcoins as it will still pick up this when it searches for bitcoin. Cryptocurrency is irregular and therefore it is necessary to add the plural for cryptocurrency as

the full word is not present in the plural. If the user intends to add additional keywords to the algorithm they should take note of this and add the relevant words accordingly.

This dictionary would serve as the main input to our algorithm. Therefore, it is important to note that the words selected were in accordance with the point in the time and scope of this project along with the stakeholders involved. This was done with the intention of making our model user friendly and to be reused at any point in time in the future. Then, if a new type of cryptocurrency that is more likely to be adopted by public companies emerges, it can be added into the keyword list to explore its performance.

The automated keyword tool is designed to go through the relevant SEC forms and count the occurrences of our keywords and return a dataframe with the number of keywords found in the whole form and the number found within the financial table. The number of keywords found within a table is important for this analysis as many companies mention keywords in passing within the text of their 10-Ks without indicating that they own cryptocurrencies. However if a company has mentioned one of these cryptocurrency-related keywords within a financial table it can be assumed that that company does indeed utilize cryptocurrencies within their business model. This tool was developed in three stages:

Stage 1:

In order to acquire a list of all the CIK's (token used to identify companies) we scrapped a JSON file from the SEC website that contained the latest update of tokens available. After acquiring this list we looped over the EDGAR's mainpage to search results for each company. This first step allows our tool to be reusable in the future; by extracting the CIK from the SEC whenever there is an update with new companies registered.

Stage 2:

The scraping for each CIK is done based on statutory information, we look for Company Name, CIK, SIC code, Industry type, State Location, State of Incorporation, and compared to what is found on the EDGAR main page in that order. If we lack any of this information (ex: SIC code or location), then the process and search will be stopped and continue to search for the next CIK in the list. Therefore discarding from analysis those that lack information.

Once companies with all the required information are compiled, the forms for these companies are retrieved in accordance with the parameters; filling date and filling type. For those companies that match all of the criteria will be appended into a dataframe with all of the information and their respective URLs. This allows the tool to be user friendly and saves time by setting the different parameters as desired.

Stage3:

At this stage we have our appended list of URLs along with the crypto related keywords selected ready to be scrapped. The script starts looping through each URL looking for instances of these keywords and counts the number of times each keyword appears, if it is present. It is to be noted that adoption as an asset is almost always confirmed if keywords appear in a table, as assets are always presented in a tabular manner. So keywords are counted separately if they appear within tables, specifically within the <td> HTML tags, as this indicates a significantly higher chance of presence of cryptocurrency assets. Finally the script returns the count of keywords within text as well as tables.

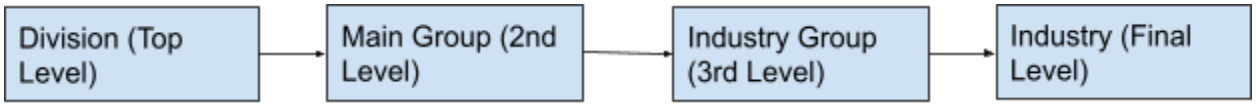
The developed tool will then be returned into a data frame with the count of each keyword for each form scraped, along with the information available in the EDGAR's main page that identifies each filling. Therefore providing information in a format that is easy to manipulate and conduct further research. In the next section of our report we will be showing some of our findings and results from the scraped data.

4. Data Analysis

The first stage of the analysis will be executed by doing comparisons on the data retrieved based on industry classification. The U.S government uses the Standard Industrial Classification (SIC) codes to identify the primary business of the establishment. This classification was developed to facilitate the collection, presentation and analysis of data; and to promote uniformity and comparability in the presentation of statistical data collected by various agencies of the federal government, state agencies and private organizations.

These codes are listed in a company's electronic data gathering, analysis, and retrieval systems (EDGAR) filings. Given the scope of the project and the need for consistency and accuracy on the results provided, the SIC codes would serve as the main classification characteristic used for analysis.

The SIC system classifies the economy into 11 major divisions (main industry group), that are then divided into 83 two-digit major groups, and then further subdivided into 416 3-digit industry groups, and finally disaggregated into 1,005 4-digit sub-industries. The 4- digit sub-industries would be the basis of our comparison, since this level would allow us to give more detailed and clear analysis. A detailed list of SIC codes, office they belong to, and detailed Industry Title given for each code could be found on Appendix # XX.



The developed web scraping tool is to be used along with the SIC classification to derive the desired insights given in the scope of the project. The tool was used to extract the count of the keywords of the most recent 10-K of every publicly traded company. The tool returned 5764 companies. Out of the 5746 companies 7.13% of the companies mentioned a crypto-related keyword in their 10-K, and 1.46% of the companies mentioned a keyword in a financial table within their 10-K.

CIK	Company Name	SIC	Industry	State Location	State Inc	Filling Date	digital asset	cryptocurrency	cryptocurrencies	digital holdings	bitcoin	ethereum	digital asset table	cryptocurrency table	cryptocurrencies table	digital holdings table	bitcoin table	ethereum table	sum	sum_tables
1725210	Grayscale Ethereum Trust (ETH)	6199	FINANCE SERVICES	CT	DE	2022-02-25	813	9	4	0	46	416	3	0	0	0	0	14	1288	17
1844971	Greenidge Generation Holdings Inc.	7374	SERVICES	CT	DE	2022-03-31	78	252	44	0	413	0	5	10	0	0	3	0	787	18
1839341	Core Scientific, Inc./tx	7374	SERVICES	TX	DE	2022-03-30	584	3	1	1	158	9	17	0	0	1	3	0	756	21
1507605	MARATHON DIGITAL HOLDINGS, INC.	7374	SERVICES	NV	NV	2022-03-10	208	49	38	73	387	0	4	5	4	1	5	0	755	19
896493	BitNile Holdings, Inc.	3679	ELECTRONIC COMPONENTS	NV	DE	2022-04-15	76	224	122	2	297	10	0	11	4	2	3	0	731	20
1050446	MICROSTRATEGY Inc	7372	SERVICES	VA	DE	2022-02-16	105	5	7	0	516	0	12	0	0	0	25	0	633	37
1436229	BTCS Inc.	7372	SERVICES	MD	NV	2022-03-11	368	44	43	0	124	30	21	0	2	0	3	5	609	31
1829311	BITMINE IMMERSION TECHNOLOGIES, INC.	7374	SERVICES	GA	DE	2021-12-09	401	17	11	0	176	0	18	0	0	0	1	0	605	19
1083301	TERAWULF INC.	7374	SERVICES	MD	DE	2022-03-31	189	48	39	1	292	2	3	0	0	0	5	0	571	8
1167419	Riot Blockchain, Inc.	7374	SERVICES	CO	NV	2022-03-16	8	72	164	0	321	0	0	0	26	0	2	0	565	28

Figure # displays the 10 companies which have mentioned the cryptocurrency related keywords the most in their 10-K. All of these companies have mentioned these keywords over five hundred times in each of their 10-Ks. They have also disclosed these keywords within one of their financial tables over seventeen times apart from Terawulf Inc. which has disclosed it eight times. Grayscale Ethereum trust mentioned these keywords the most with 1288 mentions in their 10-K and 17 mentions in their tables. Grayscale Ethereum Trust is solely and passively invested in ETH (Ethereum), enabling investors to gain exposure to ETH in the form of a security while avoiding the challenges of buying, storing and safeguarding ETH, directly (Grayscale). This company's business model revolves purely around cryptocurrencies. In fact within this list every company's business plan revolves around cryptocurrencies apart from Microstrategy which has the largest holdings of cryptocurrencies out of any public company (Graves et al.). This confirms that our algorithm correctly identifies cryptocurrency utilizers.

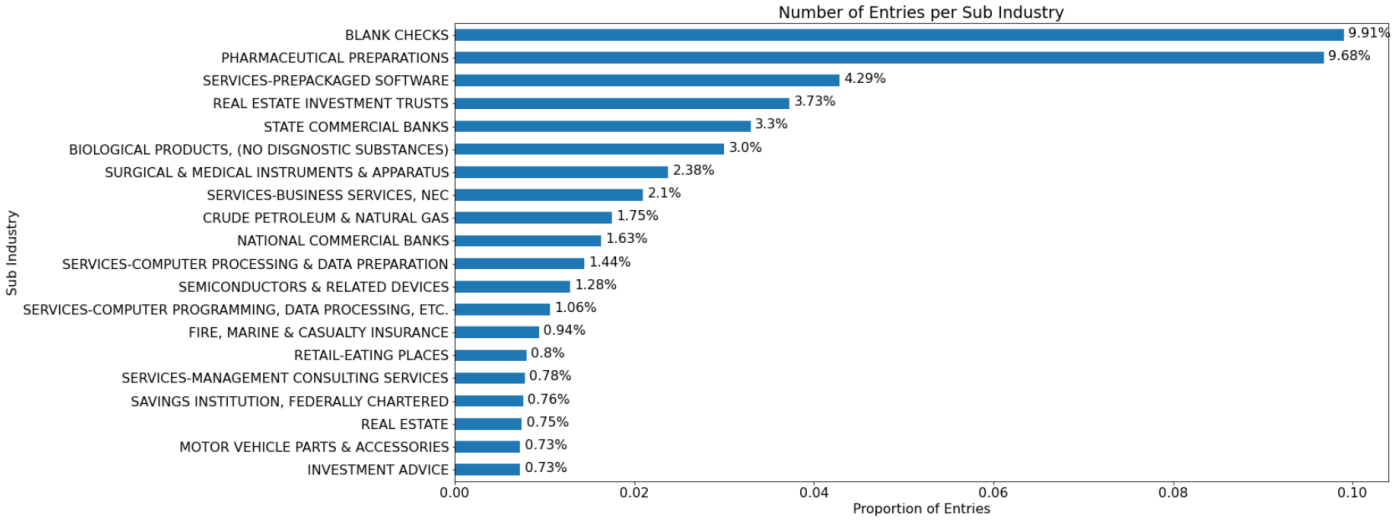


Figure # displays the distribution of sub-industries within the 5764 companies which were found. The most common sub-industry is Blank Checks with 9.91% of the companies belonging to that industry. A Blank Check Company also known as a Special Purpose Acquisition Company (SPAC) is a development stage company that has no specific business plan or purpose or has indicated its business plan is to engage in a merger or acquisition with an unidentified company or companies, other entity, or person (SEC). The second most common sub industry is Pharmaceutical Preparations with 9.68% of the companies belonging to that industry.

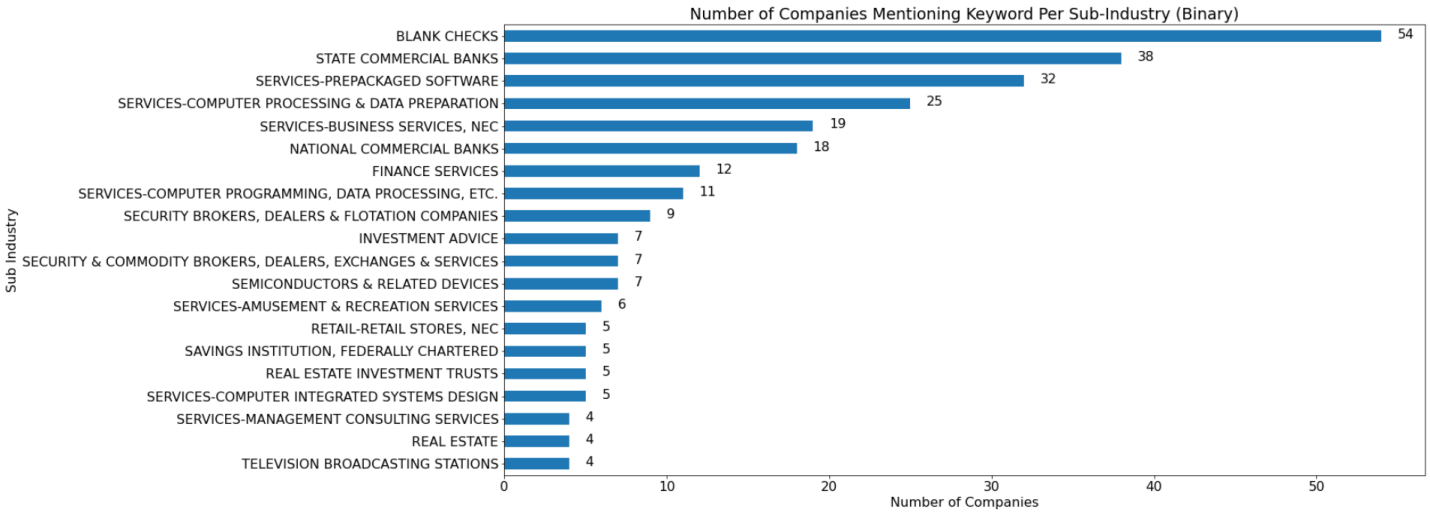


Figure # displays the number of companies which have mentioned any of the crypto related keywords in their 10-K for each sub-industry. The Blank Checks industry contains the

most companies which have crypto-related keywords in their 10-K with 54 companies. State Commercial Banks and Service-Prepackaged Software has the second and third most companies with crypto-related keywords in its 10-K with 38 companies and 32 respectively. All other sub industries are found to have 25 or less companies.

The tool is meant to identify the keywords being mentioned throughout the 10-K, but it is important to note that understanding the location of where these keywords are found provide a higher level of importance on it being used. That being said, we classify our retrieved data into two different categories; number of keywords mentioned on the full report (which would serve as qualitative search) and number of keywords mentioned in the tables inside the reports (a section that is usually used to quantify amounts).

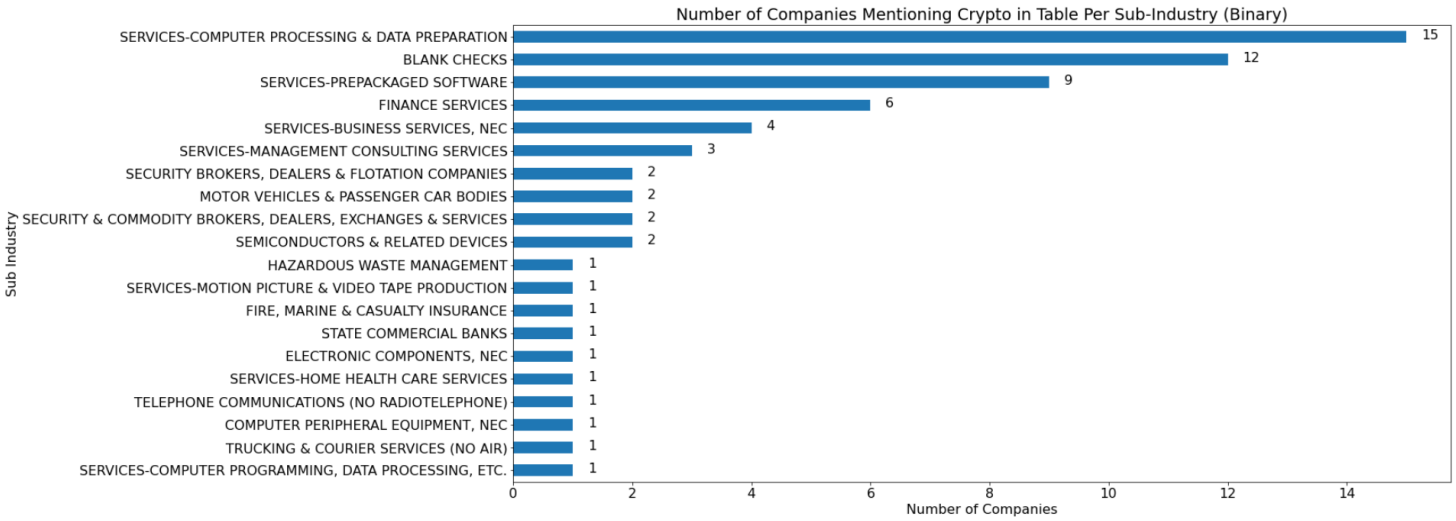


Figure # displays the number of companies which have mentioned any of the crypto related keywords in their 10-K financial tables for each sub-industry. The Services-Computer & Data Preparation industry contains the most companies which have crypto-related keywords in their 10-K tables with 15 companies. Blank Checks has the second most companies with crypto-related keywords in its 10-K financial table with 12 companies. Only the top 37 sub-industries have any companies which have crypto-related keywords in their 10-K financial tables.

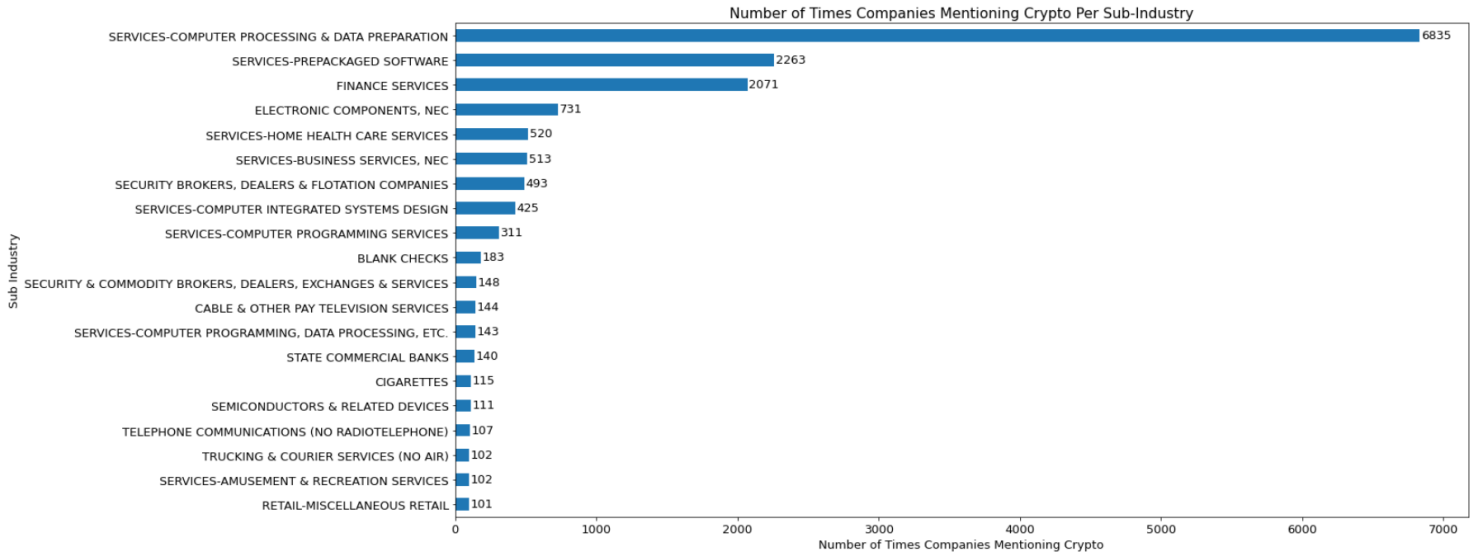


Figure # displays the number of times a crypto-related keyword is mentioned in the 10-Ks for each sub-industry. The services-computer & data preparation sub-industry has the most crypto-related keywords in their 10-Ks with 6835 mentions. The services-prepackaged software sub-industry has the second most crypto-related keywords in their 10-Ks with 2263 mentions.

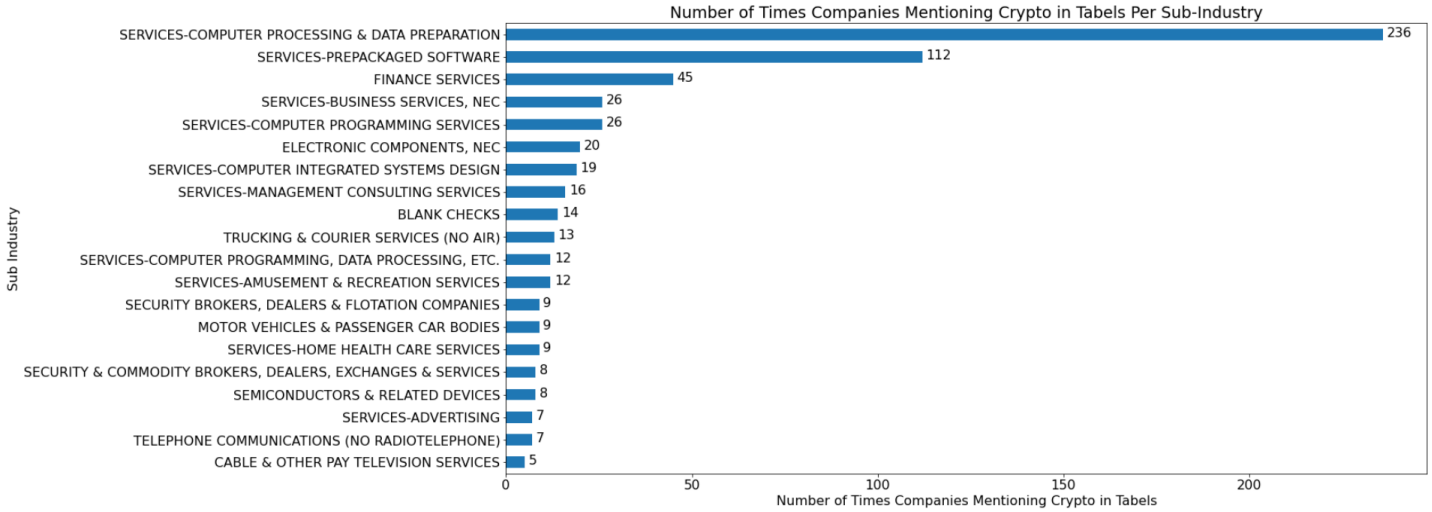


Figure # displays the number of times a crypto-related keyword is mentioned in the 10-K financial tables for each sub-industry. The services-computer & data preparation sub-industry has the most crypto-related keywords in their 10-K financial tables with 236 mentions. The services-prepackaged software sub-industry has the second most crypto-related keywords in their 10-K financial tables with 112 mentions.

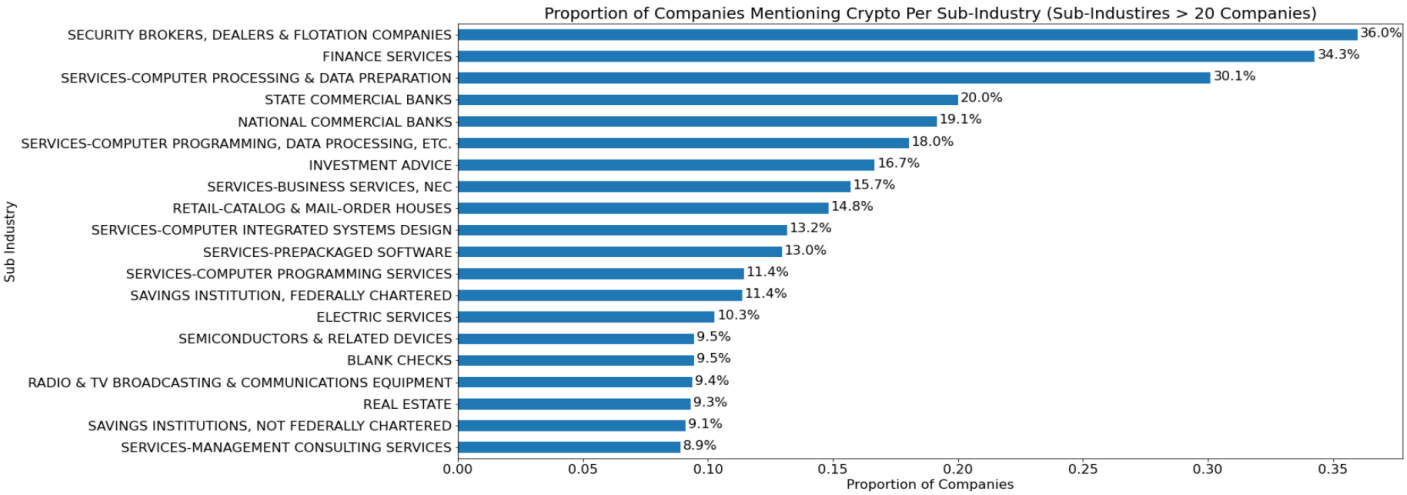
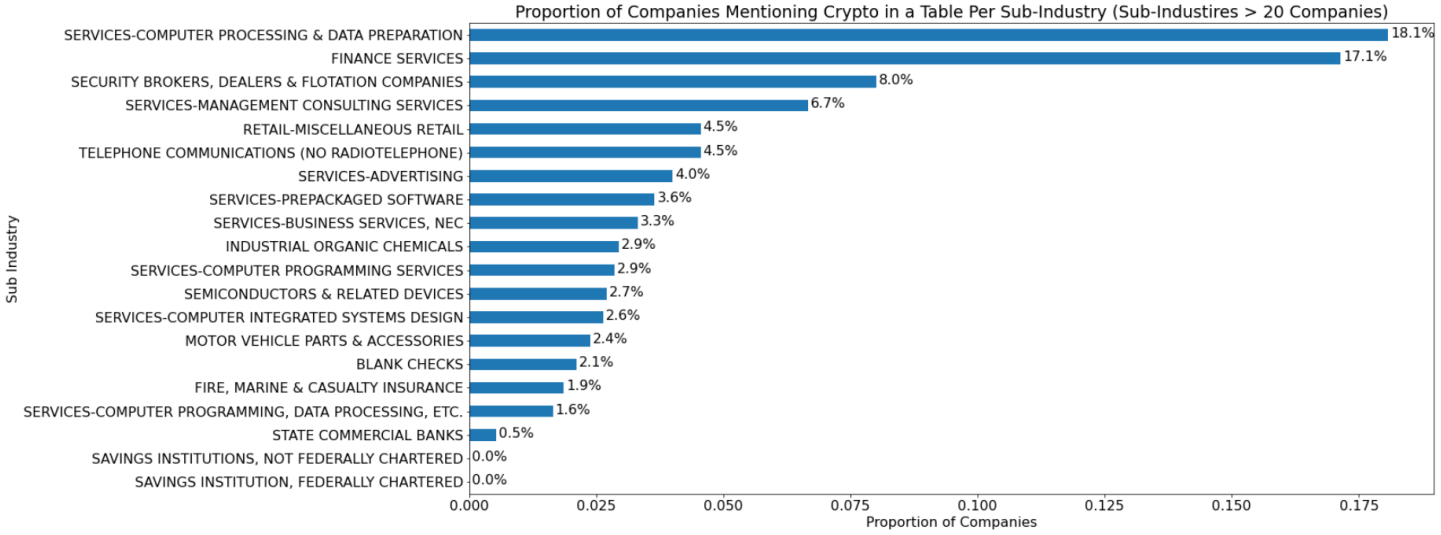


Figure # groups the 5764 companies scraped into their sub-industries, filters for those who have 20 or more companies and displays the proportion of companies which have mentioned any of the crypto related keywords in their 10-K. The Security Brokers, Dealers & Flotation Companies industry contains the highest proportion, 36.0% of companies within this industry mention keywords related to crypto. The Financial Services industry (34.3%) and Services-Computer Processing & Data Preparation (30.1%) have the second and third highest proportion, while all other industries have 20.0% or less proportion of companies mentioning crypto related keywords.



The services-computer processing & data preparations sub-industry comes in on top in 4 out of the 6 crypto related metrics above. This is expected as Crypto Mining is a computer intensive task and therefore crypto mining companies such as Riot Blockchain fall in this sub-industry so it is expected that we will see this industry appear first in the majority of our metrics. There are also other sub-industries which are highly related to this within our top 20 such as Services-Computer Integrated System Design, Services-Prepackaged Software, Services-Computer Programing Services.

The Financial services industry appears in the top 4 for all of our metrics apart from one, where it appears 7th. This is expected as a cryptocurrency is an asset that has created a new type of financial industry. Therefore it is expected that Financial services would have an interest or holding in cryptocurrencies as they will want to ensure that they are adapting to new trends and have a stake in this new market.

The Security Brokers, Dealers & Flotation sub-industry appears in the top 20 for all of our metrics and has the highest proportion of companies mentioning crypto-related keywords in a 10-K. This sub-industry primarily engaged in the purchase, sale, and brokerage of securities; and those, generally known as investment bankers, primarily engaged in originating, underwriting, and distributing issues of securities (United States Department of Labor). This is linked closely to financial services and therefore it is expected that this sub-industry has a large interest in cryptocurrencies as cryptocurrencies can be thought of as a type of security. There are also a number of other sub-industries related to Financial Services which appears in the top 20 for some of our metrics such as; State Commercial Banks, National Commercial Banks, Savings Institutions-Federally Chartered, Investment Advice

The Blank Checks sub-industry appears in the top 20 for all of our metrics. Seeing that the crypto industry is relatively novel and growing fast it is not surprising that there are many companies being created whose business plan is to get involved with cryptocurrencies.

In the second stage of our analysis we dive deeper into understanding the prevalence of the different keywords. These keywords are imputed into the model based on the user's specific needs in the detection of the adoption of cryptocurrencies. This allows for an insight into which keywords are being used to speak about cryptocurrencies and disclose cryptocurrency assets in financial tables.

It is important to note that this is a rapidly changing industry and that new cryptocurrencies for different functionalities are being created everyday. The list of keywords selected is subject to be updated at the user's judgment on what are the most renown words used by public companies to disclose their involvement or adoption of cryptocurrencies within their business.

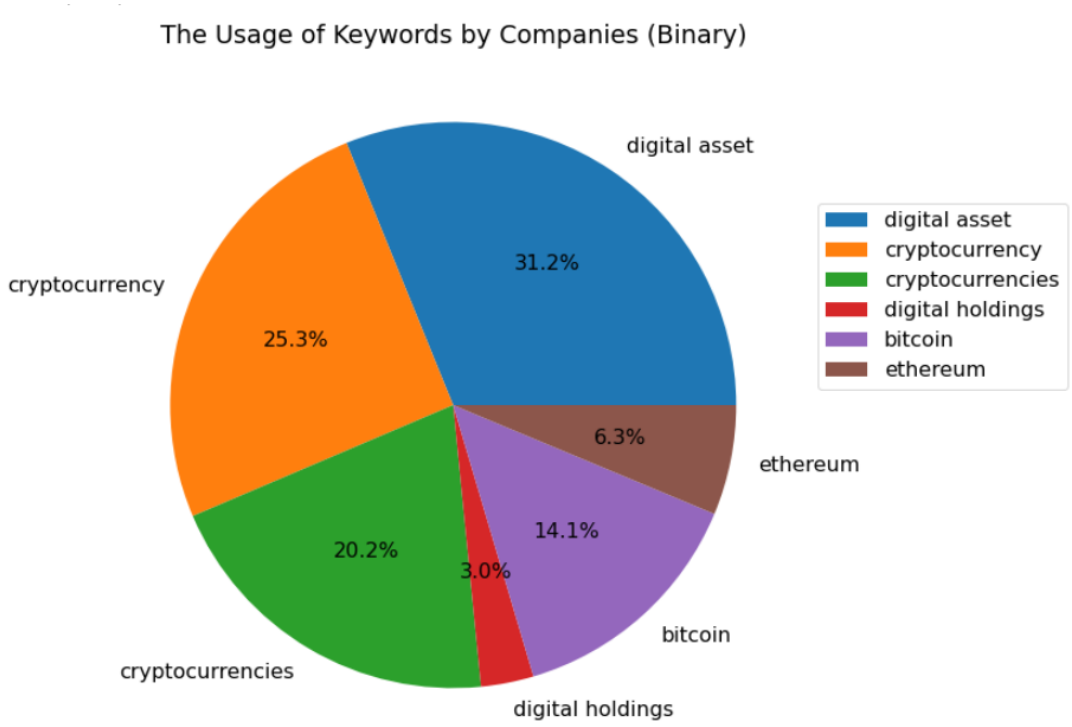


Figure # displays the prevalence of keywords within the whole 10-K document. 31.2% of our keywords found within 10-Ks were Digital Asset. This is used as an umbrella term for all cryptocurrencies. Cryptocurrency and Cryptocurrencies account for 25.2% and 20.2% of the keywords found within the 10-Ks respectively. Considering that one of these is the plural of the other it would be fair to take the sum of these two words and suggest that the forms of the word cryptocurrencies account for 45.5% of the words mentioned within the 10-K. Out of the two cryptocurrency names which were added to the keywords Bitcoin was the most prevalent with 14.1% prevalence compared to Ethereum with only 6.3% prevalence. This means that more comapnies are acknowledging Bitcoin in their 10-Ks when compared to Ethereum.

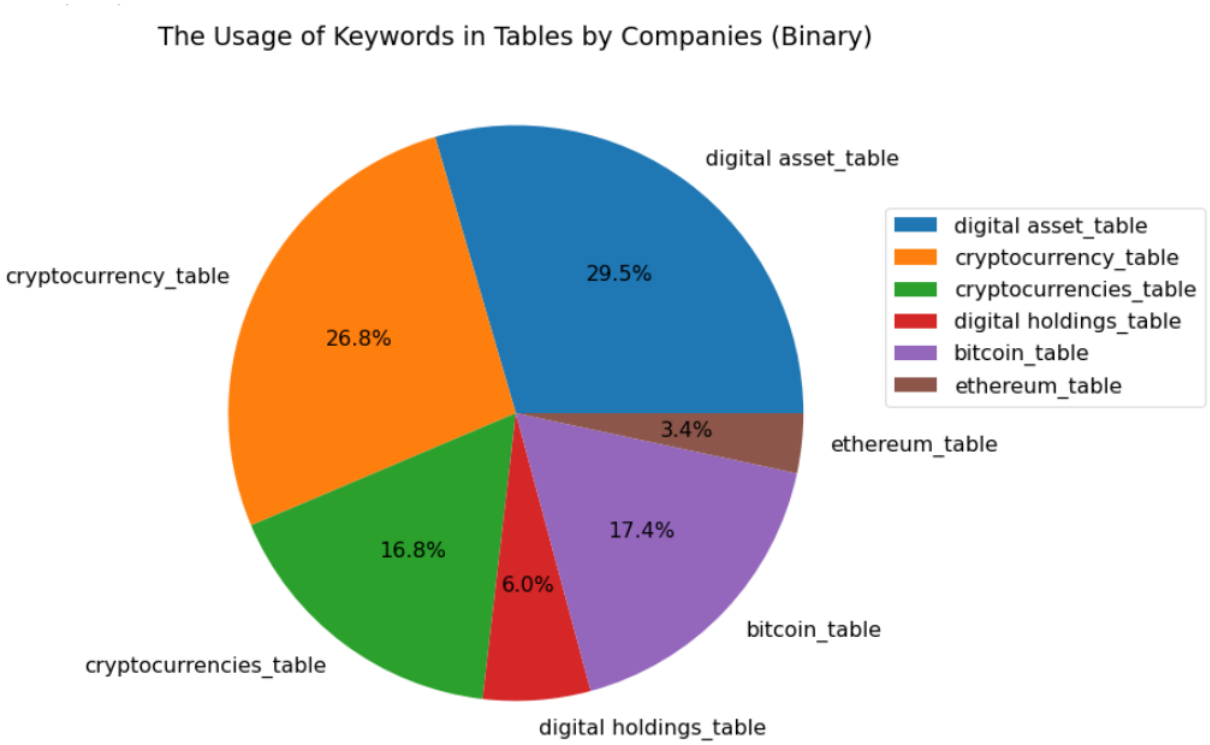


Figure # displays the prevalence of keywords within the financial tables of the 10-Ks. The most prevalent word is Cryptocurrency with 26.8% and 16.8% found for Cryptocurrency and Cryptocurrencies respectively. Out of the names of coins which were evaluated we found that Bitcoin was over five times as prevalent as Ethereum. This is expected as Bitcoin has the largest market capitalization out of all of the cryptocurrencies and therefore it is the most stable. The stability of Bitcoin compared to the rest of the crypto-market draws more attention from public companies and therefore it is expected that it is the most prevalent disclosure out of the coins we have selected for our keywords.

5. Future Recommendations

A possible next step in this analysis would be to build a predictive model to predict which companies are likely to disclose cryptocurrencies in a financial table but have not explicitly disclosed them as of yet. For the target variable, every company which has more than 2 of our keywords within a table in their 10-K would be labeled as a crypto adopter, and label the others as non-crypto adopters.

The independent variables consist of two sections, the first are the presence of keywords outside the tables. This is a good indicator of whether a company will disclose crypto-assets in the future as it means that that company has acknowledged cryptocurrencies already. The second part is the company statistics, this could be extracted from Yahoo Finance using the yfinance package within Python. These could include a range of statistics, for example, market capitalization, gross profits, PEG ratio, etc.

These independent variables can be used to predict the probability of disclosure of crypto assets for each company. The results from this model will identify which companies are likely to disclose cryptocurrencies in the future. K1 can use this information to approach companies which are likely to disclose cryptocurrencies to offer assistance in disclosing them.

6. Conclusion

In conclusion, this paper has explained the thought-process and methodology of the identification of public companies which have adopted cryptocurrencies. A tool was created to automatically search through relevant SEC forms and search for the presence of crypto-related keywords, and return a dataset with the count of these keywords within the whole 10-K and specifically within financial tables. The analysis which proceeded evaluated the adoption rate of each sub-industry and the keywords which companies are using to identify their crypto assets. The tool returned 5764 companies. Out of the 5746 companies 7.13% of the companies mentioned a crypto-related keyword in their 10-K, and 1.46% of the companies mentioned a keyword in a financial table within their 10-K. It found that the services-computer processing & data preparations sub-industry was the most prevalent industry when it comes to crypto-adoption, with 30.1% and 18.1% of the companies have a keyword present in their 10-K and 10-K financial tables respectively. The tool and the analysis highlighted in this paper can be used by K1 to identify sub-industies and specific companies in order to obtain new clients which require consulting to disclose crypto assets.

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