Erasmus School of Economics

Master Thesis Accounting, Auditing & Control

Voluntary disclosure in the digital era; the effect of social media on traditional voluntary disclosure

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Abstract: This thesis examines the relation between “modern” voluntary disclosures and “traditional” voluntary disclosures, for the 100 largest S&P 500 firms and the 100 largest Russell 2000 firms, in order to assess whether the rise of voluntary disclosure through social media has resulted in a decline of voluntary disclosure through traditional channels. Results show that a statistically significant, positive relation exists for the Russell 2000 sample, but results are insignificant for the S&P 500 sample. However, the relation for the Russell 2000 becomes statistically insignificant if the firms are audited by a Big 4 auditor. Again, no significance is found in the S&P 500 sample, regardless of auditor. The thesis adds to the existing literature by showing that smaller companies are incorporating social media more in their disclosure strategy, along with traditional disclosure, if audited by a non-Big 4. However, if audited by a Big 4, this relation disappears.

Key words: Disclosure; Voluntary disclosure; Company traits; Social media; Twitter

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1. Introduction

This master thesis endeavors to research the relation between voluntary disclosure via social media, and voluntary disclosure through traditional channels (e.g. conference calls and press releases). The focus will be on whether the rise of voluntary disclosure through social media has resulted in a decline of voluntary disclosure through traditional channels. As such, the research question is stated as follows:

"Has the introduction of voluntary disclosure through social media led to a decline in traditional voluntary disclosure?"

Finding an answer to this research question may provide valuable information on how the meteoric rise of social media over the past decade has influenced the corporate landscape (Ospina, 2019). Several studies show similar adoption rates of social media by companies of roughly 84%, showing an ever-increasing importance of this medium within a business context (Barnes & Jacobsen, 2013; Veldeman, Praet & Mechant, 2017). Additionally, certain landmark cases such as the row between Netflix and the SEC in 2012, regarding information voluntarily disclosed in a Facebook post, and the dispute between the SEC and Tesla founder Elon Musk, regarding frivolous tweets with significant monetary consequences, have fueled discussions and reports related to voluntary disclosure through social media (Michaels & Rapoport, 2018; Salyer, 2012). While the SEC did rule in 2013 that such disclosure through social media is acceptable, it did state that every case must be evaluated on its own facts and that investors must reasonably know which channels to use (Securities and Exchange Commission, 2013). A significant decline in traditional voluntary disclosure may therefore trigger the SEC or other policy makers to act, in order to protect investors' interests if this decline is seen as detrimental to disclosure quality.

The aforementioned relation may play out in one of three ways. Voluntary disclosure through social media may merely be auxiliary to traditional voluntary disclosure, which means that there most likely will not be a significant relation with traditional voluntary disclosure, or there may be a positive relation if companies decide to disclose all information twice over through both methods. On the other hand, if voluntary disclosure through social media is a substitute to traditional forms of voluntary disclosure, then a significant decline in traditional voluntary disclosure may be expected as voluntary disclosure through social media rises in prominence.

In order to answer the research question, OLS regressions will be used to determine whether a relation exists between “voluntary social media disclosures” and “traditional voluntary disclosures”, and whether the direction of the relation is positive or negative. The data for “voluntary social media disclosures” will be hand collected, using tweets as a proxy. The data for “traditional voluntary disclosures” will be collected using WRDS, with “management guidance” as a proxy. Necessary control variables will likewise be sourced through WRDS.

Two sample groups will be used, one consisting of “large” S&P 500 companies, and one of “small” Russell 2000 companies. This is done because some prior research suggests that company size may affect social media disclosure.

The findings show a positive significant relation between “voluntary social media disclosures” and “traditional voluntary disclosures” for the Russell 2000 sample, suggesting that more disclosures through social media also result in more traditional disclosures. However, after including the interaction term “Adjusted*Auditor” (whether or not a company is audited by one of the Big 4), a significantly negative relation is found, mostly erasing the previously positive relation. This may be because Big 4 auditors are aware that smaller companies benefit relatively less from “traditional” disclosure, thus advising their clients not to issue as much “traditional” disclosure. Big 4 auditors may also be able to assert more influence on their clients and their disclosure decisions compared to non-Big 4 auditors, possibly due to their reputation and perceived professional judgment. This would also explain why the relation only holds for the Russell 2000 sample, as Big 4 auditors would still have more difficulty influencing the decisions of their much larger S&P 500 clients, along with the possibility that they may not even see it as worthwhile. The results for the S&P 500 sample show no statistically significant relation, with or without the interaction term. This may suggest that neither the relatively much larger S&P 500 firms, nor their auditors, see much added value in social media disclosures, aside from occasional use. This may be because these firms already have very high visibility, and they may thus consider social media disclosures redundant. The thesis may be limited by the sample size as it only contains the 100 largest companies of the respective indices. Similarly, while Twitter is one of the most used platforms for the disclosure and dissemination of company information, other platforms do exist. Thus, only using tweets as a proxy for “voluntary social media disclosure” may not include the entire spectrum of “modern” disclosure.

The thesis adds to the existing disclosure literature by providing new insights regarding the interaction between the "modern" and "traditional" disclosure outlets. More specifically, it shows that Russell 2000 firms with a Big 4 auditor, are less likely to disclose information through "traditional" channels, if the same information has already been issued through a Tweet, compared to Russell 2000 firms with a non-Big 4 Auditor. This supports findings such as by Blankespoor (2014), which found that low-visibility firms benefit less from "traditional" disclosure. Russell 2000 firms seem to therefore fall under this "low-visibility" umbrella when compared to their peers. The comprehensive review by Miller and Skinner (2015) on disclosure related papers, discusses the emergence and gradual acceptance of new forms of disclosure by the wider public. This same trend can be seen regarding social media disclosures, with most companies starting a Twitter account in 2009 and a subsequent steady rise in "voluntary social media disclosures".

The thesis may have implications for general shareholders, as the acquisition of company information becomes less obfuscated behind several press releases, 10-K's, 10-Q's and other traditional forms of disclosure. The use of social media by companies simplifies the process of information gathering and possibly allows less sophisticated shareholders to access the same information as their more educated peers, providing more equal opportunities. While an exact economic impact of additional disclosure is difficult to ascertain as it differs per firm, voluntary disclosure has been shown to come with monetary benefits, so companies, especially smaller ones, may want to at least increase their social media disclosures (Core, Hail, & Verdi, 2014; Easley & O'hara, 2004) As this thesis shows an increase in the use of Twitter for voluntary disclosure in the past years, legislators may need to assess what is and is not appropriate regarding this use.

2. Literature review

The research question spans several different types of literature concerning voluntary disclosure, the adoption of social media, and the disclosure of information via social media.

2.1 Voluntary disclosure

First of all, it is important to determine the definitions and differences between "traditional voluntary disclosure" and "social media voluntary disclosure". Before these can be discussed, a general overview of "voluntary disclosure" must be given. Voluntary disclosure can be defined as any information which is not by law mandated to be made public (i.e. disclosed), but which the company made public anyway, either because it was deemed relevant for its stakeholders or due to other incentives which will be discussed further on (Ronen & Yaari, 2002). Ghio and Verona (2020) provide some examples of "traditional" forms of communication through which disclosure is provided. This includes, but is not limited to: management forecasts, investor meetings, conference calls, and press releases. A recurring element of these traditional forms is the presence of some kind of intermediary between the company which discloses information and the stakeholders which receive this information. These could be the media and analysts which would traditionally funnel the information from the company to the wider audience. Another characteristic which may be applicable to traditional forms is that they either originated before the World Wide Web, or that they are not dependent on the World Wide Web to function. Blankespoor (2014) used the term "direct-access information technologies" to refer to new information technologies and channels which bypassed the intermediaries of the "traditional" channels. This is similar to my use of "voluntary social media disclosures", however, "direct-access information technologies" also included other aspects, such as corporate email alerts, which "voluntary social media disclosures" does not. "Voluntary social media disclosures" are therefore only the voluntary disclosures which are made through a social media platform such as Twitter or Facebook. "Traditional voluntary disclosures" are the voluntary disclosures made through intermediaries such as analysts or the media. This does leave a small number of voluntary disclosures which fit in neither category, such as disclosures via corporate websites. These rely on the World Wide Web and bypass intermediaries, but are also not a social media platform. These are mentioned by Ghio and Verona (2020) as "web communication", the general transfer of information between one entity to another through the World Wide Web. "Voluntary social media disclosures" can therefore be seen as a very specific subset of "web communication".

One may wonder whether social media is actually more of a dissemination tool instead of a proper disclosure tool. Blankespoor (2018) provides a comprehensive overview of financial communications, which includes the workings of both disclosure and dissemination. Disclosure is seen as a three-part process. A company first decides "what" kind of information is included, be it earnings, forecasts, sales, et cetera. Secondly, the company chooses "how" the information is presented. This encompasses the medium which is chosen and other factors such as the narrative and general tone. Lastly, the company chooses the "who". This is the perspective from which the information is presented. These steps create what Blankespoor calls, the "information package". This package is then distributed (disseminated) through a certain channel, be it "traditional" channels such as press releases, investor meetings and conference calls, or "modern" channels such as social media. After the information is disseminated, the last two steps of financial communications follow, these being the investor response, followed by the manager response. While from this overview it may seem that social media is no more than a dissemination tool, Blankespoor provides multiple examples in which social media alters the general financial communications framework. Not only does it clearly affect the dissemination part, it also influences the disclosure part by bringing a higher degree of subjectivity, personalization and information density. Changes likewise apply to the investor response and management response. Thus, social media's malleability allows it to not only be usable as a tool for dissemination, but as an instrument to shape the entirety disclosure process. Therefore, this thesis uses "voluntary social media disclosures" instead of "voluntary social media disseminations".

2.2 Incentives for voluntary disclosure

The literature on traditional voluntary disclosure is vast and diverse, with studies such as the one by Eng and Mak (2003) investigating the relation between ownership structure and voluntary disclosure, and others by Boesso and Kumar (2007) researching the drivers behind voluntary disclosure. This stream of literature also provides explanations as to why firms decide to voluntarily disclose information, with the most common explanations being reduced information asymmetry and the subsequent reduction in the cost of capital, and for companies and managers to shield themselves from possible lawsuits due to a lack of transparency (Core, Hail & Verdi, 2014; Cuny, 2016; Scott, 1994).

As mentioned in the previous paragraph, one of the most prevalent incentives for voluntary disclosure is a possible reduction in the cost of capital. The cost of capital can

simply be defined as the return an investor demands before investing in something (Easley & O'hara, 2004). In the context of a reduction in cost of capital, this means that an investor is willing to take a lower return when investing. This is advantageous for the firm in question, since it makes attracting new investors and capital "cheaper". The theory behind this is reasonably simple. A lack of information brings uncertainty, since one does not know what is likely to happen. Uncertainty results in investors wanting a higher return. Logically, if you knew the exact chance that you would get your initial investment back, you could demand an appropriate return to offset any potential losses. However, if you as an investor have no idea what the likelihood is of getting your investment back, then you may assume the worst possible scenario, and thus ask for a large return, regardless of what the likelihood is in reality. By issuing voluntary disclosures, a company provides potential investors with more information, reducing information asymmetry, and in turn reducing their cost of capital (Heitzman, Wasley, & Zimmerman, 2010).

This previous incentive is especially relevant to the research question, as the use of social media for voluntary disclosure may be a significant driver in reducing the cost of capital by lowering information asymmetry. Blankespoor et al. (2014) state that usual firm disclosures only reach a certain number of investors. They find that the use of Twitter allows firms to reach a broader audience, thus reducing information asymmetry and subsequently the cost of capital. This mainly holds for firms which already have a lower exposure, as any new avenues of exposure contribute relatively more compared to companies which already have large amounts of exposure.

Another main driver of voluntary disclosure is more focused on litigation costs. When a company or manager is aware of negative earnings news, but is not obligated to disclose anything until the earnings announcement day, then the shareholders may sue the manager or company in question when their shares plummet, despite the fact that the entity was not by law required to disclose anything beforehand. Thus companies may be incentivized to voluntarily disclose information, especially bad information. (Skinner, 1994). This incentive may be particularly affected by the introduction of social media, as multiple studies and reviews find that social media can be used to influence investors' and shareholders' reactions during times when a company experiences backlash, thus possibly lowering litigation costs (Ghio & Verona, 2020; Miller & Skinner, 2015).

2.3 Social media and voluntary disclosure

Social media can generally be defined as tools to share and discuss information over the internet (Bashar, Ahmad, & Wasiq, 2012). As stated previously, the adoption of social media by businesses has significantly increased over the past decade, with many companies using social media as a marketing tool to better connect to and understand their customers, while also enhancing the way the public perceives them (Aspasia & Ourania, 2014; Barnes & Jacobsen, 2013; Siamagka, Christodoulides, Michaelidou & Valvi, 2015; Veldeman, Praet & Mechant, 2017). Social media has also been able to generate business value via a plethora of ways. Examples being "sales" (i.e. linking to a purchase page), providing customer service, engaging consumers during product development for increased feedback, and the aforementioned use of social media as a marketing tool (Culnan, McHugh, & Zubillaga, 2010).

While research concerning corporate disclosure through social media is still relatively young, several studies have already denoted several aspects of this new field of study. Research has shown that both Facebook and Twitter have been used for the disclosure of corporate information, with respectively 7.06% and 3.45% of messages by companies being related to some form of business disclosures, be it voluntary or mandatory. The same study finds that users are quicker to engage with disclosures on Twitter than on Facebook, respectively 13 and 25 minutes. Of the Fortune 500 firms, 53% had adopted Twitter compared to 46% which had adopted Facebook. 30.24% of all disclosures on Twitter were financial disclosures, compared to 16.8% for Facebook. This study provides reasoning as to why this thesis will mainly focus on voluntary disclosures through Twitter. (Zhou, Lei, Wang, Fan, & Wang, 2015). Prokofieva (2015) finds that the abnormal bid-ask spread decreases when firms tweet relevant information during the announcement's respective period, thus finding practical significance for social media-based disclosure. This study shares similarities in its findings with the study of Blankespoor et al. (2014), as disclosures via Twitter are again found to have greater significance for smaller and less visible firms. However, firms are found to be less likely to disclose information via twitter when this information is considered to be "bad news" and when the magnitude of the news is worse, thus possibly skewing announcements based on a company's performance. While this may appear to be quite self-explanatory, it does show that social media disclosures follow the same basic strategic behavior as would be expected (Jung, Naughton, Tahoun, & Wang, 2018).

This study aims to contribute to the literature in two ways. First, no prior research has examined the relation between "modern" social media voluntary disclosure and "traditional" voluntary disclosure. It will therefore add to both streams of literature within the context of corporate disclosure. Second, the findings of this thesis may impact past research by uncovering new interactions between the forms of disclosure, allowing for deeper insights within the field of corporate disclosure.

3. Hypothesis development

As was briefly mentioned in the introduction, the underlying relation between social media voluntary disclosure and traditional voluntary disclosure may be represented by one of the following assumptions:

1. The introduction and rise of voluntary disclosure through social media may only be complementary to traditional voluntary disclosure, thus no decline in traditional voluntary disclosure would be expected. While there has not been any research on this specific topic, this assumption may be supported by the actions regulatory authorities have taken in the past. As previously stated, the SEC took action against Netflix's CEO Reed Hastings for his use of voluntary social media disclosure (Securities and Exchange Commission, 2013). While this case was eventually dropped, it may dissuade companies from wholly neglecting traditional channels, since the SEC appears to take less action against disclosures made through traditional channels. In other words, companies may consider decreasing traditional voluntary disclosure for social media voluntary disclosures as risky, and may therefore only use social media voluntary disclosure as an additional form of voluntary disclosure instead of a replacement for traditional voluntary disclosure.

2. The introduction and rise of voluntary disclosure through social media may act as a substitute to traditional voluntary disclosure, thus one may expect a decline in traditional voluntary disclosure. There is once again no research on this specific topic. However, traditional voluntary disclosure often requires the help of an intermediary, such as the press, in order to reach the largest amount of investors (Miller, The Press as a Watchdog for Accounting Fraud, 2006). Therefore, dissemination costs are often times higher for traditional forms of voluntary disclosure when compared to social media voluntary disclosure, since creating a social media account is often times entirely free and disseminating information through it requires less time and resources when compared to conference calls or investor meetings. Some research regarding municipal disclosures has shown that the introduction of

an online system allowed municipalities to reach a larger audience and enhanced disclosure (Cuny, 2016). One could argue that social media voluntary disclosures are the next step in the evolution of online voluntary disclosures. Social media voluntary disclosures may therefore substitute traditional voluntary disclosures by lowering dissemination costs and allowing companies of all sizes to reach a broader audience.

Nevertheless, neither of these scenarios is based on direct prior research, but merely on assumptions and inferences from surrounding studies. Therefore, the hypothesis is formulated as follows:

H1: The level of voluntary disclosure through social media is not correlated with voluntary disclosure through traditional channels.

The alternative hypothesis would be a decrease of traditional voluntary disclosure due to the rise of voluntary social media disclosure (assumption 2).

A second hypothesis may be related to the apparent relation between firm size and their tendency to use social media voluntary disclosure. Additional disclosure through outlets such as twitter do appear to reduce information asymmetry, especially for smaller and less visible firms which usually do not gain much attention through traditional channels of disclosure (Blankespoor, Miller, & White, 2014). As was already mentioned in the literature review, the introduction of voluntary disclosure through social media has allowed firms to directly contact investors (Blankespoor, Miller, & White, 2014). This allows smaller firms which would not have had as much reach with traditional voluntary disclosure to still disseminate their information to a sizeable audience. Providing more investors with information reduces information asymmetry, thus increasing the liquidity of a company's stock and reducing the cost of capital. This holds especially true for smaller and less visible firms when compared to large firms which already receive large amounts of exposure for their disclosures. As such, some smaller firms may prefer to use social media voluntary disclosure instead of traditional voluntary disclosure, possibly resulting in a decline of traditional voluntary disclosure.

A hypothesis regarding this relation may be formulated as follows:

H2: Smaller firms are more likely than larger firms to substitute traditional voluntary disclosure with social media voluntary disclosure, due to the apparent benefits which they receive.

There has been some prior evidence to suggest that the size of the audit firm is positively related to a company's tendency to disclose information, as larger audit firms would have a reputation to keep (Ahmed, 1994). Also, auditors of a larger size may influence companies' disclosure decisions, especially for smaller clients, due to their perceived status and reputation. Following the research of Blankespoor (2014), Big 4 auditors may be more able than non-Big 4 auditors to recognize the added benefits of disclosure through social media compared to traditional disclosure, especially for smaller clients. However, some of the studies in question are quite dated and as such, it is unclear if this relation holds for these "modern" social media disclosures. Nevertheless, the hypothesis can be formulated as:

H3: Companies audited by a Big 4 auditor are more likely to substitute traditional voluntary disclosure with social media voluntary disclosure, compared to companies which are audited by a non-Big 4 auditor.

4. Methodology

4.1 Research design

The Libby boxes provided in the appendix (Appendix 8.1), demonstrate how this paper aims to operationalize the underlying conceptual abstracts. This thesis will measure voluntary social media disclosure by the number of tweets posted by a company, which are related to voluntary disclosure of a financial nature. This follows the example which shows that Twitter had overtaken other social media platforms in corporate adoption and the dissemination of corporate announcements (Jung, Naughton, Tahoun, & Wang, 2018). The dependent variable of "traditional" voluntary disclosure can be measured in a similar manner, by determining the number of management guidance in the respective timeframe. This type of disclosure is voluntary and encompasses a company's expectations regarding their future results. This same kind of information will be looked for in companies' tweets.

The control variables used are derived from the research of Ahmed (1994) and Ghio and Verona (2020). These include the size of the firm, which may affect disclosure since larger firms usually have more resources at their disposal for the publication of financial and non-financial information. The size of the company does not have a direct test associated with it, but is instead tested by utilizing the different sample sizes (i.e. comparing the coefficients of "Adjusted" of the "large" S&P 500 against the "small" Russell 2000). Note that the variable "Assets" is only a control variable used to measure the size of a firm in general. It is not related to the size differences between the two different samples (i.e. S&P

500 and Russell 2000), which is tested by comparing the difference in coefficients of "Adjusted" for the S&P 500 and Russell 2000, as was just stated. Furthermore, the size of the audit firm may affect disclosure since larger audit firms have a reputation to uphold and may push the company to disclose additional information. Lastly the debt/equity ratio, on which the literature has found mixed evidence, but which I have decided to include for safety measures. The control variables by Ghio and Verona include growth, measured as the change in revenues year on year, the Return on Assets, the intangible assets measured as intangible assets divided by lagged assets, and the number of analysts following a company.

After considering all these aspects, the OLS regression which will be used to test this relation is as follows:

$$GUIDANCE = \alpha + \beta_1 ADJUSTED + \beta_2 ASSETS + \beta_3 AUDITOR + \beta_4 DEBT/EQUITY + \beta_5 GROWTH + \beta_6 Market/Book + \beta_7 ROA + \beta_8 INTANG + \beta_9 \#ANALYST + \varepsilon$$

H1 will be *rejected* if the coefficient of "Adjusted" is found to be significant. H2 will be *rejected* if the coefficient of "Adjusted" for the Russell 2000 is not statistically more negative than for the S&P 500, or if it is not negative at all. For H3, an interaction term is required, resulting in the following equation:

$$GUIDANCE = \alpha + \beta_1 ADJUSTED + \beta_2 ASSETS + \beta_3 AUDITOR + \beta_4 DEBT/EQUITY + \beta_5 GROWTH + \beta_6 Market/Book + \beta_7 ROA + \beta_8 INTANG + \beta_9 ANALYST + \beta_{10} ADJUSTED*AUDITOR + \varepsilon$$

H3 will be *rejected* if "Adjusted*Auditor" is not statistically negative.

An important consideration when evaluating the relation between "traditional" and "social media" types of disclosure, is the actual content of the respective disclosures. One can reasonably only expect a possible relation if the two types are somewhat similar regarding the type of information they convey. The Financial Accounting Standards Board has defined six categories into which voluntary disclosures can be divided. These include *business data* (e.g. performance measurements), *management's analysis of business data* (e.g. the reasoning behind changes in performance data), *forward looking information* (e.g. opportunities and risks), *information about management and shareholders* (e.g. compensation), *background about the company* (e.g. objectives and strategies) and *information about intangible assets* (Financial Accounting Standards Board, 2001). Meek, Roberts and Gray provide similar

categories in the form of *strategic information*, *financial information* and *non-financial information* (Meek, Roberts, & Gray, 1995).

By looking at some of the S&P 500 companies and their tweets, I can try to categorize them into one of the previously mentioned categories of voluntary disclosure, in order to see if "social media" voluntary disclosure contains the same kind of content as "traditional" voluntary disclosure. By filtering tweets based on some keywords pertaining to financials, I find tweets which fall into the *financial/business data* category. Such tweets have been made by companies such as Microsoft and Royal Dutch Shell and mostly include business figures, be they announcements or guidance (e.g. operating income, revenues, costs, etc.). They are often accompanied by a link to the entire financial report or a video with further information, most likely due to twitter's 280 character limit. If I also include voluntary disclosures regarding *non-financial information*, one subset being socially responsible practices as defined by Meek et al., then I can find a plethora of companies disclosing their socially responsible practices concerning a wide array of topics. These range from companies tweeting about their minimum wage practices to their approach in the current Corona Virus outbreak as of the writing of this thesis. Most of these tweets are also accompanied by a link to some further reading. This shows that most of the "social media" voluntary disclosures are very similar to "traditional" voluntary disclosures content wise, as defined by the FASB and Meek et al,. The main difference lies in the amount of information in these disclosures, since tweets can only be 280 characters as already mentioned. Nevertheless, since both types of voluntary disclosures do pertain to the same content and have information regarding company guidance and expectations, I do believe that they can be compared.

4.1.1 Variable definitions

Table 1: Definitions of variables used in the thesis

ID	Firm identifier. Used to track the number of companies in the respective sample.
Year	Time period from 2006 until 2019 for which data is gathered.
Assets	Total worth of all items owned by a company, expressed in dollars.
Log(Assets)	Same definition as the variable "Assets", but the Log has been taken in order to improve readability.
Auditor	The audit firm employed by the respective company, dummy variable where 0 equals a non-Big 4 auditor, and 1 equals a Big 4 auditor.
Unadjusted	Disclosure related tweets by a company, where each tweet counts as an entry. Given as a whole number.
Adjusted	Days on which disclosure related tweets were sent by a company. Multiple tweets on a single day still count as a single entry. Proxy for "social media voluntary disclosures".
Sentences	Any amount of text in a tweet. A new sentence starts only if the previous text ended with a period (.).
Avg. Sentences	The average number of sentences per tweet. Calculated as the number of sentences by a company in a given period, divided by the variable "unadjusted" in the same period.
Guidance	Number of management guidance published by a company, as retrieved from the Wharton Database. Proxy for "traditional voluntary disclosure".
Growth	Calculated as the difference in revenues from t-1 to t, given as a percentage change.
Market/Book	Market to book ratio. Calculated by dividing the variable MKVALT by BKVLPS from the Compustat database.
ROA	Return on Assets. Net income divided by total assets.
Intang	Intangible assets. Intangible assets divided by lagged total assets.
Analyst	Number of analysts following the firm. Retrieved from IBES database.
NA	Dummy variable for the state where a company does not (yet) have a twitter account. 1 if the company does not (yet) have a twitter account.

Note: The variable "Analyst" is not directly available in the IBES database. In order to obtain the number of analysts for a firm in a given year, the number of estimates for the earnings per share for fiscal year 1 was taken to be the total amount of analysts for that year.

4.2 Data and sampling

4.2.1 Data collection

Data collection will make use of two different applications. The collection of the number of tweets a company makes regarding disclosure will be done manually by retracing a company's tweeting history. This is possible due to Twitter's advanced search machine which allows for the sorting of tweets based on date of posting, and the search engine allows one to filter specific words, which narrows the search down to disclosure related tweets. For the collection of data regarding the dependent variable and the control variables, the Wharton Research Data Services will be used. The I/B/E/S databases allow for the collection of data concerning the number of management guidance made by companies, which is used as the amount of traditional voluntary disclosures made. The data regarding the control variables can be accessed through the COMPUSTAT databases.

4.2.2 Sampling

The sample will consist of firms listed on the S&P 500, starting in 2006. The reason 2006 is chosen as the start of the sample period is because this is the year that Twitter officially launched, and thus the first year that companies could possibly start posting disclosure related tweets. The use of S&P 500 firms also only includes US firms, which one can argue are more likely to adopt Twitter than non-US firms, since Twitter is an American company and most of its content is in English. This is beneficial for the thesis since firms which do not adopt Twitter are not of relevance. The Russell 2000 will be used to sample companies of a smaller size.

4.3 OLS assumptions

The following assumptions may be of concern to this thesis.

4.3.1 Homoskedasticity

Formally speaking is homoskedasticity one of the four OLS assumptions which should be adhered to. However, multiple papers, of which I utilized the paper by Halbert White (1980), show that by employing heteroscedasticity-consistent standard errors, the presence of some heteroskedasticity may not be of great concern. These findings demonstrate that this assumption should not cause much difficulty regarding the OLS.

4.3.2 Independence

The independence assumption requires the independent variables to be independent from the error term. This notion can be eased by the conditional mean independence assumption, by which only the main independent variable of "social media voluntary disclosures" needs to be independent. This assumption is much more likely to hold compared to a situation where all independent variable need to be independent from the error term.

4.4 Endogeneity concerns

Endogeneity relates to a situation where the explanatory variables are correlated with the error term (ε), thus biasing coefficient estimates (Roberts & Whited, 2011). This usually manifests in one of three ways: omitted variables, simultaneity or a measurement error. Omitted variables and simultaneity may be of concern.

4.4.1 Omitted variables

Omitted variables concern all variables which should have been included as explanatory variables, but which have not been, thus ending up in the error term (ε). This may be due to these variables being difficult, if not impossible to measure, or any other reasons as

to why they were not included. While there may be a theoretically infinite amount of variables influencing a company's tendency for traditional voluntary disclosure, this thesis uses control variables found in the research of Ahmed (1994), Ghio and Verona (2020), and therein cited studies to determine the variables which are most likely to affect the traditional voluntary disclosure tendency, thus hopefully minimizing the effect of any omitted variables. Panel data will also be utilized in order to detect possible time invariant omitted variables.

4.4.2 Simultaneity

Simultaneity (also known as reverse causality) occurs when the direction of causality cannot be definitively determined. In such a situation, it is unclear whether the independent variable causes the dependent variable, or whether the dependent variable causes the independent variable (Roberts & Whited, 2011). Reverse causality arises as a consequence of this thesis not performing an experiment. However, the use of panel data allows for weaker assumptions regarding the randomized sampling (Brüderl & Ludwig, 2019). This thesis also merely endeavors to test several assumptions regarding the dependent and independent variable and not to establish definitive causal relations between these. As such, while the presence of simultaneity is likely, it should not be detrimental. Furthermore, a two stage least squares (2SLS) regression will be used to correct for possible simultaneity bias.

5. Results

The following section will examine the results acquired through testing. The first part will discuss the results from the S&P 500 sample and the subsequent part will discuss the Russell 2000. Models only include H-C Standard Errors if explicitly stated in the title, accompanying text or table notes. All variables are defined at the firm-year level.

5.1 Results S&P 500

5.1.1 Descriptive statistics

Table 2 contains the cleaned, descriptive variables of the S&P 500. This table only contains data regarding the firms which have a Twitter account, regardless of whether or not they use it for voluntary disclosures. The appendix contains the table with the raw descriptive variables for the S&P 500 (Appendix 8.2.1; Table 8). This table contains all data entries, including firms which do not have a Twitter account (NA).

Table 2 shows sizeable differences in the Debt/Equity ratio of the S&P 500 companies. A reason for this may be the fact that the S&P 500 lists the largest U.S. based companies, but it does not distinguish based on other factors such as industry. The specific

industry in which a company operates can substantially influence its Debt/Equity ratio, thus explaining the large range of this variable (Talberg, Winge, Frydenberg, & Westgaard, 2008). Another explanation for these Debt/Equity ratios may also lie in the timeframe of the sample, since the 2008/2009 financial crisis occurred which may have substantially impacted firms' Debt/Equity ratios. Such outliers may be interesting regarding disclosure, since these changes in capital structure may result in companies increasing their voluntary disclosure in order to explain these decisions. For this reason, these outliers were not removed.

Table 2 shows that the majority of the S&P 500 companies which have been sampled, employ a Big 4 audit firm (87%). This is to be expected as larger companies would have more resources to spend on hiring one of the larger audit firms, and many of these audit firms have been the main auditors of their respective companies for many years.

The variable "unadjusted", shows the number of disclosure related tweets published by a company. This is regardless of when the tweet was made or how many were made on the same day. Every tweet which was deemed to contain some kind of "disclosure" was counted as an entry. The variable "adjusted", shows the number of times a disclosure related tweet was published by a company, but only one entry would be allowed per day. This was done because it was deemed to be inappropriate to count every tweet as a full disclosure. Companies would tweet multiple times per day regarding the same subject (e.g. annual report), and every tweet would contain a small part of the overall disclosure. So in order to not inflate the number of "social media voluntary disclosures" a maximum of one "social media voluntary disclosures" was permitted per day.

From Table 2 it can be deduced that, on days that companies tweeted, they would tweet roughly twice. The kurtosis of the variables "adjusted" and "unadjusted" shows that the distribution is quite "peaked". This does align with both the mean and the standard deviation, as a large number of companies do not tweet disclosures, or very rarely, with a few companies tweeting dozens of times per year, resulting in a moderately skewed distribution.

Since the variables "adjusted" and "unadjusted" are likely correlated (the former is derived from the latter), it will be prudent to not run a regression with both of these variables together due to possible multicollinearity concerns. This distinction is made because not all companies provide the same amount of information in a single tweet. Thus, simply counting the tweets may skew results if one company tweets many small tweets compared to another company which tweets a single large tweet.

The variable “Sentences”, along with “Avg. Sentences”, also experiences a skewed distribution, similar to the previous variables “unadjusted” and “adjusted”. The reason for this lies mostly in the fact that “sentences” is a derivative of “unadjusted”, since a larger number of tweets would logically lead to a larger number of sentences. Multicollinearity would therefore also be expected between “sentences” and “unadjusted”.

The variable “guidance” is used for tracking the number of “traditional voluntary disclosures”. There is on average much less of these disclosures when compared to “social media voluntary disclosures”. This is most likely due to the fact that disclosing through twitter requires much less effort, as a company only needs a twitter account to start tweeting and disclosing information.

The Market/Book ratio is also portrayed using a Log, as one can see a significant spread regarding the highest and lowest values. A low Market/Book ratio is usually the consequence of a negative book value, which can occur since the book value is simply the net assets. If the liabilities are greater than the worth of the assets, then this will result in a negative book value.

The average number of analysts for the S&P 500 is roughly three times larger than for the Russell 2000 (Respectively 24.30 and 7.40; Table 5). This is to be expected as larger companies would logically require more analysts and be of greater interest due to the inherent rise in complexity as companies grow in size.

Table 2. Descriptive statistics S&P 500

	Mean	SD	Median	Min	Max	Skewness	Kurtosis	SE
Debt/Equity	0.06	34.46	0.55	-776.59	143.99	-20.12	457.74	1.45
Log(Assets)	4.57	0.55	4.60	2.78	5.90	-0.56	0.42	0.02
Auditor	0.94	0.24	1.00	0.00	1.00	-3.72	11.88	0.01
Unadjusted	8.70	13.06	3.00	0.00	101.00	2.64	10.11	0.55
Adjusted	4.31	5.57	2.00	0.00	37.00	1.97	5.48	0.23
Sentences	10.68	16.60	4.00	0.00	113.00	2.64	9.38	0.70
Avg. Sentences	0.78	1.08	1.00	0.00	16.00	7.08	83.54	0.05
Guidance	0.59	1.11	0.00	0.00	9.00	2.86	11.47	0.05
Growth	0.07	0.18	0.04	-0.45	2.17	5.66	57.62	0.01
Log(Market/Book)	5.49	61.22	3.77	-1099.85	540.02	-7.06	173.94	2.26
ROA	0.08	0.07	0.08	-0.40	0.34	-0.60	6.84	0.00
Intang	0.34	0.39	0.26	0.00	4.77	4.39	34.87	0.02
Analyst	24.30	10.50	24.00	0.00	56.00	-0.31	0.95	0.44
Instrumental Variable	2.3E8	1.08E8	2.76E8	3E7	3.36E8	-0.71	-1.04	4.73E6

Note. This table shows the descriptive statistics for S&P 500 companies with a Twitter account, regardless if they tweet or not. The number of observations equals 568. The descriptive statistics are based on observations during the period 2006-2019. The variables "assets" and "Market/Book" are noted as Log in order to improve readability. Companies without a Twitter account are excluded, and the descriptive statistics including companies without a Twitter account can be found in the appendix. Variables with relatively large outliers such as "Growth" and "Market/Book" have not been removed, as such outliers may precisely trigger companies to release guidance in order to explain these anomalies. The Instrumental Variable is independent of the sample groups, which is why it is the same for both the S&P 500 and Russell 2000. Due to the large nature of Twitter's yearly users, scientific notation was used for the Instrumental variable.

5.1.2 Descriptive figures

Figure 1 gives a better, graphical understanding of the proportion of companies which do and do not use twitter. This figure includes both companies which have never tweeted something disclosure related, and companies which did not have a twitter. For the purpose of these figures, no distinction is made between not having a twitter account and never tweeting something disclosure related. The figure appears to roughly follow a Pareto distribution, with a substantial amount of tweets being made by only a few companies.

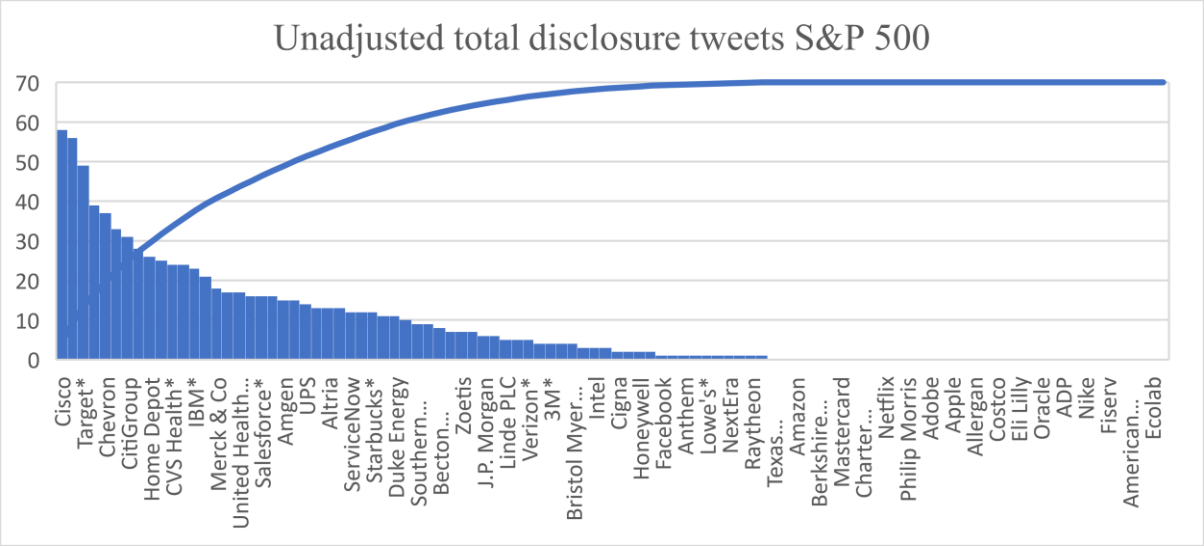

Figure 1. Unadjusted total disclosure tweets S&P 500

Note. The figure shows the number of unadjusted disclosure tweets per company, with the pareto line showing the cumulative total.

Figure 2 provides the yearly average disclosure related tweets. A steady rise has been occurring since 2008, which is the earliest year for which there have been disclosure related tweets in the S&P 500. This rise seems to have plateaued around 2015 to 2016, with a subsequent decline. This may be related to Twitter's decision to increase the character limit to 280 characters from the original 140 characters in 2017, effectively doubling the amount of information which could be disclosed in a single tweet (Rosen, 2017) (Additional figures regarding total disclosure tweets can be found in appendix 8.2.2).

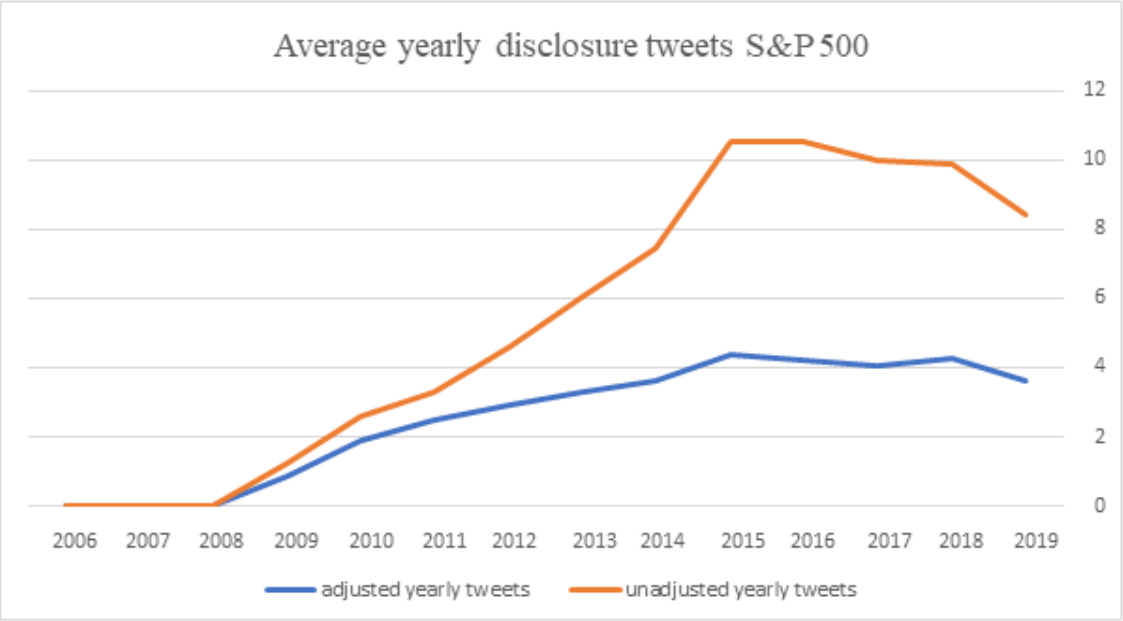

Figure 2. Average yearly disclosure tweets S&P 500

Note. The figure gives the average disclosure related tweets for a given year.

Lastly, figure 3 provides a scatterplot of the dependent variable "management guidance" against the independent variable "adjusted". There does not appear to be a significant case of non-linearity when inspecting this figure, thus safeguarding the first OLS assumption.

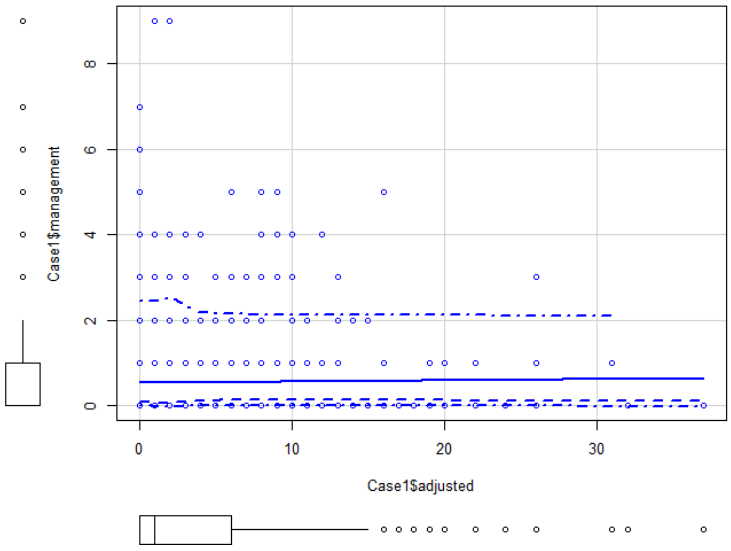

Figure 3. Scatterplot S&P 500

Note. The X-axis provides the number of adjusted tweets. The Y-axis provides the number of management guidance. The dots on the outside represent outliers.

5.1.3 Correlation matrix

Table 3 shows the correlation coefficient for the corresponding variables of the S&P 500. As was mentioned previously, some of the variables may bring multicollinearity concerns when paired with other variables due to their significant correlations to each other. Most importantly, we see that the variables “unadjusted” and “adjusted” are significantly correlated at a 0.01 level. As already stated, this is most likely due to “adjusted” being derived from “unadjusted”. The variable “sentences” is also almost perfectly correlated with the variable “unadjusted”. This was also expected, as more tweets logically lead to more sentences. In order to contain the possible bias caused by multicollinearity, multiple regressions have been performed in order to try and isolate variables which correlate significantly. The variables “unadjusted” and “sentences” were not run due to their high correlation coefficients. The variable “unadjusted”, is partly still included in its derivative “adjusted”. Other correlation coefficients do not seem to cause multicollinearity concerns, as the second highest correlation after removing “unadjusted” and “sentences” still lies beneath 0.50.

Table 3. Correlation matrix S&P 500

Correlation coefficients												
Variable	Guidance	Adjusted	Unadjusted	Sentences	Assets	Auditor	Debt/Equity	Growth	Market/Book	ROA	Intang	Analyst
Guidance	1.00											
Adjusted	-0.06	1.00										
Unadjusted	-0.09**	0.69***	1.00									
Sentences	-0.10**	0.62***	0.96***	1.00								
Assets	-0.08**	0.23***	0.25***	0.24***	1.00							
Auditor	0.05	-0.10**	-0.08*	-0.03	-0.26***	1.00						
Debt/Equity	0.01	0.03	0.02	0.02	0.00	0.00	1.00					
Growth	-0.12***	-0.12***	-0.10**	-0.09**	-0.01	-0.12***	0.00	1.00				
Market/Book	0.02	0.02	0.04	0.03	0.04	0.02	0.47***	0.02	1.00			
ROA	0.05	0.01	-0.01	-0.01	-0.08**	0.20***	0.03	-0.01	-0.03	1.00		
Intang	-0.03	-0.12***	-0.09**	-0.09**	0.09**	-0.17***	0.01	0.34***	-0.02	-0.17***	1.00	
Analyst	0.09**	-0.05	-0.09**	-0.08*	0.16***	0.13***	0.04	0.03	0.02	0.27***	-0.24***	1.00

Note. The table provides the S&P 500 correlation coefficients for the relevant variables used in the regression analyses. The variables "Sentences" and "Unadjusted" will not be included in the regression analyses, as they correlate significantly with each other and the variable "Adjusted", which could lead to multicollinearity issues. *Significant at the 0.10 level. **Significant at the 0.05 level. ***Significant at the 0.01

5.1.4 Regressions

The Breusch-Pagan test was used to test for heteroskedasticity in the various regression models. As a result, heteroskedasticity standard errors were applied to all of the S&P 500 regression models.

Regression model 1 covers the entire sample of the S&P 500, including firms which do not have Twitter accounts. Not having a Twitter account was taken to be a dummy variable (NA) and this first regression shows a statistically significant, positive relation between not having a Twitter account and the number of management guidance (traditional voluntary disclosure), at the 0.01 level. This shows that, ceteris paribus, there were on average 1.4 more management guidance in this "pre Twitter" phase (Table 4; Model 1). This may be due to the financial crisis which ran parallel with this phase, urging companies to release more management guidance to release more information. Quantifying the effect of the financial crisis in the form of year fixed effects proves difficult as not every industry experienced the crisis at the same time or to the same extent. The number of voluntary social media disclosures (adjusted) does not appear to be significant. This is opposite to the main hypothesis, which expected a significant correlation. This may be due to omitted variables. "Assets" is negatively significant at the 0.05 level, stating that larger companies would release fewer management guidance. This becomes economically important, since some companies have experienced large shifts in their assets per year. This is contrary to most prior literature which found a positive relation. Most of these prior papers are quite old, so the current climate may have changed companies' stances regarding management guidance. The financial crisis may have also reduced companies' assets while increasing the number of management guidance, as was mentioned before, thus providing some explanation for this peculiar relation. "Growth" also has a statistically, significantly negative relation with management guidance, suggesting that companies which experience rapid growth would be less likely to disclose information. This corresponds to the existing literature concerning proprietary costs, which states that information disclosure is more troublesome for profitable companies (Ghio & Verona, 2020). Rapidly growing companies may be hesitant to release information for fear of improving their competitors' positions. "Analyst" has a positively significant relation with management guidance. A company with a large amount of analysts following it will be more inclined to release information in order to satiate the needs of the analysts. The constant is not interpretable since not all of the other variables can be set to 0.

Regression model 2 removes all entries without a Twitter account, only including those companies which own a Twitter account, regardless of whether they tweet or not. “Assets” loses some statistical significance and effect size compared to model 1. This may once again be due to the financial crisis, which was more present in model 1 due to the inclusion of “NA” (most “NA” are from the period 2006-2007, with a large amount still present in 2008 and 2009, coinciding with the start of the crisis and the immediate subsequent years). Since “NA” is removed from model 2, this mostly takes the years after and allows companies to recuperate in the subsequent few years. This may possibly alleviate some parts of the crisis, as the initial hit of the crisis is ignored, and weaken the relation between the crisis and the relation between “assets” and “management guidance”. Likewise, “Growth” becomes even more negatively statistically significant. Companies which experienced growth in the few years immediately following the crisis may have been even more reluctant to disclose information to potential competitors.

Model 3 adds the interaction term “Auditor*Adjusted”. This is done because in some prior literature, firms with Big 4 auditors are found to disclose more information, possibly because failure to do so may result in reputational damage to the audit firm, thus the audit firm would push their client towards increased disclosure. The interaction term does not appear to be statistically significant, nor does its inclusion affect the rest of the model in statistically significant ways. Big 4 auditors may be able to push their clients towards additional disclosure through social media if they see it as a worthwhile investment, more so than non-Big 4 auditors due to their perceived reputation and prestige. This could either mean that a positive relation unfolds, if the social media disclosure is in addition to traditional disclosure, or a negative relation if the social media disclosures substitute traditional disclosure. The insignificance of “Adjusted*Auditor” may be because Big 4 auditors are not able to influence their bigger clients in the same way as their smaller clients towards increased disclosure via social media, or because the auditors themselves realise that for these large clients, additional disclosure through social media may not be quite as valuable as it would be for significantly smaller clients. This all goes back to the research of Blankespoor (2014) and the notion that smaller companies would benefit more from additional disclosure through social media.

Table 4. Regression models 1, 2, 3, panel data and Two Stage Least Squares S&P 500

	Model 1	**Model 2**	**Model 3**	**Panel Data (Random Effects)**	**Two Stage Least Squares**
Dependent Variable:	Guidance	Guidance	Guidance	Guidance	Guidance
Constant	1.015*	1.343***	1.376***	1.405**	1.105**
	(0.549)	(0.464)	(0.474)	(0.705)	(0.529)
Adjusted	-0.006	-0.009	-0.014	-0.016	-0.018
	(0.008)	(0.007)	(0.015)	(0.010)	(0.029)
Assets	-0.094**	-0.092**	-0.092**	-0.091	-0.065
	(0.045)	(0.038)	(0.038)	(0.057)	(0.040)
Auditor	0.082	-0.056	-0.090	-0.037	-0.227
	(0.192)	(0.151)	(0.208)	(0.313)	(0.286)
Debt/Equity	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Growth	-0.575**	-0.959***	-0.959***	-0.662**	-0.661**
	(0.270)	(0.310)	(0.308)	(0.283)	(0.260)
Market/Book	0.001*	0.001*	0.001*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
ROA	0.706	0.269	0.268	0.198	0.854
	(0.854)	(0.933)	(0.934)	(0.798)	(0.708)
Intang	0.263	0.157*	0.155*	0.124	0.179
	(0.214)	(0.090)	(0.091)	(0.152)	(0.126)
Analyst	0.017***	0.013***	0.013***	0.010	0.010**
	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)
NA	1.444***				
	(0.183)				
Adjusted*Auditor			0.005		0.019
			(0.016)		(0.030)

Observations	735	568	568	568	527
Adjusted R^2	0.1615	0.0246	0.0229	0.007	0.010
Residual Std. Error	1.397 (df = 724)	1.095 (df = 558)	1.096 (df = 557)		0.997 (df = 527)
F Statistic	15.13***	2.59***	2.33**	13.212	1.545

Note: The table provides the regression results for the relationship between management guidance and social media disclosures for the S&P 500. Companies are only included if data on all relevant variables could be found in the COMPUSTAT and IBES databases. Model 1 includes companies which do not own a Twitter account. Model 2 only includes companies which do own a Twitter account. Model 3 includes the interaction coefficient Adjusted*Auditor and only includes companies with a Twitter account. The panel data shows the results for the relation between management guidance and social media disclosures utilizing random effects. The Two Stage Least Squares regression shows the results regarding the relation between management guidance and social media disclosures. As is noted in the thesis, the function used to provide the Two Stage Least Squares regression output automatically incorporates the Instrumental Variable and omits the one stage regression, which is the reason why these are not present in table 4. All results include H-C Standard Errors. The coefficients of "Adjusted" for Models 2, 3 and the 2SLS of the S&P 500 have been tested against the same models for the Russell 2000 in order to ascertain whether they differ significantly across samples. Model 2 (P = 0.233) does not differ significantly. Model 3 (P = 0.001) and 2SLS (P = 0.006) do differ significantly. $^{*}p^{**}p^{***}p<0.01$

5.1.5 Panel data

In order to account for the possibility of time invariant omitted variable bias within the previous regression models, panel data will be compared to model 2 discussed in the previous section (Table 4). The fixed effects and random effects are defined at the company-level. Heteroskedasticity-consistent standard errors have also been used in this panel data. The panel is unbalanced as there is not data for each company for each year. The Hausman test was performed to determine whether the panel data would have to be that of a fixed effects model or of a random effects model. The Hausman test was insignificant for the S&P 500 panel data, thus a random effects model was used.

Significant changes can be seen when comparing the panel data to the previous OLS regressions. Both "Assets" and "Analyst" have lost their statistical significance in their entirety, while "Growth" has lost some of its significance. These differences between the panel data and OLS regressions indicate that the OLS most probably suffers from some type of time invariant omitted variables.

5.1.6 Two stage least squares

In order to account for the possibility of simultaneity bias in the OLS regression, a two stage least squares (2SLS) regression is run (Table 4). H-C Standard Errors were also used in this 2SLS regression. In order to run a 2SLS regression, an instrumental variable must be used. This variable must adhere to two assumptions. The first assumption states that the variable must have a causal effect on X. The second assumption states that the variable may only affect Y through X. The instrumental variable which was used in this regression was taken to be the number of active Twitter users per year. The reasoning behind this lies in the assumption that companies would have more incentive to disclose information through Twitter if the number of possible people who would see this disclosure increased. At the same time, the number of active Twitter users should not have a direct effect on a company's likelihood to disclose information through traditional means, that being management guidance. The function "ivreg()" from the package "AER" is used in R. This function is found to produce a more valid output and it automatically integrates the instrumental variable and stage one regression, which is why these are not found in table 4.

The results from the S&P 500 2SLS regression do not appear to differ significantly from the original S&P 500 OLS regressions. The main variable of interest, "Adjusted", is virtually unchanged. This could technically suggest that there is no omitted variable bias present in the original OLS regression, however, the Chi-squared of the 2SLS regression is insignificant with a p-value of 0.12. Thus, it is not appropriate to make any real inferences from this output.

5.2 Results Russell 2000

5.2.1 Descriptive statistics

As with the S&P 500, the raw descriptive statistics including the firms which do not have Twitter (NA), can be found in the appendix (Appendix 8.3.1; Table 9).

The Russell 2000 differs from the S&P 500 in some substantial ways. Fewer companies have a Twitter account when compared to the S&P 500 (73 compared to 93). Of the companies which do have Twitter, we see that less tweets are being made, both when comparing the "unadjusted" variable and the "adjusted" variable. As a logical result of this, the number of sentences is lower compared to the S&P 500. Interestingly, the average number of sentences appears to be the same, suggesting that the tweets which are made, still contain roughly the same amount of information. Management guidance also appears to be lower for the Russell 2000. Both the Russell 2000 and the S&P 500 do appear to have roughly the same percentage of companies which have a Big 4 auditor (respectively 86% and 87%). The variables "Debt/Equity" and "Assets" are lower for the Russell 2000, as is to be expected from smaller companies. As mentioned previously, the outliers for "Debt/Equity" were not removed, since such outliers may push companies to disclose more information in order to explain such abnormalities and may therefore be of use to the thesis. The same can be said for the outliers in "Growth" for the Russell 2000. Interestingly, "Growth" does appear to be higher for the Russell 2000, despite the Russell 2000 having a negative Return on Assets when compared to the S&P 500. As mentioned previously, the number of analysts following Russell 2000 companies is roughly a third the amount of the S&P 500.

Table 5. Descriptive statistics Russell 2000

	Mean	SD	Median	Min	Max	Skewness	Kurtosis	SE
Debt/Equity	-0.06	4.89	0.16	-69.73	34.01	-8.44	109.06	0.17
Log(Assets)	2.88	0.66	2.90	0.28	4.50	-0.41	0.18	0.02
Auditor	0.83	0.38	1.00	0.00	1.00	-1.76	1.10	0.01
Unadjusted	2.03	4.44	0.00	0.00	35.00	3.71	17.86	0.19
Adjusted	1.68	3.10	0.00	0.00	15.00	2.01	3.28	0.13
Sentences	2.48	5.26	0.00	0.00	42.00	3.43	15.31	0.22
Avg. Sentences	0.45	0.68	0.00	0.00	3.33	1.30	0.88	0.03
Guidance	0.25	0.74	0.00	0.00	5.00	3.64	14.26	0.03
Growth	0.91	12.54	0.09	-1.00	283.11	20.09	416.51	0.45
Log(Market/Book)	3.17	19.67	2.64	-384.19	199.46	-9.04	215.33	0.71
ROA	-0.05	0.28	0.03	-2.51	0.80	-3.45	20.23	0.01
Intang	0.29	0.36	0.18	0.00	3.30	2.90	15.33	0.01
Analysts	7.40	4.77	7.00	0.00	24.00	0.53	0.34	0.17
Instrumental Variable	2.3E8	1.08E8	2.76E8	3E7	3.36E8	-0.71	-1.04	4.73E6

Note. This table shows the descriptive statistics for Russell 2000 companies with a Twitter account, regardless if they tweet or not. The number of observations equals 447. The variables "assets" and "Market/Book" are noted as a Log in order to improve readability. The descriptive statistics are based on observations during the period 2006-2019. Companies without a Twitter account are excluded, and the descriptive statistics including companies without a Twitter account can be found in the appendix. Variables with relatively large outliers such as "Growth" and "Market/Book" have not been removed, as such outliers may precisely trigger companies to release guidance in order to explain these anomalies. The Instrumental Variable is independent of the sample groups, which is why it is the same for both the S&P 500 and Russell 2000. Due to the large nature of Twitter's yearly users, scientific notation was used for the Instrumental variable.

5.2.2 Descriptive figures

The scatterplot below shows some instances of outliers from the norm, however, linearity does still appear to be preserved when looking at the majority of data points. The OLS assumption should therefore still hold for the Russel 2000.

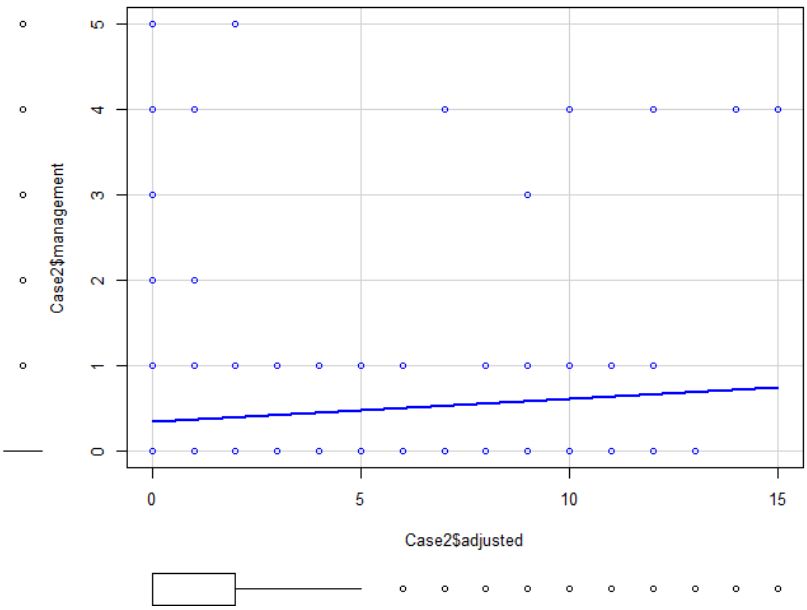

Figure 4. Scatterplot Russell 2000

Note. The X-axis provides the number of adjusted tweets. The Y-axis provides the number of management guidance. The dots on the outside represent outliers.

The rest of the Russell 2000 figures can be found in the appendix for the sake of brevity, since they mostly provide the same information as the figures previously discussed during the S&P 500.

5.2.3 Correlation matrix

The Russell 2000 correlation matrix does differ in some ways from the S&P 500, however, these should not lead to a large difference in the way the regressions are conducted. The variables "auditor" and "guidance" do have a statistically very significant correlation compared, especially considering that the S&P 500 did not have such a relation. However, the magnitude of the correlation remains relatively small. Multicollinearity should therefore not be an issue. None of the "Social media" variables (adjusted, unadjusted, sentences) are

correlated to management guidance, as opposed to the S&P 500 where both “unadjusted” and “sentences” had some statistically significant correlation to management guidance. The previous concerns regarding multicollinearity for variables such as “sentences” and “unadjusted” are still present. These will once again not be run in the regressions. The Russell 2000 appears to have fewer statistically significant correlations when compared to the S&P 500, however, this may be due to less data being available for the Russell 2000 firms in WRDS.

Table 6. Correlation matrix Russell 2000

Correlation coefficients												
Variable	Guidance	Adjusted	Unadjusted	Sentences	Assets	Auditor	Debt/Equity	Growth	Market/Book	ROA	Intang	Analyst
Guidance	1.00											
Adjusted	0.03	1.00										
Unadjusted	0.01	0.89***	1.00									
Sentences	0.00	0.87***	0.97***	1.00								
Assets	0.10**	-0.03	0.01	-0.01	1.00							
Auditor	-0.12***	-0.01	0.01	0.00	-0.22***	1.00						
Debt/Equity	0.01	-0.04	0.00	0.00	0.04	-0.02	1.00					
Growth	-0.03	-0.03	-0.03	-0.03	-0.07	-0.05	0.00	1.00				
Market/Book	-0.01	-0.01	0.00	0.03	-0.09**	0.02	0.53***	0.01	1.00			
ROA	0.16***	-0.07	-0.02	-0.03	0.50***	-0.02	0.02	-0.12***	-0.12**	1.00		
Intang	0.02	-0.07	0.01	0.03	0.07	0.07	0.04	-0.04	-0.07	0.20***	1.00	
Analyst	-0.05	-0.01	0.01	0.03	0.11**	0.25***	-0.07	0.00	0.05	0.12***	0.00	1.00

Note. The table provides the Russell 2000 correlation coefficients for the relevant variables used in the regression analyses. *Significant at the 0.10 level. **Significant at the 0.05 level. ***Significant at the 0.01 level. As with the S&P 500, the variables "Sentences" and "Unadjusted" will not be included in the regression analyses, as they correlate significantly with each other and the variable "Adjusted", which could lead to multicollinearity issues.

5.2.4 Regressions

Heteroskedasticity standard errors were once again used in all of the Russell 2000 regression models except for model 3. And the panel data. The F-statistics of all the models are statistically significant.

Model 1 of the Russell 2000 provides very different results from its SP counterpart. The variable "NA" is still significant, however, its relation is inverted, suggesting that Russell 2000 companies which did not or do not have a Twitter account, are less likely to issue management guidance. Furthermore, "Analyst" has lost its significance, which may be due to the fact that Russell 2000 companies in general are smaller and less complex and newsworthy than S&P 500 companies, thus having fewer analysts following them and likewise requiring relatively fewer management guidance to be issued. "Assets" has lost its statistical significance, suggesting that the size of the company is not related to the number of guidance issued. This may be because there are larger absolute differences between the smallest and largest S&P 500 companies when compared to the smallest and largest Russell 2000 companies. Interestingly, "Auditor" does have some significance compared to the S&P 500. The relation is negative, suggesting that Russell 2000 companies audited by a Big 4 issue fewer traditional disclosures. This may be because Big 4 auditors realize that traditional disclosure is less valuable for smaller companies as they are already less visible. However, the results are only significant at the 0.10 level. Lastly, "Growth" appears to have lost most of its statistical significance while "ROA" has become very statistically significant, suggesting that companies of varying sizes differ in which financial measurements entice them to issue voluntary disclosures. Smaller companies appear to be less worried about competitors gaining a competitive advantage from their disclosures, while at the same time being more inclined to disclose higher Returns on Assets to potential investors.

Model 2 again removes the variable "NA". As with the S&P 500 model 2, most results stay the same. "ROA" has increased in its coefficient, as was the case with "Growth" in the S&P 500. A similar explanation may be applicable in this case, namely that companies with higher Returns on Assets in the years following the crisis would be even more enticed to disclose this information to potential investors. "Auditor" remains at the same significance level.

Regression model 3 of the Russell 2000 also adds the variable “Adjusted*Auditor”. Both this variable and “Adjusted” are statistically significant, compared to the S&P 500. The variable “Adjusted” is statistically positive, suggesting that an increased number of disclosures through social media results in an increased number of management guidance. This may be a case of simultaneity bias, as the reverse would be more logical, that being that management guidance is issued and in addition also tweeted at some later point in time. The interaction term suggests that Russell 2000 companies with a Big 4 auditor would be less likely to issue management guidance if their number of social media voluntary disclosures increases. As noted earlier during the S&P 500 regression, Big 4 auditors, as opposed to non-Big 4 auditors, may be able to push their smaller clients towards increased social media disclosures in addition to traditional disclosures, or even the substitution of traditional disclosure for social media disclosure. Big 4 auditors may see the added benefits for these smaller clients as was discussed by Blankespoor (2014). The negative, statistical significance of this interaction term appears to support H3.

Table 7. Regression models 1, 2, 3, panel data and Two Stage Least Squares Russell 2000

	Model 1	**Model 2**	**Model 3**	**Panel Data (Random Effects)**	**Two Stage Least Squares**
Dependent Variable:	Guidance	Guidance	Guidance	Guidance	Guidance
Constant	0.609***	0.778***	0.454		0.414
	(0.181)	(0.286)	(0.325)		(0.324)
Adjusted	0.010	0.011	0.110***	0.012	0.107***
	(0.018)	(0.018)	(0.033)	(0.017)	(0.032)
Assets	0.003	-0.000	0.019	-0.192**	0.023
	(0.019)	(0.033)	(0.038)	(0.092)	(0.038)
Auditor	-0.182*	-0.286*	-0.054	-0.561	-0.107
	(0.103)	(0.159)	(0.146)	(0.400)	(0.146)
Debt/Equity	0.001	-0.001	-0.002	-0.002	-0.001
	(0.004)	(0.007)	(0.011)	(0.010)	(0.011)
Growth	-0.001*	-0.001	-0.001	0.000	-0.001
	(0.001)	(0.001)	(0.003)	(0.002)	(0.003)
Market/Book	-0.000	0.001	0.001	0.004	0.000
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
ROA	0.351***	0.694***	0.661***	0.279	0.592***
	(0.087)	(0.172)	(0.224)	(0.299)	(0.222)
Intang	0.008	-0.017	-0.028	0.021	-0.013
	(0.075)	(0.094)	(0.108)	(0.144)	(0.107)
Analyst	-0.006	-0.011	-0.012	0.016	-0.007
	(0.005)	(0.009)	(0.011)	(0.016)	(0.011)
NA	-0.426***				
	(0.052)				
Adjusted*Auditor			-0.117***		-0.112***
			(0.036)		(0.035)

Observations	746	495	485	425	478
Adjusted R^2	0.078	0.025	0.044	-0.167	0.045
Residual Std. Error	0.751 (df = 735)	0.916 (df = 485)	0.9072 (df = 484)		0.8905 (df = 467)
F Statistic	7.321^{***}	2.401^{**}	3.269^{***}	0.929	3.251***

Note: The table provides the regression results for the relationship between management guidance and social media disclosures for the Russell 2000. Companies are only included if data on all relevant variables could be found in the COMPUSTAT and IBES databases. Model 1 includes companies which do not own a Twitter account. Model 2 only includes companies which do own a Twitter account. Model 3 includes the interaction coefficient Adjusted*Auditor and only includes companies with a Twitter account. The panel data shows the results for the relation between management guidance and social media disclosures utilizing random effects. The Two Stage Least Squares regression shows the results regarding the relation between management guidance and social media disclosures. As is noted in the thesis, the function used to provide the Two Stage Least Squares regression output automatically incorporates the Instrumental Variable and omits the one stage regression, which is the reason why these are not present in table 4. All results include H-C Standard Errors with exception of Model 3 and the Panel Data. The coefficients of "Adjusted" for Models 2, 3 and the 2SLS of the S&P 500 have been tested against the same models for the Russell 2000 in order to ascertain whether they differ significantly across samples. Model 2 (P = 0.233) does not differ significantly. Model 3 (P = 0.001) and 2SLS (P = 0.006) do differ significantly.* *p**p***p<0.01

5.2.5 Panel data

The panel for the Russell 2000 remains unbalanced as there is not data for each company for each year. The Hausman test was again performed to determine whether fixed effects or random effects should be used. The result for the Russell 2000 panel data suggested that a random effects model should be used.

As was the case with the S&P 500 panel data, the Russell 2000 panel data differs significantly from the Russell 2000 OLS regressions. "ROA" has lost all of its significance while "Assets" has become somewhat significant. This once again indicates that time invariant omitted variable bias is present in the current OLS regression with the respective dataset.

5.2.6 Two stage least squares

As was done with the S&P 500, a two stage least squares regression is run with the Russell 2000 in order to account for any possible simultaneity bias. H-C Standard Errors are once again incorporated into the model. The instrumental variable is the same as for the S&P 500.

The results from the Russell 2000 2SLS regression are very similar to the results found in model 3 from the original OLS regression. Along with the fact that the Chi-squared is very significant, it would suggest that there is no simultaneity bias present in the OLS regression. Since H1 stated that there is no correlation between "Adjusted" and "Guidance", we can firmly reject this hypothesis, if a company is audited by a non-Big 4. If the company is audited by a Big 4, the effect of "Adjusted" becomes negative in the interaction term, but the joint effects become practically 0. H2 stated that smaller businesses would be more likely to *substitute* traditional disclosures with social media disclosures. When comparing the coefficients of the variable "Adjusted" across the different models to those in the S&P 500 sample, it appears quite clear that smaller companies are not more likely to substitute traditional disclosures for modern social media disclosures, since all coefficients are positive compared to the S&P 500, thus rejecting H2. However, there does appear to be some support in favor of H3, as the interaction term still remains very statistically negative.

6. Conclusions

The main driver behind this thesis has been the permeation of the digital media within the old-fashioned world of company disclosures. The thesis attempts to unravel the relation between these modern "voluntary social media disclosures" and the conventional "traditional voluntary disclosures", in order to see whether the former has led to a decline in the latter. Tweets were used as a stand-in for these "voluntary social media disclosures" and were evaluated against management guidance, which acted as a substitute for the "traditional voluntary disclosure". Not all results were consistent with the limited research which was done before due to research limitations, such as a relatively small sample size and imperfect proxies. Nevertheless, the Russell 2000 2SLS regression does show that a significant relation exists between the independent and dependent variables. Since hypothesis 1 stated that "*The rise of voluntary disclosure through social media is not correlated with voluntary disclosure through traditional channels",* we can with some confidence reject this hypothesis, if only for Russell 2000 companies with a non-Big 4 auditor. The S&P 500 sample did not produce any significant results. The actual direction of this relation proves to be more difficult to ascertain, although there is some statistically significant evidence in the Russell 2000 regressions and 2SLS regression to believe that companies with Big 4 auditors are more likely to substitute traditional disclosures with social media disclosures. However, the joint effects of this relation end up only being slightly negative, suggesting that there is no effect of "Adjusted" on "Guidance", if a Russell 2000 company is audited by a Big 4. While companies with non-Big 4 auditors appear to release additional guidance along with the disclosure tweets, Big 4 auditors may realize that their relatively small Russell 2000 clients will not benefit much from this additional "traditional" disclosure. This would be in line with previous research which suggested as much, and on which hypothesis 2 was based (Blankespoor, Miller, & White, 2014).

As was mentioned earlier, the coefficients of "Adjusted" in the Russell 2000 models are not statistically more negative than those in the S&P 500 sample. On the contrary, Model 3 and the 2SLS Model of the Russell 2000 (Table 7) provide statistically positive coefficients for "Adjusted" and do statistically differ from their counterparts in the S&P 500, however they are statistically *more* positive than their counterparts (Tablenotes Table 4 & 7). Therefore, H2 "*Smaller firms are more likely than larger firms to substitute traditional voluntary disclosure with social media voluntary disclosure, due to the apparent benefits which they receive"*, should be rejected.

There appears to be evidence that Russell 2000 companies with a Big 4 auditor are *less* likely to disclose through traditional disclosures, although this relation only holds at the 0.10 level (Table 7). However, when taking a look at the interaction term, Russell 2000 companies with a Big 4 auditor appear to issue significantly *less* traditional disclosures when their social media disclosures increase, once again possibly due to Big 4 auditors realizing that smaller companies gain comparatively less from this type of disclosure, as was discussed earlier. Since hypothesis 3 states: *"Companies audited by a Big 4 auditor are more likely to substitute traditional voluntary disclosure with social media voluntary disclosure, compared to companies which are audited by a non-Big 4 auditor.",* it appears that this hypothesis can be supported.

As mentioned above, the sample size and proxies used are most likely the largest shortcomings of this research. While a sample of 100 is generally sufficient, a sizable number of these companies does not have Twitter, or does not use Twitter for disclosures. A larger sample size can undoubtedly only improve results if this research were to be recreated. Using management guidance as a proxy for traditional disclosures seems to be a decently accurate measure, given its voluntary and informative nature, in line with the FASB's general descriptions of what constitutes a voluntary disclosure. The proxy for social media disclosures may be more dubious, and the inclusion of non-Twitter disclosures into a more comprehensive proxy could be a beneficial addition to the research. Methodologically speaking, the process of data collection may be the largest hurdle to overcome, as the line between voluntary disclosure and general tweet is sometimes difficult to determine. Possibilities for automation may therefore remain limited, and professional human judgment remains an important factor.

Despite the understandable shortcomings of the research, the thesis still adds to the growing body of knowledge by reexamining the results of previous research in a new context. Furthermore, it lays the foundation for future research through such ways as the role of the auditor regarding this new medium of disclosures. Potential research may also include other avenues for social media disclosures, besides Twitter. Future policy makers may have to set clearer guidelines for what is and is not considered to be acceptable in terms of social media disclosure etiquette.

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8. Appendix

8.1 Libby Boxes

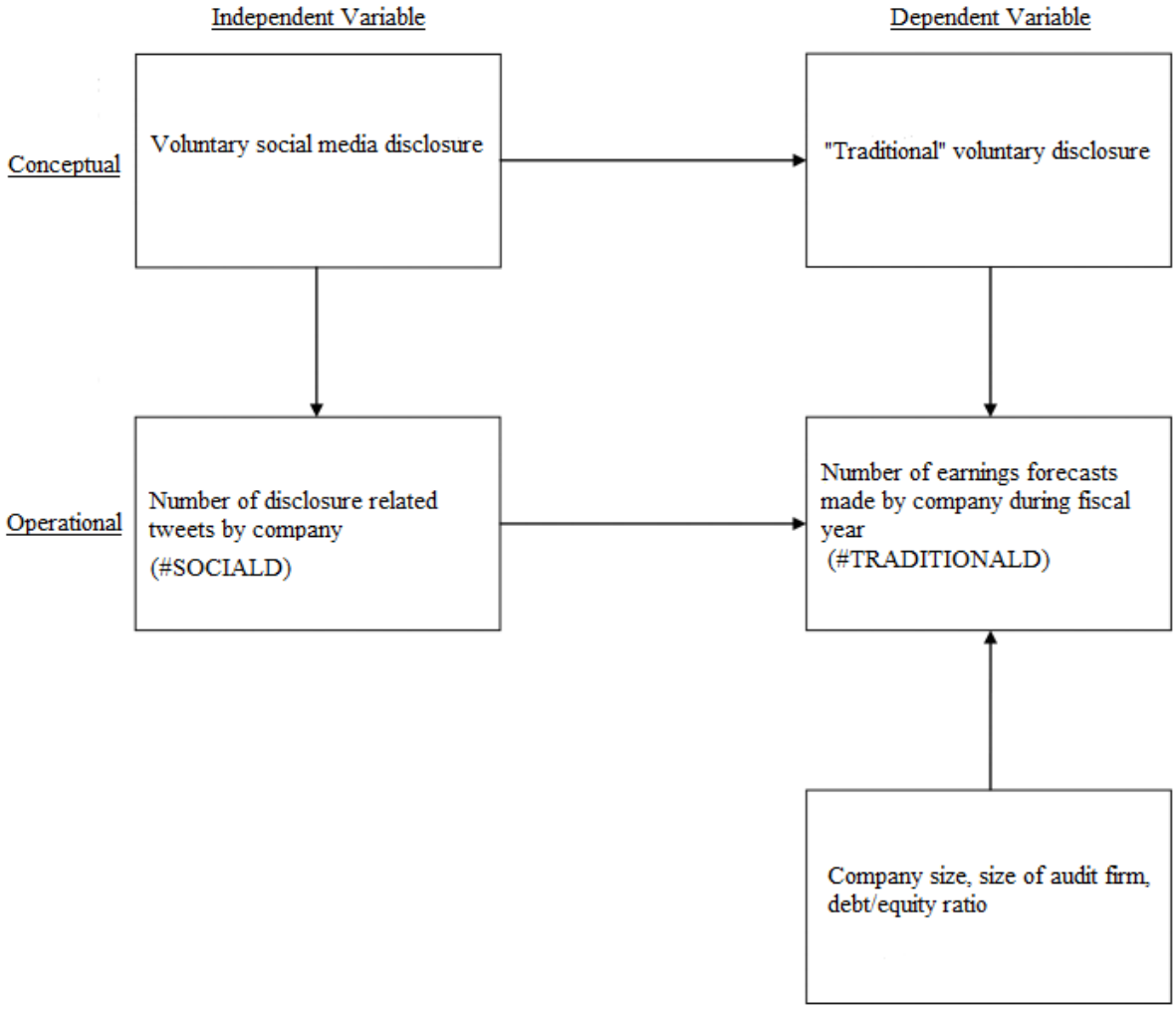

Figure 5. Libby boxes

8.2 Appendix S&P 500

8.2.1 Raw descriptive statistics S&P 500

Table 8. Raw descriptive statistics S&P 500

	Mean	SD	Median	Min	Max	Skewness	Kurtosis	SE	N
ID	49.95	28.48	50.00	1.00	99.00	0.00	-1.20	0.77	99
Year	2012.58	4.01	2013	2006	2019	-0.02	-1.20	0.11	738
Debt/Equity	0.20	30.24	0.50	-776.59	144.00	-22.92	594.12	1.11	738
Log(Assets)	4.57	0.55	4.60	2.78	5.90	-0.56	0.42	0.02	738
Auditor	0.94	0.23	1.00	0.00	1.00	-3.83	12.73	0.01	738
Unadjusted	8.68	13.06	3.00	0.00	101.00	2.64	10.13	0.55	569
Adjusted	4.30	5.57	2.00	0.00	37.00	1.98	5.49	0.23	569
Sentences	10.66	16.59	0.00	0.00	113.00	2.64	9.39	0.70	569
Avg. Sentences	0.78	1.08	0.00	0.00	16.00	7.08	83.57	0.05	569
Guidance	0.91	1.52	0.00	0.00	9.00	2,19	5.21	0.06	738
Growth	0.08	0.18	0.05	-0.58	2.17	4.86	46.54	0.01	737
Log(Market/Book)	5.49	61.23	3.77	-1099.85	540.02	-7.06	173.94	2.26	735
ROA	0.09	0.07	0.08	-0.40	0.68	0.07	10.75	0.00	738
Intang	0.33	0.41	0.23	0	4.77	4.88	38.18	0.02	737
Analyst	23.28	10.24	23	0	56	-0.16	0.86	0.38	738
NA	0.23	0.42	0.00	0.00	1.00	1.30	-0.33	0.02	738

Note. This table shows the descriptive statistics for S&P 500 companies with or without a Twitter account, regardless if they tweet or not. The table also includes the properties of the "meaningless" variables "Year" and "ID". The variables "assets" and "Market/Book" are noted as Log in order to improve readability.

8.2.2 Figures S&P 500

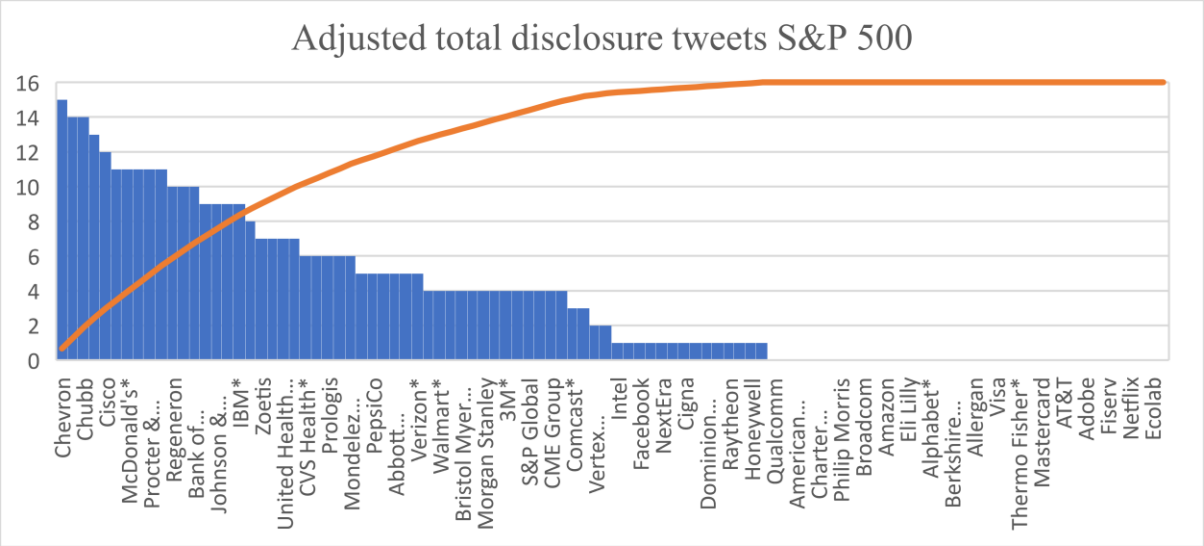

Figure 6. Adjusted total disclosure tweets S&P 500

Note. The figure shows the number of adjusted disclosure tweets per company and the pareto line gives the cumulative total.

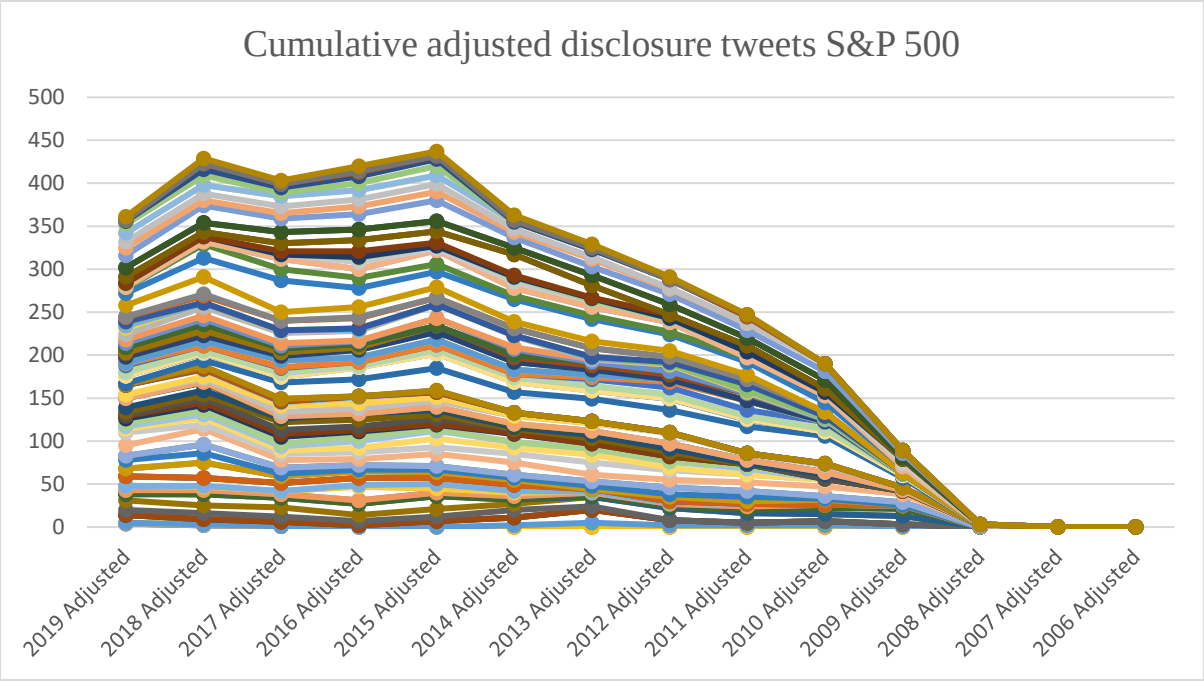

Figure 7. Cumulative adjusted disclosure tweets S&P 500

Note. The figure gives the cumulative adjusted disclosure tweets per company in a given year.

8.3 Appendix Russell 2000

8.3.1 Raw descriptive statistics Russell 2000

Table 9. Raw descriptive statistics Russell 2000

	Mean	SD	Median	Min	Max	Skewness	Kurtosis	SE
ID	37.43	21.73	38.00	1.00	73.00	0.00	-1.25	1.01
Year	2013.36	3.86	2014.00	2006.00	2019.00	-0.29	-1.01	0.13
Debt/Equity	-0.06	4.89	0.16	-69.73	34.01	-8.44	109.06	0.17
Log(Assets)	2.88	0.66	2.90	0.28	4.50	-0.41	0.18	0.02
Auditor	0.83	0.38	1.00	0.00	1.00	-1.76	1.10	0.01
Unadjusted	2.03	4.44	0.00	0.00	35.00	3.71	17.86	0.19
Adjusted	1.68	3.10	0.00	0.00	15.00	2.01	3.28	0.13
Sentences	2.48	5.26	0.00	0.00	42.00	3.43	15.31	0.22
Avg. Sentences	0.45	0.68	0.00	0.00	3.33	1.30	0.88	0.03
Guidance	0.25	0.74	0.00	0.00	5.00	3.64	14.26	0.03
Growth	0.91	12.54	0.09	-1.00	283.11	20.09	416.51	0.45
Log(Market/Book)	3.17	19.67	2.64	-384.19	199.46	-9.04	215.33	0.71
ROA	-0.05	0.28	0.03	-2.51	0.80	-3.45	20.23	0.01
Intang	0.29	0.36	0.18	0.00	3.30	2.90	15.33	0.01
Analyst	7.40	4.77	7.00	0.00	24.00	0.53	0.34	0.17
NA	0.34	0.48	0.00	0.00	1.00	0.65	-1.58	0.02

Note. This table shows the descriptive statistics for Russell 2000 companies with or without a Twitter account, regardless if they tweet or not. The table also includes the properties of the "meaningless" variables "Year" and "ID" The number of observations equals 1050. The variables "assets" and "Market/Book" are noted as a Log in order to improve readability.

8.3.2 Figures Russell 2000

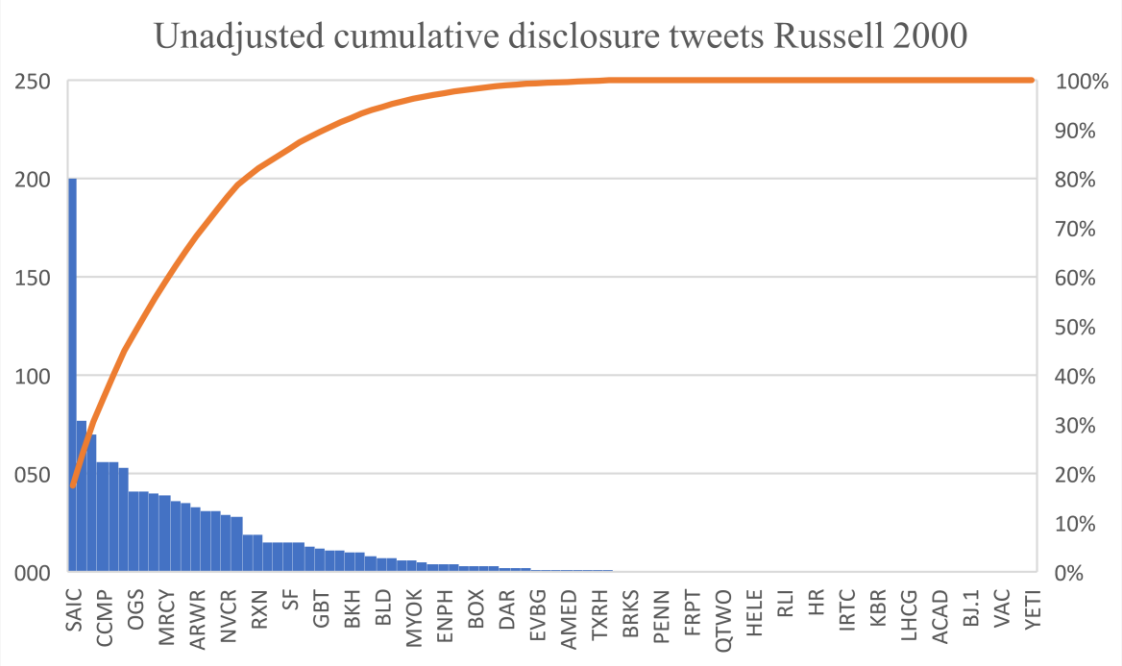

Figure 8. Unadjusted cumulative disclosure tweets Russell 2000

Note. The figure shows the number of unadjusted disclosure tweets per company and the pareto line gives the cumulative total.

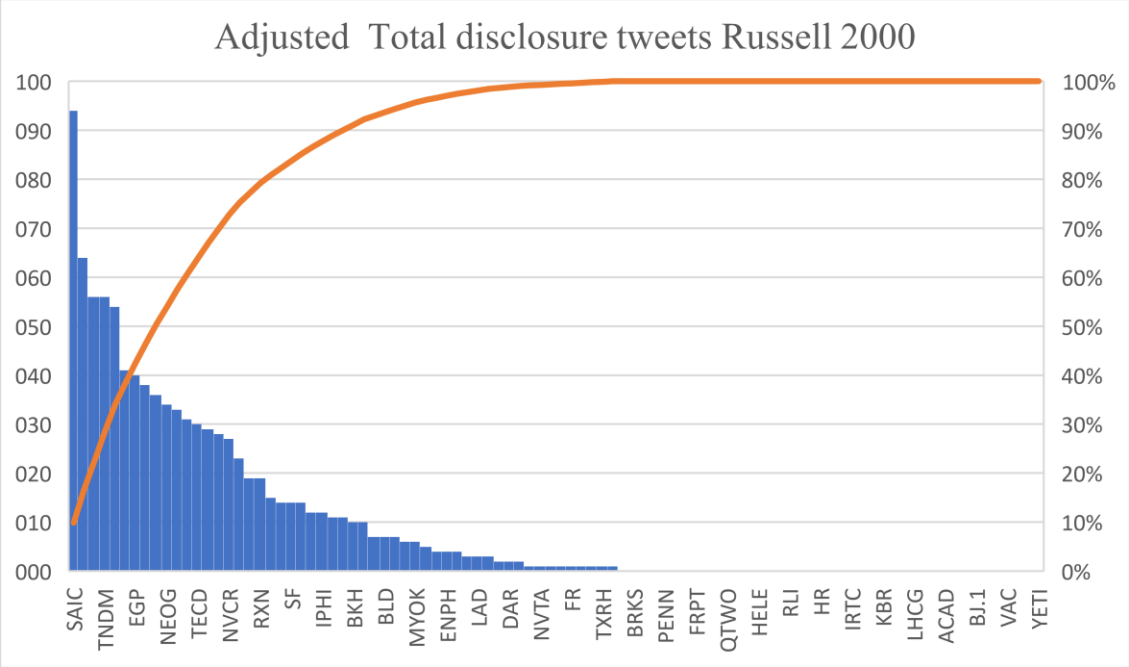

Figure 9. Adjusted Total disclosure tweets Russell 2000

Note. The figure shows the number of adjusted disclosure tweets per company and the pareto line gives the cumulative total.

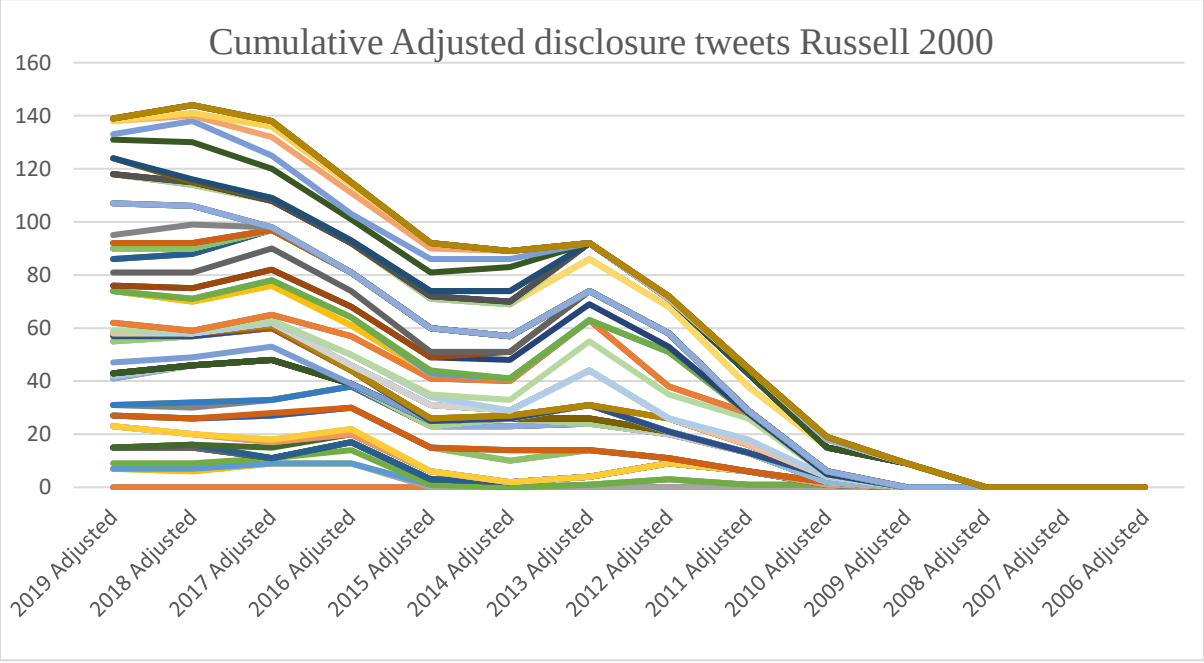

Figure 10. Cumulative Adjusted disclosure tweets Russell 2000

Note. The figure gives the cumulative adjusted disclosure tweets per company in a given year.