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Master Thesis

Disclosure Quality and Capital Market Effects – A Blockchain Perspective

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Abstract

The growing emphasis of relying on technology in the production of financial reports and the drastic effects blockchain technology potentially can have on this process was found highly relevant by the authors. This coupled with the growing interest of contemporary literature on disclosure levels' relevance for firms and its stakeholders motivated this thesis. On this basis, the objective was to investigate the relationship between disclosure quality and the related capital market effects.

In order to analyze the research objective, the paper comprehensively covers existing disclosure theory and theory on the use of financial information from an investor perspective. From this, it was found that the most apparent capital market effects are related to disclosures' ability to reduce information asymmetry and hence facilitate increased liquidity and decreased cost of capital of firms. This relationship was consequently hypothesized and empirically tested. Also, as we suspected that disclosure levels have been increasing historically, as well as the notion that disclosure levels vary across industries, these relationships were also investigated.

In order to empirically test the formulated hypothesis, several regression analyses were conducted, and quality tests were conducted. Here it was found that disclosure quality, defined as the disaggregation level of financial statements (DQ), had been significantly increasing over time, as well as significantly varying across industries, why the following analysis needed to control for these fixed effects. With this in mind, a significant positive relationship between DQ and liquidity was found as well as significant negative relationships between cost of equity, cost of debt, and cost of capital.

These findings were ultimately related to the attributes of blockchain technology, where the possible effects of an emergence of blockchain accounting systems were discussed. Here it was detected that a drastic increase in disclosure quality and levels could be expected. This will most likely benefit many stakeholders as information asymmetry is reduced, however, a risk of a possible information overflow was also identified. Also, the role of auditors can be expected to change drastically. Finally, the increased transparency was found to give potential competitive drawbacks for firms, which may prevent a total utilization of blockchain technology's ability to increase transparency in the capital market and hence reduce information asymmetry.

Table of Contents

Figures and Tables

1. Introduction

1.1 Context

Blockchain technology has attracted broad and significant interest since its initial practical application in 2009. As a part of the 4th industrial revolution, it has the potential to impact many aspects of our lives significantly. A blockchain is a shared and secured database, which is controlled by a whole network instead of the single user. By using a secure protocol, the network collectively verifies, records, and approves transactions, which consequently creates trust in the information that is theoretically tamper-proof (Lazanis, 2015). From this, many parallels can be drawn to the disclosure of financial reports and other financial information. Auditors traditionally verify transactions to create trust in terms of the disclosed information. This is the basis from which this thesis has obtained its inspiration for the research objective, as it has made the researchers aware of the relevance of the potential changes the process of disclosing financial information may face.

Disclosure of financial information and hence accounting information is an essential part of carrying out economic decisions for both companies and investors. To illustrate, when companies desire to raise capital, it is necessary to entice investors. Investors' decision to invest essentially hinges on the companies' annual reports and the disclosed information in these. Increased information leads to less uncertainty, and it is definite that people pay extra for positive assurance. Moreover, decreased uncertainty reduces risk, which results in a diminished premium required. Linking this to financial information, the ultimate outcome is that increased quality disclosure results in a lower cost of capital and increased liquidity due to the overall reduction of information asymmetry in the market (Foster, 2003).

1.2 Research Objectives

In previous economic literature, an abundance of research has examined the relationship between economic cost factors and information (Botosan & Plumlee, 2000; Healy, Hutton, & Palepu, 1999a; Leuz & Verrecchia, 2000; Mohd, 2005; Prodhan & Harris, 1989). The relationship between accounting information and the cost of capital, in particular, has been a significant matter in the accounting literature, which regularly receives numerous mentionings.

Existing literature demonstrates that increased voluntary disclosure results in a lower cost of capital. More specifically, certain studies, including Petersen and Plenborg (2006), have discovered a negative relationship between voluntary disclosure and proxies for information asymmetry, which yields an indirect relationship. This indirect relationship signifies that increased voluntary disclosure lowers the cost of capital at the hand of the reduction of information asymmetry. In addition to this, Brown and Hillegeist (2007) have detected a negative relationship between information asymmetry and the quality of voluntary disclosure. Conclusively, this offers support to the theory, which indicates that higher disclosure quality is linked to a lower level of information asymmetry and consequently higher liquidity and lower cost of capital. To test the theory, this study applies a direct approach where disclosure quality is measured from the disaggregation level of financial statements, liquidity is measured by bid-ask spreads, and the cost of capital is measured by CAPM estimations.

This thesis is significant for scholars and particularly practitioners. Consequently, if the research, show support of the already existing theory, which indicates that more disclosure lowers information asymmetry, then companies should favor an optimization within their disclosure policy to ensure that both companies and investors benefit from these effects. Furthermore, since this paper is one of few to discuss financial disclosure and the capital market effects under a blockchain regime, the thesis contributes to the empirical research of financial disclosure.

2. Research Question

Based on the above introduction and the authors' motivation, the purpose of this thesis is to understand how firms can benefit from the attributes of blockchain technology with respect to the disclosure of financial information. This is done through theoretical considerations, which are empirically tested.

Consequently, the primary problem statement, which this paper seeks to answer can be formulated as follows:

- *How does increased disclosure quality affect information asymmetry and subsequent capital market effects?*

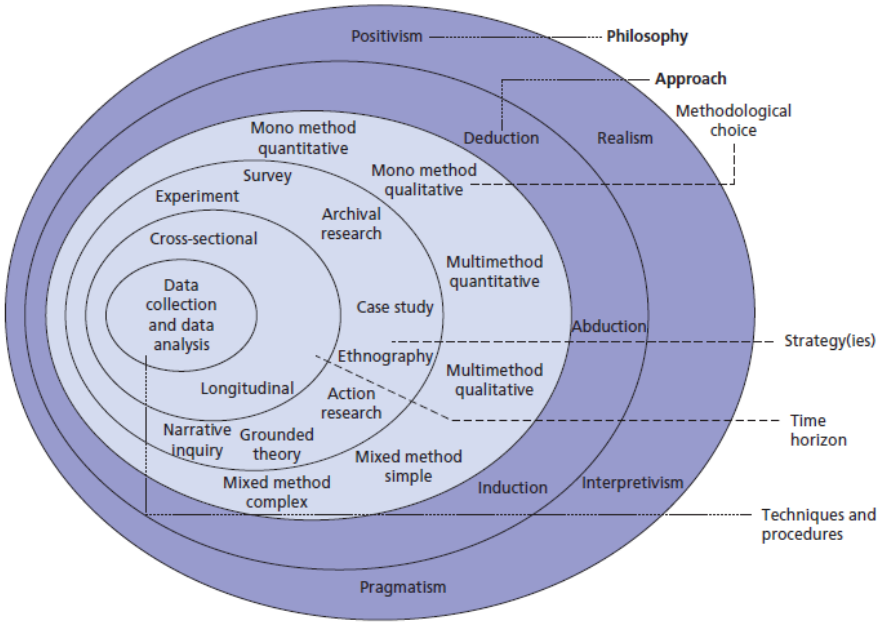
In order to answer the problem statement comprehensively, we find it necessary to investigate the following research sub-questions, which highlight the relevance of the research topic as well as the underlying factors that may affect the answer to the problem statement.

1. Which theory exists regarding the economic consequences of financial disclosures?
2. How has financial disclosure quality developed over time?
3. Does disclosure quality vary between industries?
4. Which capital market effects carry the highest relevance for further investigation and how are these related to financial disclosure levels?
5. How can blockchain technology affect financial disclosure of firms?

3. Research design

The discussion regarding how the research of this thesis is designed will follow the framework of "the research onion", developed by Saunders et al. (2007), which Figure 1 displays below. Its purpose is to illustrate the stages that must be covered when designing an efficient research approach. The research onion provides an effective progression through which a research methodology can be developed and facilitates a proven efficient structure. We will start with the outer layer and work our way in with the objective of covering the aspects found relevant in regards to our research.

Figure 1: The Research Onion



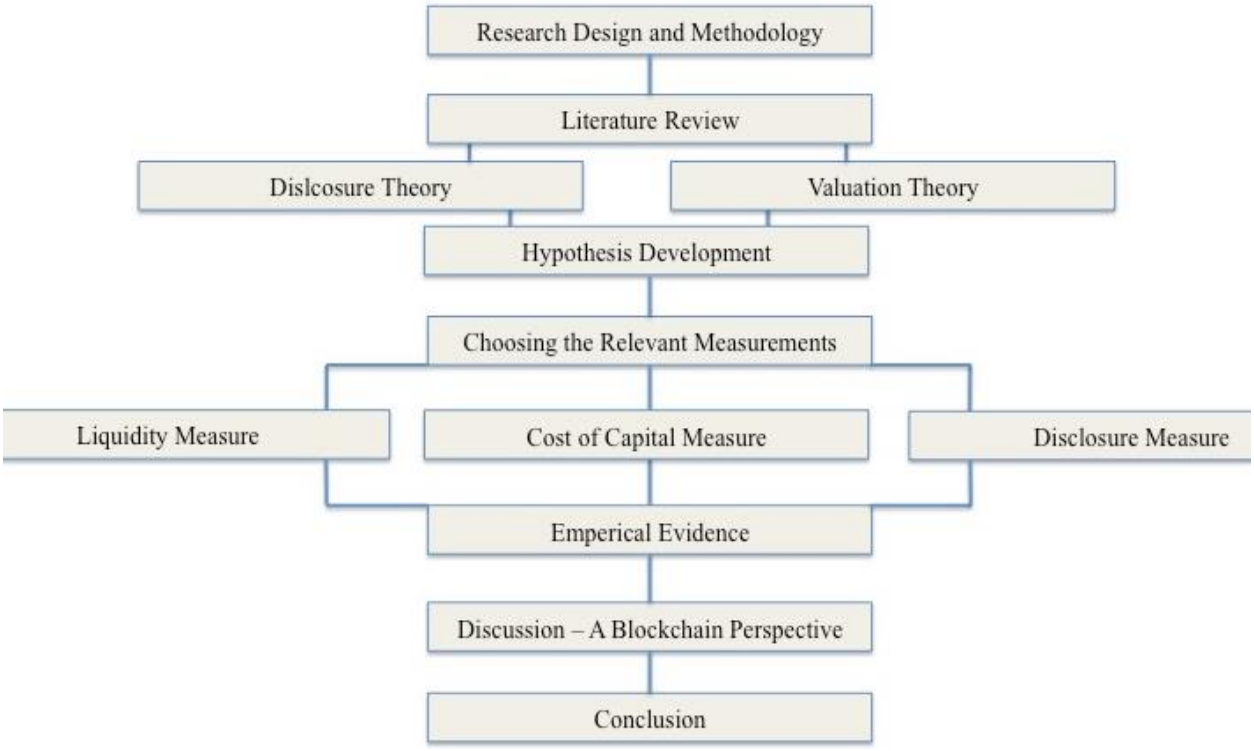
Source: (Saunders, Lewis, & Thornhill, 2012, s. 128).

Before delving into the discussion about the research design, the following section will briefly cover the structure of the thesis.

3.1 Thesis Structure

The structure of this paper can be categorized into the following sections: Research Design and Methodology, Literature Review, Hypothesis Development, Choice of relevant proxies for the empirical research, Empirical results and subsequent limitations, Discussion of the empirical findings from a blockchain perspective, and Conclusion. Figure 2 below illustrates the structure and highlights the interconnectedness of the sections.

Figure 2: Thesis Structure



Source: Own construction

3.2 Methodology

The following section contains a discussion regarding the papers methodological considerations behind the conducted research. This includes various theoretical and philosophical assumptions regarding the applied methods of choosing, collecting, analyzing, discussing, and presenting the research (Malhotra & Birks, 2012). In this specific perspective, the goal is to determine the best suitable research paradigm for analyzing and discussing the problem statement defined above. Firstly, the philosophical aspect regarding the applied epistemological and ontological view will

be addressed. These views form the basis for how the later research is carried out as well as for the related findings (Malhotra & Birks, 2012).

3.2.1 Epistemology

When discussing epistemology, the question of what knowledge is must be considered from a philosophical perspective (Bryman & Bell, 2007). This comes from the heavily debated quandary of whether or not social science and the realm of natural science should be researched in the same way. More specifically, the discussion can be narrowed down to the possible quantification of social phenomena, i.e., if it can be measured and examined in the same way as observations in the realm of natural science.

This debate draws parallels to the aspect of ontology, which will be elaborated upon in the following section. Here, three fundamental views are being recognized, which include positivism, realism, and interpretivism. The views differentiate themselves in their way of seeing the social science and their way of studying social phenomena (Bryman & Bell, 2007). The poles of the spectrum of opinions are the positivists and the interpretivists. The interpretivists believe that social reality differs from natural reality, and argue that the observer, the setting, and bias of the subject influence observations, consequently preventing the occurrence of objective observations (Lincoln & Guba, 1985). The positivists, on the other hand, believe in an objective reality within the social world and that it can be studied through objective observations, which is equal to the views of natural science. Between the two extremes that were just covered is the view of realism. This view acknowledges the opinion of positivists and an objective reality. However, this position also realizes that some form of subjectivity will influence an observer, why the reality can only be imperfectly understood (Bryman & Bell, 2007).

The considerations outlined above make it clear that there is no right answer to how the reality is observed and understood. Furthermore, it is clear that it will be problematic to fit the applied research philosophy of this paper into one of the three epistemological views mentioned above. To give a deeper understanding of the approach and theoretical background of the paper, a discussion on the ontology is vital.

3.2.2 Ontology

Ontology focuses on the existence of objective social entities, more specifically, whether they exist or if they are socially constructed (Bryman & Bell, 2007). Even though this is in contrast to the epistemology, the ontological approach still affects the epistemology since the way the world is constructed is central to how it should be observed. Within the aspect of ontology are the two dominating opinions, namely objectivism, and constructivism. In the context of an objectivistic view, an organization is argued to be tangible and have its own agenda, thus not being influenced by individuals. On the contrary, the followers of constructivism argue that the meaning of phenomena is constructed by social actors, thus inferring that entities have no individual agenda but are created by social actors (Bryman & Bell, 2007). To put this into context, a researcher should reflect on the applied paradigms and models when following the school of constructivism. To elaborate, researchers are believed to construct the observed reality and will therefore always be somewhat subjective in their observations.

Taking these insights into account, the thesis' theoretical considerations will follow the epistemological view of realism. The researchers seek to provide findings that can illustrate the relationship between financial disclosure and relevant capital market effects. These findings will then be used as arguments for firms adapting to blockchain accounting systems, thus facilitating improved and increased disclosure level of financial information. Consequently, a somewhat objective truth is desired. It is however realized that when researching the effects of a novel technology, we, as researchers, inevitably are affecting the obtained knowledge, why a non-falsifiable truth is deemed impossible. This fact is admitted, and the following sections will describe how we are trying to diminish this subjective influence.

3.2.3 Research Approach

This section is conducted to provide an understanding of how the underlying theoretical assumptions are combined with the research and how it is conducted. By doing so, the researchers are given a well-rounded foundation to conduct the analysis upon.

When choosing methodological reasoning, two central choices are available, specifically the inductive and the deductive method (Malhotra & Birks, 2012). In inductive research, the

rationale stems from observations, which are generalized in order to be applied in cases that have a resemblance. On the contrary, deductive research constructs knowledge by testing existing theory on observations, which is frequently done through hypotheses. This thesis will primarily adopt a deductive research approach based on the nature of the research question.

One goal of this thesis is to investigate the effects of increased financial disclosure on information asymmetry and the cost of capital for firms. We deploy a regression approach, utilizing existing publicly available data, hence an empirical method, as it adapts straightforwardly into our theoretical choices as well as to the deductive characteristics of the paper.

The choice of a deductive research approach is based on the realization that some form of predetermined hypotheses about how the stock market behaves is necessary for making assumptions regarding the related effects of increased financial disclosure (Malhotra & Birks, 2012).

This type of method, however, comes with several difficulties in regards to measuring essential concepts. In order to counter this challenge, literature is used to interpret these concepts to the most exact extent possible. Furthermore, with respect to the earlier-mentioned research questions, this choice of method comes with certain positive aspects. Initially, accurate data is favored since the thesis seeks general findings, and lastly, the regression approach pursues causalities amongst variables deduced from theoretical frameworks (Wooldridge, 2009).

Another goal of this paper is to detect the patterns and regularities regarding the use of blockchain technology and the related effects, thus incorporating inductive elements to the research approach.
Consequently, this thesis ends up with an actual approach with a resemblance to the school of realism.

In practice, the research objective is based on predetermined assumptions that firms are interested in increased financial transparency and that investors benefit from decreased information asymmetry.

Consequently, a mix of deductive and inductive research approaches are used as we seek to provide insights from analyses that are conducted as objectively as possible but still are influenced by some pre-defined hypotheses.

In conclusion, the section above confirms the discussion of the methodology, where an approach based on the views of realism as is found to be the most appropriate epistemology and ontology. Positivistic values are adopted why the research approach primarily is deductive. Despite this, it is realized that we are influenced by our own observations, and these are used in detecting patterns to formulate tentative hypotheses about potential effects. Despite this, an inductive approach built on interpretivism is acknowledged as equally important. The chosen paradigm of realism assists the authors in the search of explaining relationships between disclosure quality and the related capital market effects.

3.2.4 Data Considerations

Besides the methodological aspect of the research design, the choice of which data to collect and how to collect it is essential for the analysis of the research question. Data can either be classified as primary or secondary data. The characteristics of primary data are that it is collected by the researchers themselves and is unique to the paper. Secondary data is collected from second-hand sources and is therefore often less time-consuming to obtain but is often less useful due to the lack of specificity to the purpose of the project. Also, the researcher must be careful with the use of secondary data since a third party has collected it and hence potentially contains validity and reliability issues (Malhotra & Birks, 2012). This study will use both types of data in which primary data will be used to complement the secondary data where it is deemed insufficient. Thus, by combining the two types of data, the researchers can deduct a comprehensive analysis of the proposed research question.

Primary data can be of either qualitative or quantitative nature. Malhotra & Birks (2012) define

quantitative research as; *"research techniques that seek to quantify data and, typically, apply some form of measurement and statistical analysis."* By doing so, the positivistic epistemology is implicitly applied to the understanding of the social world. In terms of qualitative data, it is defined as: *"an unstructured, primarily exploratory design based on small samples, intended to provide depth, insight, and understanding*." Thus, qualitative research adapts the reasoning from an inductive approach and the school of interpretivism to establish legitimacy.

With their individual characteristics and related upsides covered, it is important to be critical. Quantitative data is being criticized for providing misleading or shallow information when studying the complex social world. On the contrary, qualitative data is argued to be subjective, and the method of collecting data is too difficult to generalize and lacks transparency.

This study will be founded on secondary quantitative data as this will be the main source of data in line with the argumentation made on the epistemology, ontology, and research approach. As mentioned above, supporting primary qualitative data and quantitative data will be used to overcome potential shortcomings of a single approach.

3.2.5 Data Collection

As the last step of the methodology, the reasoning for the choice of data collection method will be accounted for, and we will briefly present the process of how it has been conducted.

In regards to the actual process of collecting and cleaning quantitative secondary data for constructing our chosen disclosure measure of disaggregation quality as well as the other variables included in our regression analysis will be presented when actually applied. The argument for this approach is that we find that it allows for a smoother reading of the paper.

In short, the quantitative data collected in this thesis is collected from three primary databases, namely CRSP, Compustat, and Aswath Damodaran's own database (damoraran.com).

CRSP data contains security-level historical, descriptive information and market data on more than 27,000 stocks (inactive and active companies) from the NYSE, NYSE American,

NASDAQ, and Arca exchanges. Here we collect data regarding bid-ask spreads, return volatility, stock prices and trading volumes.

Compustat data contains thousands of annual and quarterly income statements, balance sheet, cash flow, pension, supplemental, and descriptive data items for active and inactive companies. Here we more specifically use data regarding various income and balance sheet statement measures.

Damodaran.com contains combined data from Bloomberg, Morningstar, Capital IQ, and Compustat collected by Aswath Damodaran. Here we collect data regarding the cost of capital grouped by industry.

Scholars whose research and publications must withstand rigorous analyses for accuracy rely on all databases. Quantitative analysts in the commercial market depend on the historical depth and unrivaled quality in order to perform back-testing and modeling calculations. In the government sector, regulators and policymakers value Compustat's and CRSP's data as the basis for financial and economic research (wrds-web.wharton.upenn.edu; Damodaran.com). With this in mind, the databases are considered reliable data providers.

The data is gathered for firms included in the S&P 500 index as per the 10th of April 2018. Here firms from the financial and utility sectors are excluded leaving us with 402 firms. For CRSP and Compustat, data is collected in the period 1973-2017. Data from Damodaran.com is only available from 1998-2017.

With respect to the type of data collected, we collect cross-sectional data, which is grouped over time; thus it has the characteristics of longitudinal data.

To support the theoretical justification of findings from the analysis based on the secondary quantitative data, qualitative secondary qualitative data has been collected from various acknowledged research journals.

The primary qualitative data for this paper is gathered through interviews, and its primary purpose is to contribute to the discussion about, how and why firms can/cannot benefit from increased financial disclosure with the use of blockchain technology. This is done since the aim is to gather insights beyond that of quantitative surveys, so an elaboration of the insights is essential for the usefulness of the primary data.

With respect to the degree of structure in conducted interviews, it can be classified from completely unstructured to highly structured. The highly structured interviews function as quasi-quantitative research as they follow a strict structure and only allow for answers made possible by the interviewers (Malhotra & Birks, 2012). Consequently, this approach is not deemed appropriate, as the insights from the interviews are aimed towards the inductive part of this thesis. Instead, semi-structured interviews are conducted, where a certain list of topics and questions are to be covered. In line with this, there is also flexibility allowing for the interview to adapt to the answers given, thus following the trajectory found most appropriate for answering the research question.

Further, the interview subjects need to be selected in accordance with the research objective, giving us a comprehensive view of the prospect of blockchain technology being incorporated into the financial statement auditing process. Consequently, the interview subjects have been selected carefully, making them relevant for answering the research objective.

More specifically, the insights we seek to gather are opinions on why firms' would/would not benefit from increased disclosure to investors, facilitated by blockchain technology. Thus, allowing us to initiate a discussion of what the future holds for disclosure processes compared to how the scene looks today.

Due to the rather complex subject, we have decided to interview a blockchain expert from the investment sector, who has further knowledge about auditing. In practice, this means that the concern has been on finding the right person to interview, rather than the number of interviewees.

In sum, we have interviewed and had ongoing conversations with the following:

- Steve Nabil Lauritsen. Co-founder, Partner, and CIO (the investment officer) at Blockchain Nordic. He basically creates the product and does the daily and monthly trading activities and rebalancing.

3.2.6 Reliability, Replication and Validity

In terms of reliability, the variables used and constructed to measure key elements may be subject to inconsistency. That is, the way our cost of capital values are gathered is only on GICS sub-sector level, rather than on firm level, which all other variables are gathered on. Consequently, the measure might not perfectly reflect the relationship between disclosure aggregation and cost of capital, and the findings may be somewhat unstable.

The findings in this paper are in general considered replicable since the data used to answer the primary research question of this paper, is gathered from databases available to the public. Still, some processes are done manually, which might induce less transparency. More specifically, the data cleaning is conducted in Excel, where missing items and errors are removed from the sample. Also, our cost of capital measures are only available on the sector level, why the values are manually assigned to each company in each industry for each year, consequently being a possible source of errors. However, these processes of cleaning and inspecting data are presented throughout the paper when deemed relevant.

With respect to the validity of the analysis conducted in this thesis, we use a rather new and hence less acknowledged disclosure measure of disclosure quality. Further, the favored disclosure measure only measures disclosure levels on non-missing items in financial statements. Consequently, it is feasible to assume that the missing information, in theory, could be communicated otherwise, thus leading to an increased possibility of type II errors.

3.2.7 Delimitation

To answer the research questions effectively and comprehensively without deviating from the main focus of the thesis, certain delimitations have to be made. The purpose is to inform the reader of which subjects are purposely left out or only superficially covered, as space or

relevance limitations did not allow them to be comprehensively covered. Several of these could have been interesting to explore, had the focus of the thesis been different. Yet, the chosen topic and outline are found of the highest relevance to the existing literature and most interesting by the researchers.

Firstly, this thesis limits its scope of the empirical findings to only covering the US market, and more specifically, large corporations included in the S&P 500 index as of the 10th of April 2008. This is done because, historically, different countries have adapted to different accounting standards. Further, the choice of only including large corporations, which by their listing status and inclusion in the S&P 500 index are more liquid and face high disclosure requirements, has been made in order to analyze if the empirical findings can be generalized despite these factors. Also, we limit us to exclude companies related to the financial and utility sector, as their disclosure requirements possibly could affect our analysis credibility negatively.
Consequently, we do not delve into an analysis of the effects of increased disclosure levels on smaller firms, financial and utility firms, and foreign firms.
Further, we limit us from analyzing how blockchain systems should be implemented and other technical aspects, but rather focus the discussion on the general relationship between the empirical findings of the paper and the primary features of blockchain technology.

4. Literature review

The following section is conducted to justify the relevance of the research topic by shedding light on the relevant theory and empirical research. Firstly, a section describing the role of disclosure in capital markets will give insights of what factors are interesting for the researchers to empirically test. Following this, a section regarding the CAPM model and the underlying theoretical assumptions will be covered. Finally, a review of relevant previous studies on the relationship between financial information and stock market effects will conclude the theoretical section of this paper. This section is conducted in order to get a theoretical insight of the capital market arguments provided in the disclosure section.

4.1 Disclosure Theory

This section presents a literature review about the theories of the subject of financial disclosure. Firstly, the rationale behind mandatory disclosure will be covered. Next, research on voluntary disclosure from a capital market perspective will follow. A section will then comment on the credibility and limitations of the covered literature before the last section will elaborate on the capital markets consequences of disclosure.

Owusu-Ansah (1998) explains disclosure as "*the communication of economic information, whether financial or non-financial, quantitative or otherwise concerning a company's financial position and performance*". The emphasis of this paper will mainly be on financial information, but other factors, which affect the capital market, are also found relevant to confront to ensure full comprehension of the rationales behind voluntary disclosure and the related effects. This is done to examine why it would be attractive for firms to deploy blockchain technology to efficiently optimize and increase financial disclosure.

4.1.1 Mandatory Disclosure

In all countries around the world, significant regulations are governing corporate disclosure and reporting. Therefore, the economic rationale that justifies this is a very relevant research question. Furthermore, it is interesting to investigate the effectiveness of disclosure regulation in solving the agency and adverse selection problems in capital markets, identified earlier.

In a perfect market without externalities, firms will have incentives to produce the efficient level of information for investors in the economy by finding the equilibrium of the costs and benefits of voluntary disclosure. Researchers have consequently sought to identify the potential externalities and market imperfections that justify the existence of disclosure regulations (Healy & Palepu, 2001; Healy, 2007). Scholars argue that accounting information can be viewed as a public good. The argumentation used broadly is that existing stockholders pay for the making of the information while potential investors cannot be charged for their use of the information, i.e., potential investors free-ride with respect to the information that existing investors have paid for. A consequence of this is a possible underproduction of information. Another proposed explanation for the need for regulation diminishes the argument of market failures. Here it is

argued that regulation is needed to protect investors and other stakeholders with limited financial insights. Thus, by creating a minimum requirement of financial disclosure, the information gap between the uninformed and informed is reduced (Watts & Zimmerman, 1986; Beaver, 1998; Enriques & Gilotta, 2014). The second explanation, however, implies that the purpose of disclosure regulation is to distribute wealth rather than improve economic efficiency. In practice, the more unsophisticated investors could choose to invest in financial knowledge or invest through intermediaries, who are more capable.

Both arguments above open up for many intriguing unanswered questions. Are there negative consequences of mandatory disclosure? Are disclosure regulations central to the development of capital markets? What type of disclosure should be made mandatory and which should be voluntary?

Enriques & Gilotta (2014) distribute the description of the goal of disclosure regulation into three central pillars:

1. It protects investors and thus their confidence in the market. By doing so, it preserves a well-functioning market, i.e., it helps market prices to more accurately reflect relevant information (increases price accuracy), enhances liquidity, lowers volatility, decreases firms' cost of capital, and promotes market allocative efficiency at the benefit of the economic system as a whole.
2. *"it addresses the agency problems affecting large corporations, thus supporting their ability to serve as a means of organizing, financing and operating today's large entrepreneurial ventures*." This is a side effect of more efficient stock prices as they are necessary for the proper functioning of incentive compensation and more effective incentive compensation. It also works better in aligning managers' incentives to those of shareholders and thus reduces agency costs.
3. "*it ensures that prices fully reflect all value-relevant information to help financial markets in their fundamental function of efficiently allocating scarce financial resources across the economy*." Further, it may be needed to achieve standardization in the information disclosed to support the activity of informed traders.

It is also relevant to note that a world without any mandatory disclosure would not be entirely free of disclosure. Corporate agents would still have incentives to disclose which would lead to some level of transparency. However, the amount and information content will not be at a level, which is socially optimal, and avoid agency costs sensitive topics such as compensation. With the arguments for why disclosure regulation is relevant covered, the limits and drawbacks will be briefly analyzed.

When studying the literature regarding the costs of disclosure regulation, and here with a focus on mandatory disclosure, it becomes clear that it may not always be effective. This could be due to an ineffective regulatory and enforcement process. An example of this is that legislation on increased mandatory disclosure only has beneficial capital market effects if there is high regulatory quality and very limited to no effect if not. Similarly have the adoption of IFRS shown valuable where there is high regulatory quality and where the institutional environment provides firms with powerful incentives to be transparent (Daske et al., 2008). Further, regulators may suffer from cognitive biases, i.e., they deviate from public interest when deciding on the rules as strong interest groups can capture them or because populism drives their regulatory choices. Likewise, investors may also have cognitive biases and bounded rationality (Bainbridge, 2000).

Mandatory disclosure also imposes different costs and benefits on firms. Disclosure of financial information is faced with direct costs (gathering information and drafting and ensuring compliance with the regulation) which can be seen as fixed, why smaller firms will have a relatively larger burden of complying. Consequently, they are faced with a competitive disadvantage compared to larger firms. Thus, it can be inferred that one universal approach is not optimal. Also, mandatory disclosure increases the risk of being held liable for misstatements as the amount and frequency of disclosure might increase for some firms. Therefore, firms may end up with a more conservative approach to compliance, reducing the total amount of useful information being released. Finally, mandatory disclosure may prevent firms from making the optimal investment decisions as it may result in some privacy and competition issues (Enriques & Gilotta 2014).

In conclusion, it is not needed to increase the levels of mandatory disclosure to improve capital market efficiency as this involves all kinds of information. Furthermore, we found that it significantly varies when it comes to which firms have incentives to disclose information, primarily because of the costs associated with it.

Also, corporate disclosure is a rather broad definition. In the theory section, it became apparent that financial information is the most informative in terms of investment decisions, why a narrower focus around this and a further look into financial reporting will follow in the next section.

4.1.2 Research on Voluntary Disclosure

The research on the disclosure decisions by managers can be divided into two central focus areas. One is the area of managements' financial reporting choices, often referred to as positive accounting theory. The second focuses on managements' disclosure decisions and is referred to as voluntary disclosure literature. Due to the focus of this paper, the following section will only deal with the aspect of voluntary disclosure.

This research topic focuses on the role of financial reporting and the information it contains for capital markets. Thus, the stock market rationales for accounting and disclosure decisions will be in focus. In general, disclosure studies assume that managers have superior information to investors in regards to the future earnings of the company, despite the markets being considered efficient. Thus, if their auditing and accounting are perfectly functioning, then their disclosure decisions are only relevant to investors when changes are made to the economics of the business. However, as the covered literature and above analysis suggest, this is not the case. Therefore, business managers are faced with the trade-off of costs and benefits of disclosing superior knowledge.

As technology improves, the possibilities for financial disclosure increase and the related costs decrease, which both are factors that are likely to increase the amount of voluntary disclosure. Even though markets theoretically have been assumed to be efficient and available information has been considered sufficient, studies find that as technology improves so does the amount of

disclosed information. This is confirmed by Healy (2007), who investigated the effects on the U.S. capital market after increased mandatory disclosure was introduced between 2000 and 2003[1]. Furthermore, a study by Premuroso & Bhattacharya (2008) finds that the emergence of the XBRL (this will be covered in section 7) significantly improved the amount of voluntary disclosure for certain firms.

Conclusively, this technological aspect, the motives for making voluntary disclosure, and the credibility of it are all central to this paper.

4.1.3 Motives for Voluntary Disclosure

Several theories exist that try to explain why companies provide information beyond what is mandatory. However, no theory fully explains the disclosure phenomenon. The documented theories for voluntary disclosure as well as the potential limitations of the research will be covered in the following.

Information Asymmetry Theory

Information asymmetry arises when information differences exist between firm management and investors. As managers actively partake in the daily operations of a firm and investors do not, managers tend to have better information than outside investors regarding the firms' operations. The issue with information asymmetry arises when investors are facing investment decisions, i.e., before they actually make their investment. Scholars argue that information asymmetry leads investors to charge a higher risk premium in terms of lower prices for bearing the information risk. Thereby the manager is faced with a substantial cost for not providing substantial disclosure. Therefore, in order to reduce the information asymmetry problem and consequently reduce the cost of external financing, managers have incentive to disclose more relevant information. This applies both to equity and debt financing (Grossman, 1981; Milgrom, 1981; Healy & Palepu, 2001).

[1] Between 2000 and 2003, two significant new regulations, Regulation Fair Disclosure and the Global Settlement, were adopted in the US to improve the quantity and quality of information available to investors.

Capital Market Transactions Theory

The theory evolves about the notion that investors' perception is especially important to a company when it is faced with the need of external financing. The management's disclosure choices are central to affecting the investors' perception since the managers are expected to have superior knowledge regarding the future prospect of the firm, as we learned from the theory section. Graham (2005) notes that if the level of information asymmetry is large it will be costlier for firms to acquire financing, thus harming the investors of the company. Therefore, managers who expect to make capital market transactions are incentivized to provide voluntary disclosure to reduce the information asymmetry problem and the firm's cost of capital (Healy & Palepu 2001). Several studies confirm this notion. For example, there is found evidence proving that disclosure ratings from analysts increase when firms are issuing securities. There is also found a significant increase in the amount of disclosure in the period (six months) leading up to the offering. Finally, increased analyst ratings of disclosures are found to result in above average amounts of public debt offers (Lang & Lunholm, 1993; Lang & Lunholm, 1997). Nevertheless, external financing is not an isolated event, why the conclusion of capital market transactions defining voluntary disclosure strategies is somewhat ambiguous.

Corporate Finance Theory

Here, the primary notion is that large firms with high growth opportunities provide more voluntary disclosure compared to with firms with low growth opportunities. It is argued that firms with high growth potential are more inclined to be in need of external financing; hence their incentive to improve disclosure levels is greater, following the rationales provided from the information asymmetry section. Also, for these firms, the mandatory disclosure requirements are expected to be too low, and it would be expected for them to reduce the information asymmetry through increased disclosure levels. Further, Core (2001) argue that the optimal disclosure level is found as a trade-off between the benefits of reduced information asymmetry, and the potential litigation proprietary and incentive costs[2]. These will be covered later in the paper.

[2] Incentive costs are the price that shareholders pay in order to reduce agency problems, i.e., the cost of reducing management incentives for making improper decisions that contradict the shareholders' interest.

Corporate Control Contest

This part of the theory is motivated by research showing that managers are held accountable for current stock performance by investors and the board of directors. Consequently, managers are willing to increase communication with stakeholders due to the risk of job loss. Examples of such are that managers use voluntary disclosure as a tool to protect the company from any eventual undervaluation as a result of information asymmetry. Also, in case of poor performance, managers prefer to disclose bad news voluntarily, protecting the firm from any drastic drops that are out of their control (Healy & Palepu, 2001).

Other factors of control include that voluntary disclosure often leads to increased analyst coverage. This can potentially lead to a reduction in the dispersion of analyst estimates. Graham (2005) notes that many executives believe that this will lead to a "P/E boost" as a result of greater voluntary disclosures (this can be seen as an indirect way of explaining a reduction in the cost of capital). Conditional analyses reveal that unprofitable, small, and young firms are more interested in using disclosure to attract more analysts and to correct an undervalued stock.

Stock Compensation

In order to align the interests of managers and investors and thus overcome the agency problem of disclosure theory, management is often compensated through stock options and stock appreciation rights. According to Healy & Palepy (2001), this has a positive effect on managers' attitude for voluntary disclosure for several reasons. In order to increase stock liquidity and comply with insider trading regulations, managers have incentives to disclose private information. These regulations further incentivize managers to correct any possible undervaluation by disclosing more information than what is considered mandatory before the granting of stock options. However, if insider-trading regulations are absent, managers may profit from a possible undervaluation by buying the cheaper shares instead of providing information that will enable a more accurate stock valuation (Aboody & Kasznik, 2000). Also, increased levels of voluntary disclosure are argued to reduce the cost of contracting related to stock compensation of new employers. Consequently, firms that use a considerable degree of stock compensation (like the technology sector) will be more likely to have increased voluntary disclosure to lower the risk of a possible over/undervaluation caused by information asymmetry

between managers and investors (Healy & Palepu, 2001; Graham, 2005).

To support the arguments made, it must be clarified that managers and investors are assumed rational, and markets are efficient throughout the paper and stock prices therefore fully incorporate all public information. This will be covered in section 4.2.

Signaling Theory

Signaling theory suggests that companies with superior performance have incentive to distinguish themselves from other companies of lower quality by sending signals to the market through financial disclosures. Thus, decreasing information asymmetry and increasing their attractiveness as an investment opportunity (Watson et al. 2002).

Trueman (1986) argues that business managers have an incentive to make voluntary disclosures to illustrate their capabilities to conduct accurate earnings forecasts. The market values depend on investors' perception of management skills and here among their ability to recognize and respond to future economic changes. If the forecast disclosed information by the manager satisfies the wishes of the stakeholders, the market value of the company is more likely to increase (Healy and Palepu 2001). Graham (2005) finds statistical significance for this hypothesis but highlights that there are indications of this being more important for managers of smaller and high growth firms than for other firms.

Litigation Cost Hypothesis

The literature on disclosure finds two ways that risk of litigation can affect voluntary disclosures. Managers can be encouraged to disclose more information in a timely manner due to potential legal actions for inadequate or untimely disclosures. In this context, bad news regarding company earnings is more likely to be voluntarily pre-disclosed than good news. It is found that pre-disclosure of bad news spreads the drop in stock prices over a longer period, thus reducing the possibility of being noted in stock market screens used to identify litigation cases. Further, it is easier to recover once good news is provided (Francis et al., 1994; Skinner 1994, 1997; Graham et al., 2005). Also, the threat of litigation can potentially reduce managers' incentives to provide forward-looking disclosures. This is relevant in cases where it is not possible to

effectively differentiate between errors of forecasts made in good faith and those due to deliberate management bias (Healy & Palepu, 2001).

4.1.4 Constraints on Voluntary Disclosure

The litigation costs argument for voluntary disclosure is two-sided in terms of arguments for and against voluntary disclosure. In this section, we will investigate further factors that constrain voluntary disclosures.

Disclosure Precedent

Graham et al. (2005) find that one of the most likely reasons for business managers to limit their voluntary disclosure decisions is to avoid setting a precedent for a disclosure level, which they will have difficulty complying with in the future. In addition, setting disclosure precedents is more important in insider-dominated firms as insiders seek to protect their advantage. Also, concerning the analysis above, higher levels of disclosure might affect the managers' ability to delay the release of bad news; thus, disclosure precedence can increase the cost related to commitment (Verrecchia, 2001). Graham et al. (2005) describe the situations for the firms as: "*getting on a treadmill that you cannot get off*." The market then expects the company to continue with the newly initiated disclosures each quarter, unconcerned with whether the news is good, bad, or costly to produce.

Agency Costs

The primary reason that an agency problem arises is that investors more often than not, do not actively manage the firms. Instead, the firms' management acts as an agent and the investor as a principal. This creates incentives to the self-interested manager to make decisions that will utilize the invested capital to his own benefit. Given the investor acquires equity in the firm, the manager can use this to increase benefits, pay excessive bonuses, or make operating decisions, which might benefit his personal goals but not the long-term interest of the investor (Jensen & Meckling, 1976; Smith & Warner, 1979; Healy & Palepu, 2001; Hendrikse, 2003). If the investor, on the other hand, acquires a debt stake, the management can issue further senior claims by using the cash from the investment to pay out dividends or taking on projects with higher risk. Senior debt and dividend payments will make it less likely that, in a scenario of financial

distress, the existing lower priority debt will be able to be repaid, consequently benefitting the business. Finally, the high-risk projects shift the probability of outcomes that helps the business manager and outcomes that are bad for the debt (or equity) holders who take on most of the risk (Smith & Warner, 1979; Healy & Palepu, 2001).

In the context of constraining disclosure, it is suggested that businesses may decide to avoid unnecessary attention from the stakeholders by limiting voluntary disclosure of unimportant information, which can have the benefits of a faster decision-making process. This is despite managers generally agreeing that career concerns and external reputation are essential drivers of the need to meet earnings benchmarks and voluntarily disclose information (Graham et al., 2005).

Thus, the importance attached to career concerns lead Graham et al. (2005) to conclude that there is support for agency cost explanation.

The authors of this paper, however, find that this is a two-sided problem, as it is the case with litigation costs. By increasing the disclosure level, bondholders, stockholders, and other stakeholders will be more informed leading to a decrease in the potential agency costs, given that the economic situation of the company is positive.

Proprietary Costs

Several researchers argue that full disclosure is often prevented due to proprietary costs, i.e., the risk that some disclosed information may put the firm's competitive position in the market at risk. It is argued that firms have incentives to retain information that potentially can affect their competitive position negatively, even if it becomes costly to raise additional equity and thus increases their cost of capital. However, scholars have found that this cannot be generalized and is highly depended on the nature of the company and the competitive environment. It is found that small firms and those that provide little earnings guidance are more worried about proprietary costs, and Graham et al. (2005) find that very few CFO’s see proprietary costs as a significant barrier to disclosure, as competitors often will obtain much information regardless.

Political Costs

In relation to the section above, Watts & Zimmerman (1986) argue that the proprietary cost hypothesis can be extended to other externalities. Political costs from financial disclosures and their effect on voluntary disclosure are found most relevant in this context. Graham et al. (2005) find ambiguous evidence of this, but acknowledge its relevance as finding truthful evidence to this issue can be difficult since managers might not want to voluntarily disclose information that could be used against them by regulators. Due to the ambiguity of the matter, not all firms are concerned with this aspect, and it is found that firms with high inside ownership put more emphasis on regulatory scrutiny, but in general, the scale of concern is limited.

4.1.5 Credibility of Voluntary Disclosure

From the sections above, it has become clear that increased disclosure levels in many cases increase the efficiency of resource allocation in the capital market. This effect is nevertheless dependent on the degree of credibility of information regarding the economic situation of the firm and cannot be gathered from other sources in a timely manner. This also includes mandatory disclosures.

As it was discovered above that managers have incentives to make voluntary disclosures that benefit their own image, we find it reasonable to question the credibility of the disclosed information.

Scholars argue that there are two primary mechanisms, which increase the credibility of voluntary disclosures for firms. First are the third-party intermediaries, who, in alignment with our previous findings, can help reassure the quality of the disclosed information. Second, disclosed information can be validated prior to the actual disclosure. Traditionally, this has been done through the required financial reporting and the work of accountants and auditors. Lundholm (1999) specifies that this role of accounting is especially relevant regarding information on intangible assets, assuming that regulators can distinguish between random forecast errors from deliberate management bias, thus preventing the risk of litigation costs. A practical example of how managers' disclosures are traditionally verified is that revenue and

earnings forecasts are controlled using actual realizations. Healy & Palepu (2001) note that this mechanism is efficient in making disclosures credible if the punishment for knowingly making false disclosures is sufficient in preventing this.

Most early evidence on disclosure credibility concentrates on stock price effects of management forecasts and their accuracy. Various studies find evidence of a direct relationship between management forecasts and stock movement. If disclosed information is positive, then the price effect is positive and vice versa. However, good news forecasts are only significantly informative when supported by verifiable information (Hutton et al., 2000). Further, Pownall and Waymire (1989) find that the reaction to expected and unexpected earnings forecasts are of equal magnitude, which indicates that the credibility of management forecasts can be compared to audited financial information.

In addition, there is found evidence which justifies the fact that investors see management forecasts as a mean of gathering new information. Implementing these forecasts are found to increase the accuracy of analysts' forecasts as they can use this information to revise their forecasts in response to the released additional information (Hassell et al., 1988).

Scholars also find other voluntary disclosures than management forecasts to be credible. For example, increased segment reporting disclosures are found to be associated with a decline in analysts' forecasts dispersion and an increase in their accuracy (Piotroski 1999a).

4.1.6 Weaknesses of the Covered Disclosure Literature

Despite the credibility of voluntary disclosure, there certainly are a few limitations concerning the above studies why it becomes crucial to outline these. One of the leading limitations is the challenge of measuring the magnitude of voluntary disclosure. Different proxies, such as management forecasts, metrics derived from the Association for Investment Management and Research (AIMR) database, and other self-established measures are (or have been) all used by researchers for this challenge. Each one of these methods, however, carries limitations (Healy & Palepu, 2001).

Management Forecasts

Management forecasts are useful as they can be measured precisely. Further, the timing of disclosure is often known, which allows for assessment regardless of whether the forecasts lagged or anticipated certain alterations with respect to the desired variables employing weekly or daily data. A challenge of deploying management forecasts as an approach, however, is that outside investors can confirm the forecasts' precision and correctness with ease at the hand of concrete earnings realizations. Oppositely, it is significantly more troublesome to confirm the precision and correctness of alternative sorts of voluntary disclosure like human capital ex-post. This ultimately means that the deployment of management forecasts as a proxy is inclined to enhance the competence of the tests, but simultaneously may lack adaptability to other types of voluntary disclosure (Healy & Palepu, 2001).

AIMR Data

AIMR data contributes with a more routine approach of voluntary disclosure compared to management forecasts. Company rankings of aggregate voluntary disclosure, disaggregate rankings for voluntary disclosure released in 10-K's and annual financial statements, voluntary disclosure presented as a result of investor affiliations, and voluntary disclosure issued in quarterly financial reports are all created from the annual survey. These rankings are presented by panels including prominent analysts from every industry and are thus presumably well-qualified judges. Moreover, this particular metric encompasses all disclosure, counting conference calls and analyst meetings. Despite all of this, there are certain uncertainties involved in this metric, which include question marks concerning the panels' seriousness in regards to the rankings, what biases are involved in the rankings, and finally how companies are chosen to be a part of the rankings (Healy & Palepu, 2001).

It is necessary to note that the AIMR scores no longer is a substantial approach as it has been discarded. It has simply been mentioned to express a further comprehension of the matter.

Self-established Measures

Self-established measures of disclosure encounter unique challenges. Due to this approach being self-made, the certainty that the metric actually conquers the intended parameters is raised. The

downside, however, is that because judgment of the researcher is part of the metric, it can potentially be burdensome to duplicate the findings. Also, self-established measures commonly depend on disclosures published in annual reports, and consequently conference calls, analyst meetings, or other such examples that companies provide disclosures in, are excluded from the predetermined examination (Healy & Palepu, 2001).

Lastly, endogeneity is potentially a major issue for several of the earlier-mentioned studies. To illustrate, companies that embody public capital market transactions are inclined to experience adjustments in their investment opportunity sets. Therefore, it is problematic to estimate if the affiliation between improvements in disclosure and grand levels of disclosure is due the public issue or alternative adjustments that the company is facing (Healy & Palepu, 2001).

4.1.7 Capital Market Effects of Reporting and Disclosing

Several studies analyze the capital market effects for companies that report and disclose financial information voluntarily. Three types of potential effects are suggested in these, which include enhanced stock liquidity, decreased cost of capital, and increased information intermediation. These effects are examined below. Due to numerous of the studies sharing limitations, these have been considered jointly following the analysis of their fundamental findings. Therefore, it is necessary to recognize these limitations when comprehending the findings below (Healy & Palepu, 2001).

Improved Stock Liquidity

Diamond and Verrecchia (1991) as well as and Kim and Verrecchia (1994) suggest that information asymmetry is lessened between acquainted and unacquainted investors as a result of voluntary disclosure. Thus, investors can be rather certain, in the case of companies with high levels of disclosure, that stock transactions eventuate at a legitimate price, leading to increased liquidity in the company's stock. Besides, these same studies propose that increased stock liquidity and disclosure will be correlated with enlarged institutional ownership.

Different papers support with evidence that is persistent with the above-mentioned. According to Healy et al. (1999a), companies that increase disclosure encounter compelling increases in stock

prices simultaneously that are unconnected to the performance of current earnings. Further, it is found by Gelb and Zarowin (2000), that companies containing high disclosure ratings encompass soaring stock price affiliations with future earnings compared to companies with insignificant disclosure ratings. These observations propose that the disclosure strategies that companies use influence the pace in which information is priced into the stock.

Moreover, various studies strive to estimate stock liquidity and analyze its affiliation to company disclosure measures. Welker (1995) reports an effective unfavorable affiliation amongst bid-ask spreads and analysts' ratings of the disclosures of companies. Further, Healy et al. (1999a) observed that firms with higher analyst ratings of disclosure had notably greater bid-ask spreads compared to their peers before the disclosure alteration. Following the disclosure expansion, the bid-ask spreads for those companies returned to the levels equivalent to their peers. Lastly, Leuz and Verrecchia (2000) analyzed the bid-ask spreads for Neuer Market companies, which are obligated to have increased disclosure. It was found that these companies have inferior bid-ask spreads compared to those on the Frankfurt Exchange (Healy and Palepu, 2001).

Reduced Cost of Capital

Barry and Brown (1984–1986) argue that if disclosure is flawed, then investors carry the risks in regards to forecasting future payoffs from their investment. Moreover, investors will require an incremental return for carrying that risk in case the risk is non-diversifiable. Correspondingly, companies with significant levels of disclosure, and thus little information risk, tend to have a reduced cost of capital compared to companies with diminished disclosure levels and hence high information risk (Healy and Palepu, 2001).

Proof constant with the above is offered by Botosan (1997). Botosan (1997) notes that if a company has minor analyst following, there is a weak association between the extent of the company's voluntary disclosure and the cost of equity capital. Piotroski (1999b) observes that companies contributing with further segment disclosures have a simultaneous gain in the market's capitalization of their earnings, constant with the lessened cost of capital. Lastly, an unfavorable cross-sectional association between analyst ratings of annual report disclosures is found by Botosan and Plumlee (2000). Despite this, they also found that there is a positive

relationship between cost of capital and ratings of quarterly disclosures. This relation is unaffiliated with investor relations activities.

Increased Information Intermediation

It is suggested that voluntary disclosure lessens the cost of acquiring information for analysts and thus enhances supply if management's private information fails to be published via required disclosures (Bhushan, 1989a, 1989b; Lang and Lundholm, 1996). The consequence of voluntary disclosure in regards to demand for analysts' services, however, is dubious. On one hand, increased disclosure allows analysts to construct relevant information, like superior forecasts for instance, and consequently, demand for their services rises. On the other hand, however, a decrease in demand for analysts' services could also appear since public, voluntary disclosure diminishes the necessity for analysts to communicate managers' private information to investors (Healy & Palepu, 2001).

Further, it was found that reduced volatility in forecast revisions, reduced dispersion in analyst forecasts, and greater analyst following all appear in companies with additionally revealing disclosures (Lang and Lundholm, 1993). Moreover, it is illustrated by Healy et al. (1999a) that companies containing elevated analyst ratings of disclosure have inferior analyst coverage in the pre-event period compared to industry peers. However, at the conclusion of this elevation in disclosure, normal levels are restored for these companies. Lastly, it was found by Francis et al. (1998) that companies executing conference calls experience a rise in analyst coverage.

4.1.8 Critique of the research on Capital Market Effects

The most essential limitation of the above observations is the possible endogeneity. To illustrate, the companies with the best disclosure ratings are also often inclined to present the superior earnings performance. This may be a result of the self-selection bias, where companies may elevate disclosure during times of high performance. The consequence of this is that there is a possibility that company performance is the driver of the affiliation between disclosure and capital market variables instead of disclosure being the primary driver. In most cases, disclosure alterations occur in times of firm economics alterations and governance changes and thus are rare events that appear by chance (Healy and Palepu, 2001).

Numerous studies try to manage alterations in performance with the goal of separating the significance of disclosure. To illustrate, Healy et al. (1999a) simultaneously adjust for alterations in earnings and earnings levels when analyzing the cross-sectional association between elevations in disclosure and variables including institutional ownership, stock performance, dispersion in analyst forecasts, and analyst following. However, in the absence of a dependable model of the affiliation between disclosure and performance, this sort of handling is inclined to be incomplete. Lastly, it is possible that other connected variables are excluded from this analysis (Healy and Palepu, 2001).

An associating issue concerning self-established and AIMR proxies of voluntary disclosures is that the timing of disclosure alterations is challenging to specify accurately. This is because disclosure is typically calculated for a given year, and hence it is burdensome to conclude if disclosure alterations occur prior to or after changes in variables of interest. As a result, it is problematic to conclude upon the cause of the underlying affiliations (Healy and Palepu, 2001).

In order to further analyze these, especially the last question, it is necessary to gain an understanding of how third parties use disclosed financial information and which information is used. This will be elaborated upon in the following section, which will undertake valuation theory with an additional focus on the accounting sector.

Table 1 below summarizes the findings from the section above, listing the pros and cons of voluntary financial disclosure.

Table 1: Advantages and Disadvantages of Voluntary Disclosure

Advantages	Disadvantages
- Less information asymmetry - Increased frequency in regards to information - Lower cost of capital - Increased stock prices - Enhanced analyst coverage - Fulfilled compulsory information - More communication with stakeholders - Fewer contracting costs - Better business reporting - Decreased risk of misallocation of capital - Motivation for enhanced performance - Displays talent of management - Decreased uncertainty of investors - More complete view of the firm - Protects from undervaluation - Assists in reflecting firm's real value - Improves investment decisions - Prevents bad hidden information (investor's perspective) - In case of poor performance, drop in share price spreads over time - Stronger fluidity of stocks	- Generates additional costs - Potential for political attacks - Potential for a slower decision-making process - Increased attention from stakeholders - Bad information has to be shared - Loss of competitive advantage - Hard to stop once started (need of continuity) - Public's expectations regarding futures disclosures increase - Can be used against management - Information could be false (nobody controls it) - Penalization for failure - Increases involvement of shareholders, which might lead to unnecessary conflicts

Source: Own contribution

4.2 Theory on the Use of Disclosed Financial Information

From the section above it became clear that the most prominent effects of voluntary disclosure of financial information are the capital market effects related to firms' liquidity and cost of capital. As this relationship is at the center of our research purpose, we as researchers find it relevant to cover the theory explaining this relationship.

4.2.1 Determining the Fair Value of a Company

The price of a stock at any given time is merely the point of equilibrium at which the number of buyers willing to buy at that price is equal to the number of sellers willing to sell at that price. But how do investors know what they are willing to pay?

Valuation approaches are classified into four main groups, namely, present value approach, relative valuation approach (multiples), liquidation approach, and contingent claim valuation models.

According to Petersen & Plenborg (2012), four attributes that characterize an ideal valuation include precision (unbiased estimates), realistic assumptions, user-friendly, and understandable output. Present value approaches such as the as the Discounted Cash Flow approach (DCF) and the Economic Value-Added model (EVA) are the most frequently used valuation models, due to the ability to satisfy the attributes listed above (Kaplan & Ruback, 1995; Petersen & Plenborg, 2012; PWC, 2016). The value of any asset is estimated as the future income generated by the assets discounted to present value with a discount factor. The discount factor takes the time value of money and risk associated with the income generated by the asset into consideration. Thus, the DCF approach uses future free cash flow projections and discounts them by using the company's weighted average cost of capital (WACC) to calculate company value. According to the EVA model, the value of a company is determined by the sum of the initially invested capital and the present value of all future EVA's. Despite the difference, they are theoretically equivalent valuation approaches. In order to project the future free cash flows, analyses of companies' historical financial performance are conducted to determine trends in financial value drivers (Petersen & Plenborg, 2012).

4.2.2 Cost of Capital and CAPM

A firm's cost of capital can be seen as the price investors charge for the risk of a company's cash flow compared to what is expected. Thus, when a firm is being valued, the used discount rate should mirror the riskiness of its cash flows. Firms can raise capital from equity, debt, and preferred stocks, why the cost of capital must reflect a weighted average from both equity and debt holders. Moreover, it can be described as the following (Petersen & Plenborg, 2012):

$$WACC = \frac{D}{(D+E)} * R_d * (1-t) + \frac{E}{(D+E)} * R_e$$

When estimating investors' required rate of return, the Capital Asset Pricing Model (CAPM), derived by Markowitz (1952) is most commonly used. However, other models that differ in the way risk is defined such as the FAMA-French three-factor model, and the arbitrage pricing theory model are also used. This thesis will take the view of the CAPM.

$$\boldsymbol{R_d} = R_f + Credit\ spread$$

Where

R_f = the risk-free rate of return, which often follows government bonds.

Credit risk depends on firms' credit rating. Better credit rating will decrease the credit spread and vice versa (Moody.com).

The CAPM states that the return of a security in an efficient market and diversified portfolio is described by the associated risk and required return as the CAPM formula shows (Petersen & Plenborg, 2012):

$$E(R_e) = R_f + \beta_e[E(R_m) - R_f]$$

The CAPM equation is also known as the security market line (SML) and illustrates equilibrium of companies' risk premium and the market portfolios' risk premium.

In the CAPM equation, $E(R_e)$ is the expected return of security i, where the securities own risk contribution to a diversified portfolio has been adjusted for. R_f is the risk-free rate of return,

$E(R_m)$ defines the expected market return, β_i is measured by $\beta_i = \frac{cov((R_e)(R_m))}{\sigma^2(R_m)}$ and describes the comovement of a security with the market (Petersen & Plenborg, 2012).

The CAPM states that a security's return is shaped by the risk-free rate and the required premium of taking on risk. Thus, assuming rationality, investors diversify their portfolios to the point where asset specific risk is prevented, thus only requiring a premium for taking on systematic risk (β_e), i.e., the required return of a security can be measured from its systematic risk only according to the CAPM.

The main points in the context of this paper are that assets fluctuate with the market, and the required rate of return is a function of an asset's systematic risk. The greater the beta of an asset, the higher expected return (both positive and negative), and the rational investor requires a higher return as compensated by the more systematic risk an investment entails (Petersen & Plenborg, 2012).

Despite the popularity of CAPM, its validity has often been subject to criticism, and the main limitations have been found to stem from its assumptions, which have been deemed unrealistic by many critics. The underlying assumptions are that all investors (Arnold, 2015):

1. Aim to maximize economic utilities.
2. Are rational and risk-averse.
3. Are broadly diversified across a range of investments.
4. Are price takers, i.e., they cannot influence prices.
5. Can lend and borrow unlimited amounts under the risk-free rate of interest.
6. Trade without transaction or taxation costs.
7. Deal with securities that are all highly divisible into small parcels (all assets are perfectly divisible and liquid).
8. Have homogeneous expectations.
9. Assume all information is available at the same time to all investors.

First of all, it is challenging to find a risk-free security. In the CAPM, highly liquid government

security is considered to be risk-free since a stable government is found unlikely to default. The real issue, however, lies in the fact that inflation creates uncertainty about the real rate of return. Furthermore, the assumption of equal borrowing and lending rates are problematic, as these, in practice, differ (Rossi, 2016). Finally, the critique concerns the financial ratios analyzed by investors, which in reality holds some predictive information, i.e., not all predictive information is captured by β. Consequently, Farma & French (1996) tried to improve and replace the CAPM. However, recent studies contradict the critique and illustrate that the criticized ratios converge to normal over a business cycle (Chung, Johnson, & Schill, 2004).

4.2.3 The Efficient Market Hypothesis

When analyzing the relationship between accounting information and market effects, market efficiency in relation to the Efficient Market Hypothesis (EMH) is an implicit assumption. The EMH states that asset prices fully reflect all available information; thus, prices are "instantly" adjusted. In the semi-strong form of the EMH, asset prices reflect all public information, i.e., accounting information is incorporated (Fama, 1965; Brigham & Houston, 2012; Petersen & Plenborg, 2012).

When accounting information is made public through companies' financial statements and the like, the market reacts. This can be due to earnings not matching expectations and is hence the factor that drives abnormal returns on stock prices. On this basis, the EMH has enabled researchers to verify the relationship between accounting information and market efficiency (Gambi Cavallari Amorim, Siqueira Lima & Dal-Ri Murcia, 2011).

Accounting information and CAPM are directly interrelated since cash flows and related relevant accounting information provides past data used for prediction of future data. A study by Gambi Cavallari Amorim, Siqueira Lima, and Dal-Ri Murcia (2011) illustrates that earnings are one of the accounting figures that are most commonly used as a substitute for cash flows. Past earnings tend to give useful information about future earnings and hence future cash flows, which are used in the valuation of securities as described above.

Consequently, the CAPM and EMH serve as a relevant theoretical foundation when investigating

the effect of financial disclosures on capital market aspects.

4.2.4 Literature on the Relevance of Financial Statement information

When investigating the relationship between accounting information and market effects, many studies have been found to be using proxies; especially when investigating the relationship between accounting information and systematic risk. Here the majority of studies have been found to use β_m as a proxy for systematic risk and β_C as a proxy for the accounting information.

In 1968, Beaver examined how investors react to earnings announcements with respect to trading volumes. From this, a significant increase in trading volumes in the week after earning announcements was found along with significant changes in stock prices. Thus, the research showed that the accounting information is central to investment decisions. In his research, an emphasis is put on financial disclosure levels' capability to affect the liquidity and cost of capital of firms, which is consequently the definition of the value relevance of accounting information.

Later studies confirm these findings and add that investors can estimate expected risk and returns of assets through accounting information (Ball and Brown, 1968). Ball and Brown (1969) further studied accounting information's ability to describe the variations in the value of a company. Here net income, operating income, and earnings per share (EPS) were examined using regression on 261 companies and their β_M over a 20-year period. In conclusion, the investigated types of earnings were found to be effective in predicting cyclical patterns and in explaining 35-40% of the variation in systematic risk. Other various empirical studies have found accounting information to have value relevance through a statistically significant relationship with stock market returns (Pettit & Westerfield, 1972; Lev & Kunitzky, 1974; Ismail & Kim, 1989; Easton & Harris, 1991; Ali, 1994; Dechow, 1994; Barth et al., 2001; Beaver, 2002; Cao, 2005; Hand, 2005; Nekrasov & Shroff, 2009).

Despite these findings, some studies found that accounting information's ability to explain market value variations is small (small R^2) (Dhingra, 1982; Chun & Ramasamy, 1989; Tandelilin, 1997). Moreover, all or most of the examined coefficients were insignificantly different from zero (Breen & Lerner, 1973; Gonedes, 1973; Lev, 1974; Elgers, 1980).

The missing consensus of previous studies calls for a clarification of when financial statement information is relevant in the context of this paper. With respect to Beavers' (1968) definition of value relevance, information is relevant when it has the ability to affect an individual's decision (Scott, 2009), even though individuals do not necessarily react in the same way to that information (Scott, 2009; Kim and Verrecchia, 1997). The purpose of information given in financial statements is to provide information relevant to the informed entity's decision making, and therefore it claims its relevance (Day, 1986; Beaver, 1989). In order to fulfill its purpose concerning investors' rational decision-making, accounting information also has to be accurate, complete, and timely (Landsman, 2007; Scott, 2009).

Thus, the purpose of relevant accounting information from financial statements is to give investors the ability to make useful economic decisions due to information about the financial position and performance of a company. This information is however based on historical data, why it is being questioned whether it can paint a correct picture of a company's future performance without other qualitative characteristics from financial statements. Consequently, relevant information is found to be such that can affect the investors' beliefs about future returns and should be accessible within a relevant timeframe. Furthermore, appropriate accounting information shall be free from bias, verifiable, and neutral (FASB, 1980, Maines and Wahlen, 2006; Scott, 2009).

4.3 Summary

The sections above presented the primary disclosure valuation literature. In the disclosure section, special emphasis has been put on voluntary disclosure from a capital market perspective. Firstly, the rationale behind disclosure was examined through mandatory disclosure literature. Following this, a broad range of theories on voluntary disclosure was presented in order to fully understand the advantages and disadvantages of high voluntary financial disclosure levels.

The credibility of voluntary disclosure for the stakeholders is essential, why settings facilitating increased as well as reduced credibility was examined. With this in mind, the primary capital market effects of increased liquidity, reduced cost of capital, and increased information

intermediation was argued for. Finally, critique regarding the applied literature was made, where especially the previous proxies for disclosure quality was found to have several drawbacks.

In the valuation section, i.e., the section regarding the use of disclosed financial information, it was presented that CAPM-based present value approaches are most commonly used by investors. Consequently, the assumptions behind the CAPM and the EMH were covered, illustrating a direct theoretical relationship between financial statement information and stock prices. Following this notion, literature regarding what characterizes relevant financial information was covered. Here it was found that the most important factor of financial disclosures is the ability to affect the investors' beliefs about future situations of the company by being accurate, complete, and timely.

5. Hypothesis Development

From the literature review, it became clear that the regulations leading to mandatory disclosure have been implemented on several occasions over time. Further, technological innovation has in generally allowed firms to easier produce and stakeholders to easier collect and analyze financial statement information. Also, as our investigated time span is from 1973 - 2017, firms have experienced increased globalization, expansion, or changes in their business operations and are consequently becoming more complex.

From the proposed relation of information asymmetry and relevant capital market factors, we expect companies to initiate ongoing initiative in order to illustrate transparency. Hence, we expect companies to have expanded their disclosure levels over time. For these reasons, it is expected that the amount of voluntary disclosure will increase over the years. This expectation is relevant to investigate, as we may need to control for this in our later analysis. From this, we formulate the following hypothesis:

- **H1: Disclosure quality has increased significantly in the period from 1973 to 2017.**

Several previous studies indicate that industry type affects the level of disclosure, as expectations of stakeholders as well as public scrutiny and other interest groups vary across industries

(Nassreddine 2016). Also, differences in disclosure levels can exist from differences in proprietary costs between industries. An example of this is found in a study in Denmark conducted by Petersen and Plenborg (2006). Here evidence was found that industrial firms tend to disclose more information regarding marketing strategies and less about human capital and strategy concerns. Evidence was also found that tech firms tend to have higher disclosure levels regarding human capital concerns. Finally, healthcare and pharmaceutical firms tend to disclose more forward-looking information while construction firms provide little information.

Also, as mentioned regarding the justification for H1, differences among industries are relevant to investigate, as we may need to control for fixed effects related to this. Consequently, it seems relevant to investigate the following hypothesis:

- **H2: Differences in disclosure quality levels exist between industries.**

Empirical research suggests that disclosure levels affect market liquidity. The two most commonly used measures of liquidity are share turnover, which measures the overall trading volume, and the bid-ask spread, which addresses liquidity issues as the friction that burdens traders.

Studies find that trading activity shows strong indications of being affected by various disclosure forms. This relationship has been studied thoroughly, and multiple papers examining different and large samples in various capital markets show a positive relation between disclosure and share turnover (Beaver 1968; Morse 1981; Bamber 1986; Sivakumar & Waymire 1994).

From the covered literature, it is also found that information asymmetry is reduced if information that has been private is made public or if the disclosed information is entirely new to the market. Thus, it is argued that lower information asymmetry reduces the risk of passive traders to lose against active traders who are assumed better informed. Since passive traders will then compete, the liquidity increases and the actual spread reduces accordingly (Welker 1995; Bloomfield & O'Hara 1999; Healy et al. 1999; Leuz & Verrecchia 2000).

Despite these findings, a different stream of literature suggests a negative relationship between corporate disclosures and liquidity. Firstly, it is argued that trading volumes increase with investor uncertainty and larger differences in individual expectations. The more the individual expectations vary, the higher is the advantage of being informed, which in turn can be transformed into economic benefits by trading in the market and hence liquidity increases (Thornton et al. 2002). Further, with lower information asymmetry, uninformed traders may leave the market as they cannot benefit from increasing spreads, and also as they are more aware of the fact that they may be relatively uninformed. These arguments imply that liquidity decreases and the bid-ask spread increases (Wu and Zhang 2002). However, the literature proving a negative relationship between liquidity and spreads is more comprehensive. Diamond & Verrecchia (1991) further proves that the mechanisms facilitating a negative relationship outweigh the contrary. A negative relation between corporate disclosure and liquidity is therefore expected, and we, therefore, formulate the following hypothesis:

- **H3: A positive relationship exists between disclosure quality and liquidity.**

The role of voluntary financial disclosure is to reduce the information asymmetry problem between firms and stakeholders (Leuz & Verrecchia, 2000). We argue that there are several factors providing reason for us to expect that higher quality disclosures lower the cost of capital of firms. Firstly, it is suggested that higher levels of disclosure reduce investors' estimation risk. Secondly, increased levels of financial disclosure are argued to reduce transaction costs by reducing asymmetric information. This should be related to the notion that investors prefer to invest in firms with low transaction costs and estimation risk, which lower levels of information asymmetry facilitates (Botosan, 2006). Healy & Palepu (2001) argue that managers, who anticipate making capital market transactions, will benefit from a lower cost of capital and are therefore motivated to provide voluntary disclosure. From this relationship, we predict that voluntary disclosure is expected to reduce the cost of capital of firms, facilitated by reduced information asymmetry. Following this rationale, there is also found evidence that increased financial disclosure reduces the information asymmetry component related to the cost of equity (Brown & Hillegeist, 2007; Petersen & Plenborg, 2006). The rationale for this is that investors become more certain about the future price expectations of stocks (lower estimation risk) and are

therefore more likely to accept a lower return for their invested funds ($r_f - r_m$), which in sum is related to a lower cost of equity.

The covered empirical and theoretical findings above provide strong arguments in terms of voluntary disclosure's negative association with cost of equity, why we seek to investigate the following hypothesis:

- **H4: A negative relationship exists between disclosure quality and cost of equity.**

In relation to the arguments provided above, we argue that increased disclosure should also lead to a lower effective interest cost of issuing debt, i.e., resulting in a lower cost of debt. This assumption is consistent with the findings of Sengupta (1998) and stems from the associated credit risk which is inclined to be reduced when it can be estimated more precisely as a result of lower information asymmetry. As it can be estimated more precisely, the premium related to risk is inevitably reduced. Thus, we formulate the following hypothesis:

- **H5: A negative relationship exists between disclosure quality and cost of debt.**

Finally, we seek to investigate the relationship between disclosure and the WACC of firms. As the theory describes, it is comprised of the cost of equity and a cost of debt component. Consequently, the findings are expected to be similar to that of H4 and H5, and we formulate the following hypothesis:

- **H6: A negative relationship exists between disclosure quality and cost of capital.**

With the main hypotheses covered, the following sections will seek to test them. As the variables included when testing the various hypotheses are not the same, the sample and related explanatory statistics, as well as the included control variables, will be covered individually in each section. Further, we will have a separate section covering relevant firm-specific control variables, as these will be included when testing H3-H6.

6. Choosing the Relevant measurements

6.1 The Liquidity Measure

From the hypothesis development, we learned that several studies found that both trading volumes and bid-ask spreads are widely accepted measures for liquidity.

Based on the focus of the thesis, we choose bid-ask spreads as our liquidity measure. These are gathered from the Center for Research in Security Prices' (CRSP) monthly security files and are defined as the average of the difference between the daily closing bid and ask quotes for a security in each month:

$$Spread_{id} = \frac{Ask_{idk} - Bid_{idk}}{M_{idk}}$$

Ask_{idk} is the ask price of firm i's stock for a given offer k in month d, Bid_{idk} is the bid price of firm i's stock for a given offer k in month d, and $M_{idk}$is the mean of Ask_{idk} and Bid_{idk}.

If the closing price of bid/ask average is zero and the spread between bid and ask is negative, then the spread represents a bid or low price. If the closing price of bid/ask average is zero and the spread between bid and ask is positive, then the spread between bid and ask represents an ask or high price. It is set to zero if unavailable and thus removed from the sample.

6.2 The Cost of Capital measure(s)

The following discussion will be conducted as to which cost of equity measure this thesis should adopt. Most literature focuses on disclosure's effect on the cost of equity, why the following discussion will be related to this measure. However, we argue that increased disclosure quality also should lead to a lower effective interest cost of issuing debt, i.e., resulting in a lower cost of debt, consistent with the findings of Sengupta (1998), why this measure will also be included.

Cost of equity is a forward-looking concept and has to be estimated since it is not directly observable. This naturally complicates the use of the measure. However, academics construct various methods for measuring the cost of equity capital, and until today, no consensus is found

regarding which measure is preferred. To measure the cost of equity capital, we have considered three market-based models:

1. The classic dividend discount model (DDM)
2. The price-earnings growth ratio model (PEG)
3. The capital asset pricing model (CAPM)

These have been considered since their calculation of the cost of equity capital are simpler and less complex meaning they are easier to understand, which we learned in the literature review are central factors.

6.2.1 The Classic Dividend Model

The following equation illustrates how DDM estimates the cost of equity and was applied as a proxy by Botosan & Plumlee (2002):

$$P_t = \sum_{t=1}^{\infty} (1 + r_e)^{-t} E_t(d_t)$$

In the equation above, P_t is the stock price at time t, r_e is the cost of equity, E_t is the forward-looking component as it describes that d_t is the dividend per share for each year t which is expected. Thus, the DDM estimates the cost of equity as the discount rate, which results in the present value of all, expected future dividends.

6.2.2 The Price-Earnings Growth Ratio Model

The PEG ratio model estimates the cost of equity based on the following equation and has been empirically tested by Easton (2004) and Francis J. et al. (2007), among others:

$$R_e = \sqrt{(eps_2 - eps)_1 / P_0}$$

Here eps_t is the earnings per share for year t+1, and t+2 and P_0 defines the current share price. Thus, the PEG measure defines the cost of equity as the square root of the expected earnings per share between year one and two from t_0 divided by the current share price.

6.2.3 The Capital Asset Pricing Model

As covered in the theory section above, the CAPM estimates the cost of equity based on the following model:

$$R_e = R_f + \beta_e\left[E(R_m) - R_f\right]$$

$E(R_e)$ is the expected return of each firm, R_f is the risk-free rate of return, $E(R_m)$ defines the expected market return, and β_i describes the comovement of a security with the market. By looking at the components of the model, it becomes evident that it does not calculate the cost of equity using firm-specific characteristics. Instead, it provides the expected cost of equity capital caused by co-movements with market prices.

Each model has its own limitations and benefits. For the purpose of this paper, we seek to apply the CAPM model. Despite the critique made about the CAPM in the literature review and the fact that the CAPM does not calculate the cost of equity capital using firm-specific characteristics, it is the model which is mostly applied in practice and thus why it is the chosen model and why it is covered in the literature review. Further, little research uses this measure, why we seek to contribute to the existing literature by adopting this measure into our analysis.

With this in mind, we seek to apply the cost of debt measure and the cost of capital (WACC) described in section 4.

6.3 The Disclosure Measure

From the reviewed literature above, we found several limitations to the disclosure measures applied in previous research of disclosure and related capital market effects. Further, as we wish to use the findings of the following research in a discussion related to blockchain technology's possible effect on disclosure quality, the measure must be consistent with these attributes. The features of blockchain technology will comprehensively be covered in order to facilitate our

discussion. However, in short, we seek a disclosure measure that incorporates the detail level, timeliness, and validity of financial information, as these are the primary factors blockchain technology is expected to improve in terms of financial disclosure.

Following these requirements, we deploy and analyze an existing, but relatively unexplored measure of disclosure quality, namely disaggregation quality (DQ) originally constructed by (Chen et al., 2015), which is built upon the disaggregation level of financial data items found in companies' annual reports. According to Blackwell (1951), finer information is of higher quality, which is what we base DQ on. More disaggregation leads to increased finer information accessible to investors. Moreover, disclosure with further detail supplies investors with added information for valuation, decreases information asymmetry, may enhance the accurateness in the financial statements information, and lessens mispricing (Fairfield et al., 1996; Jegadeesh and Livnat, 2006). Also, greater disaggregation increases the trustworthiness of companies' financial reports since managers have less freedom to administer the disclosed numbers (Hirst et al. 2007; D'Souza et al. 2010), which leads to enhancement of the stewardship and contracting role of accounting information. Therefore, it is suggested that greater disaggregation depicts better disclosure quality (Chen et al., 2015).

DQ can be applied to all Compustat industrial firms. The amount of non-missing financial items disclosed in the annual reports of companies is counted. Higher quality of disclosure is the result of more non-missing accounting data items. Even though extensive literature on disclosure and specifically voluntary disclosure remains, no distinct disclosure quality measure, formed from complete accounting data found in financial reports, exists (Chen et al., 2015).

Already existing proxies of disclosure quality, which consist of voluntary disclosure measures such as management forecasts, conference calls, or self-constructed proxies (e.g., Botosan 1997; Francis et al. 2008), analyst ratings like the discarded AIMR scores, or the narrative quality of MD&A found in annual reports like the Fog Index (Li, 2008), are highly different to DQ. DQ's ability to catch the fineness of financial information, which is illustrated in the disaggregation level of financial data items found in financial statements, makes it different from the abovementioned measures (Chen et al., 2015). On this basis, this measure of disclosure is found

to have the highest value relevance, as the measure fits the attributes of where blockchain technology can affect disclosure better than any other measure found in the existing literature. Further, DQ varies from existing disclosure proxies by being more objective as: "*it is based on all Balance Sheet and Income Statement line items, either reported in the financial statements or in the footnotes, not just the items judged to be most important by researchers and analysts*" (Chen et at., 2015). In sum, DQ captures the level of details of accounting data items included in annual reports and can, therefore, be interpreted as an overall measure of the fineness of financial statement information.

In addition to the direct differences to existing disclosure measures, DQ has the advantage that it is based on machine-readable data. Over time, presentations of financial data and reporting methods have varied among companies and industries. We are using the Compustat database and balancing models, as they use standardized data definitions and collection procedures to assure a consistent presentation of data. Computerized validation and balancing models are designed to guarantee the most comparable and consistently accurate data available. This consistency provides accurate comparisons of information across companies and over time. Also, the data is available for a high number of firms and for all years, which are also clear benefits compared to existing disclosure measures as described earlier.

Instead of an analysis of the included control variables, they will be described independently for each regression analysis, as different control measures are included for different analysis. The following will focus on the construction of our disclosure measure in order to ensure a thorough understanding of its attributes.

6.3.1 Constructing the DQ Measure

The construction of the DQ measure is conducted in alignment with the approach of Chen et al. (2015) and with the use of Compustat's Balancing Models (Appendix 1).

Counting Non-missing Items and the Balancing Models

As described above DQ measures the disaggregation of firms' financial statements. This is done by counting the number of non-missing items and finding the DQ ratio by diving by the

maximum number of items, thus finding the DQ ratio for each of the data points from the balancing models.

Items can be counted as missing if firms have the underlying item, but do not report it, e.g., if the actual value is zero for the year or if the firm actually does not have the underlying item. Chen et al. (2015) argue that the possibility of firms actually reporting an item and Compustat not capturing it is insignificant, and consequently no further emphasis is put on this. We wish to conduct our analysis solely on items that firms have, but do not report. As our sample is made of 402 S&P 500 companies as per the 10th of April 2018, it is assumed that the companies are large and complex. We experienced only slight occurrence of firms not having the underlying item, but some adjustments had to be made to ensure an equal amount of observations for the Income Statement (IS) balancing and the Balance Sheet (BS) balancing. This was done in Excel.

When counting non-missing Items, Computat has templates or "Balancing Models" for all three types of financial statements (income, balance, and cash flow statements). However, in alignment with Chen et al. (2015), we do not include a DQ component for the cash flow statement of the firms in our analysis as the difference in the number of missing items is assumed to be insignificant and often is inferred from the IS and BS regardless (Petersen & Plenborg, 2012). This in spite the fact that we acknowledge the information value of such as mentioned in the literature review. Also, during our sample period from 1973 to 2017, several different formats of cash flow reporting have been allowed, and especially the differences in pre and post 1989 reporting formats are drastic and is hence another argument for the exclusion (Chen et al. 2015).

The Balancing Models illustrate the inter-relations of the data items on the financial statements[3]. We use compact versions of the templates, which can be found in Appendix 1 along with a full overview of the data items in Appendix 2 and 3. The logic of conducting the Balance Sheet and Income Statements from the template and aggregate data points are the same, and we will start with an explanation of how DQ is derived using the Balance Sheet statement.

[3]. Full versions can be found here:
http://web.utk.edu/~prdaves/Computerhelp/COMPUSTAT/Compustat_manuals/user_04.pdf.

Compustat allows us to choose from 212 different Balance Sheet items and 131 different Income Statement items. However, the majority of these are excluded, following Compustat's own templates, and many are not relevant for the purpose of this analysis. Naturally, all items related to firms in the utility and finance sector as well as items labeled "Formula" are excluded as these can be derived from other financial statement items and would be a source of inaccuracy as some items would be counted double. Also, Compustat creates its own measures such as invested capital. This is an immensely useful item for analysts as it is used when deriving the cash flow from the firm as described in the theory section, but again it can be directly derived from the financial statements. Finally, items noted as "per share" are excluded as it would mean counting the same item twice; once at the general level and once at the per share level.

Constructing the DQ Related to the Balance Sheet

We refer to all line items under the column "Item Description" in the Balancing Model (Appendix 1) as "sub accounts". We then classify 13 of the accounts from the column "mnemonic" as "group" accounts in alignment with the classification of Chen et al. (2015). The goal of this exercise is to capture the variation in the disclosure of these 93 accounts (for the Balance Sheet). All sub-accounts are linked to the group accounts, and the linking table can be found in Appendix 2. Thus, all sub-accounts are linked to a group account, so that all sub-accounts to asset group accounts. For example (ACT + PPENT + IVAEQ + IVAO + INTAN + AO) add up to total assets.

Also, the sub-accounts for the Balance Sheet are linked to the "Parent" account, which is a disaggregation of the group accounts, e.g., the 20 sub-accounts with a group up to ACT (Current assets Total) are divided into seven parent accounts, where items such as inventories and receivables are disaggregated.

Two of the group accounts, MIB (Non-controlling interest – Redeemable) and IVAEQ (Investment and advances - Equity), have no sub accounts and are excluded because there is no variation in the reporting of these items, leaving us with 93 sub accounts and 11 group accounts, still in alignment with the approach of Chen et al. (2015).

The parent accounts are merely used as a screening mechanism, as all observations with parent account = 0 are excluded, as this implies that the firm does not have the operations related to these accounts. A further screening mechanism we employ is to control if the sub-accounts add up to the parent, thus preventing that a field is counted as missing where it instead should be zero.

Constructing the DQ Related to the Income Statement

Here we capture the variation in the disclosure of the 51 sub-accounts from the Income Statement. The group account CITOTAL (Comprehensive Income – Total) is originally on the Balancing Model for the Income Statement; however, the associated accounts are classified as Income Statement accounts. We then classify seven of the accounts from the column "mnemonic" as "group" accounts. All sub-accounts are linked to the group accounts, and the linking table can be found in Appendix 3. Again, we screen for accounts that equal zero, but unlike the Balance Sheet, the parent accounts are not identified for the Income Statement, and the nesting is only on two levels.

Constructing the Total DQ Score

Our DQ scores are constructed from a simple average of the DQ score from the Balance Sheet (DQ_BS) and the DQ score from the Income Statement (DQ_IS). In the approach of finding these scores, it is necessary to cover each measure individually, starting with the DQ_BS.

DQ_BS

In order to approximate the economic significance of each non-missing item, we value-weight the groups of the Balance Sheet relative to the total assets of the firm, using this formula:

$$\sum_{X=1}^{11} \left\{ \left(\frac{Number\ of\ non-missing\ items}{Number\ of\ total\ items} \right)_x * \frac{Assets}{Total\ Assets} \right\} \div 2$$

X indexes the group accounts, which there are 11 of for the Balance Sheet, and these are linked to 93 sub accounts which, when summed, will equal the group accounts. For each of these 11 groups, the non-missing sub-accounts are counted and divided by the number of sub-accounts in

each group. To illustrate this, the group, PPENT (Property Plant and Equipment - Total (Net)), is associated with nine sub accounts. If we assume that three of the nine sub-accounts are missing, then the ratio of non-mission items will be $\frac{6}{9}$ for this group. This ratio is then multiplied by the value of that group account divided by the total asset value for each firm for each period, thus giving the value-weighted value of each group account for each firm observation. This allows bigger, i.e., more appropriate accounts for investors, to have additional importance in the model. These values are finally summed for all 11 Balance Sheet groups, giving a disclosure score with possible values from 0 - 2. Therefore, we divide by two at the end of the equation, giving a theoretical DQ_BS score between 0 and 1.

DQ_IS

The construction of the DQ_IS differentiates itself from the DQ_BS as the exercise of value-weighting the value in this context is problematic. Income statements can have both positive and negative values, why a value-weighting will require that absolute values are used, making it difficult to interpret. Further, and equally important, is that the natural parameter for value-weighting the DQ_IS will be using revenue (sales), why variation would be dominated by the changes in XOPR (Operating Expense – Total) as this accounts for 90% of the weight when using sales as a natural denominator in common-size statements (Chen et al. 2015).

Our goal is instead to measure the number of non-missing items, why an equal-weighted average will be applied for the DQ_IS. Here, group accounts have been identified, but the account SALE only have REVT (Revenue – Total) as a sub-account, and "all" firms have non-missing values, why it is excluded from our DQ measure. Therefore, seven group accounts with 51 related sub-accounts have been used for the DQ_IS score.

Here the approach is just like the first part of the DQ_BS score, where the number of non-missing sub-accounts is divided by the number, total accounts, for each group. An example could be the group of TXT (Income Taxes – Total), which comprises 11 sub accounts. Thus, if eight out of 11 sub accounts are present, i.e., non-missing, the ratio of non-missing items will be 8/11. An equal average of the values for all seven groups are then calculated to define the DQ_IS, having possible values between 0 and 1.

DQ

In order to have one measure for further analysis of DQ, we construct a summary measure that combines the disaggregation of both the Balance Sheet and the Income Statement, by taking the simple average of the DQ_BS and DQ_IS.

7. Empirical Evidence of Disclosure and Capital Market effects

The sections above have covered the relevant theory, allowing us to develop relevant hypotheses and choosing appropriate measures for this purpose. The following section will utilize this and seek to test the formulated hypothesis consequently providing insights allowing us to answer the primary research question of this paper.

7.1 DQ Overview

In this section, the sample used for constructing the DQ measure will be covered. Following this, DQ's development over time and the central drivers for this development will be analyzed, facilitating arguments for the H1. This section will also cover DQ's H2 test, regarding whether or not differences in DQ levels exist between industries. However, we wait till later in the thesis with the testing of whether these findings need to be controlled for in the remainder of the hypothesis tests.

7.1.1 Sample and Descriptive Statistics

Our model contains feasible data from CRSP/Compustat companies, more specifically the S&P 500 companies as per the 1st of April 2018. We have chosen to omit firms from the Global Industry Classifications Standards' (GICS) utility and financial industries. Utility and financial companies are excluded because they are inclined to have highly distinct disclosure methods, whereas foreign companies simply do not appear in the S&P 500; hence our sample only contains U.S. companies.

Our various regression analyses require diverse data why our sample varies for each assessment. As a consequence of this, we include a description of the specifics regarding each sample as well as an explanation of the affiliated variable. The fundamental measure in the following is the DQ

measure. Hence our concentration lies on this measure when displaying and explaining the results of the relationship between DQ and other variables.

Table 2 – Descriptive Statistics on DQ Scores

	Mean	Standard Deviation	Q1	Median	Q3
DQ	0,632	0,139	0,524	0,625	0,762
DQ_BS	0,750	0,158	0,629	0,732	0,904
DQ_IS	0,514	0,158	0,406	0,496	0,632

Table 2 demonstrates descriptive statistics of DQ computed with the use of feasible data for CRSP/Compustat non-utility and non-financial S&P 500 companies from 1973 to 2017. 1973 is the starting point of our data gathering as FASB was founded and the first FASB guideline was published in that year. Our endpoint is in year 2017 due to the simple reason that companies do not have annual reports for 2018 yet. Our sample is comprised of 402 companies and a total of 12978 observations between 1973 and 2017, which we utilize to estimate the DQ disclosure score. Table 2 shows that, in our sample, DQ displays substantial disparity, where the standard deviation, mean, and median equal 0,139, 0,632, and 0,625 respectively. Furthermore, the range between maximum and minimum equals 0,405. The DQ_BS and DQ_IS scores display similar disparity.

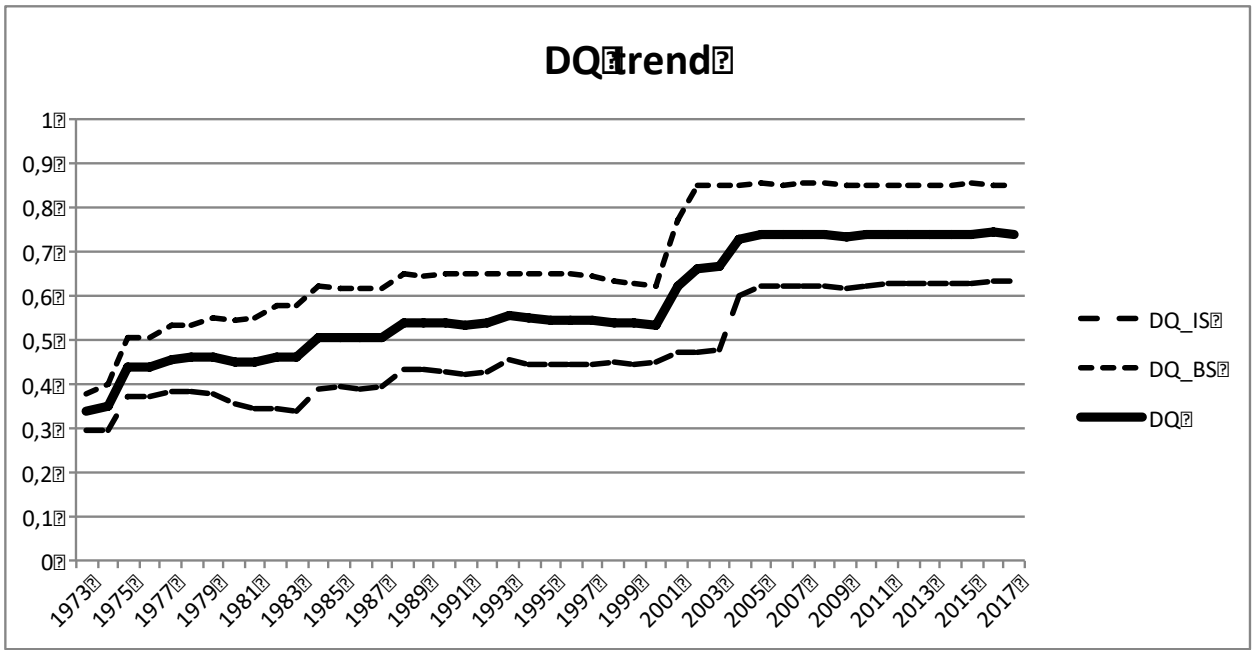
7.1.2 The Development of DQ Over Time

As figure 3 below indicates, DQ levels have been steadily increasing over time. This can be the result of not only the progression of business models over time but also firms' response to regulation changes. Furthermore, technological innovation allows firms to register and administrate their finance and accounting in a more sophisticated manner, and also allows investors to benefit from more detailed and complex information without suffering from information overload, as we argue throughout the paper.

Consequently, before testing how firm-specific factors affect DQ and further moving into an analysis of how DQ affect factors such as liquidity and the cost of capital of firms, we find it necessary to include a timeline of fundamental disclosure and financial reporting events that

functions to illustrate the development of the underlying data generating process. Furthermore, it will function as a thorough analysis of the driving factors of the upward going DQ trend.

Figure 3 – Historical DQ Trend



The Financial Accounting Standards Board (FASB) has since 1973 been the chosen organization for forming guidelines for financial reporting and accounting in the private sector and is, hence, the reason why we choose to start our data sample at this point. These guidelines dictate the formation of financial reports and are officially acknowledged as authentic by the SEC and the American Institute of Certified Public Accountants (AICPA). Due to the fact that many actors including auditors, investors, and more have confidence in transparent, credible, and comparable financial information, these guidelines are fundamental to ensure that the economy is operating smoothly and efficiently (FASB, 2009). The following is intended to describe the timeline of important events regarding financial reporting, where the chosen events are included because of the link between these and the researchers' topic. As a result, there may be several significant events that are excluded from the following timeline.

1973 - Disclosure of Foreign Currency Translation Information (FASB is Formed)

The year 1973 is the opening year of our timeline with respect to our data gathering as that was the year FASB was formed and where the initial FASB standard was published. The first standard that FASB issued was the Disclosure of Foreign Currency Translation Information, which was a consequence of the fact that FASB concluded that it was necessary to include distinct disclosures in financial statements that contain amounts expressed in foreign currencies, which have been adjusted into the present currency of the company doing the reporting. These amounts may be a result of reasons such as equity methods of accounting or transactions. Following this, FASB formed several disclosure requirements for firms, which are summarized below (FASB, 1973):

1. Information in regards to which accounts are historical rates and which are translated at current rates.
2. Methods of accounting for exchange adjustments (for example, whether gains and losses are identified in income during the period where exchange rates altered or whether they are postponed for subsequent identification.

1987 - Statement of Financial Accounting Standards (Statement of Cash Flows)

Statement of Financial Accounting Standard (SFAS) 95 (Statement of Cash Flows) was issued to accomplish improved conformity in the disclosure of information relating to cash flows and became effective after July 15, 1988 (FASB, 1987). The standard characterizes cash equivalents as highly liquid short-term investments, demands companies, within a three-month period, to establish which investments are cash equivalents, and requires disclosure of companies' approach for determining cash equivalents (The CPA Journal Online, 1990).

Before SFAS 95 was issued, GAAP accepted various reporting types allowing for flexibility, which culminated in significant diversity with respect to the focus of the statement of changes in financial position (The CPA Journal Online, 1990). This is the exact reason why the researchers of this paper have chosen to exclude a DQ measure for the statement of cash flows as various types of reporting for the statement of cash flows during our timeline of chosen data were allowed. This diversity in reporting creates difficulties when wanting to establish a substantial disclosure score for each year, and consequently we have decided not to include such a measure

for cash flow statements. This omission is a warning in regards to our DQ measure and is thus important to mention (Chen et al., 2015).

The SFAS 95 sets up requirements for cash flow reporting and demands, for all firms, a cash flow statement as part of the complete set of financial statements instead of a statement of changes in financial position. The statement further requires that payments and cash receipts are determined in accordance to whether they originate from investing, financing, or operating activities, and descriptions of each of these categories are obligatory (FASB, 1987).

The statement also demands that cash flow statements report the reporting currency in accordance with foreign currency cash flows by utilizing the prevailing exchange rate at the present time of the cash flows. Cash carried in foreign currencies, and its effect of exchange rate changes is reported in the reconciliation of beginning and ending balances of cash and cash equivalents as an independent item. Also, it is required that information regarding financing and investing activities that fails to result in payments or cash receipts in the time frame is presented independently (FASB, 1987).

2000 - Regulation Fair Disclosure

In order to increase the information available to outsiders such as investors in terms of quantity and quality, two substantial regulations were employed in the United States in the years 2000 and 2003, namely Regulation Fair Disclosure (RFD) and the Global Settlement (GS) (Healy, 2007).

The RFD regulation was passed on the 10th of August 2000 by the independent agency of the United States, the U.S. Securities and Exchange Commission (SEC), and became effective on the 23rd of October the same year. These new rules ensured that it was forbidden for companies to disclose valuable information to distinct investors privately, and if such happened to be disclosed accidentally, management was obligated to disclose it publicly within a full day (Healy, 2007).

In regards to this rule, the SEC claimed that private disclosure to specific investors allowed these to escape from losses or acquire profits at the mercy of others. The SEC was thereby apprehensive about the issue of companies distributing significant information on future earnings

to specific sizable investors, and thus concerned about the possible deficit in the confidence in the sincerity of the capital markets from an investor's standpoint. This, in turn, causes other investors, who are given this information with a delay, to cast doubt upon whether or not they are at an equal informative level compared to those investors with inside knowledge (Healy, 2007).

Apart from improving the investor confidence, the RFD regulation was, according to the SEC, asserted to restrain companies from giving analysts, who conducted positive earnings forecasts, entry to private information as a mean of reward, and oppositely a mean of punishment towards analysts who remained doubtful of the firm. At last, it was indicated by the SEC that technological advances assisted in wider publishing of information than what was formerly achievable. Issuers are now able to confer straightly with the market through several different methods including teleconferencing, Internet webcasting, and others, though this may not have been possible previously when they had to depend on information intermediaries, namely analysts. Thus, the previously existing technological limitations that may have functioned as an excuse to the danger of loss in market sincerity that private disclosure contributed to in the past no longer exist (Healy, 2007).

The Association for Investment Management and Research as well as the Securities Industry Association, which both are adversaries of the regulation, claimed that it would be problematic to actuate when disclosure would be subject to the regulation, and hence have an alarming impact on the disclosure of information by issuers. Ultimately, these adversaries forecasted that the regulation would result in companies stopping all informal communications with outsiders and lead to a breach that would not be fixed by increased public disclosure of comparable information (Healy, 2007).

2003 - Global Settlement

Following the employment of the RFD, the capital markets of the United States hit a swirling spell. A combination of scandals such as the Enron scandal, the passing of Arthur Andersen, and the Internet and telecommunications business crash all resulted in an urge for increased regulation regarding the financial analysts as part of the capital market actors (Healy, 2007).

Ten of the most sizable investments banks settled for a settlement on the 28th of April 2003 with the New York Stock Exchange (NYSE), the SEC, the North American Securities Administrators Association (NASA), state securities regulators, the North American Securities Dealers (NASD), and the New York State Attorney General. This Global Settlement came to surface due to an investigation regarding accusations concerning banking incentives influencing equity research defectively. More precisely, this investigation revealed that research reports containing fraud, lacking payment disclosure, or simply missing good faith were issued by the banks' analysts (Healy, 2007).

After agreeing to the settlement, banks were obligated to settle with an $875 million penalty, contribute to independent research costing $432.5 million, and pay $80 million for investor education. To further mitigate the problem of equity research being influenced inappropriately by banking incentives, a separation between companies' investment banking and equity research departments was enforced. Moreover, nil guidance from investment banking was allowed towards budgets for research and at the same time these budgets were not permitted to be established upon investment banking revenues. Investment bankers were prohibited from having any say on decisions regarding research coverage, and analysts were banned from approaching the investment banking business and acquiring repayment for the support given to investment banking (Healy, 2007).

The $432.5 million that were outlaid to independent research were required by the settlement to be used to purchase at least three independent reports meant for clients in addition to their own reports for the following five years. Furthermore, by publishing price targets and historical recommendations for their analysts, the banks agreed to raise research transparency. Ultimately, the spinning process in which shares in hot IPO's are distributed to directors of important clients and executives was restricted by the banks (Healy, 2007).

The settlement is inclined to alter the supply and demand for equity research due to the increase in funding for research firms combined with the decrease in opportunity for funding equity research via investment banking. For research companies, the additional financing for research, excluding investment bank research, is expected to result in a rise regarding the number of

employed analysts, whereas for penalized investment banks, the regulations concerning the use of analysts to assist in selling investment banking is predicted to cause a decrease in hired analysts as well as a reduction in equity research budgets (Healy, 2007).

2005 – XBRL

eXtensible Business Reporting Language (XBRL) presents a computer-based structure that is both interactive and standardized for financial reporting and the formation of financial statements and has furthermore turned out to be a thriving technological advancement for firms in the past ten years. Additionally, this framework presents important benefits including comparability regarding the delivery of financial information to all actors in the information supply chain such as investors unconcerned with differing needs, increased efficiency, and transparency (CFA Institute, 2009; CFA Institute 2016). This is particularly interesting for the researchers' topic as these characteristics correspond to those of blockchain technology.

On the 16th of March 2005, the Final Rule (33-85-29) concerning the XBRL Voluntary Financial Reporting Program on the electronic data gathering, analysis, and retrieval (EDGAR) System, which has the objective of increasing the fairness and efficiency of the securities market to aid corporations, investors, and the economy by advancing the acceptance, dissemination, receipt, and analysis of time-sensitive corporate information registered with the organization, was published (SEC, 2010). SEC registrants were encouraged to submit distinct mandated reports voluntarily using XBRL as the format for EDGAR filings enforced under the 1934 Securities Exchange Act. The submissions mentioned above were to take place at the same time as already existing plain text formats of reporting to the EDGAR system (Debreceny et al., 2005). The ambition behind the rule was to analyze the practicability and desirability of deploying XBRL-formatted data to investors, the Commission, registrants, and the marketplace. The practicality and implications of the rule were firmly inspected by Debreceny et al. (2005) as a component of a working party under the protection of the Information Systems and Artificial Intelligence/Emerging Technologies section of the American Accounting Association (AAA). With robust support for the initiative of the SEC, the Debreceny et al. (2005) Committee was formed to facilitate better transparency, supervision, and fluid functioning of capital markets (Debreceny et al., 2005). As the Committee regarded XBRL as highly important for the

accessibility of the markets, it was recommended that XBRL for Form 8-K filings should be considered for adoption by the SEC and ultimately commanded that the XBRL format should be deployed for every submission made to the SEC (Premuroso and Bhattacharya, 2008).

Firms have started to receive incentive offerings from the SEC with the hope of getting the firms to partake in the XBRL filing program (Baldwin et al., 2006; CFA Institute, 2016). Additionally, companies already have plenty incentives to use the XBRL format voluntarily for the filing of financial statements. Financial reporting in the XBRL format can effectuate efficiency in regards to internal and external financial reporting for companies, and consequently, the costs of generating and reporting financial information are diminished. Also, possible differences between companies with respect to disclosure content and level are reduced with the deployment of XBRL, and investors' playing field is leveled simultaneously. Companies choosing to adopt the XBRL format early may anticipate to be granted future improved corporate governance evaluations and increased or easier entry to capital markets as a reward by the marketplace (Premuroso and Bhattacharya, 2008).

As a consequence of the above, a potential affiliation between firm performance, corporate governance, and voluntary and early adoption of the XBRL format is proposed by voluntary XBRL-connected financial statement filing initiatives. Since some of the first adopters of the technology are vendors of the XBRL technology, it is not surprising that there is an anticipated connection between corporate governance and XBRL approval. It is predictable that some of the first to adopt the XBRL format are XBRL-related vendors due to the SEC's aspiration of achieving increased corporate transparency and hence its enthusiasm about the technology (Scannell, 2006b). The efficacy of the technology is illustrated due to the fact that the vendors mentioned above are some of the pacesetters within the technology category. Moreover, they anticipate benefitting from the increased transparency, which is the result of adopting the XBRL format; hence the efficacy of the technology is confirmed. The adoption of XBRL may actually improve companies' reputation regarding corporate transparency in the capital markets even though some may claim that it is not necessary for companies to display superiority with respect to corporate governance due to their already-existing reputation and magnitude (Premuroso and Bhattacharya, 2008).

7.1.3 DQ on Industry Level

In Table 3, we display results of simple regression of DQ, DQ_BS, and DQ_IS, which are based on the GICS industry taxonomy. Due to our exclusion of utility and financial companies, our regression is built upon the remaining nine industries and the following equation:

$$DQ = \beta 0 + \sum \beta i \times INDi + e_i$$

Table 3 – Regression Analysis of Variation by Industry

DQ and Indusries	DQ	DQ_BS	DQ_IS
	Coefficients	*Coefficients*	*Coefficients*
Industrials Intercept	0,614	0,738	0,490
Health care	0,026	0,027	0,025
Information Technology	0,062	0,053	0,070
Consumer Discretionary	0,026	0,021	0,032
Materials	0,024	0,016	0,032
Real Estate	0,008#	0,002#	0,014
Consumer Staples	0,010	0,005#	0,016
Energy	-0,037	-0,060	-0,013
Telecommunication Services	-0,004#	-0,031	0,024#
Adjusted R Square	7,24%	9,33%	3,92%

The confidence level is set to 95% and all coefficients except those marked with # are significant at this level. The regression is done using industry dummies, and each industry is regressed on the base industry, which is set to be the Industrials Sector, as its DQ score is of the highest approximation to the sample average of all the industries, which benefits the validity of the regression.

The many significant coefficients confirm our choice of segmenting in industries as the different values confirm the difference in the DQ level between industries. This facilitates arguments for confirming H2 and highlights our intuition that it is relevant to test if it needs to be controlled for in the later regressions.

7.2 DQ, Firm Fundamentals, and Fixed Effects

Now, with an established measurement and a thorough analysis of the driving factors of the upward trend, we wish to test how firm-specific factors affect DQ, before moving onto an analysis of how DQ affects factors such as liquidity and the cost of capital of firms, thus relating it directly to our research questions and the theory covered throughout the paper.

More specifically, we wish to investigate how firm fundamentals of large American firms can drive DQ. Here we find firm fundamentals such as special items, restructuring items, the level of intangibles, and other factors, which can systematically affect DQ interesting to analyze. By doing this, it enables us to include significant variables, hence allowing us to control for firm fundamentals when analyzing DQs' effect on the market specific factors later on. Thus, we perform a regression analysis as we wish to capture that part DQ, which is driven by managerial incentives to increase DQ.

The sample will be the same as described in the section above.

7.2.1 Control Variables

We find the following four variables most relevant and most likely to capture the firm's fundamentals effect on DQ, even though we recognize that more elements such as the number of business segments, ratios such as D/E and P/E are used in previous studies and would make the following analysis more sophisticated.

Firm Size

Prior studies show that voluntary disclosure will be positively correlated with firm size, why it has to be considered a control variable (Lang & Lundholm, 1993; Chen et al., 2015). If not controlled for, the findings of this study may lead to wrong conclusions to our hypotheses regarding the relationship between DQ, bid-ask spreads, and cost of capital.

Based on this prior research, we will use the value of total assets as a proxy for from size. More specifically, the control variable will be: *LOG(AT)* and is the natural logarithm of the value of

total assets for each firm at year t. We take the natural logarithm to mitigate heteroskedasticity. Thus, the argument will be the same for all logarithmic variables in the following analysis as the regressions are better specified when these variables are logged (White, 1980).

Also, we will include another control variable related to firm size, namely the relative size of intangible assets of the firms, in order to make sure that it is not only intangible assets driving DQ levels. This variable is: *INT* and is the intangible assets' intensity ($\frac{Intangibles\ Assets}{Total\ Assets}$). This variable is included as Chen et al. (2015) find it to be the most significant factor for the increasing trend in DQ over time.

Special Events

Relevant literature suggests that firms are incentivized to increase disclosure levels when the possibility for information asymmetry increases. Thus, in order to control for special events in financial statements driving DQ levels, we include a variable for special items: *SPI* and represents the level of special events relative to firms and is calculated as the absolute value of special items divided by total assets. Unique events require higher levels of disclosure, and since this increases the information asymmetry, we expect a positive correlation with DQ.

Changes

Like special events, changes in business prospects and the like may affect disclosure levels. Chen et al., (2015) suggest that assets restructuring could be a significant driver for DQ, why we include the control variable: *Restructure*, which indicates asset restructuring items being disclosed in financial statements and is set = 1 if RCP (Restructuring Costs Pretax) is > 0 (Appendix x), and 0 if not.

This can occur due to many reasons. A company may restructure as a mean for preparing for a sale or a merger, its overall goals can be changed, or a product/service may have failed and does not bring in enough revenue for covering payroll and debts, why a restructure occurs. Thus, using the argumentation from above, disclosure is needed to mitigate information asymmetry of stakeholders, which in turn may affect the company negatively. Hence, we expect a positive relationship with DQ.

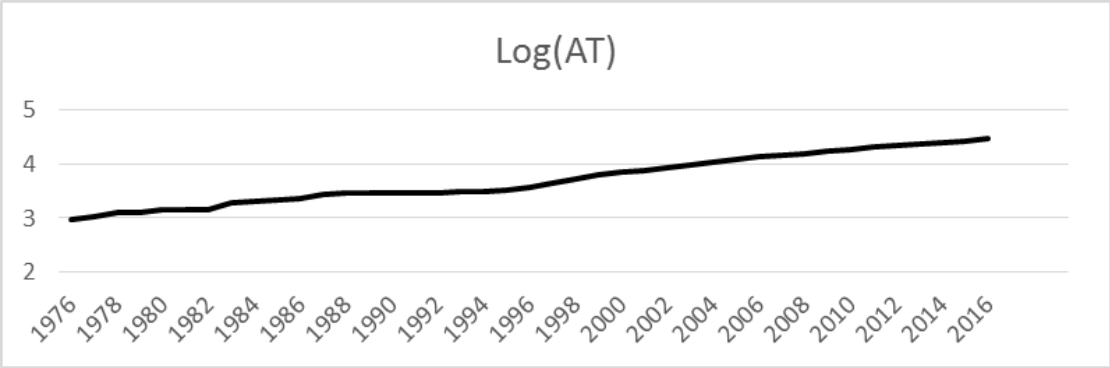
Table 4 – Descriptive Statistics on Firm Fundamentals

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Q1*	*Median*	*Q3*	*Max*
DQ	12978	0,632	0,139	0,092	0,524	0,625	0,762	0,920
LOGAT	12978	3,779	0,894	-0,810	3,239	3,885	4,416	6,106
SPI	12978	0,006	0,133	0,000	0,000	0,001	0,003	14,205
INT	12978	0,074	0,122	0,000	0,000	0,009	0,105	0,793
Restructure	12978	0,229	0,420	0,000	0,000	0,000	0,000	1,000

With reference to the findings throughout this paper, it can be hypothesized that we expect DQ's relationship to be positive for all the above variables.

Log(AT), and indirectly, INT, represent firm size, and common sense tells us that the larger (more complex) a firm gets, the more resources for investing in technology and workforce for handling the financial reporting and auditing of this increased complexity it has. Further, we learned from section 4 that corporate management has several different incentives for increasing levels of disclosure, and these incentives increase as they have more at stake as the size of the firm increases. Finally, the average asset base of the companies in the sample shows an upward trend over time, which DQ also does.

Figure 4 – LOG(AT) Over Time



However, even though larger firms may have more resources to handle operational complexity, the relationship is not so simple. For example, Chen et al., (2015) argue that the relationship can be negative if GAAP standards constrain complex firms by enforcing upper boundaries on the allowed number of items they can report even though they have more items to be reported.

Further, theory suggests that the risk of setting too high a disclosure precedence, agency costs, proprietary costs, or political costs can prevent firms from fulfilling their DQ potential. This theory can be applied to an eventual explanation as to what can affect the DQ and firm size relationship negatively.

Table 5 – Correlation Matrix of DQ and Firm Fundamentals

	DQ	*LOG(AT)*	*SPI*	*INT*	*Restructure*
DQ	1				
LOG(AT)	0,453	1			
SPI	0,028	-0,011	1		
INT	0,018	-0,015	-0,022	1	
Restructure	0,523	0,341	0,014	0,012	1

Table 5 above shows the correlation matrix between DQ and the firm fundamentals covered above.

SPI shows a very low correlation. This, however, could be due to the fact that the absolute value of SPI is relatively small compared to the absolute value of the observations of the other variables. Also, DQ and INT show very low correlation, which was unexpected. Conversely, DQ and Restructure as well as DQ and LOG(AT) show high correlations, suggesting they may be the primary drivers. The negative relationship between firm size in total assets and intangible assets is counter-intuitive as well. Finally, no significant collinearity between variables is found since the highest correlation coefficient is 0,523 between DQ and Restructure.

Below, Table 6 shows the output of a multiple regression on DQ and the same five firm fundamental variables. The regression is presented below:

$$DQ = \beta_0 + \beta_1 * LOG(AT)_{it} + \beta_2 * SPI_{it} + \beta_3 * INT_{it} + \beta_4 * Restructure_{it} * + e_{it}$$

Table 6 – Regression of DQ and Firm Fundamentals

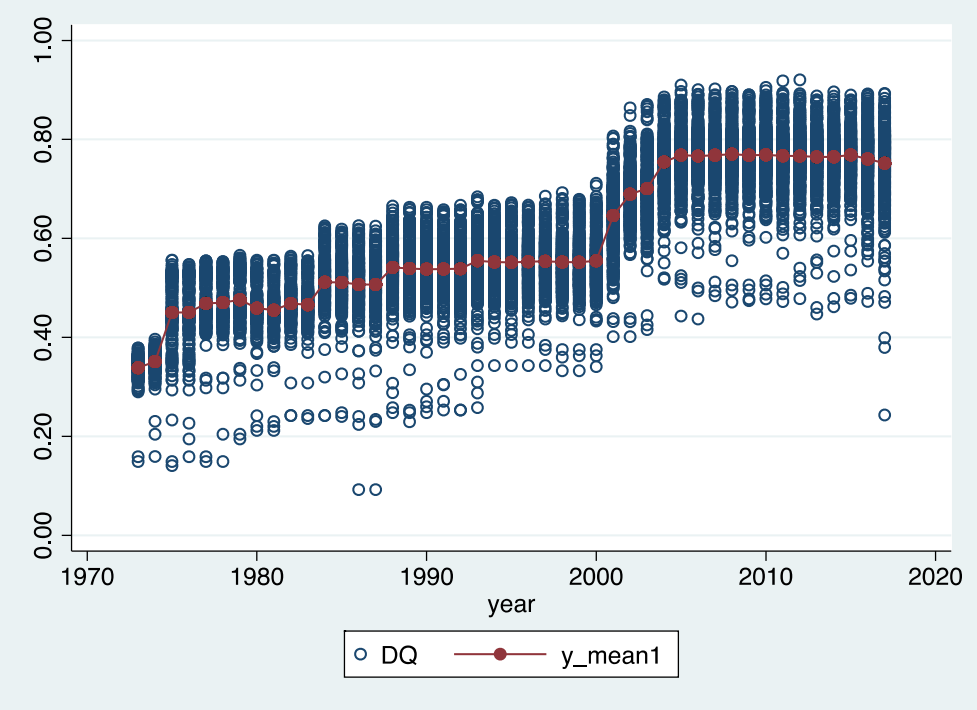
	Coefficient	*Std. Error*	*P-value*
Intercept	0,417	0,001	0,000
LOGAT	0,044	0,007	0,000
SPI	0,043	0,008	0,000
INT	0,307	0,002	0,000
Restructure	0,107	0,004	0,000
R Square	0,428		

When conducting a regression with panel data, it can be conducted using random effects or fixed effects. Initially, the model has been calculated using random effects; however, we cannot be exactly sure that we can trust the findings of the model above just yet.

7.2.2 Testing for Fixed or Random Effects

The reason for including fixed effects for these two entities in our analysis is that we suspect that they may influence the predictor variables. Our arguments for controlling for the time fixed effect is the strong increasing DQ trend over time in addition to the heterogeneity, which can be found. Figure 5 displays this below. Secondly, the fact that Table 6 above shows that DQ varies significantly across industries facilitates a strong argument for making sure this does not influence our conclusions.

Figure 5 – DQ Fixed Effects: Heterogeneity Across Years



When using fixed effects controls, we assume that something may bias the outcome variables, and we need to control for this as it is the rationale behind the assumption of correlation between an entity's (industry and time) error-terms and the predictor variables. Controlling for fixed effects in the regression removes these effects, enabling an assessment of the actual effect of the predictor variables on the dependent variable (Torres-Reyna, 2007).

Consequently, a Hausman test is conducted in order to confirm our intuition. Here the null hypothesis is that the preferred model is random effects and the alternative $H_{\neq 0}$ hypothesis is that the effects are fixed. In other words, we test whether the error-term e is correlated with the coefficients, where the H_0 is that they are not.

In order to perform the test, we first run a fixed effects model and a random effects model, which we perform the Hausman test on. This gives a $prob > chi^2$ value < 0,05, and the fixed effects are significant and should be included (Appendix 4).

As we have an indicator that there might be a fixed time component as well, we also control for this. The test is a joint test with an H_0= the coefficients for all years are jointly = 0, i.e., it controls if the dummy variables for all years are = 0. If they are, then there is no need for including time fixed effects. The approach is to run a fixed effects regression on the firm fundamentals variables and include dummies for t-1 years. We then use the STATA command "testparm i.year", which controls the H_0. If the value for Prob>F is > 0,05, we fail to reject the H_0. However, the test gives Prob > F = 0,0000, thus rejecting the H_0 that the coefficients for all years are jointly = 0, and we will, therefore, include time fixed effects in the following analysis. Comprehensive outputs for the fixed effect tests can be found in Appendix 5.

Table 7 below shows the same regression as Table 6, however, here we control for industry effects and time fixed effects. This we do by adding binary (dummy) variables to the regression as described here for the industry and time fixed effects:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \cdots + \beta_k X_{k,it} + \gamma_2 E_2 + \cdots + \gamma_n E_n + \delta_2 T_2 + \cdots + \delta_t T_t + e$$

Where:

$\boldsymbol{\gamma_{it}}$ = the dependent variable and i = entity (industry) and t = time (year)

$\boldsymbol{X_{k,it}}$ = the independent variables, which in this case are the ones described above.

$\boldsymbol{\beta_k}$ = the coefficient for each independent variable

$\boldsymbol{E_n}$ = representation of each industry (we have 1 - 9). This is a dummy variable, and we will, therefore, have n-1 included. Industrial is not included as this is defined as the base case.

$\boldsymbol{\gamma_n}$ = the coefficient for the industry dummies.

$\boldsymbol{T_t}$ = the dummy variable representing each year, so that we have t-1 time periods (out of 2017-1973 = 45 in this case).

$\boldsymbol{\delta_t}$ = the coefficient related to each time dummy variable.

$\boldsymbol{e}$ = the error-term.

Table 7 – Regression of DQ and Firm Fundamentals Including Industry and Time Fixed Effects

	Coefficient	*Std. Error*	*P-value*
Intercept	0,351	0,004	0,000
LOGAT	-0,005	0,001	0.000
SPI	0,005	0,003	0,113
INT	0,003	0,004	0,374
Restructure	0,021	0,001	0,000
R Square	0,845		

The coefficient for the variable firm size LOG(AT) and for the variable Restructure are both significant at a 99% confidence level when controlling for fixed industry and time effects, i.e., they have a p-value < 0,001. This is also the case when fixed effects are not controlled for. However, the variables for special items SPI and intangibles INT become insignificant when fixed effects are included. Thus, these are excluded from the "firm fundamentals" and will be the variables, which are included in the remainder of the analysis whenever "firm fundamentals" are being controlled for. These findings are contradicting the work of Chen et. Al., (2015).

When only regressing these two variables on DQ while still controlling for fixed effects, the regressors look like the following:

Table 8 – Regression of DQ and Firm Fundamentals Including Industry and Time Fixed Effects

	Coefficients	*Std.Error*	*P-value*
Intercept	0,3517	0,0045	0,0000
LOG(AT)	-0,0485	0,0007	0,0000
Restructure	0,2075	0,0129	0,0000

From Table 8 above it is evident that the negative relationship between firm size and DQ is unexpected. However, as mentioned above, GAAP standards may put constraints on complex firms by enforcing upper boundaries on the allowed number of items they can report. Also, the risk of disclosure precedence, agency costs, proprietary costs, or political costs could be an

explanation to the negative coefficient. Further, the regression shows that restructure is the variable, which affects DQ the most.

With the validity and an understanding of what affects our disclosure measure DQ, we will continue our analysis with a test of DQ's effect on relevant capital market elements; hence, the next section will examine our hypothesis H3.

7.3 DQ and Bid-Ask Spread

To examine the relation between DQ and market liquidity, and thereby testing H3: A negative relationship exists between DQ and bid-ask spreads, we estimate the following equation:

$$Bid - Ask = \beta_0 + \beta_1 * DQ_{i,t} + \beta_2 * LOG(VOL)_{i,t} + \beta_3 * LOG(PRICE)_{i,t} + \beta_4 * \sigma(RET)_{i,t} + \sum FE.Industry + \sum FE.Year + \sum Firm.Fund + e_{it}$$

The dependent variable *Bid-Ask* is calculated as the average of the difference between the daily closing bid and ask quotes for a security in each month. If the closing price of bid/ask average is zero and the spread between bid and ask is negative, then the spread represents a bid or low price. If the closing price of bid/ask average is zero and the spread between bid and ask is positive, then the spread between bid and ask represents an ask or high price. It is set to zero if unavailable from the database and thus removed from the sample.

7.3.1 Control Variables

We find the following three variables most relevant to include in order to ensure that DQ's effect on bid-ask spread is being illustrated as truthfully as possible. Again, we realize that including more variables, especially related to the market capitalization of the included firms, such as book-to-market ratios, could improve the findings, but the available data were too affected by errors.

Liquidity

Scholars argue that it is necessary to control for additional liquidity of companies' stocks as it can affect the holding costs' inventories of firms (Demetz, 1968; Chen et al., 2015). The measure we choose as control is the trading volume of the firm's stock represented by *LOG(VOL)*. More specifically, it is defined as the natural logarithm of the sum of the trading volumes for each company during that month for each year t and is expressed in units of hundred shares. We take the natural logarithm to mitigate heteroscedasticity as we did when controlling for firm size. This argument will be the same whenever LOG is used.

Stock Price

Stoll (1978) found that controlling for the market processing costs makes sense when investigating liquidity. This we do by including the variable: *LOG(PRICE)*, which is the natural logarithm of the average daily closing price over year t for each firm. This measure is chosen as we want to control for the possibility of bid-ask spreads being driven by the price of the individual stocks.

Volatility

In order to control for the operational risk of the firms, we include a variable related to the return volatility: $\sigma(RET)$, which is defined as the annual standard deviation of daily returns.

7.3.2 Sample and Descriptive Statistics

Here we gather data from Wharton Research Data Services (WRDS), and more specifically, the Center for Research in Security Prices' (CRSP) monthly security files. Here data on bid-ask spreads, trading volumes, share prices, and return volatility are available from 1973 until 2017, also after it has been cleaned. When cleaning the data, we remove missing values and average monthly values over year T. After removing all errors, we end up with 5494 observations with observations through all years. However, there is an overweight of new observations and fewer observations from especially the 1970's.

Table 9 below shows the descriptive statistics.

Table 9 – Descriptive Statistics on Bid-Ask and DQ

	Obs	*Mean*	*Std. Dev*	*Min*	*Q1*	*Median*	*Q3*	*Max*
BidAsk	5494	0,140	0,203	0,000	0,013	0,036	0,209	1,927
DQ	5494	0,696	0,108	0,310	0,593	0,732	0,782	0,920
LOGVOL	5494	5,377	0,743	1,599	4,983	5,444	5,876	7,297
LOGPRICE	5494	1,598	0,338	-1,505	1,424	1,626	1,803	2,994
Std.dev(RET)	5494	0,020	0,011	0,000	0,013	0,017	0,023	0,157

7.3.3 Empirical Results

Based on the covered literature and analysis throughout the paper, we expect the coefficients related to firm price LOG(PRICE) and return volatility $\sigma(RET)$ to be positive. Firstly, a higher price means that the numerical value of bid and ask prices are higher, e.g., if investors offer (bid) 0,2% below the asking price, it will result in a numerically higher spread compared to if the stock was lower. Secondly, financial theory suggests that with higher stock liquidity, i.e., lower bid-ask as this is our proxy of such measure, volatility decreases since volatility can describe the level of uncertainty and risk in the market. Thus, if volatility is low and uncertainty and risk are at a low, then the bid-ask spread is small. For the β relating to the trade volume LOG(VOL), we predict a negative relationship since when trading volume increases, liquidity is expected to increase and vice versa.

Most importantly, the coefficient related to DQ is predicted to be significantly different from 0 and negative in the regression, hence illustrating that a better DQ (public information) is expected to result in narrower bid-ask spreads and lower risk of informed trading.

Table 10 – Correlation between Bid-Ask Spread and DQ

	DQ	*Bid-Ask*	*LOG(VOL)*	*LOG(PRICE)*	*Std.dev*
DQ	1				
Bid-Ask	-0,638	1			
LOG(VOL)	0,557	-0,395	1		
LOG(PRICE)	0,203	-0,010	0,242	1	
Std.dev	-0,132	0,134	0,002	-0,138	1

From the correlation matrix in Table 10 above, we see that the coefficients in broad terms are as expected. Only the slightly negative relationship between stock price and bid-ask spread is inconsistent with the expectations and does not make any intuitive sense. Further, the correlation coefficient between DQ and bid-ask is relatively large (negative). However, at a level of -0,638, we do not worry about collinearity issues.

Table 11 and 12 below show that DQ affects the bid-ask spreads negatively and β_1 is significant, both when including and excluding firm fundamentals. Further, our expectations are that trading volume is negatively correlated with bid-ask spreads and facilitates increased liquidity is confirmed. Thus, the higher the trading volumes, the better aligned are the investors' decision-relevant information. Price is positively associated with bid-ask spreads as expected, and all three coefficients are significant as indicated by their p-value.

Return volatility was expected to have a positive association to bid-ask, which the correlation matrix above also confirms. Though, when controlling for fixed effects, a negative relationship is indicated, which is counterintuitive. This relationship is, however, not significant.

With the significant coefficients, it should be taken into account that the bid-ask spreads have decreased massively after stock markets converted to decimalization of quoted stock values, as seen in Appendix 6 (Mulligan, 2001). A further explanation to the decreasing bid-ask spreads and the increasing trading volumes (and these factors' relationship) could be that trading automation is being increasingly utilized through algorithms that either read financial statements automatically or other automated signals. This is a relatively new area of research, but evidence has been found suggesting that algorithm trading narrows bid-ask spreads and hence reduces adverse selection. Thus, studies indicate that improved liquidity enhances the informativeness of quotes with the increased use of technology when trading (Hendershott et. Al., 2011; Upson & Van Ness 2017).

In sum, the predictions are mainly as expected, and the necessity for controlling for firm and time fixed effects are confirmed with the relationship between variable changes in value and even more important changes in the sign (+/-) changes.

Table 11 – Bid-Ask and DQ Incl. FE excl. FF

	Coef.	*Std. Error*	*P-value*
Intercept	0,025	0,072	0,729
DQ	-0,191	0,035	0,000
LOG(VOL)	-0,019	0,003	0,000
LOG(PRICE)	0,104	0,006	0,000
Std.dev(RET)	-0,194	0,198	0,327

Table 12 – Bid-Ask and DQ incl. FE and FF

	Coefficient	*Std. Error*	*P-value*
Intercept	0,022	0,072	0,526
DQ	-0,191	0,036	0,000
LOG(VOL)	-0,038	0,004	0,000
LOG(PRICE)	0,102	0,006	0,000
Std.dev(RET)	-0,186	0,196	0,345

7.4 DQ and Cost of Capital

Our final series of regression analysis is conducted in order to validate the relationship between DQ and the cost of capital for firms. Hence, we seek to test H4: A negative relationship exists between DQ and cost of equity, H5: A negative relationship exists between DQ and cost of debt, and H6: A negative relationship exists between DQ and cost of capital, which will be conducted using the following model:

$$CoC/CoE/CoD = \beta_0 + \beta_1 * DQ_{i,t} + \beta_2 * ROA_{i,t} + \sum FE.Industry + \sum FE.Year + \sum Firm.Fund + e_{it}$$

The depended variables are estimated as follows:

Cost of equity **(***CoE*) is estimated using the capital asset pricing model: $CoE = R_f + \beta * (R_m - R_f)$

Where:

R_f = the risk-free rate of return

$R_m - R_f$ = the risk premium for the use of equity

β = the comovement of each security with its market

Beta for the sector is used to adjust for a company's debt to equity ratio. We use the long-term treasury bond rate as the risk-free rate, and a 5,5% risk premium, or as reported in the datasets, if different (damodaran.com).

- Beta is estimated by regressing weekly returns on stock against S&P 500, using two years and five years of data. Beta = (2/3) two-year regression beta + (1/3) five-year regression. If the five-year regression beta is missing, it is replaced with one (damodaran.com). Beta is not directly included as a variable as it is indirectly represented in *CoE* and *CoC*.

Cost of debt, *CoD* (Pre-tax) $= R_f + Credit\ spread$

Where:

R_f = the risk-free rate of return

Credit risk depends on a firm's credit rating. A better credit rating will decrease the credit spread and vice versa (Moody.com).

It is estimated by adding a default spread to the risk-free rate. To estimate the default spread, a company bond rating is controlled for, which is then used to get a default spread. If the bond rating is not available, then the standard deviation in stock prices over the last five years is used to estimate a default spread (damodaran.com). Following the intuition argued for throughout the paper, the higher the standard deviation, the higher the default spread, and hence the higher the CoD.

Cost of capital (*CoC*) resembles the WACC covered in section 4 and is the weighted average of the cost of equity and after-tax cost of debt, weighted by the market values of equity and debt: Cost of Capital = Cost of Equity (E/(D+E)) + After-tax Cost of Debt (D/(D+E)). For the weights, cumulated market values for the entire sector are used. For the tax rate, we apply the marginal tax rate.

7.4.1 Control Variables

We find the following variables most relevant to include in order to ensure that DQ's effect on the cost of capital measures is being illustrated as truthfully as possible. Again, we realize that

including more variables, especially related to the market capitalization of the included firms, such as book-to-market ratios, could improve the findings, but the available data were once again too affected by errors.

Profitability

ROA = income before extraordinary items/total assets and will be used as a proxy for profitability. Studies show that profitability affects a firm's credit rating positively (Ashbaugh-Skaife & LaFond 2006). Furthermore, we assume that credit ratings are negatively associated with cost of capital, consistent with the assumptions of Kisgen (2006). Following this argumentation, we expect ROA to be negatively related to all cost of capital measures.

Firm size

It is also common in economic literature to include the market value of equity, but we choose not to. The reason is that we already include total assets, and these are strongly correlated (Chen et. Al., 2015). Even though LOG(AT) has already been covered as to why it is relevant to include when controlling for firm fundamentals, we find it relevant to argue for the relationship of cost of capital. Studies find that firm size affects the cost of capital and they argue that larger firms face lower default risk and are therefore expected to have a lower cost of capital (Titman & Wessels, 1988; Ashbaugh-Skaife & LaFond, 2006). As mentioned earlier, literature on the topic suggests different measures for firm size. We will continue with the natural logarithm of total assets even though the findings of Titman & Wessels (1988) use total sales instead of assets.

7.4.2 Sample and Descriptive Statistics

Here we gather data from htttp://damodaran.com, which is a database constructed by Aswath Damodaran, who is a renowned finance professor of Finance at the Stern School of Business at New York University. The database is comprised of a vast amount of financial data. The data is collected from various sources, namely: Bloomberg, Morningstar, Capital IQ, and Compustat. We gather data from the data group labeled "Risk/Discount Rate" and we then choose the dataset "Cost of Capital by Industry Sector" under the topic "Discount Rate Estimation". Lastly, we choose U.S. as the regional dataset (damodaran.com).

Here data is available from 1998-2017 giving us 19 years of data. Moreover, the GICS Sub-industries of the companies are matched with industry indexing of A. Damodaran. Thus, the value for each firm in each year reflects the CoC value for the suitable sub-industry (88 different when removing utility and finance related sub-industries). In most cases, the indexing of A. Damodaran matches the actual GISC indexing, and the manual distribution have been done by our best ability when needed.

For the ROA data, we have already used the component AT (Assets – Total). From Compstat we can also find the IBCOM (Income before Extraordinary Items) (Appendix 1), which is divided by total assets.

Table 13 below shows the descriptive statistics of the included variables and the following will present arguments for the inclusion of the independent variables.

Table 13 - Descriptive Statistics for Cost of Capital and DQ

	Obs	*Mean*	*Std. Dev*	*Min*	*Q1*	*Median*	*Q3*	*Max*
CoC	4541	0,081	0,094	0,042	0,068	0,079	0,090	0,230
CoD	4541	0,055	0,015	0,028	0,040	0,056	0,064	0,088
CoE	4541	0,094	0,021	0,052	0,081	0,092	0,103	0,232
DQ	4541	0,727	0,089	0,380	0,686	0,751	0,789	0,920
ROA	4541	0,057	0,122	-2,687	0,029	0,061	0,097	0,482

7.4.3 Empirical Results

As we argued above, we expect ROA to negatively affect all three cost of capital measures, implying expectations of negative correlations as well as significantly negative coefficients in the regression. The correlation coefficients of -0,365, -0,219 and -0,242 for CoE, CoD and CoC respectively, confirm this.

Most importantly, the coefficient related to DQ is predicted to be significantly different from zero and negative for all three regressions, hence illustrating that better public information is expected to result in a lower cost of capital, whether it is equity or debt capital or a combination of both. The correlations between the variables below in Table 14 confirm these arguments.

Finally, the correlation below indicates a positive relation between DQ and firm profitability. Whether this is related to the signaling hypothesis indicating that successful firms or managers are incentivized to increase disclosure to show the performance or the other way around where increased disclosure enables firms to be more profitable due to the benefit of reduced information asymmetry, the results do not indicate.

Table 14- Correlation Matrix Cost of Capital and DQ

	CoE	*CoD*	*CoC*	*DQ*	*ROA*
CoE	1				
CoD	0,412	1			
CoC	0,893	0,526	1		
DQ	-0,205	-0,121	-0,160	1	
ROA	-0,365	-0,219	-0,242	0,117	1

Table 15 below shows the results for the three regressions testing H4, H5, and H6. Here it is evident that DQ is significant for all three cost of capital measures, which makes sense as they are highly correlated. If we use CoC as an example, the coefficient of -0,037 indicates that a one standard deviation (0,089) increases in unconditional DQ is associated with a 0,37% decrease in CoC. This is highly relevant, and we can consequently confirm H4, H5, and H6, and conclude that increased DQ is negatively associated with cost of capital.

Table 15 – Cost of Capital Measures and DQ

CoE	*Coefficient*	*Std. Error*	*P-value*
Intercept	0,036	0,064	0,238
DQ	-0,048	0,028	0,000
ROA	-0,069	0,005	0,046

CoD	*Coefficient*	*Std. Error*	*P-value*
Intercept	0,024	0,049	0,517
DQ	-0,023	0,039	0,000
ROA	-0,019	0,009	0,097

CoC	*Coefficient*	*Std. Error*	*P-value*
Intercept	0,032	0,056	0,414
DQ	-0,037	0,033	0,000
ROA	-0,079	0,006	0,017

7.5 Summary

The sections above provide answers to the sub research questions 2, 3, and 4. This was done by firstly developing relevant hypotheses based on the findings from previous studies on the subject. Following this, relevant measures for testing disclosure quality's relationship with liquidity and cost of capital were discussed. Here it was found of highest value relevance to adapt to a self-constructed disclosure measure, namely a proxy measuring disclosure quality through the disaggregation of financial statements (DQ). This measure was argued to better capture disclosure quality than many other popular proxies, better resemble disclosure aspects of where blockchain technology could have a possible effect, and finally be relatively new, allowing us to contribute to the existing literature more significantly. With respect to the chosen cost of capital measures, we deploy the WACC and its elements of cost of equity (CAPM estimated measure) and cost of debt. Finally, bid-ask spreads were used as the liquidity measure.

With respect to the formulated hypotheses, we find a significant increase in DQ in the sample period as well as significant variations across industries. This was confirmed by a Hausman test, indicating that it was necessary to control for industry and time fixed effects in our test of the rest of the hypotheses, and we thereby confirm H1 and H2.

When testing the relationship between DQ and bid-ask spreads, we find a significantly negative relationship, allowing us to confirm H3 and indicate that a reduction in asymmetric information increases liquidity.

Finally, we test H4, H5, and H6, which suggest that increased DQ will reduce the cost of equity, debt, and capital of firms. All these hypotheses are also confirmed with significantly negative DQ coefficients for all regressions.

7.6 Research Limitations

The analysis above is based on several assumptions and on the use of several proxies working as measures for key aspects of the research. Consequently, there are several limitations that need to be addressed. The following section will cover the most central limitations, namely limitations related to the chosen disclosure measure of DQ, the cost of capital measures estimated from CAPM, the sample size, and the paper's ability to generalize its findings.

7.6.1 The Disclosure Measure

This thesis is applying a self-constructed disclosure index for measuring the disclosure quality and is hence inclined to be more subjective, why the replicability of the study may be difficult. However, the replicability issue is addressed in the methodology section and diminishes as all data is available. Also, at least one other study applies this measure, namely Chen et al., (2015) and our qualitative findings are in line with the findings of this study. With respect to the subjective aspect, we acknowledge that this measure was applied as is eases the transition to our discussion in the following section. This discussion concerns blockchain technology's possible effects on financial disclosure. Here we have identified the detail level of disclosure to potentially be affected, why we chose a disclosure measure displaying this. However, as DQ is a measure of annual report disaggregation level, it does not capture the timeliness of new information because annual reports provide, perhaps predominantly, a confirmation role to earlier or timelier voluntary disclosures. This aspect was found as central to the value relevance of disclosed financial information in the literature review.

Finally, it is possible that the complementarity between mandatory and voluntary disclosure can induce an upward bias in the estimation of the impacts of DQ. Future researchers interested in using DQ should consider these limitations.

7.6.2 The Cost of Capital Measures

When choosing the applied cost of capital measure, we primarily focused on finding a relevant cost of equity measure. We choose to apply a CAPM estimated measure as we argued for the relevance in relation to the practical valuation of firms as well as the limited research using this method, thus allowing us to contribute to the existing literature by filling this theoretical knowledge gap.

However, the CAPM makes the assumption that the priced risk factors are known and further restricted to the market beta factor in the model; hence CAPM overlooks estimation risk. Therefore, the cost of capital can solely be influenced by information via the market beta. However, it is proposed by theory that negative relationships between the market beta and the level of information do not exist (Botosan, 2006). Also, the data available for this approach have several drawbacks. Firstly, it is available for a shorter time period than what we investigate in our other hypothesis tests. Also, the data we used was only available on GICS sub-sector level, and not on firm level. This a major limitation to the analysis as the sample size decreases and the estimate illustrates sub-sector values instead of the true firm values. However, judgment call was made, and we argue that the number of industries (88) included and the amount of time saved taking this approach, outweighs the utility of collecting/estimating the value individually for each firm.

In relation to the cost of debt estimate, firms' actual cost of debt could be used instead of the estimated version we apply. Future research may test if there are qualitative differences in the applied approaches. Our expectations suggest that there are no differences.

7.6.3 The Sample Size

The sample consists of 402 American companies, which were all included in the S&P 500 index on the 10th of April 2018. Depending on the chosen time period, which includes spans from

1973-2017 and 1998-2017, we have between 4541 and 12978 observations. We argue that this sample size should be large enough to avoid biases. However, the number of observations for each year are not equal, which indicates that not all firms have observations for each year. Further, the number of observations for early observations, namely observations from the 1970's is significantly smaller than the rest of the sample. This might result in the observations not being equal to the actual mean of periods with fewer observations. Also, as we only include firms from the S&P 500, we only look at large firms. However, if the study was to be replicated, using a larger sample could open up for certain concerns, which must be addressed. Chen et al., (2015) argue that Compustat concentrates more on bigger companies compared to smaller companies in regards to gathering and coding data; hence, bigger companies could greatly dictate DQ's variation, even if the research was to be replicated with all available firms in the database. Furthermore, the conducted research is only involving companies listed in the U.S., and the results can consequently not be generalized for other countries.

In the remainder of the thesis, a link will be made to the future situation regarding financial disclosures. As mentioned in the introduction, the inspiration to the chosen research topic came from the emergence of blockchain technology and the associated attributes, namely increased transparency, automation of processes, trust, and reduced time and costs with respect to financial disclosure. Consequently, we will attempt to relate the empirical findings to attributes of blockchain technology, as we believe these can result in the disclosure level being significantly improved. However, in order to comprehensively discuss the possible effects, the characteristics and application areas must be understood, why the following will cover the relevant aspects of the technology in this context.

8. Blockchain Technology

Literature regarding blockchain technology will be covered in the following to illustrate the characteristics that potentially could be beneficial for financial disclosure. This will further lead to a discussion about the possibilities blockchain technology entails in regards to increasing the above mentioned DQ score, which is found to be attractive for both companies and investors. This section is essentially, where we found the inspiration for the research topic of the thesis why it is deemed fundamental for the overall paper.

In this section, the focus is on the genesis of blockchain technology and its development since its origin. Further, imperative terms, applications, and limitations of the technology are described to develop a thorough understanding of the subject, and how the features can change many aspects of the process of disclosing financial information.

8.1 Origin

The idea of blockchain originated in 1991 when Haber and Stornetta (1991) proposed a solution to the digital time stamping of documents in regards to the verification of authorship of intellectual property in the article "How to time stamp a digital document". However, the initial practical application of blockchain technology was established by Satoshi Nakamoto in 2009 when he pushed forward the major virtual currency known as Bitcoin, which adopts blockchain as the underlying mechanism to validate ownership of this digital cash (Hileman & Rauchs, 2017). Since then, blockchain technology has grown, and a wide variety of applications now exist, which are touched upon in a section to follow. Interestingly, blockchain technology is not an immensely new technology, but rather an intelligent mixture of already-existing technologies, such as distributed timestamping, peer to peer (P2P) networking, digital signatures, and more (Hileman & Rauchs, 2017).

8.2 Definition

Blockchain has no definitive technical definition but is instead a term used by different actors to refer to some level of correspondence to bitcoin and its database (Narayanan & Clark, 2017). Blockchain is essentially a database that is duplicated in a P2P network. This definition is however applicable in other distributed databases as well, which are sold by software vendors like Oracle. What makes blockchain different is that actors in blockchain networks agree upon changes in the shared database without the necessity of trusting the integrity of each other (Hileman & Rauchs, 2017). Further, consensus regarding the authorization of each transaction is reached by the majority of the actors in the system (Crosby et al., 2015). Lazanis (2015) describes blockchain similarly by saying it is a public, decentralized, and distributed ledger that can store and validate all transactions passing through. This further means that no single actor owns nor controls the database, and alternatively, the ledger is distributed between all parties on

the network. When dealing with blockchain, it is essential to note that no intermediary, such as a bank, is needed apart from the user on the backend of the transaction. An example of this would be that when sending a Bitcoin, it is sent directly from one user to another without any third party holding it along the way. This ensures that the trust factor is eliminated since the necessity of trusting a third party is erased (Lazanis, 2015). The authorization process is managed by the network's users, called miners, who constantly use computers with the ambition to solve involved mathematical equations to ultimately earn a predetermined reward in the form of bitcoins. These miners function as a way of securing the network by verifying the transactions going through the blockchain (Lazanis, 2015). A further description of blockchain is proposed by Swan (2015), who suggests that blockchain, in addition for transactions, can be used as an inventory system for the tracking, recording, monitoring, and transacting of all assets. Indeed, blockchain functions similarly to a large spreadsheet for registering all assets, and an accounting system for transacting them on a global scale that can consist of all forms of assets held by all parties globally.

Since the Internet, Blockchain technology has turned out to be one of the most hyped technologies but has simultaneously become one of the most inadequately conceived. A recent HSBC survey from 2017 uncovered that 80% of the people, who had heard about the technology claimed they did not understand it (HSBC, 2017). This remains although considerable attempts have been made by industry reports, online as well as academic courses, media, and other mediums to rationalize the technology to the unspecialized public (Hileman & Rauchs, 2017).

Due to this excessive incomprehension, it is necessary to state the integral foundation of blockchain to develop a clearer understanding of the matter before shoveling further into the subject. This is accomplished by articulating inevitable characteristics, which have led to the technology's recognition, and by defining paramount terms and applications within blockchain.

8.3 Terminology and Characteristics

The following are central characteristics and reasons for the technology’s recognition:

- *Public while anonymous*: Due to hashing, the blocks are anonymous, yet they remain public because of the copies on the entire nodes of the network they generate. The meaning of public is that everyone can review the transactions using mining, and subsequently, transparency becomes apparent (Shaw, 2017).
- *Decentralized*: No single authority controls it. No individual owns nor rules the database, and consequently, the ledger is distributed among all individuals on the network (Lazanis, 2015).
- *Immutable*: The ledger is immutable, meaning it is possible to add new transactions but impossible to remove, adjust, or backtrack existing ones (Narayanan & Clark, 2017).
- *No mediator fees* (Shaw, 2017).
- *Transaction-verification*: Every ten minutes, transactions are authorized through the process called mining (Shaw, 2017).

The subsequent includes several essential terms related to blockchain, which will function as important information to the overall understanding of the topic.

Blocks

Transactions are combined into single blocks, and every ten minutes a new block is created and added to the continually growing public ledger, namely the blockchain (Swan, 2015). Every block is organized chronologically on the chain and includes parts from the previous block (a hash), so it functions as a fully assembled and immutable database (McKinsey & Company, 2017; Swan, 2015). Every block consists of four elements: a timestamp, a reference to the preceding block, a rundown of the transaction, and the proof of work (POW) that was used to create the secure block (Shaw, 2017).

Secure hashing implies that it is unachievable to alter a single block without changing the subsequent blocks. It would quite frankly be impossible for any actor to access the technology's network and complete a successful transfer worth X amount of money due to two reasons identified by Shaw (2017):

1. Each block demands numerous independent confirmations.

2. Solving mathematical equations for the cryptographic issues is challenging and requires specialized miners.

Nodes

Nodes are every single distributed computer connected to the network using a client that performs the task of validating and relaying transactions. All these nodes carry a copy of the blockchain, which is downloaded in consequence of miners joining the network (Swan, 2015; ICAEW, 2017). The data is duplicated, synchronized, and distributed between all of the nodes over several networks (Shaw, 2017).

The Ledger

The ledger is a database and a place to record all transactions that occur in the system and is open to and trusted by all actors using the system. Bitcoin applies this system for the conversion of payments into a currency.

Moreover, it is necessary to state that there are several desirable properties regarding the ledger and the choice of data structure. First off, the ledger should be immutable meaning that it should be possible to add new transactions but not remove, alter, or revert existing ones. Also, it should be attainable to obtain a brief digest of the status of the ledger at any point in time. A digest is a string that makes it possible to detect if the ledger is being tampered with. This happens since the string attains the avoidance of storing the whole ledger, which means that if any actor on the network tried to tamper with the ledger, the remaining digest would alter, and consequently the tampering would be revealed. The rationale behind these characteristics is that the ledger is a universal data structure managed jointly by untrusting actors, which is in contrast with an ordinary data structure stored on a lone machine (Narayanan & Clark, 2017).

Linked Timestamping

According to Haber and Stornetta's proposition from papers between 1990 and 1997, documents are continually produced and broadcasted. The generators of these documents put forward a time of creation and sign the documents, the timestamps, and the prior broadcasted document. The preceding document has signed its forerunner and subsequently a long chain of documents is

created with indicators back in time. Once a message is timestamped, it is impossible for any outside actor to alter it because the generator cannot change the message without changing the rest of the chain that follows. This further means that the chain up to this specific point is immutable, locked in, and temporarily ordered in case an individual item is received from a trusted source (Narayanan & Clark, 2017).

Proof of Work (POW)

Proof of Work verification indicates that transactions have been verified through mining and is an element of the system's consensus mechanism (Swan, 2015). The process remains to ensure trustless general agreement and demands that costly computations should be completed to facilitate transactions. Hashed blocks are distinguished as POW (Shaw, 2017).

POW has two main properties. The first is that it functions as a defense mechanism against Sybil attacks (where a single node claims multiple identities (Howard)), spam, and denial of service. The second is that the resulting puzzle solutions should be effortlessly validated, meaning minor computational difficulty for recipients (Narayanan & Clark, 2017).

Hashcash

Hashcash is a POW function and an algorithm that produces data that is simple to validate for others, but complex in terms of the computational work required producing. A hash and a nonce number (random string of numbers (Investopedia)) are needed for all blocks to create a hash with an adequate number of leading zero bits to meet the complexity-requirement. It is the miners' job to create these (Shaw, 2017).

Hashcash is based upon an uncomplicated characteristic: a hash operates as a random function for some practical intentions, which means that the only way to find an input that hashes to a specific output is to try diverse inputs until the desired output is created. Moreover, the only way to find an input that hashes into a certain set of outputs is to hash distinct inputs individually (Narayanan & Clark, 2017).

Mining

Mining is computational processing work, where users use their computing abilities to validate and record payments into the public ledger (Swan, 2015). The process involves intricate hardware, which is used to complete mathematical calculations to ultimately avoid double spending (double spending is described below) (Shaw, 2017).

Solving proof of work is completed by users called miners. Miners are always in a race with each other to find the next puzzle solution; the individual miner works on a marginally distinct version of the puzzle so that the success rate is proportional to the fragment of the universal mining power the miner controls (Narayanan & Clark, 2017). The miner who first solves the puzzle gets to place the following block of transactions on the ledger and is rewarded accordingly (Investopedia). In exchange for engaging in mining, individuals or companies who contribute a block is rewarded with transaction fees and newly created units of the currency (Swan, 2015; Narayanan & Clark, 2017). In the case of an inoperative transaction or block being added to the public ledger by a miner, it will most probably be discarded by the bulk of other miners who add the following blocks. This will further discredit the reward for the invalid block. In this way, due to the incentives, miners ensure that each individual complies with the protocol (Narayanan & Clark, 2017).

Double Spending

Double spending is where the same digital file is being copy-and-pasted and transferred several times without having a centralized ledger preventing users from spending the same digital file twice (Hileman & Rauchs, 2017).

The double spending problem must be avoided at all costs (Shaw, 2017). Blockchains solve this problem through a mix of a specific data structure and the consensus mechanism, where each individual user's view of the ledger is aligned with all other users' view (Hileman & Rauchs, 2017).

To sum up the above sections, Appendix 7 illustrates how blockchain works in practice.

8.4 Fundamental Applications of Blockchain Technology

Blockchain technology carries plenty of benefits to be emphasized. In the midst of these are point to point transmissions as well as increased efficiency through the distributed ledger, lower costs as a result of the entirely automatic processes combined with the elimination of intermediaries, and lastly improved safety due to the distributed data storage that cannot be altered because of the use of hashes, which ensures that participants' personal information is further guarded. All strong indicators that blockchain potentially is highly relevant for different sectors in the future.

Thus, it has been demonstrated, that the foundation of the technology is profoundly pertinent in various situations. The following section of the thesis serves to portray the different areas in which the technology is applicable.

Alongside the attributes described earlier, it can be determined that blockchain can be utilized to form trust in circumstances where mutual trust between actors is nonexistent, and so it solves the issue of grand costs generated due to centralization, by working as a credit medium to decrease fraud and operational danger. This is supported by the actuality that executives in the business expect that the most probable adaption of blockchain will be inside payment infrastructure, fund transfer infrastructure, and digital identity management (PWC, 2017).

For structure and usefulness, the current and potential applications of the technology are divided into three distinct groups as proposed by Swan (2015):

Blockchain 1.0

Blockchain 1.0 is currency and applications associated with cash such as digital payment systems, remittance, and currency transfers. Presently, there are plenty different cryptocurrencies, but bitcoin comprises the majority of the market capitalization (coinmarketcap). These currencies may have slightly various characteristics, but primarily, they are used similarly as a mean of exchange for transfers and payments of digital property.

Blockchain 2.0

Blockchain 2.0 is a layer of contracts, which are more extensive than everyday cash transactions. This layer of contracts includes stocks, loans, mortgages, bonds, smart contracts, titles, smart property, and futures. Where the blockchain 1.0 grouping stands for the decentralization of money and payments, the 2.0 grouping represents the decentralization of markets.

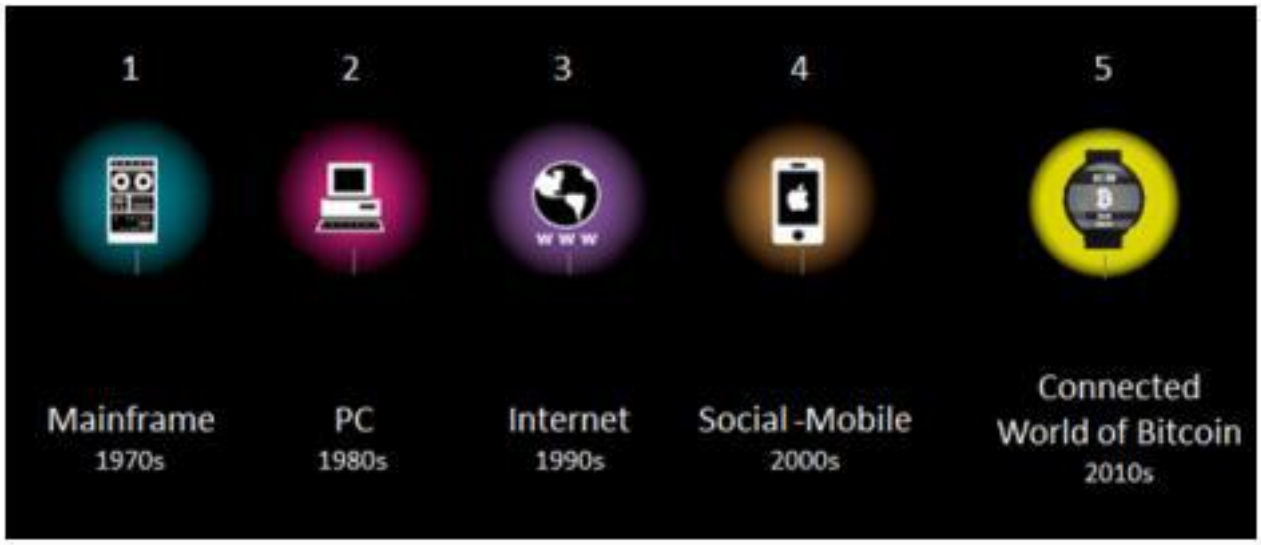
Blockchain 3.0

Blockchain 3.0 is applications beyond the bounds of currency and financial markets and involves mainly government, science, culture, art, and literacy. Examples of the 3.0 grouping applications are voting systems, Namecoin (the decentralized domain name system), freedom of speech applications including Ostel and Alexandria, and several others deploying the transparency and immutability properties of the technology.

The global research director for digital strategies at research firm IDC, Michael Versace, describes the overall technology as an advancement within industries and innovation based upon the capability of the third platform, technology. Mainframes and the associated networks are elements of the first platform, while personal computers, the Internet, and local area networks make up the second. The third platform ensures computing anywhere and promptly, while it also makes it possible for firms to use computing resources in joint communities. Versace continues and says, "The core capabilities of the third platform of technology are beyond any we have seen before. Innovation accelerators like blockchain mean we can achieve technology value outcomes that we couldn't achieve before" (Underwood, 2016).

Similarly, Swan (2015) produced the following chart that portrays the potential importance of the technology, which follows a comparable platform pattern as described by Versace:

Figure 6 - Disruptive Computer Paradigms



Source: (Swan, 2015).

8.5 Expectations of the Technology

The growth expectations for the blockchain technology market is immense. The industry is predicted to be up by more than 31 percent in 2022 compared to its current state according to analysts. In addition, numerous banks and corporations are moving to comprehend blockchain and intend to deploy it. A portion of vital statistics regarding the technology's potential and how corporations expect to fulfill this potential is emphasized by PYMNTS (PYMNTS, 2018).

According to Markets & Markets data, the valuation of the industry is expected to rise to $7.7 billion in 2022, which is a significant increase from 2016 where the market was valued at $242 million (PYMNTS, 2018). Further, the research firm Statista provides inside to the value of investment in the U.S FinTech market in 2018, which is valued at $4.7 billion. American Banker has reported that blockchain is expected to draw increased support and investment (Crosman, 2017). Despite the many interesting application areas, we will only cover the expectations for the technology within the aspect of financial disclosure and reporting.

The massive interest is justified, and many industry professionals argue that blockchain may become the industry standard for accounting and reporting sooner rather than later, hence overturning decades of reporting practices and backend systems (FERF, 2017).

As illustrated above, the expectations of the technology are colossal and have often been accused of being hyped above proportions. Nevertheless, Vice President of the XBRL Services of Merrill Corporation, Lou Roman, along with several other industry experts contradict this notion. They suggest that it has become the norm rather than the contrary for major corporations to experiment with blockchain technology as a safe and transparent mean of digitally tracking the ownership of assets (Rohman 2016). In addition, PWC (2017) illustrate that the investments in blockchain technology have been drastically increasing from 16 million USD in 2011 to 1,6 billion USD in 2017 (Appendix X). This facilitates arguments against the notion that is often made, regarding the general aspects of blockchain technology being dependent on the success of Bitcoin. "*Bitcoin could disappear tomorrow, and it would not affect the future of blockchain technology*," says Campbell Harvey, Professor of Finance at Duke University's Fuqua School of Business (FERF, 2017).

The massive technology is far more general, and the significant investments, as well as the development of the technology, are expected to remove many of the issues within the technology, which are going to be addressed later. Specifically, the expectations of the technology in financial disclosure and reporting contexts can be summed up into one term: real-time. With the intense investments and research, the technology is going to be inherently more trustworthy and accurate and consequently facilitating increased transparency and frequency of date of delivery for financial statements. Ultimately, the expectation is that they will be more regularly seen in real-time (Berkman 2017).

Finally, in order to facilitate a flowing transition, it is found relevant that the technology can work together with existing technologies. Here the possibility of blockchain and XBRL to complement each other is considered particularly relevant in terms of enabling the transition as well providing means for analyzing the data more efficiently (Rohman 2016).

8.6 Challenges and Limitations

Despite blockchain's many upsides and expectations described previously, it is still early days for the technology, and many potential barriers are present. Due to the number of challenges the technology encompasses, it is necessary to include a section, which focuses solely on limitations.

This functions as a crucial section as these challenges need to be overcome to ensure a broad industry adoption (Hileman & Rauchs, 2017).

8.6.1 Business Models

The first limitation is the issue regarding the lack of interoperability between DLT and existing network and enterprise systems (Hileman & Rauchs, 2017). Numerous classical business models may not be adaptable to the deployment of blockchain due to the fact that the whole point of decentralized peer-to-peer models is that no intermediaries are present to seize a cut, which frequently is the opposite in traditional business models (Swan, 2015). Those business models that genuinely are compatible with blockchain still ought to confirm they are performing as instructed (Swan, 2015). While certain business models like Ripple, a network using the force of blockchain to send money globally (Ripple), have highly coherent revenue models that are rather uncomplicated to enforce; other, more involved, applications such as the artificial intelligence (AI) derived decentralized autonomous corporations/organizations (DACs/DAOs) have vastly complex business models, which remain to prove effective (Swan, 2015).

8.6.2 Government Regulation

Another challenge is the unclear government regulations that potentially could be of critical importance in whether or not the technology will become a well-established financial services industry (Swan, 2015). Various issues regarding the regulations of blockchain exist. One of the concerns is the need to regulate the legal framework and recognize cryptocurrencies as a valid form of exchange. The cryptocurrencies are the means by which individuals engage in blockchain protocols and are hence the fundamental feature of the technology why an adjustment to the regulatory framework is essential (Sharma, 2017). The New York Bitlicense could potentially be the first step towards extensive regulation. While the license presently is exceptionally broad and contains extraterritorial language, which is concerning for the Bitcoin industry, regulated consumer protections, such as KYC requirements for money service businesses (MSBs), for industry actors could accelerate the general advancement of the industry and simultaneously lessen the consumer worries of potential hacking attacks that appear to haunt the industry (Swan, 2015).

An additional concern is the needed regulation of taxation to comprise a peer-to-peer sharing economy. Correctly taxing a decentralized peer-to-peer sharing economy of Airbnb 2.0 and Uber 2.0 operated on OpenBazaar where participants pay with cryptocurrencies is virtually impossible due to the potentially lost conventional tracking of the consumption of goods and services. A possible solution to this has been proposed, which would require a significant reconstruction of the current income tax-based system to a consumption-based tax on large-ticket commodities like houses and cars (Swan, 2015).

8.6.3 Privacy

Since data is shared among numerous peers, distributed ledgers expose more data than centralized databases to other actors. This is unaffordable for firms due to legal reasons and further because this leaked private information can present a competitive edge to competitors. Therefore, techniques meant to increase privacy are being developed in an effort to becloud the content of the transaction or the actor's identity (Hileman & Rauchs, 2017).

8.6.4 Technical

There are undoubtedly several technical challenges to beat before blockchain can be adopted across industries. Many of these are above, and beyond the bounds of the paper, however, it is necessary to specify one, namely wasted resources. For the technology to sustain and remain trustable, an excessive amount of energy is required through mining. It is assessed that energy worth $15 million per day is wasted on this process. This is essentially a twofold issue as the mining makes the technology trustworthy, but at the same time, this is the only benefit the spent resources generate (Swan, 2015).

8.6.5 Public Perception

The public often affiliates blockchain with Bitcoin, which in turn can result in adverse talk involving Bitcoin being projected on the underlying technology. Further, due to Bitcoin's pseudonymous characteristic where public key addresses are used to record transactions and send and receive Bitcoins, the public perceives it as a venue that can be deployed to facilitate illicit activities, which causes it to be one of the greatest barriers to increased acceptance (Swan, 2015). It allowed the creation of services like Silk Road – an anonymous marketplace for illegal goods

including stolen credit cards, drugs, and weapons. The public perception needs to change to establish further adoption, which is possible as more people start to use Bitcoin and have ewallets. In addition, the know your customer (KYC) regulated consumer protection requirements could mitigate the current consumer worry of malicious raids (Swan, 2015).

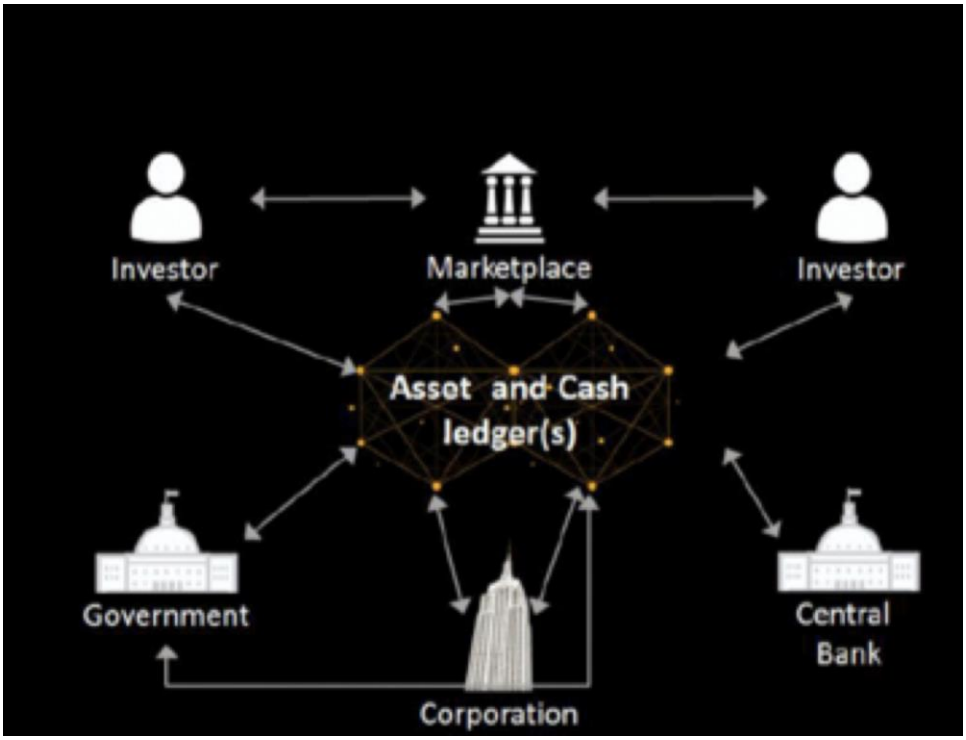
8.7 Research Implications

Despite the abovementioned limitations, blockchain technology contains characteristics, which make it applicable in many sectors. The researchers find the transparency component, the possibility of entirely automatic processes, and the potentially resulting trust, reduced time and costs, and firm efficiency to be especially interesting why it becomes appealing to analyze an area where these could optimize a current trend.

Financial disclosure is an area that possibly could face significant changes with the emergence of blockchain and its associating attributes. The previous-mentioned characteristics could potentially facilitate improved financial disclosure, and subsequently, it becomes appealing to discuss the possible implementation of blockchain technology in regards to financial disclosure and the probable effects of such. On the basis of the findings, the implications on disclosure quality as the users and producers of the information will be discussed in the following.

Figure 7 below illustrates the market with the adoption of blockchain technology, allowing for a better understanding of the possible scenario.

Figure 7 - Blockchain Technology and the Capital Market



Source: Jakob Heckscher, Manager, Ernst & Young Technology Consulting

9. Discussion

As was presented in the analysis of DQ, there are two primary mechanisms to the relationship between disclosure quality, liquidity, and the cost of capital. Firstly, it is indicated that a greater level of information reduces the cost of capital by decreasing the estimation risk of investors, which is a further element of risk, namely the skepticism of investors concerning their estimations of certain parameters. Secondly, increased information levels diminish the element of information asymmetry of a company's cost of capital; hence transaction costs decrease. Thus, stocks containing reduced information asymmetry, low transaction costs, and low estimation risk, are all favored by investors (Botosan, 2006). Leuz and Verrecchia (2000) and Mohd (2005) have illustrated that information asymmetry is lowered in the presence of greater quality disclosures, whereas Prodhan and Harris (1989) have discovered that increased disclosure decreases non-diversifiable risk.

According to Botosan (2006), and in relation to our findings, stock prices and liquidity should be higher due to the greater demand of stocks containing low transaction costs, low estimation risk, and less information asymmetry. Companies will be enabled to obtain more money when equity capital is issued, which leads to the fact that their cost of capital should be reduced. This is all due to the willingness of investors to pay more for such stocks.

Following this logic, a reduced cost of capital, reduced transaction costs, estimation risk, and information asymmetry are all considered attractive for companies and investors why it becomes interesting to draw upon blockchain technology and its characteristics as blockchain potentially could be an implementation that could function as an alternative and more efficient way of reducing these effects.

The transparency element, the completely automatic processes, and the trust component of blockchain technology, combined with the resulting reduced time and costs as well as firm efficiency make blockchain a potentially appealing way of increasing the detail level of the information being disclosed.

Co-founder and partner, Steve Nabil Lauritsen (Lauritsen), from Blockchain Nordic, which is a Danish digital asset investment firm supports our notion by saying that the cost of capital and information asymmetry are two advantageous effects to internal stakeholders in regards to things such as when making decisions and raising capital; hence the implementation of blockchain will benefit them. Furthermore, companies can benefit from cheaper capital from banks since they are additionally transparent; thus, the banks will be certain that the money is being spent on concrete processes rather than on corporate toys. That links back to blockchain consisting of this beneficial trustless network, where everything is recorded. Here, information asymmetry is the fundamental effect that decreases, so it is a favorable situation. It can further be argued that blockchain is the easiest and cheapest way of integrating an increase in the detail level of the disclosed information. Instead of having to do excessive amounts of manual work, the information on the blockchain can simply be checked and trusted due to its characteristics of being a transparent, automatic, and trustless network.

Thus, blockchain technology directly compares to DQ in the sense that it can optimize this score with its characteristics mentioned above. The analysis of DQ illustrated that higher disclosure quality lowers information asymmetry, estimation risk, cost of capital, and transaction costs, which are preferable effects for investors and companies. Therefore, it can be concluded that a focus needs to lie on figuring out how these can be further reduced. Implementing blockchain technology would be a way of improving the efficiency revolving around the level of disclosure of financial information due to its distinct characteristics.

9.1 Firms' and Investors' Perspective

Following the discovery of blockchain technology as a possible way of increasing the detail level of disclosed financial information due to its specific characteristics, it becomes interesting to examine which companies and investors would welcome such an implementation and which would be opposed to it. This has been done with the support of Lauritsen.

Regarding whether companies would be interested in such an implementation, Lauritsen thought it all depended on what information is being disclosed and whether the information is disclosed on a public or private blockchain. In the case of the information being published on a public blockchain, he saw more disadvantages than advantages for public companies, i.e., larger corporations. He proposed the question: Why would a company want to announce all its accounting in a highly competitive world publicly? In line with this, he went on to propose a McDonalds/Burger King example. Surely, bargaining power could be a valid reason for the disclosure, but as he points out, what is the extra cost of having the big 4 audit you? They are a genuine and credible source for auditing. He notes that if McDonald's were to disclose all their accounting on a public blockchain, then every little transaction would be disclosed; thus their corporate strategy would be revealed in detail. This means that Burger King would know all their expenditures and it could thereby potentially take this ledger and, by using big data software, translate the information and thus identify exactly which locations are losing money and which are the most profitable; hence increase competition accordingly. This could potentially remove entry barriers for new firms. These newcomers would be freed from taking risks in regards to locations and expenses since they would be aware of how much to spend and where the right

audience for the right product exists. By disclosing all the information publicly, boundless amounts of information are gained why it becomes a double-edged sword (Lauritsen).

This links back to the benefit and issue at hand. The disclosed information can be notably interesting for distinct actors at a certain time, but perhaps not the general public. If a private blockchain, on the other hand, was to be used and they decrypt the information for a certain actor at any specified time, then they would be able to address all the earlier mentioned benefits. However, by making all the information publicly available, the competitive advantage that a firm has over others in the field could be removed if the competitive landscape allows it. Contrarily, if the auditors persuade these firms to set up private blockchains, then it is completely different. The database would maintain its decentralized characteristic, but the access to it is private; hence, centralized solely to those relevant. The auditors, as well as governments, would benefit from reassurance when questioning particular activities, and would further have access to the blockchain and decryption tool, which would allow them to know exactly where, i.e., a capital gain came from (Lauritsen).

Despite these notions, we argue that even though the majority of firms may not be in a situation to deploy a public blockchain, some firms may, and consequently gain a competitive advantage. Our arguments follow, as disclosure levels already vary significantly across industries and firms, which was highlighted in the analysis above. Consequently, we find it reasonable to assume that firms which already have high disclosure levels might benefit from the increased transparency and their disclosure level will only be limited by GAAP regulations or technological limitations.

Another interesting point to make that Lauritsen comments on is that there is an adoption issue that is apparent, which could be another reason for why companies would be hesitant about such an implementation. Lauritsen says, “People don’t like what they don’t understand”, which takes us back to the earlier mentioned notice, uncovered by HSBC (2017), that blockchain technology is one of the most inadequately conceived technologies since the Internet.

Despite these worries, it is possible that both private and public companies can benefit from a trustless network like blockchain. In terms of accounting purposes, Lauritsen believes that

international companies that tend to depend on items sold largely, to restock, and potentially, due to logistics, may have bottlenecks in their business, can see these bottlenecks diminish if a transparent ledger is being used. Examples of these could include firms that work with cross-border supply chains and fast-moving goods.

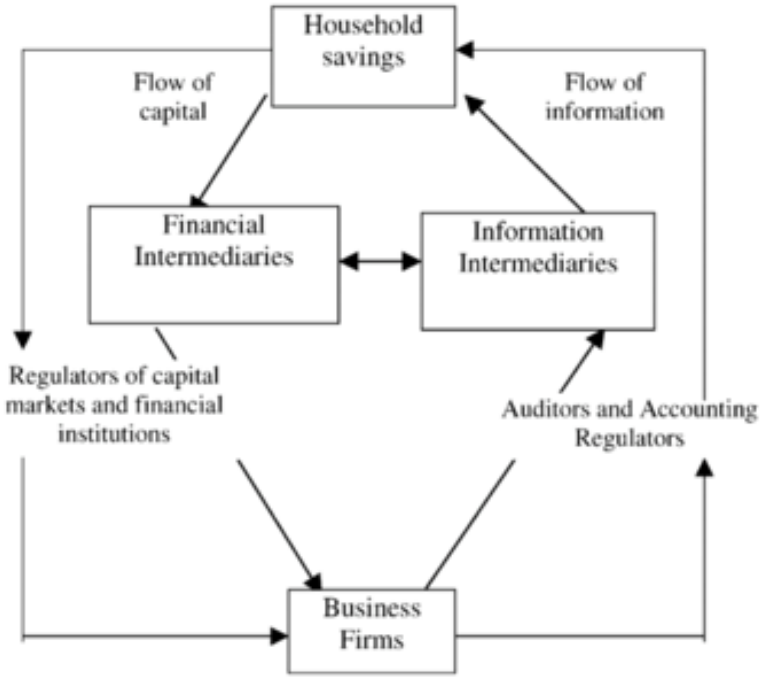
From an investors standpoint, Lauritsen argues that it would be worrying that all this information is publicly available because what is the competitive edge of the company then? What is the competitive edge as an institutional investor? The benefits disappear despite the fact that these institutional investors pay significant amounts of money for this information, because now, anyone who does not work in the field, but solely invests as a hobby, has the exact same information. The competitive edge is now gone, and as a consequence, someone could question what the point of institutional investors really is (Lauritsen). However, as simple private investors would possibly suffer from an information overflow, as the detail level increased significantly and would instead rely on intermediaries aggregating this information.

On the other hand, it could also be argued that certain other investors could be interested in such an implementation. As an example, Lauritsen noted that for a private equity firm looking to buy a company, a trustless system could result in a higher valuation, which is beneficial. So, for this group of investors, where the buying and selling of firms are on the agenda, it could be advantageous.

9.2 Auditors' and Intermediaries' Role in Financial Disclosure

If we assume that the implementation of blockchain technology emerges into reality, it becomes necessary to discuss the potential effects it would have on intermediaries such as auditors and financial analysts since these are an essential element of the disclosure of financial information, which is the main focus of this paper. To emphasize this, figure 8 below illustrates their rolw in the capital market.

Figure 8 - Financial and Information Flows in the Capital market



Source: Healy & Palepu (2001)

To discuss these effects, it is imperative that these intermediaries are discussed to enable a deeper understanding of how blockchain can influence their roles.

9.2.1 Auditors

A financial statement is merely a rundown of what has occurred in a company's books throughout a particular time. An auditor's duty is to be an independent intermediary and authenticate the information in the financial statements that have been prepared by the firm. The auditor is essentially there to decide whether the financial statements make sense or if there are inconsistencies between what the company has prepared and what they believe it should look like (Lazanis, 2015).

An auditor’s assessment of financial statements is fundamental for outside investors as they occasionally depend on this information and the interrelated financial statements when deciding upon investments. For instance, if the financial statements look discouraging and the auditor verifies that the information seems correct, then an investor may choose to refrain from investing

in that specific company. Consequently, because the public trusts and relies on the auditor for various investment decisions, it is deemed that the auditor is required to protect the public when carrying out an audit (Lazanis, 2015).

Thus, an auditor works as an intermediary who settles whether financial statements are authentic. However, there is an ingrained bias that prevails since auditors acquire fees for their work, i.e., revenues, from their clients, which consequently means that the auditors protect their clients and further the company's revenues at the expense of the general public. Although professionalism, ethics, and training are given extensive attention, this bias cannot be neglected (Lazanis, 2015). Yermack (2015) supports by saying that accounting as we know it puts too much trust into the integrity of auditors who themselves are corruptible.

Furthermore, there is a risk that a company's management falsifies its financial statements for its own self-interest in such a way that it is undetectable for auditors, which in turn potentially can result in outsiders relying on inaccurate financial statements (Lazanis, 2015).

This leads back to the important idea of trust. Once auditors release opinions regarding financial statements, the public trusts that the financial statements have been prepared fairly and thus trusts that the auditors have done an honest job. This means that self-interests and internal biases are all believed to have been discarded to assure the public. Unfortunately, these self-interests and biases do appear from time to time such as what was the case with Enron, which result in the financial statements that outside investors may be depending on are inadequate for decision-making intentions (Lazanis, 2015). Greg Weaver, a former national managing partner for assurance at Deloitte Touche Tohmatsu, stated in an interview with Kris Friswick in 2003 that the reason for this is because 100% verification would essentially require that the records would be recreated, which the public would not accept due to the high costs. In the auditors' quest for reducing the costs of auditing due to the aggressive competition on price, they were forced to lessen the number of performed procedures for the audit. Former global head of audit methodology at PwC, Ellen Masterson, admitted this in an interview with Kris Frieswick in 2003, where she stated "Uppermost in the mind was reducing the cost of the audit" and further "they pressured auditors to do the minimum." In the Enron scandal, senior executives held back

critical information from investors (Gladwell, 2007). This is where the concept of blockchain becomes vital as the establishment of such a regime would ensure that actors would not need to count on audit opinions from auditors since the technology would enable them to aggregate financial statements in real-time based on the company's transactions (Yermack, 2016). Bloomberg Tax (Bnasoftware.com, 2014) gives revealing insight to the top tax and accounting mistakes in the United States. In 2013, U.S. businesses endured almost $7 billion in IRS penalties because of incorrect reporting, where the top five errors consisted of the following:

1. Closing the books before all required, accurate data has been collected
2. Modifying asset information from past years
3. Incorrectly applying unitary state tax rules
4. Failure to keep track of/adhere to city-specific tax regulations
5. Failing to maximize depreciation by using the most advantageous depreciation tables

9.2.2 The Effects of Blockchain on Auditors

Several different accounts are included in a financial statement such as asset, liability, revenue, and expense accounts. All these accounts contain numerous transactions that comprise the balance in that account. An element of an auditor's duty consists of reviewing the accounts and deciding which of these to certify (Lazanis, 2015).

All procedures regarding auditing involve the confirmation of transactions in the accounts and further the validation of the balances found on the ledger. These procedures fail to guarantee perfect consistency in the reported information as mentioned earlier due to the inherent bias, and at the same time, the procedures are time-consuming and costly. As described previously, blockchain technology can perform this on its own why the auditor becomes unnecessary for this specific task. In theory, everything constituting a firm's financial statements could exist on a blockchain, and consequently accounting under a blockchain regime would benefit from reduced time and costs in regards to auditing (Lazanis, 2015).

Similarly, an auditor's task is to be an independent third party who certifies that the information in a company's financial statements is correct. Consequently, outside investors trust these audit

opinions. As described above, transactions on the ledger can be confirmed as true without the necessity of an independent third party such as an auditor, why it becomes reasonable to believe that the role of an auditor, and hence the accounting sector, would be significantly transformed if the technology were to be employed (Lazanis, 2015).

Further, blockchain adoption combined with suitable data analytics could assist with the transactions included in an audit, and thus the auditors are freed from spending time on manual validation, and their skills would be better spent on other significant tasks to enhance the firm's efficiency (Horton, 2017; ICAEW, 2017). To illustrate, auditing is more than purely reviewing whom a transaction has been between and the associating monetary measure; it also involves how it is booked and categorized. Answers to judgmental elements such as those and questions such as the following often times require context that is outside the reach of the general public: If a transaction credits cash, is it because of expenses or cost of sales? Is it generating an asset, or paying a creditor? Instead, knowledge of the business is required, which the auditors possess, and under a blockchain regime, the auditors can concentrate more on these elements and questions (ICAEW, 2017).

Similarly, the cutback in regards to the need for reconciliation, mixed with heightened confidence concerning obligations and rights, will ensure an increased focus with respect to transactions and how these should be examined. Numerous ongoing accounting processes can be enhanced through the deployment of blockchain technology, which will assist in improving the efficiency of the accounting sector (ICAEW, 2017).

As a consequence of the previous-mentioned, the role of the auditors will transform. The confirmation of the accuracy of financial statements and origin assurance will be skills that will be diminished or even eliminated, while other value-adding fields including advisory and technology will bolster (ICAEW, 2017). Lauritsen supports and notes that the auditor would have a simpler job. The auditors will not be completely removed but will have significantly less work as a third party. Due to how legal circumstances are, auditors still have to report to the government because they have licenses to do so. He continues by arguing that despite an individual doing his or her accounting thoroughly without any flaws and having software that

follows up with everything that has been done, i.e., bank movements, auditors are still necessary to report to the government simply because of how companies work. Overall, blockchain would merely make their lives easier; hence, result in a quicker and cheaper process. Rather than them going through excessive amounts of receipts and bills to validate numbers, they can straightforwardly click on the blockchain, and by that, they will know that whatever the number is must be completely accurate because they can trust the system (Lauritsen).

With a firm containing compelling blockchain-based transactions, the heart of the focus of auditors will change to audit the firm rightly. As mentioned earlier, the validation regarding the accuracy of transactions becomes less necessary, yet there is still a need for attention towards how these transactions are booked in the financial statements and how the earlier-mentioned judgmental elements like valuations are determined. Ultimately, blockchains would contain more and more records, which would allow auditors and regulators with admission to examine these in real time and with positive assurance (ICAEW, 2017).

It is not necessary for auditors to be immensely knowledgeable about how the technology works; however, it is imperative that they are able to advise on the deployment of the technology and further how it will impact their clients and businesses. In addition, they need to be able to have dialogues with shareholders and technologists and thus function as the bridge (ICAEW, 2017).

9.2.3 Other Intermediaries

With the role of auditors in terms of the relevancy of financial disclosure covered, we will now focus on other independent information intermediaries.

Here the existing literature primarily focuses on the role of financial analysts and the information delivered by such. Their role in the context of disclosure is to collect and evaluate information from private and public sources and make forecasts about the future outlook for the companies they follow. Investors use these predictions as a supporting tool for their investment decisions (Healy & Palepu, 2001).

Academic studies show a consensus about the information provided to investors by financial analysts being either cash flow/earnings forecasts, which were found to be of most value to investors in the theory section, or buy/sell/hold recommendations. Consequently, it is fair to say that financial analysts add value to investors and thus also the capital market.

An essential feature of the earnings forecasts is that they are found to create more value for investors than time-series models and such. Givoly (1982), Brown, et al., (1987) and Healy & Palepu (2001) argue that the timeliness of the information in the analysis of financial analysts is a central factor to the increased value creation. As a result, studies show that the relevant information created by analysts affect stock prices (Healy & Palepu, 2001).

By realizing that analyst recommendations can have an actual stock effect, we are back to the essence of the asymmetric information problem. Thus, it is no surprise that some scholars have found evidence of bias in the forecasts and recommendations of analysts. Brown et al. (1985) found that the analyst forecasts and recommendations had an optimistic bias. Recent studies, however, find that since the late 1990s, this pattern has changed. From the response of stock prices and trading volumes to upgrades and downgrades suggest that the market recognizes analysts' conflicts and properly discounts analysts' opinions. Thus, analysts are not able to systematically mislead investors with optimistic stock recommendations (Agrawal & Chen, 2008). Instead, financial analysts play an important role in improving capital market efficiency as stock prices of firms that are followed by more analysts more efficiently incorporate relevant financial information than less followed stocks (Bart & Hutton, 2000).

This leads back to the incentive problem of analysts. Studies show that analysts are compensated for providing the market with information that creates trading volumes and fees for their employer. Hence, optimistic forecasts are still incentivized (Healy & Palepu, 2001).

Another interesting point of research is the relationship between management disclosure and analyst coverage of the firm. Scholars argue that the cost of acquiring information decreases with Corporate disclosure levels and hence increases the amount of created information (Healy & Palepu, 2001). Despite this relationship, it cannot be directly implied that increased disclosure

quality increases the interest from and the need for analysts, i.e., the relationship is ambiguous. Increased disclosure has the potential to enable analysts to create more insightful and valuable analyses and consequently increase the demand for their own services. Conversely, publicly disclosed information automatically pre-empts the analysts' potential and ability to distribute more private information to investors, resulting in the demand for their services to decline. Despite this, it is found that firms with more informative disclosure policies have more analyst following, more accurate forecasts, and as a result, less volatile reactions when forecasts are revised (Lang & Lundholm, 1993; Eng & Mak, 2003).

Many of the studies described above are from the period prior to the introduction of the Reg FD and Global Settlement as covered in section 7. Healey (2007) investigates the post effects of this on the capital market. Here it was found that voluntary disclosure increased. In this context, it is found that due to increased voluntary management disclosure, studies suggest that analysts may have increased incentives for private information search. This is because the increased disclosure was found to reduce the information advantage of select financial analysts. As a result of this, the newsworthiness of their earnings forecasts and recommendations is expected to decline as voluntary disclosure increases.

Further, a relationship between stock price and critical analysis of firms' accounting decisions have been found. Foster (1987) found that if firms whose accounting was challenged by recognized accountants on average suffered an 8% decrease in stock price, and the reason of such was concluded to be superior insights.

Other intermediaries such as bond rating companies also find that rating downgrades provide new information to investors, whereas upgrades are included in the price (Hand et al., 1992). This is argued to potentially be related to the positive bias by financial analysts by the authors of this paper.

To conclude on this section, the conducted research shows that some of the information disclosed by intermediaries such as financial analyses, bond rating companies, and the press

affect stock prices. Furthermore, these studies find that increased disclosure marginalizes the role financial analysts.

9.2.4 The Effects of Blockchain on Intermediaries

Similar to the roles of auditors, it can be expected that the roles of other intermediaries and especially financial analysts will be transformed. As was the case in the auditors-section, the information on the blockchain would be directly available to investors why it can be argued that the necessity for a third party to verify and translate the information is less important. However, it can also be argued, in the case of financial analysts, that due to the increased detail level of the disclosed information, these analysts are increasingly necessary since the information is harder to understand for the investors.

This is supported by Lauritsen as he believes that financial analysts are needed even more. He argues that they will not get removed nor become irrelevant, but rather become more important because the more detailed information has to be translated so that the average person can understand it. This leads back to the point of trust. The financial analysts make forecasts based on numbers they obtain from the companies' annual reports. If the annual reports are inaccurate, then these forecasts are worthless.

In line with an earlier mentioned possible result, Lauritsen suggests that it can be argued that the third party will be removed altogether, but that would require the second party to be significantly smart. These second parties would have to be able to translate this data, comprehend what it implies, and know how to deploy it. The chance of the average investor being able to do that is slim. Institutional investors are able to do this because they have their own analysts, but that does not mean that financial analysts are unnecessary (Lauritsen).

In conclusion to the above, blockchain technology has the capabilities to operate as a system of global entry bookkeeping and thus accelerate the efficiency of the accounting process with respect to assets and transactions. This would assist in establishing positive assurance over provenance, rights, and obligations, which subsequently would allow the accounting business to

extend its scope to register more activity and penetrate nearer to the economic matter regarding the transactions recorded (ICAEW, 2017).

Furthermore, following the discovery of blockchain technology as a possible way of increasing the detail level of disclosed financial information, the examination of companies' and investors' desire for such an implementation, and the investigation of potential effects on intermediaries, it became apparent that the implementation of blockchain not necessarily would be desired by all companies and investors due to several factors why a complete adoption of such a technology still have ways to go. However, in case an implementation became a reality, a major transformation regarding financial disclosure would be evident.

9.2.5 Limitations of the Discussion

This paper covers the relationship between disclosure quality, liquidity, and cost of capital, and uses these findings as arguments for the benefits of blockchain technology. A few limitations to this discussion are necessary to have in mind.

Firstly, we only use one source of primary data, supported by several secondary sources to facilitate arguments in the discussion. Here it would be beneficial to conduct more interviews with industry experts, generating additional support for the discussion.

We also suspect that companies, which already have high disclosure levels, may be less sensitive to the competitive drawbacks that the total transparency brings compared to firms, which generally have low disclosure levels. However, further analysis is necessary in order to prove this and other notions from the discussion.

10. Conclusion

A thorough review of disclosure theory suggests several theoretical and empirical incentives for management to increase disclosure quality. From these, financial disclosure’s ability to reduce the cost of capital as well as enhancing stock market liquidity from a reduction of information asymmetry was found of highest relevance to the paper. This relationship is found to be

dependent on the value relevance of the disclosed information, i.e., its ability to affect the existing knowledge of the investors by being accurate, complete, and timely.

The reviewed literature also revealed that several different measures of disclosure quality, liquidity, and cost of capital have been used, where several drawbacks were found.

Utilizing these findings, we sought to empirically investigate the relationship between disclosure quality and these expected capital market effects. In order to do so, a proxy capturing the disaggregation of accounting line items in firms' annual reports, where greater disaggregation indicates higher disclosure quality (DQ), was chosen. Liquidity is captured by bid-ask spreads, which address liquidity as the friction that burdens traders. Lastly, cost of capital measures, based on CAPM estimation, were found of highest relevance to the thesis.

The research sample period is between 1973 – 2017 and consists of 402 American companies, which all were found in the SP500 index on the 10th of April 2018. In this period, DQ has shown an increasing trend, where regulatory and technological factors were found to be the primary drivers of this increase. Also, DQ was found to vary significantly between industries. Finally, firm size and asset restructures were detected to significantly affect DQ, why the analysis of the relationship between DQ and the capital market effects controls for these factors.

Including this in the empirical research, a significant positive relationship between DQ and liquidity as well as significant negative relationships between DQ and all cost of capital measures were found. More specifically, it was discovered that a standard deviation increase in DQ is associated with a 0,48% decrease in cost of equity, a 0,23% decrease in cost of debt, and a 0,37% decrease in cost of capital. This confirms the intuition of the covered theory as well as DQ's ability to capture disclosure quality instead of complexity.

Lastly, our discussion relates the findings of the empirical analysis to the features of blockchain technology. Through insights from an industry expert, it was found that blockchain technology could be expected to significantly improve the disclosure quality of companies by facilitating increased transparency, trust, and timeliness. Nevertheless, it became apparent that the

implementation of blockchain not necessarily would be desired by all companies and investors due to factors such as competition issues and information overflow. Further, the technology is expected to change the roles of intermediaries, including auditors and financial analysts, in different ways. On one hand, some may become redundant due to the above-mentioned features blockchain offers. On the other hand, the need for other intermediaries increases as the disclosure complexity is expected to increase.

The study's main contribution to the literature is the empirical demonstration that the disaggregation of accounting data items in firm's financial disclosures reduces the information asymmetry in the market. This measure is an important aspect of firms' disclosure decisions, which have not received a lot of attention. Suggestions for future work include research on the ability to generalize findings by examining the effects in other areas such as Europe, where financial regulations are different from the tested sample. Also, it would be interesting to test other more well-researched disclosure and cost of capital measures to control if the result qualitatively differs.

11. References

Ali A, 1994. The Incremental Information Content of Earnings, Working Capital from Operations, and Cashflows. *Journal of Accounting Research*, vol. 32 no. 1, pp. 61-74.

Agrawal, A and Chen, M.A. "Do Analyst Conflicts Matter? Evidence from Stock Recommendations," The Journal of Law and Economics 51, no. 3 (August 2008): 503-537.

Arnold, G. (2005). *Corporate financial management* (3. ed.). Harlow [u.a.]: Financial Times/Prentice Hall. p. 354.

Bainbridge, S, 'Mandatory Disclosure: A Behavioral Analysis' (2000) 68 University of Cincinnati Law Review.

Baldwin A. A., Brown C.E., Trinkle B.S. XBRL: an impacts framework and research challenge. J Emerg Technol Account (2006), pp. 97–116.

Ball R. & P. Brown, 1968. An Empirical Evaluation of Accounting Income Numbers. *Journal of Accounting Research*, pp. 159-178.

Ball,R. & Brown, P. (1969). Portfolio theory and accounting theory. Journal of Accounting Research, 7 (2), 300-323.

Bamber, L.S (1986): The Information Content of Annual Earnings Releases: A Trading Volume Approach, *Journal of Accounting Research*, 24 (1): 40–56

Barry, C.B., Brown, S.J., 1984. Differential information and the small firm effect. Journal of Financial Economics 13 (2), 283–295.

Barry, C.B., Brown, S.J., 1985. Differential information and security market equilibrium. Journal of Financial and Quantitative Analysis 20, 407–422.

Barry, C.B., Brown, S.J., 1986. Limited information as a source of risk. The Journal of Portfolio Management 12, 66–72.

Barth ME, WH Beaver, WR Landsman, 2001. The Relevance of The Value Relevance for Accounting Policy Makers: Another View. *Journal of Accounting and Economics*, pp. 1-38.

Bayer, D., Haber, S., & Stornetta, W. S. Improving the efficiency and reliability of digital time-stamping. *Proceedings of Sequences 1991.*

Beaver WH,1968. The Information Content of Annual Earnings Announcements. *Empirical Research in Accounting: Selected Studies*, pp. 67-92.

Beaver WH,1989. *Financial Reporting: An Accounting Revolution*. Second Edition. New Jersey: Prentice Hall.

Beaver, WH., 1998. Financial reporting: an accounting revolution. Prentice-Hall, Englewood Cliffs, N.J.

Beaver WH, 2002. Perspective on Recent Capital Market Research. *The Accounting Review*, vol. 77 no. 2, pp. 453-474.

Berkman, O., 2017. Practical Questions Around Blockchain and Financial Reporting. Available at: https://daily.financialexecutives.org/practical-questions-around-blockchain-and-financial-reporting/

Bhushan, R., 1989a. Collection of information about publicly traded firms: theory and evidence. Journal of Accounting and Economics 11, 183–207.

Bhushan, R., 1989b. Firm characteristics and analyst following. Journal of Accounting and Economics 11 (2–3), 255–275.

"Bitcoin Mining." *Investopedia*.

Blackwell, D. 1951. Comparisons of Experiments. Proceedings of the Second Berkeley Symposium in Mathematical Statistics and Probability, edited by J. Neyman. Berkeley and Los Angeles: University of California Press.

Bnasoftware.com. (2014). *The Top Tax & Accounting Mistakes*. [online] Available at: https://www.bnasoftware.com/resources/articles/top-tax-and-accounting-mistakes.

Botosan, C.A., 1997. Disclosure level and the cost of equity capital. The Accounting Review 72 (3), 323–350.

Botosan, C.A., Plumlee, M.A., 2000. A re-examination of disclosure level and expected cost of capital. Unpublished working paper, University of Utah.

Botosan, C. (2006). Disclosure and the cost of capital: what do we know? Accounting and Business Research. Special issue: International Accounting and Policy Forum. 31-40.

Breen, W. J., & Lerner, E. M. (1973, May). Corporate financial strategies and market measures of risk and return. Journal of Finance, 28 (2), issue 2, 339-351.

Brigham, E. &Houston, J. (2012). *FUNDAMENTALS OF FINANCIAL MANAGEMENT*. SOUTH-WESTERN.

Brown, L., Foster, G., Noreen, E., 1985. Security analyst multi-year earnings forecasts and the capital market. Studies in Accounting Research, No. 23, American Accounting Association, Sarasota, FL.

Brown, L., Griffin, P., Hagerman, R., Zmijewski, M., 1987. Security analyst superiority relative to univariate time-series models in forecasting quarterly earnings. Journal of Accounting and Economics 9, 61–87.

Brown S. and S.A. Hillegeist (2007), How disclosure affects the level of information asymmetry, of Accounting Studies, vol. 112, nos. 2/3, pp. 443-477.

Cao Y, 2005. An Exploratory on Value Relevance of Sustainable Growth Rate. *Journal of Modern Accounting and Auditing*, vol. 1 no. 5, pp. 61-65.

CFA Institute, eXtensible Business Reporting Language: A Guide for Investors, April 2009.

CFA Institute, Data and Technology: Transforming the Financial Information Landscape, June 2016.

Chen S., Miao B., T. Shevlin "A new measure of disclosure quality: the level of disaggregation of accounting data in annual reports". J. Account. Res., 53 (2015), pp. 1017-1054.

Chiles, T.H., 2003. Process Theorizing: Too Important to Ignore in a Kaleidic World. Academy of Management Learning & Education, 2(3), pp. 288-291.

Chun LS, M Ramasamy, 1989. Accounting Variables as Determinants of Systematic Risk in Malaysian Common.

Chung, P., Johnson, H., & Schill, M. (2004). Asset Pricing When Returns Are Normal. Journal' of Business. Stocks. *Asia Pacific Journal of Management*, vol. 6, no. 2, pp. 339-350.

"Coin Market Capitalizations." Coinmarketcap.

Crosby, M. et al. (2015). "Blockchain Technology: Beyond Bitcoin." Applied Innovation.

Crosman, Penny. (2017). "Where Fintech Dollars Will Go in 2018." American Banker, 26 Dec. 2017.

Daske, H and Hail, L, Leuz, C, Verdi, R, 'Mandatory IFRS Reporting around the World: Early Evidence on the Economic Consequences' (2008) 46 Journal of Accounting Research 1085.

Day J, 1986. The Use of Annual Reports by UK Investment Analysis. *Accounting and Business Research*, pp. 295-307.

Debreceny R, Chandra A, Cheh JJ, Guithues-Amrhein D, Hannon NJ, Hutchison PD, et al. Financial reporting in XBRL on the SEC's EDGAR System: a critique and evaluation. J Inf Syst 2005;19(2):191–210.

Dechow, P. M. (1994). Accounting earnings and cash flows as measures. Working Paper, 18 (1), 3-42.

Dhingra HL, 1982. The Impact of Accounting Variables on Stock Market Measures of Risk. *Accounting and Business Research*, pp. 193-201.

Diamond, D., Verrecchia, R., 1991. Disclosure, liquidity, and the cost of capital. The Journal of Finance 66, 1325–1355.

D'Souza J., K. Ramesh, and M. Shen, 2010. Disclosure of GAAP Line Items in Earnings Announcements. Review of Accounting Studies 15: 179-219.

Easton PD, TS Harris, 1991. Earnings as an Explanatory Variable for Returns. *Journal of Accounting Research*, vol. 29 no. 1, pp. 19-35.

Elgers, P. (1980, July.). Accounting based risk predictions: a reexamination. The Accounting Review, 55 (3), 389-408.

Eng, L.L. & Mak, Y.T., 2003. Corporate governance and voluntary disclosure. Journal of Accounting and Public Policy Volume 22, Issue 4, Pages 325-345.

Enriques, L. & Gilotta S., 2017. Disclosure and Financial Market Regulation. F*orthcoming Draft Chapter in The Oxford Handbook on Financial Regulation, edited by Eilís Ferran, Niamh Moloney, and Jennifer Payne, (Oxford University Press).* Available at: https://ssrn.com/abstract=2423768.

Fairfield, P., R. Sweeney, and T. Yohn., 1996. Accounting Classification and the Predicative Content of Earnings. The Accounting Review 71 (3): 337-355.

Fama, E. F (1965). "The Behavior of Stock Market Prices". *Journal of Business*. 38: 34–105.

Fama, E. F., & French, K. R. (1996). Multifactor Explanations of Asset Pricing Anomalies. Journal of Finance.

FASB (2009) "NEWS RELEASE 05/28/09 FASB ISSUES STATEMENT NO. 165, SUBSEQUENT EVENTS." FASB, FINANCIAL ACCOUNTING STANDARDS BOARD, 28 May 2009.

FINANCIAL EXECUTIVES INTERNATIONAL – FERF 2017. Blockchain and the Future of Financial Reporting, Sponsored by Deloitte. Available at:

https://www.financialexecutives.org/Research/News/2017/Blockchain-and-the-Future-of-Financial-Reporti-(1).aspx

Financial Accounting Standard Board, 1980. Qualitative Characteristics of Accounting Information. *Statement of Financial Accounting Concepts No. 2*. FASB, Stamford, Connecticut, May.

FOSS, N. and ISHIKAWA, I., 2006. Towards a dynamic resource-based view: Insights from Austrian capital and entrepreneurship theory. Available at SSRN 982102.

Foster, N., (2003). The FASB and the capital markets. The FASB Report. (June 2003).

Francis, J., D. Philbrick, and K. Schipper. 1994. Shareholder litigation and corporate disclosures. Journal of Accounting Research 32, 137–165.

Francis, J., Hanna, J., Philbrick, D., 1998. Management communications with securities analysts. Journal of Accounting and Economics 24, 363–394.

Francis, J., D. Nanda, and P. Olsson, 2008. Voluntary Disclosure, Earnings Quality, and Cost of Capital. Journal of Accounting Research 46 (1), 53-99.

Frieswick, K. (2003). How Audits Must Change, Auditors face more pressure to find fraud. *CFO Magazine*. [online] Available at: http://faculty.som.yale.edu/shyamsunder/FinancialFraud/How%20Audits%20Must%20Change.htm.

Gambi Cavallari Amorim, A., Siqueira Lima, I. and Dal-Ri Murcia, F. (2011). *Analysis of the Relationship between Accounting Information and Systematic Risk in the Brazilian Market.* [online] Scielo.br. Available at: http://www.scielo.br/pdf/rcf/v23n60/en_a05v23n60.pdf.

Gelb, D., Zarowin, P., 2000. Corporate disclosure policy and the informativeness of stock prices. Working Paper, New York University, New York, NY.

Givoly, D., 1982. Financial analysts' forecasts of earnings: a better surrogate for market expectations. Journal of Accounting and Economics 4 (2), 85–108.

Gonedes, N. (1973). Evidence on the information content of accounting massages: accounting based and market-based estimate of systematic risk. Journal of Financial and Quantitative Analysis, 8 (3), 407-444.

Grossman, S. 1981. The role of warranties and private disclosure about product quality. Journal of Law and Economics 24 (3): 461-83.

Haber, S. & Stornetta, W. S. (1991). "How to Time Stamp a Digital Document". *Advances in Cryptology - CRYPT0' 903(2): 99-111*.

Haber, S. & Stornetta, W. S. (1997). Secure names for bit-strings. In *Proceedings of the 4th ACM Conference on Computer and Communications Security*: 28-35.

Hand, J., Holthausen, R., Leftwich, R., 1992. The effect of bond rating agency announcements on bond and stock prices. The Journal of Finance 47, 733–753.

Hand JRM, 2005. The Value Relevance of Financial Statements in the Venture Capital Market. *The Accounting Review*, vol 80 no. 2, pp. 613-648.

Healy, P., Hutton, A., Palepu, K., 1999a. Stock performance and intermediation changes surrounding sustained increases in disclosure. Contemporary Accounting Research16, 485–520.

Healy PM., 2007. How did Regulation Fair Disclosure Affect the US Capital Market? A Review of the Evidence. Harward Business School. Available at: https://www.frbatlanta.org/-/media/documents/news/conferences/2008/08FMC/08FMChealy.pdf.

Healy PM. & Palepu KG., 2001. Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. Journal of Accounting and Economics 31 (2001) 405–440.

Hileman, G. & Rauchs, M. (2017). Global Blockchain Benchmarking Study (September 22, 2017).

Hirst, E., L. Koonce, S. Venkataraman, 2007. How Disaggregation Enhances the Credibility of Management Earnings Forecasts. Journal of Accounting Research 45 (4), 811-837.

Horton, M. (2017). "Financial Auditor: Job Details and Average Salary." Investopedia, 30 Dec. 2017.

Howard, A. "What Is a Sybil Attack?" TopTenReviews.

HSBC (2017). *Trust in Technology*. Available at: http://www.hsbc.com/news-and-insight/media-resources/media-releases/2017/~/media/hsbc-com/newsroomassets/2017/pdfs/170609-updated-trust-in-technology-final-report.pdf.

Hutton, A., Miller, G., Skinner, D., 2000. Effective voluntary disclosure. Unpublished working paper, Harvard Business School.

"Important Information About EDGAR." U.S. Securities and Exchange Commission (SEC), 16 Feb. 2010.

Institute of Chartered Accountants in England and Wales (ICAEW), *Blockchain and the future of accountancy*, London, U.K., 2017.

Investopedia "Accounting Valuation."

Ismail, B., & Kim, M. (1989). On the association of cash flow variables with market risk: further evidence. Accounting Review, 64 (1), 125-136.

Jegadeesh, N., J. Livnat. 2006. Revenue Surprises and Stock Returns. Journal of Accounting & Economics 41: 147-171.

Jensen, M., Meckling, W., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3, 305–360.

Juniper Research. (2017). "Nearly 6 in 10 Large Corporations Considering Blockchain Deployment." Juniper Research, 31 July 2017.

Kim, O., Verrecchia, R., 1994. Market liquidity and volume around earnings announcements. Journal of Accounting and Economics 17, 41–68.

Kim O, RE Verrecchia, 1997. Pre-announcements and Event-Period Private Information. *Journal of Accounting and Economics*, 24, pp. 395-419.

Landsman WR, 2007. Is Fair Value Accounting Information Relevant and Reliable? Evidence from Capital Market Research. *Special Issue: International Accounting Policy*, pp. 19-30.

Lang, M., Lundholm, R., 1993. Cross-sectional determinants of analysts' ratings of corporate disclosures. Journal of Accounting Research31, 246–271.

Lang, M., Lundholm, R., 1996. Corporate disclosure policy and analyst behavior. The Accounting Review 71, 467–493.

Lazanis, R. (2015). *How Technology Behind Bitcoin Could Transform Accounting as We Know It*. [online] Techvibes. Available at: https://techvibes.com/2015/01/22/how-technology-behind-bitcoin-could-transform-accounting-as-we-know-it-2015-01-22.

Leuz, C., & Verrecchia, R. (2000). The economic consequences of increased disclosure. The Journal of Accounting Research. 38:91-124.

Lev, B. (1974, September). On the association between operating leverage and risk. Journal of Financial and Quantitative Analysis, 9 (4), 627-641.

Lev, B., & Kunitzky, S. (1974, April). On the association between smoothing measures and the risk.

Levitt, A. (1998). The importance of high quality accounting standards, Accounting Horizons. 12:79-82.

Li, F. 2008. Annual Report Readability, Current Earnings, and Earnings Persistence. Journal Accounting Research 45: 221-247.

Lundholm, R., 1999. Reporting on the past: a new approach to improving accounting today. Accounting Horizons 13, 315–323.

Lylian. (2017). "Survey: 72.6% Of Chinese Bankers Suggest Blockchain Be Applied to Payment & Settlement." 8BTC, 28 Dec. 2017.

Maines LA, JM Wahlen, 2006. The Nature of Accounting Information Reliability: Inferences from Archival and Experimental Research. *Accounting Horizons*, vol. 20 no. 4, pp. 399-425.

MarketBrains. (2017). "Survey Says AI Beats out Blockchain for Securities Firms." MarketBrains, MarketBrains, 24 Dec. 2017.

McKinsey & Company. (2017). How blockchains could change the world. [online] Available at: http://www.mckinsey.com/industries/high-tech/our-insights/how-blockchains-could-change-the-world.

Milgrom, P. 1981. Good news and bad news: Representation theorems and applications. Bell Journal of Economics 12 (Autumn): 380-91.

Mohd, E. (2005). Accounting for software development costs and information asymmetry. The Accounting Review. 80(4):1.211-1.231.

Narayanan, A. & Clark, J. (2017) Bitcoin's academic pedigree. Queue,15(4):20:20–20:49, Aug. 2017.

Nassreddine, G. (2016) Determinants of Financial Information Disclosure: A Visualization Test by Cognitive Mapping Technique, Journal of Economics, Finance & Administrative Science, Vol. 21, pp. 8-13

Nekrasov, A., & Shroff, P. (2009, November). Fundamentals-Based Risk Measurement in Valuation. The Accounting Review American Accounting Association, 84 (6), 1983-2011.

"One Frictionless Experience to Send Money Globally." Ripple.

Owusu-Ansah, S. (1998) The Impact of Corporate Attributes on the Extent of Mandatory Disclosure and Reporting by Listed Companies in Zimbabwe, The International Journal of Accounting, 33(5), 605-631 ·

Petersen C. and Plenborg T. (2006), Voluntary disclosure and information asymmetry in Denmark, Journal of International Accounting Auditing & Taxation, pp. 127-149.

Pettit, R. R., & Westerfield, R. (1972, March). A model of capital asset risk. Journal of Financial and Quantitative Analysis, 7 (2), issue 2, 1649-1668.

Piotroski, J., 1999a. Discretionary segment reporting decisions and the precision of investor beliefs. Working paper, University of Chicago.

Piotroski, J., 1999b. The impact of reported segment information on market expectations and stock prices. Working paper, University of Chicago.

Premuroso R. F., Bhattacharya S. "Do early and voluntary filers of financial information in XBRL format signal superior corporate governance and operating performance?" Int J Account Inf Syst, 9 (1) (2008), pp. 1-20.

Prodhan, B., & Harris, M. (1989). Systematic risk and the discretionary disclosure of geographical segments: an empirical investigation of US multinationals. Journal of Business Finance and Accounting. 16(4):467-92.

PYMNTS. (2018). "Corporates Continue to Develop Their Blockchain Plans as Expectations Rise." PYMNTS.com.

PWC (2017) PWC (2017). Global FinTech Report. PWC.

Rohman L. (2017). The Looming Impact of Blockchain on Financial Reporting. Available at: https://www.merrillcorp.com/en/blog/blockchain-impact-on-financial-reporting

Rossi M, 2016. The capital asset pricing model: a critical literature review. Global Business and Economics Review, Vol. 18, No. 5, 2016.

Saunders, M., Lewis, P., & Thornhill, A. (2007). Research Methods for Business Students, (6th ed.) London: Pearson.

Scannell K. 2006b. Cox Puts More Tech into SEC. The Wall Street Journal (3/22/06): C1.

Scott WR, 2009. *Financial Accounting Theory*. *Fourth Edition*. Toronto, Ontario: Pearson Education Canada Inc.

Sharma, N. (2017). "What Does Cryptocurrency Have to Do with Blockchain Anyway?" Singularity Hub, 24 Dec. 2017.

Shaw, R. (2017). “Blockchain Key Terms, Explained.” KDnuggets: Analytics, Big Data, Data Mining, and Data Science.

Sivakumar, K and Waymire, G (1994), Voluntary Interim Disclosure by Early 20th Century NYSE Industrials, Contemporary Accounting Reasearch V:10, Issue_2 Spring P. 673-698

Skinner, D., 1994. Why fi rms voluntarily disclose bad news? Journal of Accounting Research 32, 38–61.

Skinner, D., 1997. Earnings disclosures and stockholder lawsuits. Journal of Accounting and Economics 23, 249–283.

Smith, C., Warner, J., 1979. On financial contracting: an analysis of bond covenants. Journal of Financial Economics 7, 117–161.

Swan, M. (2015). *Blockchain: blueprint for a new economy*. 1st ed. Sebastopol: O’Reilly Media, Inc.

Tandelilin E, 1997. Determinants of Systematic Risk: The Experience of Some Indonesian Common Stock. *Kelola: Gadjah Mada University*, vol. 4, no. 16, pp. 101-114.

Torres-Reyna O, 2007. Panel Data Analysis Fixed and Random Effects using Stata, Princeton. Available at: https://www.princeton.edu/~otorres/Panel101.pdf

Underwood, S. (2016). Blockchain beyond bitcoin. Commun. ACM 59, 11 (November 2016).

Verrecchia, R. E. 1983. Discretionary disclosure. Journal of Accounting and Economics 5 (December): 179-94.

Watts, R., Zimmerman, J., 1986. Positive Accounting Theory. Prentice-Hall, Englewood Cliffs, N. J.

Wong, Joon Ian. (2017). “One in Five Central Banks Say They Will Be Using Blockchain Tech by 2019.” Quartz, Quartz, 21 Sept. 2017.

Wooldridge, J.M., 2009. Introductory econometrics: a modern approach 4e. South-Western Pub.

Yermack, D. (2016). Corporate Governance and Blockchains (November 28, 2016). Review of Finance.

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Steve Nabil Lauritsen:

https://www.dropbox.com/l/scl/AACvttnK8IgPHGL26khgAkHUCz0wyl3T9CU

https://www.dropbox.com/l/scl/AADKZS_9GjVtHldvZVOdguh-Go7vaZV1060

12. Appendices

Appendix 1 – Compustat Balancing models

Template for the Balance Sheet

Item Description	Balancing	Mnemonic
ASSETSS		
Current Assets		
Current Assets - Total		**ACT**
Non-Current Assets		
Property Plant and Equipment - Total (Net)		**PPENT**
Investment and Advances - Equity		**IVAEQ**
Investment and Advances - Other		**IVAO**
Intangible Assets - Total		**INTAN**
Assets - Other - Total		**AO**
Assets - Total	ACT + PPENT + IVAEQ + IVAO + INTAN + AO	AT
LIABILITIES & SHAREHOLDES' EQUITY		
Current Liabilities		
Current Liabilities - Total		**LCT**
Long-Term Liabilities		
Long-Term Debt - Total		**DLTT**
Deferred Taxes and Investment Tax Credit		**TXDITC**
Liabilities - Other		**LO**
Liabilities - Total	LCT + DLTT + TXDITC + LO	LT
Noncontrolling Interest - Redeemable - Balance Sheet		**MIB**
Shareholders' Equity		
Preferred/Preference Stock (Capital) - Total		**PSTK**
Common/Ordinary Equity - Total		**CEQ**
Stockholders Equity - Parent - Total	PSTK + CEQ	SEQ
Noncontrolling Interest - Nonredeemable - Balance Sheet		MIBN
Stockholders Equity - Total	SEQ + MIBN	TEQ
Liabilities and Stockholders Equity - Total	LT + MIB + TEQ	LSE

Source: Chen et al. (2015).

Template for the Income Statement

Item Description	Balancing	Mnemonic
Sales/Turnover (Net if Excise Tax TXW)		SALE
Operating Expenses - Total	COGS + XSGA	**XOPR**
Cost of Goods Sold		COGS
Selling, General and Administrative Expenses		XSGA
Depreciation and Amortization - Total		DP
Interest and Related Expense		**XINT**
Nonoperating Income (Expense) - Total	IDIT + NOPIO	**NOPI**
Nonoperating Income (Expense) - Excluding Interest Income		NOPIO
Interest Income - Total		IDIT
Special Items		**SPI**
Pretax Income	OIADP - XINT + NOPI + SPI	PI
Income Taxes - Total		**TXT**
Income Taxes - Current	TXFED+TXS+TXFO+TXO	TXC
Income Taxes - Deferred	TXDFED + TXDS + TXDFO	TXDI
Noncontrolling Interest - Income Account		MII
Income Before Extraordinary Items		IB
Dividends - Preferred/Preference		DVP
Income Before Extraordinary Items - Available for Common	IB - DVP	IBCOM
Extraordinary Items and Discontinued Operations	XI + DO	**XIDO**
Extraordinary Items (including Accounting Changes CCHG)		XI
Discontinued Operations		DO
Net Income (Loss)	IBADJ + XIDO	NIADJ

*Note even though the group account CITOTAL (Comprehensive Income – Total) is not on Compustat's Income Statement Balancing Model, we classify the associated accounts as income statement accounts rather than balance sheet accounts.

Source: Chen et al. (2015).

Appendix 2 - Linking Table for the Balance Sheet

SUB ACCOUNTS	DESCRIPTION	PARENT	GROUP
ACODO	Other Current Assets Excl Discontinued Operations	ACO	ACT
ACOX	Current Assets - Other - Sundry	ACO	ACT
XPP	Prepaid Expenses	ACO	ACT
ACDO	Current Assets of Discontinued Operations	ACOX	ACT
ACO	Current Assets - Other - Total	ACT	ACT
CHE	Cash and Short-Term Investments	ACT	ACT
INVT	Inventories - Total	ACT	ACT
RECT	Receivables - Total	ACT	ACT
CB	Compensating Balance	CH	ACT
CH	Cash	CHE	ACT
IVST	Short-Term Investments - Total	CHE	ACT
INVFG	Inventories - Finished Goods	INVT	ACT
INVO	Inventories - Other	INVT	ACT
INVRM	Inventories - Raw Materials	INVT	ACT
INVWIP	Inventories - Work In Process	INVT	ACT
RECCO	Receivables - Current - Other	RECT	ACT
RECD	Receivables - Estimated Doubtful	RECT	ACT
RECTR	Receivables - Trade	RECT	ACT
RECUB	Unbilled Receivables	RECT	ACT
TXR	Income Tax Refund	RECT	ACT
ALDO	Long-term Assets of Discontinued Operations	AO	AO
AODO	Other Assets excluding Discontinued Operations	AO	AO
AOX	Assets - Other - Sundry	AO	AO
DC	Deferred Charges	AO	AO
AOCIDERGL	Accum Other Comp Inc - Derivatives Unrealized Gain/Loss	ACOMINC	CEQ
AOCIOTHER	Accum Other Comp Inc - Other Adjustments	ACOMINC	CEQ
AOCIPEN	Accum Other Comp Inc - Min Pension Liab Adj	ACOMINC	CEQ
AOCISECGL	Accum Other Comp Inc - Unreal G/L Ret Int in Sec Assets	ACOMINC	CEQ
RECTA	Retained Earnings - Cumulative Translation Adjustment	ACOMINC	CEQ
CAPS	Capital Surplus/Share Premium Reserve	CEQ	CEQ
CEQL	Common Equity - Liquidation Value	CEQ	CEQ
CEQT	Common Equity - Tangible	CEQ	CEQ
CSTK	Common/Ordinary Stock (Capital)	CEQ	CEQ
RE	Retained Earnings	CEQ	CEQ
TSTK	Treasury Stock - Total (All Capital)	CEQ	CEQ
CSTKCV	Common Stock-Carrying Value	CSTK	CEQ
ACOMINC	Accumulated Other Comprehensive Income (Loss)	RE	CEQ
REA	Retained Earnings - Restatement	RE	CEQ
REAJO	Retained Earnings - Other Adjustments	RE	CEQ

Linking Table for the Balance Sheet (Continued)

SUB ACCOUNTS	DESCRIPTION	PARENT	GROUP
REAJO	Retained Earnings - Other Adjustments	RE	CEQ
REUNA	Retained Earnings - Unadjusted	RE	CEQ
REUNR	Retained Earnings - Unrestricted	RE	CEQ
SEQO	Other Stockholders- Equity Adjustments	RE	CEQ
TSTKC	Treasury Stock - Common	TSTK	CEQ
TSTKP	Treasury Stock - Preferrred	TSTK	CEQ
DCLO	Debt - Capitalized Lease Obligations	DLTT	DLTT
DCS	Debt - Consolidated Subsidiary	DLTT	DLTT
DCVSR	Debt - Senior Convertible	DLTT	DLTT
DCVSUB	Debt - Subordinated Convertible	DLTT	DLTT
DCVT	Debt - Convertible	DLTT	DLTT
DD	Debt - Debentures	DLTT	DLTT
DD2	Debt - Due in 2nd Year	DLTT	DLTT
DD3	Debt - Due in 3rd Year	DLTT	DLTT
DD4	Debt - Due in 4th Year	DLTT	DLTT
DD5	Debt - Due in 5th Year	DLTT	DLTT
DFS	Debt - Finance Subsidiary	DLTT	DLTT
DLTO	Other Long-term Debt	DLTT	DLTT
DLTP	Long-Term Debt - Tied to Prime	DLTT	DLTT
DM	Debt - Mortgages & Other Secured	DLTT	DLTT
DN	Debt - Notes	DLTT	DLTT
DS	Debt-Subordinated	DLTT	DLTT
DUDD	Debt - Unamortized Debt Discount and Other	DLTT	DLTT
GDWL	Goodwill	INTAN	INTAN
INTANO	Other Intangibles	INTAN	INTAN
MSA	Marketable Securities Adjustment	IVAO	IVAO
BASTR	Average Short-Term Borrowings Rate	BAST	LCT
BAST	Average Short-Term Borrowings	DLC	LCT
DD1	Long-Term Debt Due in One Year	DLC	LCT
NP	Notes Payable - Short-Term Borrowings	DLC	LCT
DRC	Deferred Revenue - Current	LCO	LCT
LCOX	Current Liabilities - Other - Sundry	LCO	LCT
XACC	Accrued Expenses	LCO	LCT
AP	Accounts Payable - Trade	LCT	LCT
DLC	Debt in Current Liabilities - Total	LCT	LCT
LCO	Current Liabilities - Other - Total	LCT	LCT
TXP	Income Taxes Payable	LCT	LCT
DRLT	Deferred Revenue - Long-term	LO	LO

Linking Table for the Balance Sheet (Continued)

SUB ACCOUNTS	DESCRIPTION	PARENT	GROUP
DPACO	Depreciation (Accumulated) - Other	DPACT	PPENT
DPACT	Depreciation, Depletion and Amortization (Accumulated)	PPENT	PPENT
FATB	PPE - Buildings	PPENT	PPENT
FATC	PPE - Construction in Progress	PPENT	PPENT
FATE	PPE - Mach. & Equip.	PPENT	PPENT
FATL	PPE - Leases	PPENT	PPENT
FATN	PPE - Natural Resources	PPENT	PPENT
FATO	PPE - Other	PPENT	PPENT
PPEGT	PPE - Total (Gross)	PPENT	PPENT
DVPA	Preferred Dividends in Arrears	PSTK	PSTK
PSTKC	Preferred Stock - Convertible	PSTK	PSTK
PSTKL	Preferred Stock - Liquidating Value	PSTK	PSTK
PSTKN	Preferred/Preference Stock - Nonredeemable	PSTK	PSTK
PSTKR	Preferred/Preference Stock - Redeemable	PSTK	PSTK
PSTKRV	Preferred Stock - Redemption Value	PSTK	PSTK
ITCB	Investment Tax Credit (Balance Sheet)	TXDITC	TXDITC
TXDB	Deferred Taxes (Balance Sheet)	TXDITC	TXDITC

Source: Chen et al. (2015).

Appendix 3 - Linking Table for the Income Statement

SUB ACCOUNTS	DESCRIPTION	GROUP
CIBEGNI	Comp Inc - Beginning Net Income	CITOTAL
CICURR	Comp Inc - Currency Trans Adj	CITOTAL
CIDERGL	Comp Inc - Derivative Gains/Losses	CITOTAL
CIOTHER	Comp Inc - Other Adj	CITOTAL
CIPEN	Comp Inc - Minimum Pension Adj	CITOTAL
CISECGL	Comp Inc - Securities Gains/Losses	CITOTAL
ESUB	Equity in Earnings - Unconsolidated Subsidiaries	NOPI
FCA	Foreign Exchange Income (Loss)	NOPI
IDIT	Interest and Related Income - Total	NOPI
INTC	Interest Capitalized	NOPI
IRENT	Rental Income	NOPI
NOPIO	Nonoperating Income (Expense) - Other	NOPI
AQP	Acquisition/Merger Pretax	SPI
DTEP	Extinguishment of Debt Pretax	SPI
GDWLIP	Impairments of Goodwill Pretax	SPI
GLP	Gain/Loss Pretax	SPI
NRTXT	Nonrecurring Income Taxes After-tax	SPI
RCP	Restructuring Costs Pretax	SPI
RDIP	In Process R&D Expense	SPI
RRP	Reversal - Restructruring/Acquisition Pretax	SPI
SETP	Settlement (Litigation/Insurance) Pretax	SPI
SPIOP	Other Special Items Pretax	SPI
WDP	Writedowns Pretax	SPI
ITCI	Investment Tax Credit (Income Account)	TXT
TXC	Income Taxes - Current	TXT
TXDFED	Deferred Taxes-Federal	TXT
TXDFO	Deferred Taxes-Foreign	TXT
TXDI	Income Taxes - Deferred	TXT
TXDS	Deferred Taxes-State	TXT
TXFED	Income Taxes - Federal	TXT
TXFO	Income Taxes - Foreign	TXT
TXO	Income Taxes - Other	TXT
TXS	Income Taxes - State	TXT
TXW	Excise Taxes	TXT
ACCHG	Accounting Changes - Cumulative Effect	XIDO
DO	Discontinued Operations	XIDO
DONR	Nonrecurring Disc Operations	XIDO

Linking Table for the Income Statement (Continued)

Subaccount	Description	GROUP
XI	Extraordinary Items	XIDO
XINTD	Interest Expense - Long-Term Debt	XINT
AM	Amortization of Intangibles	XOPR
COGS	Cost of Goods Sold	XOPR
DFXA	Depreciation of Tangible Fixed Assets	XOPR
DP	Depreciation and Amortization	XOPR
STKCPA	After-tax stock compensation	XOPR
XAD	Advertising Expense	XOPR
XLR	Staff Expense - Total	XOPR
XPR	Pension and Retirement Expense	XOPR
XRD	Research and Development Expense	XOPR
XRENT	Rental Expense	XOPR
XSGA	Selling, General and Administrative Expense	XOPR
XSTFO	Staff Expense - Other	XOPR

Source: Chen et al. (2015).

Appendix 4 – Hausman Test

```
. hausman fixed random

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |    fixed        random       Difference          S.E.
-------------+------------------------------------------------------------
        LOGAT |   .0531256     .0521305        .0009951        .0000912
          SPI |   .0392445      .039311       -.0000664               .
          INT |   .2940792     .2952999       -.0012207               .
Restructure   |   .1000434     .1006231       -.0005796               .
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      110.93
                Prob>chi2 =      0.0000
```

Appendix 5 – Fixed Effects Tests

Test for Industry-fixed Effects

Variable	fixed	ols	areg
LOG(AT)	.05312559***	.05312559***	.01946184***
SPI	.03924455***	.03924455***	.02953709***
INT	.29407916***	.29407916***	(omitted)
Restructure	.10004343***	.10004343***	.1497218***
σ(RET)	-.03371345***	.02944575***	.0487115***
_IIndustry_2	.02125087***		
_IIndustry_3	.06221387***		
_IIndustry_4	.0345652***		
_IIndustry_5	.02269388***		
_IIndustry_6	.07824975***		
_IIndustry_7	.00662291		
_IIndustry_8	-.01771226***		
_IIndustry_9	-.04914937***		
_cons	.38628884***	.36145158***	.52406365***
N	12978	12978	12978
r2	.44742709	.46548644	.78215519
r2_a	.44691565	.46499171	.50723861

legend: *p<0.05; **p<0.01; ***p<0.001

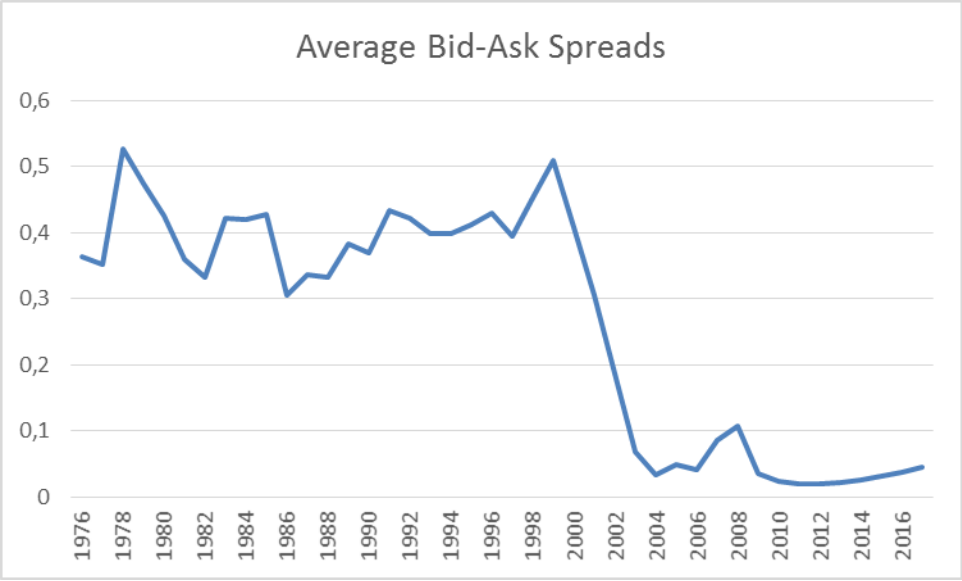
Test for Time-fixed Effects

```
. xtreg DQ LOGAT SPI INT Restructure i.year, fe

Fixed-effects (within) regression               Number of obs      =     12978
Group variable: Industry                        Number of groups   =         9

R-sq:  within  = 0.8608                         Obs per group: min =       113
       between = 0.2806                                        avg =    1442.0
       overall = 0.8453                                        max =      2450

                                                F(48,12921)        =   1664.52
corr(u_i, Xb)  = -0.0169                        Prob > F           =    0.0000
```

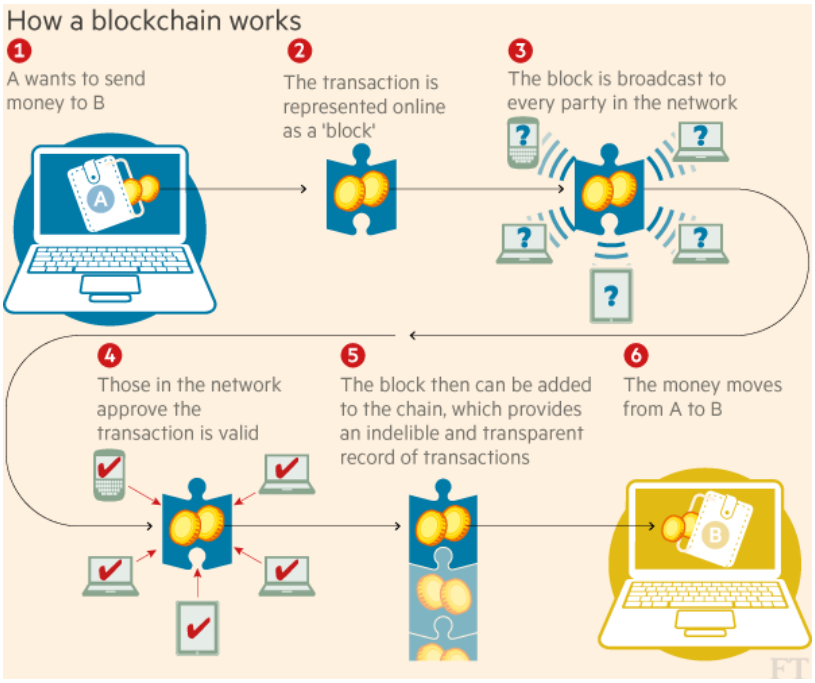
DQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LOGAT	-.0047415	.0006588	-7.20	0.000	-.0060328	-.0034501
SPI	.004748	.0033958	1.40	0.162	-.0019083	.0114043
INT	.0027176	.0044181	0.62	0.539	-.0059426	.0113778
Restructure	.020633	.001306	15.80	0.000	.018073	.0231931
year						
1974	.0128628	.0056599	2.27	0.023	.0017686	.023957
1975	.1119822	.0056432	19.84	0.000	.1009208	.1230436
1976	.11255	.0056352	19.97	0.000	.1015042	.1235959

```
F( 44, 12921) =  872.00
     Prob > F =    0.0000
```

Appendix 6 – Historical Bid-Ask Spreads

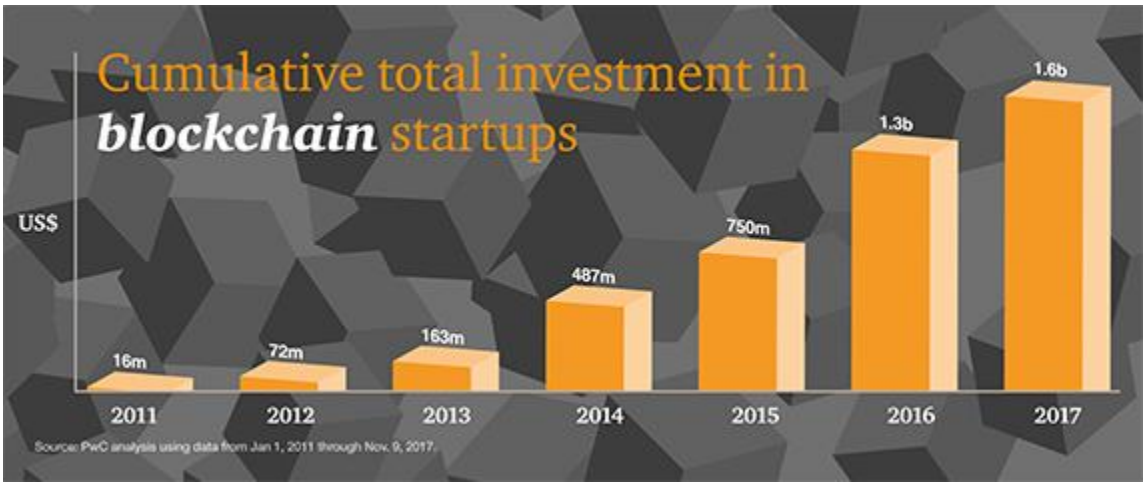


Appendix 7 – Illustration of Blockchain Technology in Practice



Source: Financial Times (https://www.weforum.org/agenda/2016/06/blockchain-explained-simply/)

Appendix 8 – Investments in Blockchain Technology



Source: PWC (2017) https://www.pwc.com/us/en/financial-services/research-institute/assets/pwc-fsi-top-issues-2018.pdf